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A Risk/Benefit Analysis of Central Clearing of Over-the-Counter (OTC)
Derivatives and a Chaos Theory-Based Perspective on Clearing
Mandates

By

Diana Milanesi

A dissertation submitted in partial satisfaction of the

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of the

University of California, Berkeley

Committee in charge:

Professor Prasad Krishnamurthy, Chair

Professor Robert P. Bartlett

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Abstract

A Risk/Benefit Analysis of Central Clearing of Over-the-Counter (OTC) Derivatives and a Chaos Theory-Based Perspective on Clearing Mandates

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Diana Milanesi

Doctor of Juridical Science

University of California, Berkeley

Professor Prasad Krishnamurthy, Chair

In the aftermaths of the global financial crisis of 2007-2009 (GFC), policymakers and regulators around the world embarked on far-reaching reforms of the over-the-counter (OTC) derivatives market. A key element in their agenda was the introduction of central clearing mandates for OTC derivatives, which was largely driven by the belief shared among policymakers and regulators that central counterparties clearing OTC derivatives (OTC CCPs) could reduce the counterparty risk and mitigate the systemic risk associated with their trading. During the past seven years, however, the scale and complexity of the process of implementation of central clearing mandates of OTC derivatives have gradually emerged. In particular, a dawning debate has arisen around the question of how OTC CCPs may themselves generate and/or exacerbate systemic risk within the financial system. The present work investigates this question in detail.

After providing some background on OTC derivatives and related financial risks, the present work examines the operations and functions of OTC CCPs, covering aspects such as novation, margins, multilateral netting and the coordinated default management process. Following this preliminary analysis, the present work discusses multiple benefits and risks of OTC CCPs and, then, investigates relationships and dynamic interactions existing among them. This risk/benefit analysis of OTC CCPs, in turn, helps gain a realistic appreciation of OTC CCPs' systemic-risk implications.

Significantly, a number of procedures and mechanisms through which OTC CCPs can generate and/or exacerbate systemic risk are identified, which include the following:

- OTC derivatives trading through OTC CCPs may create excessive concentration of multiple risks into one single focal point. This reduces the possibility for diversification and may increase the probability that the failure of an OTC CCP could have system-wide destabilizing effects. Furthermore, by concentrating the risk associated with the trades being cleared, OTC CCPs may

themselves become systemically important entities and their failure may expose many market participants to severe losses.

- By changing the topology of the network of connections in the OTC derivatives market, OTC CCPs essentially replace one set of interconnections with another, which could be as vulnerable to systemic failures as (or even more vulnerable than) the one existing prior to the implementation of central clearing mandates. The resulting interconnected structure is, then, made even more complex by the raise of “alternative forms” of clearing of OTC derivatives, which have emerged over the past few years driven by unprecedented developments in new technologies, including blockchain and hyperledger technologies.

- Rigorous margin requirements enforced by OTC CCPs may have the effect of increasing operational complexity and rigidity within the OTC derivatives market, which, in turn, may lead to a more tightly coupled financial system. In addition, as shown in the aftermaths of the Brexit vote, OTC CCPs’ rigorous margining may create pro-cyclicality problems, and in the event of large price moves it may trigger “systemic margin calls.” In such a scenario, many OTC CCPs’ members (CMs) with losing positions would be required to make large variation margin payments in a very tight frame, and would be forced to raise funds simultaneously. This rush to liquidity may, then, create severe strains for CMs with destabilizing effect for OTC CCPs, as well. Moreover, the need to raise liquidity to meet large margin calls and the need to reduce (or close) positions because of the inability to meet such calls may create tight coupling and may lead to chaotic fire sales that further exacerbate price movements. The fire sales of assets may have spillover adverse effects that go far beyond derivatives transactions to impact any institution or firm holding the assets subject to fire sales, including those that don’t have any (direct or indirect) counterparty exposure to market participants trading cleared derivatives. Last, uncertainty about the solvency of market participants may induce chaotic information contagion and further assets liquidations, which may exacerbate price volatility and may result into severe declines in trading market liquidity.

- Multilateral netting and setoff through OTC CCPs change creditor priority by increasing the priority of the OTC CCP and the derivatives counterparties over other claimants on a defaulted CM. In so doing, multilateral netting and setoff through OTC CCPs essentially redistribute value from one group of creditors to other creditors and re-allocate risks of losses from one set of claimants to another. This redistributive effect may be systemically damaging if the risk is transferred to parties that are as systemically important and as vulnerable as (or even more systemically important and more vulnerable than) OTC derivatives market participants.

- OTC CCPs’ loss mutualization and risk sharing mechanisms may expose OTC CCPs to problems of adverse selection and moral hazard, and may increase the opacity of OTC derivatives trading, which, in turn, may create the risk of runs on OTC CCPs in the event of default of one or more of their CMs. In addition,

margin and risk-sharing mechanisms of OTC CCPs make them particularly vulnerable to wrong-way risk (WWR), thus contributing further instability.

- A typical OTC CCP's default waterfall resembles the loss allocation structure of a collateralized debt obligation (CDO) as the various levels in an OTC CCP's default waterfall are typically accessed in sequence, much like the tranches of a CDO. As a result, the risk characteristics of the two structures may be very similar. In particular, much like senior and super-senior tranches in a CDO, the risk exposure of CMs via an OTC CCP's default fund is heavily concentrated in terms of systemic risk and WWR and it may increase significantly during periods of large market-wide shocks, high volatility and liquidity shortage.

By building on the findings of the described risk/benefit analysis of OTC CCPs, the present work examines a new approach to systemic risk-related financial regulation, which has emerged in the aftermaths of the GFC and has been inspired by chaos theory, and applies this new approach onto the OTC derivatives clearing context through a two-step analysis. First, the present work focuses on the OTC CCP's coordinated default management process and discusses how to improve it by considering behavior aspects in the pricing and structuring of an OTC CCP's default waterfall. In particular, the present work examines innovative designs of OTC CCPs' pre-funded mutualized default fund(s), which can create the necessary incentives for CMs to cooperate and help the OTC CCP during the coordinated default management process by participating actively in the hedging and auctioning of the defaulted CM's positions. Second, the present work identifies and discusses additional resources and stabilizing mechanisms that could be activated in the remote (but still possible) scenario in which an OTC CCP's coordinated default management process backfires, including contingent capital, central bank's liquidity resources, private systemic risk insurance fund(s), third-party systemic risk insurance, and systemic risk catastrophe bonds.

To Mom, Dad, Peter, and Karen

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Introduction

In the aftermaths of the global financial crisis of 2007-2009 (GFC), policymakers and regulators around the world embarked on far-reaching reforms of the over-the-counter (OTC) derivatives market. A key element in their agenda was the introduction of central clearing mandates for OTC derivatives. The introduction of these mandates was largely driven by the belief shared among policymakers and regulators that central counterparties clearing OTC derivatives (OTC CCPs) could reduce counterparty risk and mitigate systemic risk associated with the trading of OTC derivatives. In particular, proponents of central clearing mandates long argued that OTC CCPs could decrease interconnectedness in the OTC derivatives market, enforce more rigorous margin requirements, help achieve more extensive multilateral netting, and “insure” default risks through loss mutualization and pooling mechanisms. Moreover, the same proponents noted that OTC CCPs could improve the monitoring of OTC derivatives trading, facilitate standardization of OTC derivatives contracts, and increase their fungibility and liquidity. These benefits, in turn, were thought to help make the market for OTC derivatives safer, sounder, and more transparent.

During the past seven years, however, the scale and complexity of the process of implementation of central clearing mandates of OTC derivatives have gradually emerged. This, in turn, has created concerns regarding the system-wide effects of OTC CCPs. Significantly, a dawning debate has arisen around the question of how OTC CCPs may themselves generate and exacerbate systemic risk within the financial system. At the time of writing this question remains thinly explored.

The present work will investigate the above question in detail. The work will proceed as follows:

- Chapter 1 will provide a brief overview of OTC derivatives and their key features. The Chapter will, then, discuss the growth of the OTC derivatives market from late 1990s up to the date of writing, with particular focus on its credit derivatives segment.
- Chapter 2 will analyze counterparty risk associated with the trading of OTC derivatives. In particular, the Chapter will discuss how various financial risks can combine to generate counterparty risk, and how mitigating counterparty risk may itself create financial risks. The Chapter will, then, examine various techniques of counterparty risk mitigation that have been traditionally utilized in the OTC derivatives market, and will explain how such counterparty risk mitigants can be thought of as a progressive evolution towards the use of OTC CCPs.
- Chapter 3 will analyze the systemic risk posed by OTC derivatives. The Chapter will begin by providing a brief conceptualization of systemic risk in the context of financial markets. It will, then, focus on the structural interconnectedness and linkages existing among financial institutions and markets as key mechanisms of transmission of systemic risk. Next, the Chapter will discuss recent studies that have identified and analyzed

- alternative channels of propagation of systemic risk, and will explain why the findings of these studies are of critical relevance for the implementation of central clearing mandates of OTC derivatives.
- Chapter 4 will provide an overview of the operations and functions of an OTC CCP, covering aspects such as novation, margins, multilateral netting, and the coordinated default management process.
 - Chapter 5 will focus on the impact of central clearing on the OTC derivatives market and will discuss significant benefits associate with the use of OTC CCPs.
 - Chapter 6 will extend the analysis provided in Chapter 5 by discussing a number of disadvantages of central clearing of OTC derivatives. In particular, Chapter 6 will identify and analyze key features and mechanisms of OTC CCPs (e.g., multilateral netting and increased and rigorous margining) that may contribute systemic instability into the financial system and that may allow systemic risk to build up over time. Significantly, prior researches on central clearing of OTC derivatives have usually focused on the analysis of certain benefits (or risks) of OTC CCPs in isolation. The analysis provided in Chapter 5 and Chapter 6 differs from prior researches in that it investigates a number of key benefits and risks of OTC CCPs and, then, identifies and examines interactions existing among them. The result is, thus, a dynamic and more comprehensive analysis of the benefits and risks of OTC CCPs, which, in turn, helps gain a more realistic appreciation of their systemic risk-related effects.
 - Chapter 7 and Chapter 8 will consider a new approach to systemic risk-related financial regulation that has emerged following the GFC. The new approach has been inspired by chaos theory and is based on the acknowledgment that systemic risk-related financial regulation cannot always prevent the initial spark, nor it can always promptly interrupt the transmission of its systemic risk destabilizing effects. Because of this, the new approach suggests that systemic risk-related financial regulation should also focus on the development and implementation of tools that could help manage periodic systemic failures in a controlled manner and stabilize the parts of the financial system affected by such failures. Arguably, managing periodic failures in a controlled manner and stabilizing systemically important firms and markets impacted by such failures is one key role of OTC CCPs. Thus, the present work will apply the new approach inspired by chaos theory onto the OTC derivatives clearing context through a two-step analysis. First, Chapter 7 will analyze the OTC CCP's coordinated default management process and will discuss how to improve it by considering behavior aspects in the pricing and structuring of an OTC CCP's default waterfall. Second, Chapter 8 will examine additional resources and stabilizing mechanisms that could be activated in the remote (but still possible) scenario in which an OTC CCP's coordinated default management process backfires.

CHAPTER 1: OVERVIEW OF OVER-THE-COUNTER (OTC) DERIVATIVES

Chapter 1 will start by providing a brief overview of over-the-counter (OTC) derivatives and their key features. The Chapter will, then, discuss the growth of the OTC derivatives market from late 1990s up to the date of writing, with particular focus on its credit derivatives segment.

1.1. Derivatives Contracts

A derivative is a financial instrument whose value (directly or indirectly) depends on the value of one or more underlying variables (e.g., an asset, an index, or a future event).¹ Hence, a key idea underlying the use of derivatives is that a given payoff can be replicated in multiple ways.²

The maturity of derivatives may vary from a few weeks to months (e.g., future contracts) or many years (e.g., long-dated swaps). Derivatives can be utilized for a variety of purposes, including for hedging, speculation, investment strategies, and/or arbitrage.³ Therefore, because of the versatile nature of derivatives, it is important to understand that it is how the derivatives contract is utilized and who utilizes the derivatives contract that determine whether or not the derivatives contract is risk-reducing. As correctly pointed out by McDonald, when it comes to derivatives “[c]ontext is everything.”⁴

1.2. Exchange Traded Derivatives and OTC Derivatives

Depending on how they are transacted, derivatives can be classified into two broad categories:⁵

- Exchange traded derivatives, which are traded on organized venues or established platforms; and
- Over-the-counter (OTC) derivatives, which are traded bilaterally between two parties.

Many of the most standardized, most liquid, and typically short-dated derivatives products (e.g., futures, forward, options) are traded through derivatives exchanges.⁶ To be traded on a derivatives exchange, a derivatives product must

¹ For a comprehensive introduction to financial derivatives, see, John C. Hull, *Options, Futures, and other Derivatives*, Pearson Education, Inc. publishing as Prentice Hall, 8th ed. (2012). For a review of the history of derivatives and a description of how derivatives have been used and regulated in the United States, see, e.g., Gordon F. Peery, *The Post-Reform Guide to Derivatives and Futures*, John Wiley & Sons (2012), pp. 229-298; Alfred Steinherr, *Derivatives: The Wild Beast of Finance*, Wiley (2000); John C. Coffee, Jr., and Hillary A. Sale, *Securities Regulation: Cases and Materials*, Foundation Press, 11th ed. (2009), pp. 20-25.

² Robert L. McDonald, *Derivatives Markets*, Pearson Education, Inc. publishing as Prentice Hall, 3rd ed. (2013), p. 14 (noting that “the construction of a given financial product from other products is sometimes called financial engineering”).

³ *Id.*, pp. 11-13. See, also, Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, Federal Reserve Bank of New York, Staff Report No. 424 (2010), p. 9-10; Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the “Dodd-Frank Wall Street Reform and Consumer Protection Act,”* *Journal of Applied Finance*, Vol. 20, No. 2 (2010), p. 3 (identifying three main functions performed by a derivatives exchange: product design, trading venue (either physical or electronic), and price reporting services).

⁴ See, Robert L. McDonald, *Derivatives Markets*, *cit.*, p. 2.

⁵ See, John C. Hull, *Options, Futures, and other Derivatives*, *cit.*, pp. 2-3.

⁶ See, e.g., Robert L. McDonald, *Derivatives Markets*, *cit.*; Chicago Board of Trade, *Handbook of Futures and Options*, McGraw-Hill Education (2006); Robert W. Kolb and James A. Overdahl, *Future, Options, and Swaps*, Wiley-Blackwell, 5th ed. (2007).

first achieve a sufficient degree of standardization, and must develop a reasonable level of liquidity and trading volume.⁷ Derivatives exchanges can generate significant benefits. For instance, a derivatives exchange can promote market efficiency, increase price discovery and transparency, enhance liquidity, and facilitate access to a wide range of market participants.⁸

Compared to exchange-traded derivatives, OTC derivatives tend to have less standardized and more complex structures, their maturities are typically longer, and their liquidity is often very limited.⁹ Because of these features, OTC derivatives are not traded on exchanges, rather they are usually traded bilaterally, either between two financial institutions or a financial institution and one of its clients.¹⁰ In particular, parties to an OTC derivatives trade are often distinguished between end users and dealers, who make market for the OTC derivatives. The class of end users encompasses corporates, investment managers (e.g., pension funds, mutual funds, hedge funds), and government entities. The group of dealers includes large financial institutions.¹¹ Significantly, during the last two decades concentration of dealer participants has become a distinctive feature of the OTC derivatives market: the largest fourteen dealers count for approximately fourth-fifths of the total notional outstanding,¹² and in the United States four large commercial banks represent approximately ninety percent (90%) of the total OTC derivative notional amounts.¹³

The terms and conditions of OTC derivatives are typically privately negotiated between buyer and seller, and the parties to the trade are also generally responsible for formalizing, documenting, and recording their trade. In this respect, OTC derivative transactions are most frequently documented through standard documentation developed by the International Swaps and Derivatives Association (ISDA),¹⁴ which through the years has helped increase the speed of

⁷ The introduction and use of derivatives in a market often coincides with an increase in price risk in that market. In this sense see, Robert L. McDonald, *Derivatives Markets*, cit., p. 6 (noting that “[c]urrencies were permitted to float in 1971 when the gold standard was officially abandoned. The modern market in financial derivatives began in 1972, when the Chicago Mercantile Exchange (CME) started trading futures on seven currencies. OPEC’s 1973 reduction in the supply of oil was followed by high and variable oil prices. U.S. interest rates became more volatile following inflation and recessions in the 1970s. The market for natural gas has been deregulated gradually since 1978, resulting in a volatile market and the introduction of futures in 1990. The deregulation of electricity began during the 1992.”).

⁸ See, e.g., John C. Hull, *Options, Futures, and other Derivatives*, cit., p. 2; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, John Wiley & Sons (2014), pp. 16-17.

⁹ Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 16-17. For a comprehensive description of OTC derivatives, see, e.g., European Central Bank (ECB), *OTC Derivatives and Post-Trading Infrastructures*, European Central Bank (2009); Garry J. Schinasi, R. Sean Craig, Burkhard Drees, and Charles Kramer, *Modern Banking and OTC Derivatives Markets: The Transformation of Global Finance and Its Implications for Systemic Risk*, International Monetary Fund Paper No. 203 (2001).

¹⁰ See, Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the “Dodd-Frank Wall Street Reform and Consumer Protection Act,”* cit., p.3 (noting that “[n]early all OTC derivatives today are still negotiated between a dealer and end user or between two dealers. Inter-dealer brokers (IDBs) also play an important role in OTC derivatives by helping dealers (and sometimes end users) identify willing counterparties and compare different bids and offers. In addition, various forms of electronic trading systems have also been developed to facilitate the negotiation of OTC derivatives.”).

¹¹ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., pp. 3-4.

¹² See, International Swaps and Derivatives Association (ISDA), *ISDA Market Surveys* (2010).

¹³ See, Office of the Comptroller of the Currency (OCC), *OCC’s Quarterly Report on Bank Trading and Derivatives Activities* (First Quarter 2013).

¹⁴ For a review of the ISDA legal documentation, see, e.g., International Swaps and Derivatives Association (ISDA), *Legal Documentation*, <http://www2.isda.org/functional-areas/legal-and-documentation/> (Last visited December 2016). At the time of writing, ISDA has published two editions of its master agreement: the Multi-Currency Cross Border ISDA Master Agreement published in 1992 (the “1992 ISDA Master Agreement”), and the ISDA Master Agreement published in 2002

deal execution, reduce legal and operative costs, and enhance the liquidity of the OTC derivatives market.¹⁵

There are a number of reasons why buyers and sellers might find more advantageous transacting directly with dealers rather than executing their trades on a derivatives exchange.¹⁶ First, trading directly with another party may facilitate trade of large quantity/size. This is because the parties to the trade can negotiate a single price (which helps avoid exchange fees) and they can negotiate privately the terms of their agreement (which helps prevent the market tumult and price uncertainty that might result from announcing a large sale).¹⁷ Second, when the parties wish to trade a number of different financial claims at once, a dealer can help execute the trades as a single transaction (which helps optimizing the cost and timing efficiency of the overall transaction).¹⁸ Third, in a bilateral OTC derivatives market parties to a trade can tailor and customize OTC derivatives to meet their (or their clients') needs more precisely.¹⁹ This is a key feature, which has helped make OTC derivatives an invaluable tool for risk management and hedging purposes, and has significantly contributed to the growth of OTC derivatives markets over the past two decades.

Notwithstanding the benefits described above, it is worth noting that OTC derivatives also present a number of drawbacks when compared to exchange-traded derivatives.²⁰ First, contrary to exchange activity, OTC derivatives trading is relatively more difficult to observe and measure because it is not visible on any exchange and, typically, no subject to mandatory trade reporting. Second, customization of OTC derivatives can severely limit fungibility of the instrument. For instance, termination, assignment, and novation of a tailored OTC derivative transaction are generally subject to the consent of the original counterparty, which may take advantage of its privileged position imposing unfavorable terms and conditions. Third, the liquidity of the OTC derivatives market has been lower (sometimes even significantly lower) compared to the liquidity of exchange-traded derivatives. Fourth, in the OTC derivatives market each party to the trade is exposed to the counterparty risk of the other party and must manage it itself.

(the "2002 ISDA Master Agreement," and together with the 1992 ISDA Master Agreement, each an "ISDA Master Agreement"). Each ISDA Master Agreement consists of pre-printed standard provisions and a schedule (the "Schedule"), in which the parties make certain elections and may vary any of these pre-printed standard provisions. The legal and credit aspects of the transaction between the parties are set forth in the pre-printed standard provisions of the ISDA Master Agreement and the Schedule thereto. The commercial terms of each transaction that is subject to a particular ISDA Master Agreement are contained in a confirmation (or confirmations). The ISDA Master Agreement and all confirmations thereunder constitute a single agreement. For an interesting review of legal documents and key terms utilized in OTC derivatives and exchanged-traded derivatives trading, see, e.g., Gordon F. Peery, *The Post-Reform Guide to Derivatives and Futures*, cit., pp. 187-210; Jomadar K. Bushan, *The ISDA Master Agreement—The Rise and Fall of a Major Financial Instrument*, University of Westminster School of Law, Working Paper (2007); Frank Partnoy, *ISDA, NASD, CFMA, and SDNY: The Four Horsemen of Derivatives Regulation?* University of San Diego School of Law, Working Paper No. 39 (2002).

¹⁵ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, Palgrave Macmillan (2013), p. 26 note 4 (arguing that the initiatives promoted by ISDA and involving various OTC derivatives market participants can be thought of as a type of "club good," whereby excludable but non-rivalrous goods are created thanks to coordination.).

¹⁶ See, Robert L. McDonald, *Derivatives Markets*, cit., p. 4.

¹⁷ *Ibidem*.

¹⁸ *Ibidem*.

¹⁹ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., pp. 3-4.

²⁰ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 16-19.

As discussed in more details in Chapter 2, this has traditionally been accomplished through the use of counterparty risk mitigants, including the posting of collateral and margins.

1.3. OTC Derivatives Market Activity

Because of the features of OTC derivatives described above, it is not straightforward determining how many OTC derivatives are traded, which asset classes are dominating the market, and how large are the exposures created by OTC derivatives at a given point in time. For this purpose, two important source of information are typically considered: the Bank for International Settlement (BIS) surveys on positions in global OTC derivatives markets²¹ and the ISDA margin surveys.²²

OTC derivatives markets remained relatively small until the 1980s: in 1986, the total notional of OTC derivatives was slightly less than that of exchange-traded derivatives at US\$ 500 billion.²³ During the 1990s and again in the 2000s, OTC derivatives grew significantly to dominate in notional value their exchange-traded equivalents by something close to an order of magnitude. This growth was driven by a combination of factors, including advances in financial engineering, technology developments, regulation, and the use of OTC derivatives as customized hedging instruments and investment vehicles.²⁴ In particular, the issuance and trading of credit derivatives increased swiftly during the first decade of 2000s: the total notional principal for outstanding credit derivatives contracts increased from c. US\$ 800 billion in 2000 up to c. US\$ 30.4 trillion by the end of 2009.²⁵

Following the global financial crisis of 2007-2009 (GFC),²⁶ concerns about the counterparty risk and the systemic risk associated with the trading of OTC

²¹ Bank for International Settlements (BIS) derivatives statistics are available at http://www.bis.org/statistics/about_derivatives_stats.htm?m=6%7C32 (Last visited December 2016).

²² International Swaps and Derivatives Association (ISDA) margin surveys are available at <https://www2.isda.org/functional-areas/research/surveys/margin-surveys/> (Last visited December 2016).

²³ Ibidem.

²⁴ See, Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act,"* cit., pp. 2-3, 5-6.

²⁵ See, International Swaps and Derivatives Association (ISDA), *ISDA Year-End 2009 Market Survey* (2010).

²⁶ For an analysis of the role of OTC derivatives and other primary factors that contributes to the GFC, cf., e.g., Ben S. Bernanke (then Chairman of the Board of Governors of the Federal Reserve System), *Developments in the Financial Markets*, Testimony before the Committee on Banking, Housing, and Urban Affairs, U.S. Senate (April 3, 2008); Ben S. Bernanke (then Chairman of the Board of Governors of the Federal Reserve System), *Reducing Systemic Risk*, Speech at the Federal Reserve Bank of Kansas City's Annual Economic Symposium, Jackson Hole, Wyoming (August 22, 2008); Ben S. Bernanke (then Chairman of the Board of Governors of the Federal Reserve System), *Risk Management in Financial Institutions*, Speech at the Federal Reserve Bank of Chicago's Annual Conference on Bank Structure and Competition, Chicago, Illinois (May 15, 2008); Adrian Blundell-Wignall, Paul Atkinson, Se Hoon Lee, *The Current Financial Crisis: Causes and Policy Issues*, OECD Financial Markets Trends (2008); Markus Brunnermeier, *Deciphering the 2007-08 Liquidity and Credit Crunch*, *Journal of Economic Perspectives*, Vol. 23, No. 1, pp. 77–100 (2009); Willem H. Buiter, *Central Banks and Financial Crises*, Discussion Paper No. 619 (2008); William D. Cohan, *House of Cards: A Tale of Hubris and Wretched Excess on Wall Street*, Doubleday (2009); Giovanni Dell'Arriccia, Deniz Igan, and Luc Laeven, *Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market*, International Monetary Fund Working Paper No. 08/16 (2008); Gary B. Gorton, *The Panic of 2007*, NBER Working Paper No. 14358 (2008); Alan Greenspan, *The Age of Turbulence: Adventures in a New World*, Penguin Press (2007); International Monetary Fund, *Containing Systemic Risks and Restoring Financial Soundness*, Global Financial Stability Report (GFSR) (2008); Paul Krugman, *The Return of Depression Economics and the Crisis of 2008*, W.W. Norton & Company, Inc. (2009); Michael Lewis, *Panic: The Story of Modern Financial Insanity*, W. W. Norton & Company (2009); Matthew Richardson, *Causes of the Financial Crisis of 2007-2009*, in Viral V. Acharya and Matthew Richardson (ed.), *Restoring Financial Stability, How to Repair a Failed System*, John Wiley & Sons (2009), pp. 57-82; Robert J. Shiller, *The Subprime Solution. How Today's*

derivatives caused numerous financial institutions and other market participants to dramatically cut back on their OTC derivatives exposures and increasingly tighten up margin and collateral requirements.²⁷

According to data reported by BIS,²⁸ notional amounts of all types of OTC contracts stood at US\$ 683.7 trillion at the end of June 2008, 15% higher than six months before. However, the first half of 2008 recorded a significant decline in credit default swaps (CDSs) volumes and multilateral terminations of outstanding contracts resulted in the first ever decline of 1% in the volume of outstanding CDSs since December 2004.²⁹ In contrast to CDS markets, growth was recorded in interest rate products and a robust activity was observed in foreign exchange (FX) derivatives, as well. Significantly, open positions in interest rate derivatives contracts rose by 17%,³⁰ while those in FX contracts expanded by 12%.³¹ Finally, a steady growth was also observed in the equity derivatives and the commodity derivatives markets. In particular, notional amounts outstanding of OTC equity derivatives increased by 20% in the first half of 2008,³² while notional amounts in the market for OTC commodity derivatives increased by 56% in the first half of 2008 to reach US\$ 13 trillion at the end of June.³³

According to data reported by BIS, at the end of June 2009, notional amounts of all types of OTC contracts reached US\$ 605 trillion, 10% above the level achieved in 2008.³⁴ However, gross market values (which measure the cost of replacing all existing contracts and are thus a better gauge of market risk than notional amounts) decreased by 21% down to US\$ 25 trillion. Gross credit exposures also decreased by 18% from an end-2008 peak of US\$ 4.5 trillion to

Global Financial Crisis Happened, and What to Do about It, Princeton University Press (2008); John B. Taylor and John C. William, *A Black Swan in the Money Market*, NBER Working Paper No. W13943 (2008); U.S. Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report - Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States*, U.S. Financial Crisis Inquiry Commission, U.S. Government, Public Affairs (2011). Randall L. Wray, *Financial Markets Meltdown. What Can We Learn From Minsky?*, The Levy Economics Institute of Bard College, Public Policy Brief No. 94A (2008).

²⁷ Related to these responses, financial institutions also undertook severe reappraisals of the assumptions at the basis of methodologies utilized to price and manage the risk involved in OTC derivatives trading. In the context of these reappraisals the relevance of counterparty risk has grown considerably, as evidenced by the significant credit value adjustments ("CVA") reported in bank's financial statements. In addition, the impact that funding costs, collateral effects and capital charges have on valuation is now recognized and account for, as evidenced by the use of multiple terms, such as debt value adjustment ("DVA"), funding value adjustment ("FVA"), collateral value adjustment ("CoVA"), capital value adjustment ("KVA") and margin value adjustment ("MVA") (collectively referred to as "xVA"). In this sense, see, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, John Wiley & Sons, 3rd ed. (2015), p. 2; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 61 seq.; Steven H. Zhu and Michael Pykhtin, *A Guide to Modeling Counterparty Credit Risk*, GARP Risk Review, No. 37, pp. 16-22 (2007); Michael Pykhtin and Dan Rosen, *Pricing Counterparty Risk at the Trade Level and CVA Allocations*, Federal Reserve Board, Divisions of Research & Statistics and Monetary Affairs, Finance and Economics Discussion Series: 2010-10 (2009)

²⁸ See, Bank for International Settlements (BIS), *OTC derivatives market activity in the first half of 2008*, Bank for International Settlements Monetary and Economic Department (2008) (statistics cover the notional amounts and gross market values outstanding of the worldwide consolidated OTC derivatives exposure of major banks and dealers in the G10 countries).

²⁹ Id., p. 1 (noting that the average growth rate for outstanding CDS contracts between 2005 to 2008 was approximately 45%).

³⁰ Id., p. 2.

³¹ Id., p. 3.

³² Ibidem.

³³ Ibidem.

³⁴ See, Bank for International Settlements (BIS), *OTC derivatives market activity in the first half of 2009*, Bank for International Settlements Monetary and Economic Department (2009).

US\$ 3.7 trillion. Similarly, in 2009 notional amounts of CDS contracts continued to decline (although at a slower pace compared to the second half of 2008) and CDS gross market values dropped by 42%.³⁵ In 2010 notional amounts outstanding of CDS continued to decline.³⁶ Gross market values of all OTC contracts also fell by 14%, largely driven by a 17% decline in the market value of interest rate contracts.³⁷ Similarly, CDS market values declined sharply by 19% while the gross credit exposure dropped by 7% to US\$ 3.3 trillion, compared with a 2% increase in the first half of 2010.³⁸ Activities in OTC derivatives market remained low during the period between 2011 and 2013.³⁹

As reported by BIS, between end-June 2014 and end-December 2014, the notional amount of outstanding OTC contracts fell by 9%, from US\$ 692 trillion to US\$ 630 trillion.⁴⁰ Yet, the gross market value of outstanding derivatives contracts rose sharply in the second half of 2014: market values increased from US\$ 17 trillion to US\$ 21 trillion between end-June 2014 and end-December 2014, to their highest level since 2012.⁴¹

The negative trends continued during 2015. According to data reported by BIS, global OTC derivatives markets saw a broad-based decline in activity in the second half of 2015.⁴² The notional amount of outstanding contracts fell by 11% between end-June 2015 and end-December 2015, from US\$ 552 trillion to US\$ 493 trillion.⁴³ This fall in notional amounts was also accompanied by a significant decline in the gross market values of outstanding derivatives contracts, which decreased by 6% between end-June 2015 and end-December 2015, from US\$ 15.5 trillion to US\$ 14.5 trillion, their lowest level since 2007.⁴⁴

OTC derivatives market activity picked up in 2016: the gross market value of OTC derivatives rose from US\$ 14.5 trillion at end-2015 to US\$ 20.7 trillion at end-June 2016.⁴⁵

³⁵ Ibidem.

³⁶ See, Bank for International Settlements (BIS), *OTC derivatives market activity in the second half of 2010*, Bank for International Settlements Monetary and Economic Department (2010).

³⁷ Ibidem.

³⁸ Ibidem.

³⁹ See, Bank for International Settlements (BIS), *OTC derivatives market activity in the second half of 2011*, Bank for International Settlements Monetary and Economic Department (2011); Bank for International Settlements (BIS), *OTC derivatives market activity in the second half of 2012*, Bank for International Settlements Monetary and Economic Department (2012); Bank for International Settlements (BIS), *OTC derivatives market activity in the second half of 2013*, Bank for International Settlements Monetary and Economic Department (2013).

⁴⁰ See, Bank for International Settlements (BIS), *OTC derivatives market activity in the second half of 2014*, Bank for International Settlements Monetary and Economic Department (2014).

⁴¹ Ibidem (noting that the increase was likely driven by large moves in long-term interest rates and exchange rates).

⁴² See, Bank for International Settlements (BIS), *OTC derivatives market activity in the second half of 2015*, Bank for International Settlements Monetary and Economic Department (2015).

⁴³ Id. pp. 1-2 (noting that trade compression to eliminate redundant contracts was a key driver of this decline).

⁴⁴ Ibidem (noting that the decline was particularly concentrated in interest rate swaps).

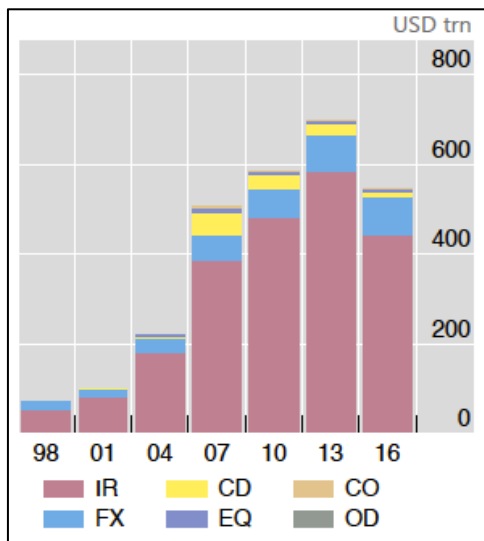
⁴⁵ See, Bank for International Settlements (BIS), *OTC derivatives statistics at end-June 2016*, Bank for International Settlements Monetary and Economic Department (2016) (noting that "outstanding positions in OTC derivatives markets are concentrated among major dealers. Of the US\$544 trillion in notional amounts outstanding at end-June 2016, US\$512 trillion (94%) was reported by dealers from the 13 countries that participate in the BIS's semiannual survey, and US\$32 trillion by dealers that participate only in the Triennial Central Bank Survey.").

1.4. OTC Derivatives Asset Classes

OTC derivatives include the following five broad classes of derivative securities: interest rate derivatives, foreign exchange (FX) derivatives, equity derivatives, commodities derivatives and credit derivatives. The breakdown of OTC derivatives by product type is illustrated in Figures 1(a) and (b): at end-June 2016, the notional amount of outstanding OTC interest rate derivatives contracts was US\$ 438 trillion (80% of the global OTC derivatives market), the notional amount of outstanding FX contracts rose to a record high of US\$ 86 trillion (c.16% of the global OTC derivatives market) and the notional principal of outstanding credit derivatives fell to US\$ 12 trillion (c. 2% of the global OTC derivatives market).⁴⁶

Figure 1. Global OTC derivatives markets, by underlying risk. Outstanding positions at end-June of the indicated year.

- **Figure 1(a).** Notional amounts outstanding.

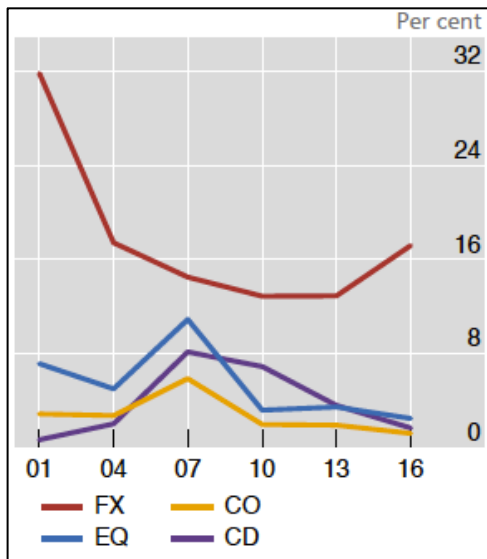


CD = credit derivatives; CO = commodity derivatives; EQ = equity-linked derivatives; FX = foreign exchange derivatives; IR = single-currency interest rate derivatives; OD = other OTC derivatives.

Source: Bank for International Settlements (BIS), *OTC derivatives statistics at end-June 2016*, Bank for International Settlements Monetary and Economic Department (2016), p. 6.

⁴⁶ Ibidem.

- **Figure 1(b)**. Gross Market Value.^(*)



CD = credit derivatives; CO = commodity derivatives; EQ = equity-linked derivatives; FX = foreign exchange derivatives.

^(*) As a percentage of the gross market value of all outstanding OTC derivatives.

Source: Bank for International Settlements (BIS), *OTC derivatives statistics at end-June 2016*, cit, p. 6.

When interpreting the above data, it is important to bear in mind two things:

- First, reference to gross notional in isolation may provide a misleading view of the relative riskiness of OTC asset classes. Hence, although interest rate derivatives contribute a significant portion of the overall notional value in the OTC derivatives market, other asset classes whose notional value is relatively lower can have an equally important or even greater (and more elusive) contribution in terms of counterparty risk. This is particularly true with respect to FX derivatives and credit derivatives. In fact, while most FX products are relatively short-dated, cross-currency swaps have longer maturity dates and are characterized by an “exchange of notional” feature that make them more dangerous in term of counterparty risk. Similarly, credit derivatives (in particular credit default swaps (CDSs)) have a very large volatility component and carry “wrong-way” risk, meaning the risk that occurs when the exposure to a counterparty is adversely correlated with the credit quality of that counterparty. These features make credit derivatives more dangerous compared to interest rate derivatives in term of counterparty risk.

- Second, the notional value is a measure of activity, but it does not necessarily capture the economic exposure or risk.⁴⁷ Contrary, the market value is a more meaningful measure because it is representative of the loss that is suffered in a default scenario and the amount that has to be funded or collateralized.⁴⁸ As illustrated in [Table 1](#) and [Figure 2](#) below, a comparison

⁴⁷ See, Robert L. McDonald, *Derivatives Markets*, Pearson Education, cit., pp. 4-5, 8;

⁴⁸ See, e.g., Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 30-31; Arshadur Rahman, *Over-the-counter (OTC) derivatives, central clearing and financial stability*, Bank of England, Quarterly Bulletin Q3, pp. 283-295 (2015), p. 285

between the actual total market value of derivatives against their total notional amount outstanding shows a significant reduction in the value of derivatives contracts.

Table 1. Comparison of the total notional outstanding and the market value of derivatives (US\$ trillion) for different classes of OTC derivatives as of December 2014.

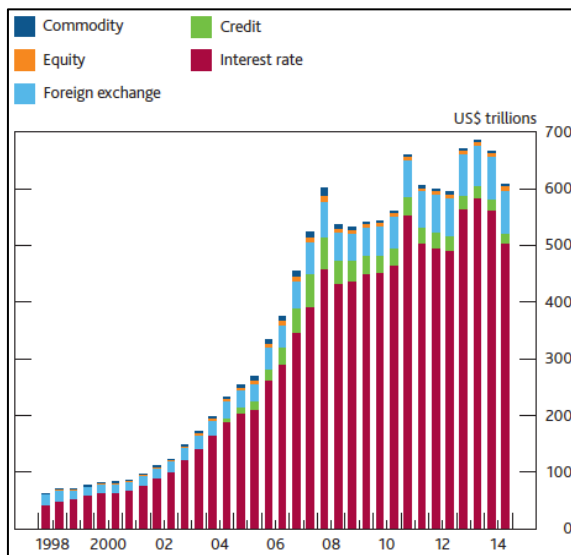
	Gross notional outstanding	Gross market value ^(*)	Ratio
Interest rate	505.5	15.6	3.1%
Foreign exchange	75.9	2.9	3.9%
Credit default swap	16.4	0.6	3.6%
Equity	7.9	0.6	7.8%
Commodity	1.9	0.3	17.0%

(*) This is calculated as the sum of the absolute value of gross positive and gross negative market values, corrected for double counting.

Source: Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, John Wiley & Sons, 3rd ed. (2015), p. 31; Bank for International Settlements (BIS).

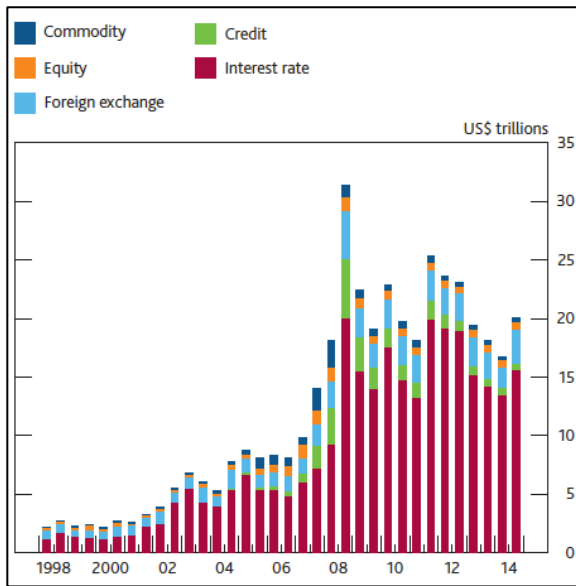
Figure 2. Size of global OTC derivatives markets.

- **Figure 2(a).** By outstanding gross notional value.



Source: Arshadur Rahman, *Over-the-counter (OTC) derivatives, central clearing and financial stability*, Bank of England, Quarterly Bulletin Q3 (2015), p. 285.

- **Figure 2(b).** By outstanding market value of contracts.



Source: Arshadur Rahman, *Over-the-counter (OTC) derivatives, central clearing and financial stability*, cit., p. 285.

1.5. Credit Derivatives

As mentioned in section 1.3 above, credit derivatives have played a major role in the process of growth and expansion of the OTC derivatives markets. In their essence, credit derivatives allow companies to transfer credit risk and to actively manage their portfolios of credit risks.⁴⁹

The sections below will analyze the features of two types of credit derivative instruments: collateral debt obligations (CDOs) and credit default swaps (CDSs).

1.5.1. Collateralized Debt Obligations (CDOs)

Collateralized debt obligations (CDOs) are OTC structured derivatives customized to match investors' specific risk tolerance(s).⁵⁰ CDOs are backed by

⁴⁹ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., pp. 547 seq. See, also, Franklin Allen and Elena Carletti, *Credit Risk Transfer and Contagion*, in *Journal of Monetary Economics*, No. 53, pp. 89–111 (2006); Jeffery D Amato & Jacob Gyntelberg, *CDS Index Tranches and the Pricing of Credit Risk Correlations*, Bank for International Settlements Quarterly Review (2005), pp. 73-88; Darrell Duffie and Kenneth J. Singleton, *Credit Risk: Pricing, Management and Measurement*, Princeton University Press (2003).

⁵⁰ For an analysis of collateral debt obligations, see, e.g., Bank for International Settlements (BIS), *CDO Rating Methodology: Some Thoughts on Model Risk and its Implications*, Bank for International Settlements Working Paper, No. 163 (2004); Xavier Burtshell, Jon Gregory and Laurent Jean Paul, *A Comparative Analysis of CDO Pricing Models*, Working Paper, BNP Paribas (2009); Citigroup, *The Structured Credit Handbook*, Global Structured Credit Research (2004); John Deacon, *Global Securitisation and CDOs*, John Wiley & Sons (2004); Nicolae Garleanu and Darrell Duffie, *Risk and Valuation of Collateralized Debt Obligations*, *Financial Analysts Journal*, Vol. 57, No. 1, pp. 41-59 (2001); Fitch Ratings, *Dynamic Funding in Cash Flow Arbitrage CDOs*, *Structure Finance, Credit Products/International*, Fitch Ratings Special Report (2003); Laurie S. Goodman, *CDO Structure and Arbitrage*, in Frank J. Fabozzi and Laurie S. Goodman (eds.), *Investing in Collateral Debt Obligations*, John Wiley & Sons (2001), pp. 79-90; Laurie S. Goodman, *Mortgage Cash Flow CBOs*, in Frank J. Fabozzi and Laurie S. Goodman (eds.), *Investing in Collateral Debt Obligations*, cit., pp. 101-114; Laurie S. Goodman, *Synthetic CDOs*, in Frank J. Fabozzi and Laurie S. Goodman (eds.), cit., pp. 141-156; Charles N. Schorin, C. and Steven Weinreich, *Introduction to Collateralized Debt Obligations*, in Frank J. Fabozzi and Laurie S. Goodman (eds.), cit., pp. 1-32; Jan Pieter Krahen and Christian Wilde, *Risk Transfer with CDOs and Systemic Risk in Banking*, Center for Financial Studies, Goethe University Working paper (2006); Morgan Stanley, *Structured Credit Insights: Instruments, Valuation and Strategies*, The Structured Credit Insights, First Edition (2005); Janet M. Tavakoli, *Structured Finance and Collateralized Debt Obligations: New Developments in Cash and Synthetic*

assets, which are held in a special purpose vehicle (SPV) and managed by an investment manager (the collateral manager). The pooled assets may include, among others, bank loans, corporate bonds or asset-backed securities (ABS) (e.g., residential mortgage backed securities (RMBS)), tranches of other CDOs (CDOs squared (CDOs²)), credit default swaps (CDSs) (synthetic CDOs) and/or a combination of the aforesaid (hybrid CDOs). The pooled assets may be either purchased from the secondary markets or transferred from the balance sheet of an originator (typically a bank). These assets are funded through issuance of several classes of debt securities or notes, the repayment of which is linked to the performance of the pooled assets.⁵¹

A CDO is typically sliced in multiple tranches,⁵² which are named according to their position within the capital structure of the CDO and the legal seniority of the securities associates with the tranches. The CDO capital structure is designed to ensure that senior tranches will receive the promised interest payments and principal repayments with priority over junior tranches, and that the senior tranches will be protected by junior tranches in the event of default.

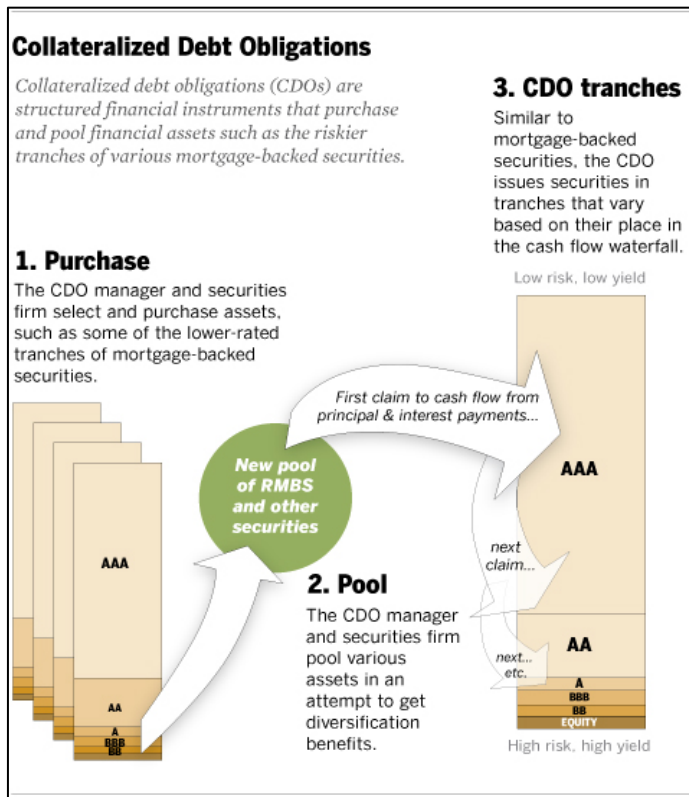
The term “CDO waterfall” is commonly used to refer to the set of covenants and other provisions that establish and regulate the priority of interest payments and principal repayments and the allocation of losses among CDO investors. Although the precise features of a CDO capital structure vary case by case, a CDO capital structure typically consists of four tranches: a senior tranche, a mezzanine tranche, a subordinate tranche and an equity tranche. Figure 3 below illustrates a typical CDO structure.

Securitization, John Wiley & Sons, 2nd ed. (2008); Diana Milanese, 'Materiality' Requirement in Credit Derivatives Fraud Litigations: The Hidden Role of the 'Short-Party,' Working Paper (December 19, 2011), pp. 1-6.

⁵¹ For a detailed analysis of securitization practices, see, e.g., Laurie S. Goodman and Frank J. Fabozzi, *Collateralized Debt Obligations: Structures and Analysis*, Wiley (2002); Gary B. Gorton, *Slapped by the Invisible Hand: The panic of 2007*, Oxford University Press (2010); Adam B. Ashcraft and Til Schuermann, *Understanding the Securitization of Subprime Mortgage Credit*, Federal Reserve Bank of New York Staff Report No. 318 (2008).

⁵² See, Robert L. McDonald, *Derivatives Markets*, cit., pp. 834 seq. On the mechanics of tranching, see, also, Peter M. De Marzo, *The Pooling and Tranching of Securities: A Model of Informed Intermediation*, Review of Financial Studies, Vol. 18, No. 1, pp. 1-35 (2005); Maciej Firla-Cuchra and Tim Jenkinson, *Security Design in the Real World: Why are Securitization Issues Tranched?*, University of Oxford Department of Economics, Economics Series Working Papers No. 225 (2005); Claire A. Hill, *Securitization: a Low-Cost Sweetener for Lemons*, Washington University Law , Vol. 74, No. 4, pp. 1061-1126 (1996); Guillaume Plantin, *Tranching*, Working Paper (2003); Steven L. Schwarcz, *Securitization Post-Enron*, Cardozo Law Review, Vol. 25, No. 5, pp. 1539-1575 (2014).

Figure 3. Typical CDO structure.

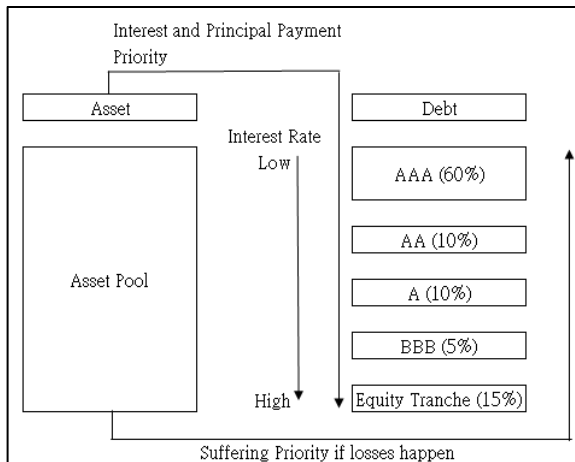


Source: U.S. Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report - Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States*, U.S. Financial Crisis Inquiry Commission, U.S. Government, Public Affairs (2011), p. 128.

As further illustrated in [Figure 4](#) below, payments from the collateral pool are usually allocated all the way down the CDO capital structure from the most senior tranche to the most junior tranche, whilst losses are allocated all the way up the CDO capital structure from the most junior tranche up to the most senior tranche.⁵³

⁵³ See, Suresh Sundaresan, *Fixed Income Markets and Their Derivatives*, Elsevier Inc. publishing as Academic Press, 3rd ed. (2009), pp. 398-399, 402-403.

Figure 4. Payment priority and loss allocation among CDO tranches.



The securities issued in a CDO are commonly divided into two categories: rated securities (including, senior and mezzanine notes) and unrated securities (including, subordinates notes and equity/first-loss piece). The rating of a note is assigned by a credit rating agency⁵⁴ and is a function of multiple variables, including the level of subordination,⁵⁵ the extent of overcollateralization (and other form of credit enhancement),⁵⁶ the priority of payment and the quality of the collateral.⁵⁷ Significantly, the equity tranche that bears the higher risk is typically unrated, whilst more senior tranches that have a greater layer of protection (subordination) are typically assigned higher ratings. This is a key feature of CDOs: through the tranche structure of CDOs it is possible to securitize a pool of assets with individual poor rating and issue notes with substantially better credit ratings, and thus achieve a more efficient risk allocation.⁵⁸ That said, it is also

⁵⁴ For an analysis of the role of rating in structured finance, see, e.g., Committee on the Global Financial System, *The Role of Ratings in Structured Finance: Issues and Implications*, Bank for International Settlements, Basel (2005); Ingo Fender and Janet Mitchel, *Structured Finance: Complexity, Risk and the Use of Rating*, Bank for International Settlements, Quarterly Review, pp. 67-79 (2005); Fitch Ratings, *Global Rating Criteria for Collateralized Debt Obligations*, Structured Finance, Credit Products, Criteria Report (2004); Fitch Ratings, *Rating CDO Asset Managers*, Structured Finance, Credit Products, Criteria Report (2005); Moody's Investors Service, *Moody's Approach to Rating Market-Value CDO*, Structure Finance, Special Report (1998); Moody's Investors Service, *Moody's Approach to Rating Synthetic CDO*, Structured Finance Rating Methodology (2003); Standard & Poor's, *CDO Spotlight: Criteria for Rating Market Value CDO Transactions* (2005).

⁵⁵ The size of the equity, subordinate and the mezzanine tranches dictates the amount of subordination available to the senior note holders.

⁵⁶ There are three types of credit enhancement: (i) originator-provided (e.g., overcollateralization, equity retention, excess spread and cash reserve), (ii) structural, (i.e., through the tranche exposure to risk and the payment priority associated to the different classes of liabilities), and (iii) third-party provided (e.g., monoline companies' insurance coverage, line of credit, liquidity support and/or interest rate hedging through a swap transaction). See, Suresh Sundaresan, *Fixed Income Markets and Their Derivatives*, cit., p. 400.

⁵⁷ As a major requirement, the pool shall be well diversified so that the correlation of default-related losses can be as low as possible. Indeed, given the described tranche structure, default correlation represents a key input in pricing CDOs and different tranches have different exposure to it: the value of the senior tranche depends negatively on default correlation while the value of the equity tranche depends positively on default correlation. Quality tests are commonly performed to ensure diversity of the assets. See, e.g., Frank J. Fabozzi, *Bond Markets, Analysis and Strategies*, Pearson Education, Inc. publishing as Prentice Hall, 7th ed. (2010), pp. 388-395; Craig Mounfield, *Synthetic CDOs – Modelling, Valuation and Risk Management*, Cambridge University Press (2009), p. 31; Suresh Sundaresan, *Fixed Income Markets and Their Derivatives*, cit., pp. 407-410; Robert L. McDonald, *Derivatives Markets*, cit., pp. 839-842; John C. Hull, *Options, Futures, and other Derivatives*, cit., pp. 561-562.

⁵⁸ For instance, institutional investors (e.g., pension funds) are required to hold only highly rated bonds, nevertheless the % of highly rated bonds has been traditionally limited. Therefore, CDOs can be used to fill the gap by creating AAA tranches even if none of the underlying assets are rated AAA.

important to understand that the total risk associated with the pool of assets is not eliminated. Hence, although more senior tranches have better rating than the underlying assets contained in the pool, more junior tranches have low rating.⁵⁹ As discussed in more details below, the concepts of risk transfer and tranching play a key role in the context of central clearing for OTC derivatives, as well.⁶⁰

Financial institutions have typically utilized CDOs to transfer assets to other investors and remove them from their balance sheet (so called, “balance sheet CDO”). In addition, investors, who are permitted to hold only investment grade bonds, have long used CDOs to create investment-grade bonds from a pool of non-investment-grade assets (so called, “arbitrage CDO”).⁶¹

1.5.1.1. Cash CDO vs. Synthetic CDO

According to the different composition of the portfolio of underlying assets, CDOs can be classified as either “cash” CDOs or “synthetic” CDOs.

Cash CDOs. Cash CDOs are a natural extension of asset-backed securitization (ABS) technology. In a cash CDO, the special purpose vehicle (SPV) holds a pool of diverse assets (e.g., bonds, loans, RMBS), which collateralizes a highly tailored, bespoke capital structure, generally characterized by long legal maturity.

The complexity of cash CDOs is largely driven by the diversity of the collateral and it increases significantly in case of multiple layers of securitization and tranching.⁶² Moreover, the timing of underlying assets’ cash-flows may create a mismatch risk between the maturity of the payments from the underlying collateral and the maturity of the payments due by the SPV to the noteholders.⁶³ Further, cash CDOs are particularly sensitive to potential interruption of the stream of cash-flows on the asset side of the structure, which may be caused by defaults or prepayments of loans.

Cash CDOs can be classified in four broad categories:

- Balance sheet CDOs, typically used for regulatory and capital relief purposes.
- Arbitrage CDOs, generally used to exploit spread mismatch between assets and liabilities within the transaction.
- Cash-flows CDOs, where cash-flows generated by the underlying pool of assets are used to satisfy principal and interest liabilities of the SPV and, in case the underlying collateral does not generate sufficient cash to meet

⁵⁹ See, Robert L. McDonald, *Derivatives Markets*, cit., p. 836.

⁶⁰ See below for further discussion on this point.

⁶¹ See, Robert L. McDonald, *Derivatives Markets*, cit., p. 837.

⁶² In case of multiple layers and tranching, two are the major risks: the risk of exposure to unwanted assets, and the “cliff risk”. See, Nomura Fixed Income Research, *CDOs-Squared Demystified*, Nomura Securities International Inc., (2005), p. 12; Craig Mounfield, *Synthetic CDOs – Modelling, Valuation and Risk Management*, cit., p.13; Adonis Antoniadis and Nikola Tarashev, *Securitisations: tranching concentrates uncertainty*, Bank for International Settlements (BIS) Quarterly Review (2014), pp. 37-53, at pp. 42-45.

⁶³ Constant monitoring is required to ensure that the SPV has enough liquidity from its long-term investments to meet its short-term liabilities. However, the mismatch risk may be mitigated by allowing the SPV to access short-term revolving credit facilities (usually made available by banks) in case of emergency liquidity.

such payment obligations, the senior tranches have priority over junior tranches.

- Market value CDOs, where the collateral manager can actively trade the underlying assets to maintain the market value of the collateral at a level more than sufficient to meet principal and interest payment obligations on CDO debt tranches.⁶⁴

Synthetic CDOs. Contrary to cash CDOs, synthetic CDOs create exposure to the risk associate with certain assets synthetically (that is, without transfer of legal title to such assets) through the use of credit default swaps (CDSs).⁶⁵

In a typical synthetic CDO structure, an SPV enters into CDS contracts that reference the performance of the identified assets. Pursuant to the terms and conditions of the CDS agreement, the SPV (the “protection seller”) sells CDS protection and agrees to make a payment to the counterparty (the “protection buyer”) upon occurrence of certain credit events experienced by the reference assets. In return, the counterparty agrees to make periodic payments to the SPV, which then uses these periodic payments to pay off synthetic CDO notes. This is an important point, as it means that a synthetic CDO cannot be created unless one party (or a series of parties) shorts the reference collateral.

Because of the described structure, the synthetic CDO principal equals the total of the notional principals underlying the CDSs. The originator has cash inflows equal to the CDS spreads and cash outflows when the reference assets in the portfolio default.⁶⁶

In a typical synthetic CDO transaction, the CDO manager identifies assets for inclusion in the portfolio and then sources CDS from counterparties willing to buy protection. Generally, the structuring bank(s) acts as initial short counterparty for a number of reasons, including the following. First, synthetic CDO vehicles with exposure to a single short counterparty may facilitate counterparty credit risk control and management. Second, the presence of a single short counterparty allows the CDO to enter a single form of swap agreement, which may help reduce transaction costs and expenses. Third, by acting as the initial short counterparty, the structuring bank can minimize the risk associated with warehousing of collateral: the structuring bank can wait until closing of a

⁶⁴ A market value structure requires the collateral pool to be market-to-market periodically. This requirement is particularly daunting when the underlying assets are illiquid and they trade at a wide bid-offer spread, or even turn out to be without any market value. See, John D. Finnerty, *The PricewaterhouseCoopers Credit Derivatives Primer*, Financial Advisory Service, PricewaterhouseCoopers (1998), p. 9.

⁶⁵ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., p. 560 (noting that “in an important market development, it was recognized that a long position in a corporate bond has a similar risk to a short position in a CDS when the reference entity in the CDS is the company issuing the bond.”); Michael S. Gibson, *Understanding the Risk of Synthetic CDOs*, Federal Reserve Board, Finance and Economics Discussion Series, Working Paper No. 36 (2004).

⁶⁶ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., p. 560. For an in-depth analysis of synthetic CDOs, see, e.g., Moorad Choudhry, *Structured Credit Products. Credit Derivatives and Synthetic Securitization*, John Wiley & Sons, 2nd ed. (2010); Fitch Ratings, *Single-Tranche Synthetic CDO*, Credit Products, Special Report (2003); Fitch Ratings, *Managed Synthetic CDOs*, Structured Finance, Credit Products, Criteria Report (2003); Michael S. Gibson, *Understanding the Risk of Synthetic CDOs*, cit.; Walter Gontarek, *Single Tranche CDOs: Mechanics and Applications*, Euromoney Institutional Investor, The Euromoney Structured Credit Products Handbook 2005/2006, Euromoney Publication (2006); Laurie S. Goodman, *Synthetic CDOs*, in Frank J. Fabozzi and Laurie S. Goodman (eds.), *Investing in Collateral Debt Obligations*, cit.; Laurie S. Goodman, *Synthetic CDOs: An Introduction*, Journal of Derivatives, Vol. 9, No. 3, pp. 60-72 (2002).

synthetic CDO transaction to write the CDS contracts, thus avoiding exposure to the collateral in the event the deal fails to close. After the closing, the initial short counterparty has the option of holding the short positions it has acquired or entering into offsetting trades in the marketplace with other counterparties.⁶⁷

In a typical synthetic CDO, the structuring bank(s) sells notes to investors for the equity, single A-tranche, double A-tranche, and a portion of the triple-A tranche (referred to as “super senior tranche”) (see, [Table 2](#)).

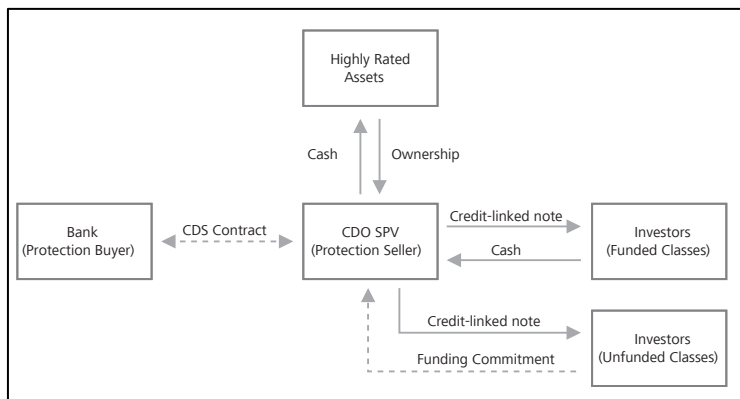
Table 2. Typical tranche exposure of a synthetic CDO.

Class	Amount (US\$MM)	% of Deal	Subordination (%)	Ratings (Moody's/S&P)
Unfunded	240.0	80.0	20.0	Aaa/AAA
Class A	13.5	4.5	15.5	Aaa/AAA
Class B	9.0	3.0	12.5	Aa2/AA
Class C	7.5	2.5	10.0	Baa2/BBB
Equity	30.0	10.0	0.0	Not Rated

Source: Thomas Schopflocher et al., *Subprime and Synthetic CDOs: Structure, Risk, and Valuation*, Nera Economic Consulting (2010), p. 15.

The proceeds raised from the sale of these lower tranches are often used to hedge the super senior tranche exposure (i.e., to pay credit default swap (CDS) protection premiums on the super senior tranche), as illustrated in [Figures 5, 6 and 7](#) below.

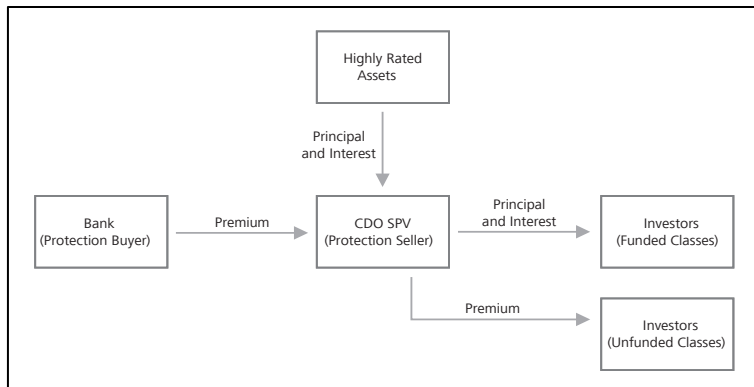
Figure 5. Initial cash flows in a synthetic CDO.



Source: Thomas Schopflocher et al., *Subprime and Synthetic CDOs: Structure, Risk, and Valuation*, Nera Economic Consulting (2010), p. 16.

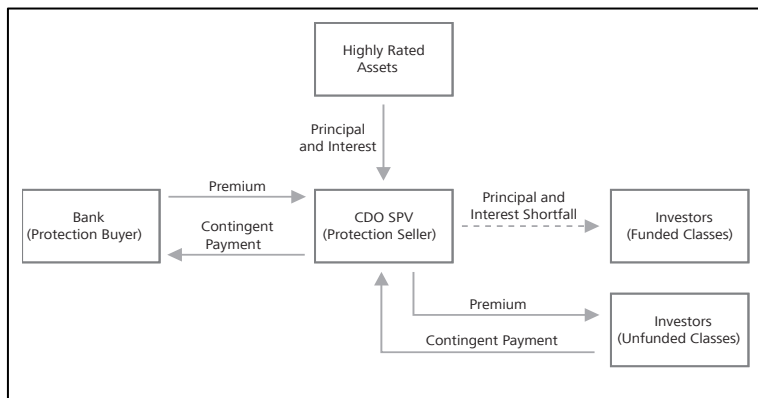
⁶⁷ Prior to the closing date in a synthetic CDO transaction, it is typical for the arranging bank to have acquired most of the collateral on behalf of the CDO. During the resulting “warehouse” period, the arranging bank typically finances the acquisition of collateral and places that collateral in a segregated account or “warehouse”. If there is a collateral manager, it is the collateral manager that directs what assets the warehouse will acquire.

Figure 6. Subsequent cash flows in a synthetic CDO assuming no credit events.



Source: Thomas Schopflocher et al., *Subprime and Synthetic CDOs: Structure, Risk, and Valuation*, cit., p. 17.

Figure 7. Subsequent cash flows in a synthetic CDO assuming credit events.



Source: Thomas Schopflocher et al., *Subprime and Synthetic CDOs: Structure, Risk, and Valuation*, cit., p. 17.

Since the only early termination mechanism for a CDS is default, synthetic CDOs do not involve prepayment risk. Contrary, the main risks associated with synthetic CDOs arise from the spread movements of the underlying CDSs, and the possibility of outright obligor default. Moreover, because the long position of a CDS underlying a synthetic CDO does not need to be fully funded, the synthetic CDO issuer does not need to raise cash and make an initial payment to complete the transaction.⁶⁸ As a result, synthetic CDOs can be structured as either funded, unfunded, or partially funded synthetic CDOs⁶⁹:

- Funded synthetic CDOs require investors to provide an up-front capital payment to fully fund the potential credit default losses within the synthetic CDO.
- Unfunded synthetic CDOs require investors to provide funding as credit losses occur. As a result, unfunded synthetic CDO expose investors to the risk of large payments particularly during periods of significant market distress, right at times when investors might be strained for cash.

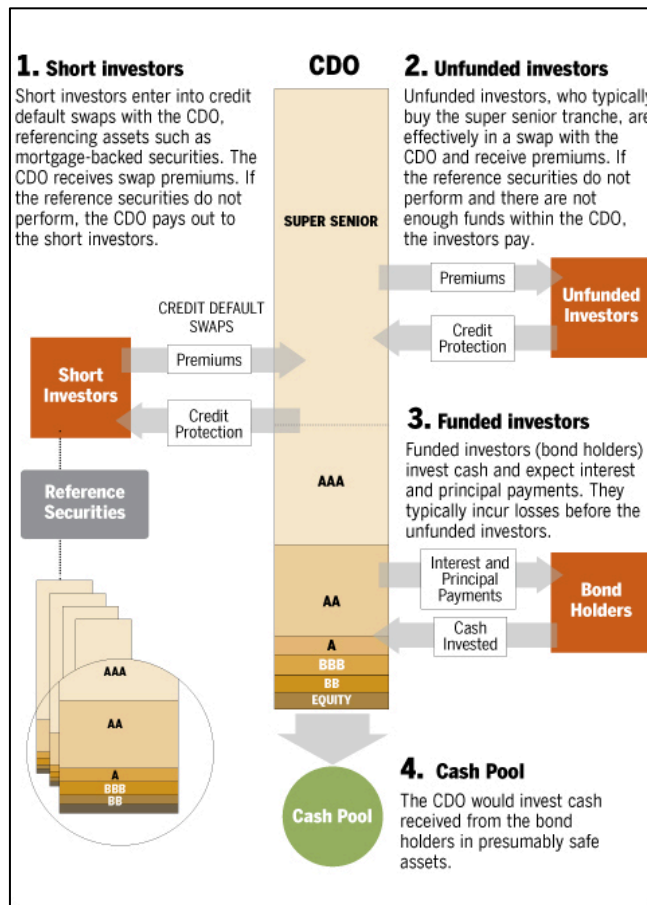
⁶⁸ See, Robert L. McDonald, *Derivatives Markets*, cit., pp. 839-840.

⁶⁹ See, Thomas Schopflocher, Elaine Buckberg, Frederick C. Dunbar, Max Egan, Arun Sen, and Carl Vogel, *Subprime and Synthetic CDOs: Structure, Risk, and Valuation*, Nera Economic Consulting (2010), pp. 15-16.

- Partially funded synthetic CDOs require investors to put up some amount less than the full notional amount of the reference portfolio (i.e., the notional amount of the protection sold by the SPV). Typically, in a partially funded CDO there is an unfunded super senior tranche, which commonly constitutes a very high percentage (c. 80%) of the entire CDO capital structure. The risk associated with this tranche is usually laid off by means of a super senior credit default swap and, as a result, the superior senior tranche usually has an effective rating higher than AAA.⁷⁰ Only the mezzanine tranches are sold with the proceeds used to purchase high-quality collateral (typically, the credit-linked note issuance amounts to 5%-15% of the notional amount of the reference portfolio). The loss level corresponding to the notes being sold is usually covered by means of a credit default swap (commonly referred to as “junior credit default swap”) entered into by the SPV and a third party protection seller. As illustrated in Figure 8 below, the sponsoring bank typically retains both the equity tranche (because the first-loss piece is too risk) and the super-senior tranches (because the superior senior tranche is generally so riskless that the return that can be offered on it would be insufficient to justify funding the purchase.)

⁷⁰ The super senior credit default swap is usually cheaper than a funded note issued by the SPV (i.e., the spread above LIBOR for a funded super senior note is greater than the premium on a super senior credit default swap exposed to the same risk, historically, around 10 bps or more). See, Douglas J. Luca, Laurie S. Goodman and Frank J. Fabozzi, *Collateralized Debt Obligations: Structures and Analysis*, John Wiley & Sons, Inc., 2nd ed. (2006), p. 250.

Figure 8. Typical structure of a partially funded synthetic CDO.



Source: U.S. Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report - Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States*, U.S. Financial Crisis Inquiry Commission, U.S. Government, Public Affairs (2011), p. 144.

1.5.1.2. CDO Squared (CDO²)

A CDO squared (CDO²) is a master CDO where each of the asset in the underlying collateral pool is itself a slave CDO: the lowest level of the CDO² structure is represented by a pool of different types of assets, including cash assets (cash CDO²), synthetic assets (synthetic CDO²) or both (hybrid CDO²); the intermediate level consists of a pool of CDOs; and at the highest level is the master CDO.⁷¹

Investors in a cash CDO² receive payments derived from the principal and interest paid by the underlying CDO tranches in the investment portfolio. Contrary, investors in a synthetic CDO² receive payments derived from the periodic premium payments that the SPV receives from the protection buyers under the CDS entered into by the SPV and the protection buyers. The payments are then allocated according to a waterfall, from the top (the super

⁷¹ See, Nomura Fixed Income Research, *CDOs-Squared Demystified*, cit., pp. 1-2; Citigroup, *Understanding CDO-Squareds*, Global Structured Credit Research (2005); Fitch Ratings, *CDO Squared: A Closer Look at Correlation*, *Global CDO*, Special Report (2004); Navroz Patel, *The Challenge of CDO Squared*, in *Risk Magazine*, Vol. 18, No. 3, (2005).

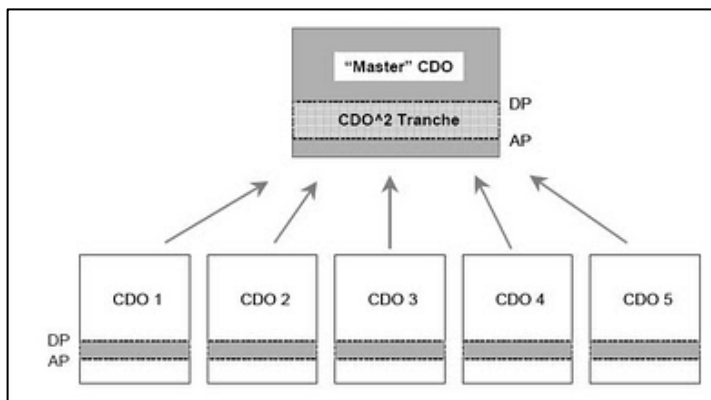
senior tranche) down to the bottom of the capital structure (the junior tranche and the equity piece).

Each slave CDO has its own attachment/detachment points. The master CDO also has a specified attachment and detachment point. As a result, when defaults occur amongst underlying obligors, the associate losses are allocated according to each slave's attachment/detachment points.⁷²

A slave tranche does not absorb losses if the total cumulative losses over time do not exceed the attachment point of such slave tranche. The losses from the slave tranches are then aggregate together to form an overall loss number. The protection seller must compensate the protection buyer when the overall loss exceeds the attachment point of the master CDO tranche. The notional amount of the master tranche is also reduced by the amount of the losses suffered by the master tranche.⁷³

As illustrated in Figure 9 below, the resulting structure, characterized by multiple levels of subordination, involves a higher degree of leverage when compared to a plain vanilla synthetic CDO, and is more vulnerable to "cliff risk" (because the default of a single highly connected obligor could have a significant impact on the master tranche).

Figure 9. Typical structure of a CDO squared (CDO²).



DP = detachment point; AP = attachment point.

Source: Nomura Fixed Income Research, *CDOs-Squared Demystified*, Nomura Securities International Inc. (2005), p. 2.

1.5.2. Credit Default Swaps (CDSs)

A credit default swap (CDS) is an OTC derivatives contract entered into by two parties - the protection buyer and the protection seller - to provide insurance against the risk of default of a reference entity or reference assets (also known as "credit event").⁷⁴

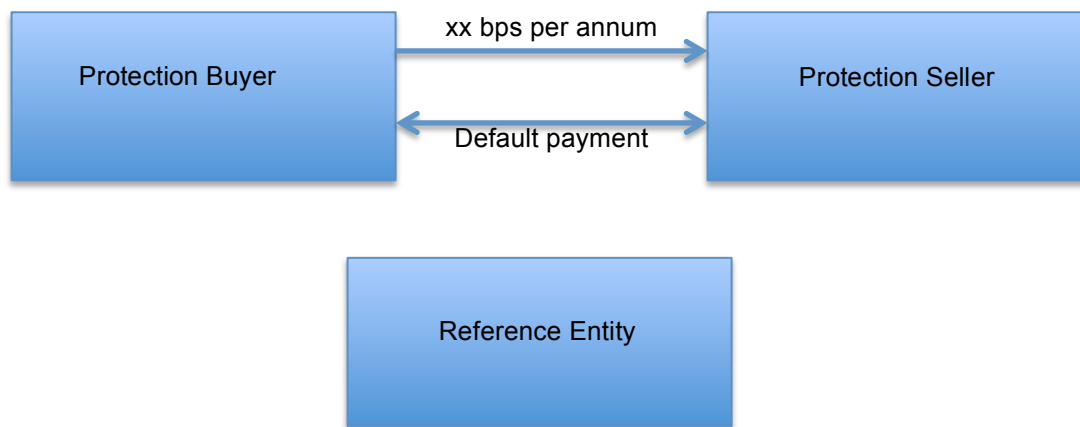
⁷² See, Robert L. McDonald, *Derivatives Markets*, cit., pp. 840-841.

⁷³ See, Nomura Fixed Income Research, *CDOs-Squared Demystified*, cit., p. 2.

⁷⁴ The types of reference assets have over time. In addition to plain bonds, the reference assets may include leverage loans (LCDS), as well as, asset-backed securities (ABSCDS). Typically the "trigger credit event" is represented by (a) bankruptcy, (b) failure to pay outstanding debt obligations, (c) repudiation or moratorium, (d) obligation acceleration, (e) obligation default and/or (f) restructuring. See, John C. Hull, *Options, Futures, and other Derivatives*, cit., pp. 458-459; Edward F. Green et al., *U.S. Regulation of the International Securities and Derivatives Markets*, Wolters Kluwer Law & Business, 10th ed. (2011), at 12.05[3].

If a certain credit event occurs, the protection seller shall pay the protection buyer a payoff. Typically, the protection buyer has the right either to be delivered the reference obligation at face value or to receive a contingent payment (often specified as the difference between the face and the market value of the reference obligation). In exchange, the protection buyer pays an annuity (referred to as “credit default spread” or “credit default swap premium”) to the protection seller⁷⁵ until the occurrence of the credit event or the maturity date of the CDS, whichever comes first. Because the protection buyer benefits if the reference asset experiences a credit event,⁷⁶ the protection buyer is said to be short in the reference obligation. Conversely, a protection seller, via the swap function, is effectively long the performance of the reference obligation.⁷⁷ (see, [Figure 10](#) below).

Figure 10. Dynamics of cash flows in a credit default swap.



Source: David Mengle, *Credit Derivatives: An Overview*, Federal Reserve Bank of Atlanta, Economic Review (2007), p. 2.

Until late 1990s, CDSs were mostly utilized by commercial banks to transfer credit risk to third parties and, thus, decrease their capital requirements. Thereafter, the use of CDSs for speculative purposes significantly increased. [Figure 11](#) below illustrates the growth in the notional amount of outstanding CDSs in billions of dollars semiannually over the period from 2001 to 2008. Ignoring the netting across contracts, the size of the CDS market increased from US\$ 631 billion outstanding in the first half of 2001 to US\$ 54.6 trillion in the first half of 2008. In particular, in the one-year period between 2006 and 2007, the growth rate for credit derivatives reached 75%.⁷⁸

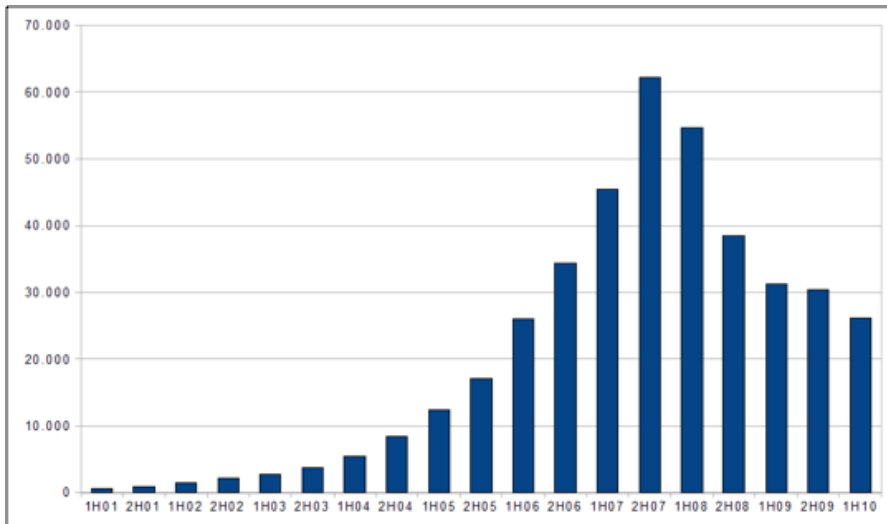
⁷⁵ CDSs are usually quoted on a spread basis. The par CDS spread is the spread (given the prevailing market conditions), which gives a fair value of the CDS at contract inception of zero. See, Suresh Sundaresan, *Fixed Income Markets and Their Derivatives*, cit., pp. 386-387.

⁷⁶ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., p. 550.

⁷⁷ See, Edward Pekarek and Christopher Lufano, *The Goldman Sachs Swaps Shop: An Examination of Synthetic Short Selling through Credit Default Swaps and Implications of Securities and Exchange Commission v. Goldman Sachs & Co., et al.*, in Greg N. Gregoriou (ed.), *Handbook of Short Selling*, Academic Press, pp. 15-64 (2011), pp. 17, 19.

⁷⁸ See, International Swaps and Derivatives Association, *ISDA Mid-Year 2007 Market Survey: Credit Derivatives at \$45.46 trillion*, International Swaps and Derivatives Association, Inc., News Release, September 26, 2007.

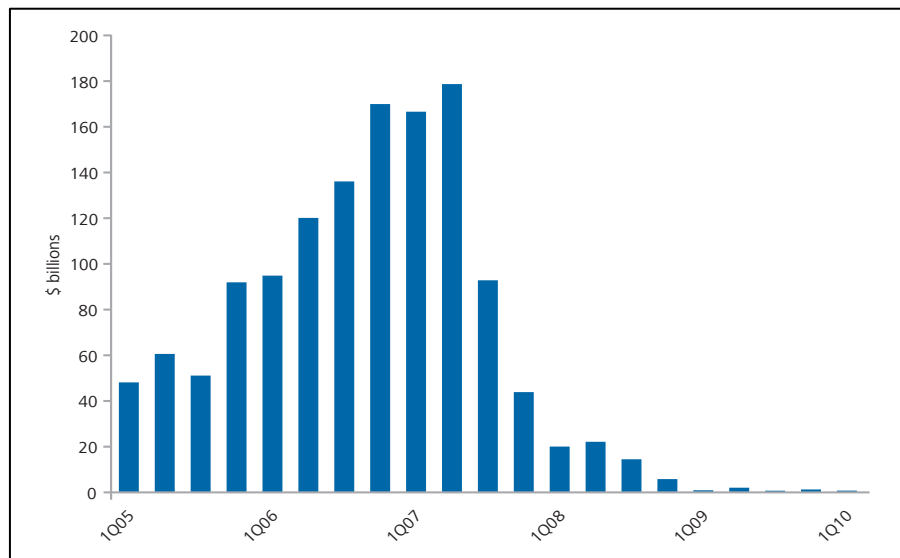
Figure 11. CDS market activity from 2001 to 2010. CDS Outstanding (Notional, US\$ Billion).



Source: ISDA.

CDS market and synthetic CDO market reciprocally greased.⁷⁹ As illustrated in Figures 12(a) and (b) below, the development of CDS allowed for the innovation in the late 1990s of synthetic CDOs, which, in turn, helped driving the growth of the CDS market. The following section will discuss this point in more detail.⁸⁰

Figure 12(a). Global CDO issuance (US\$ Billion, quarterly) from 2005 to 2010.

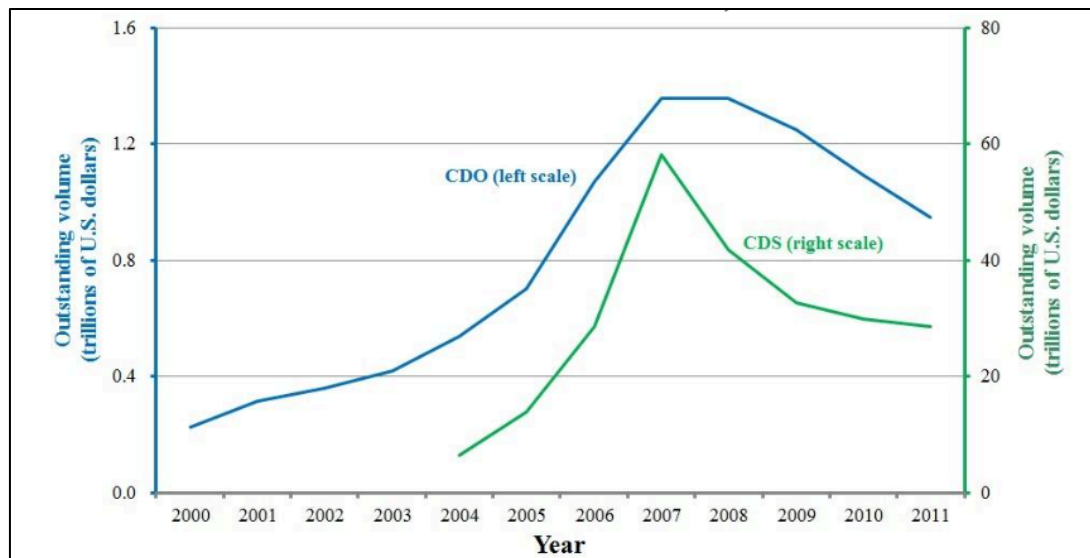


Source: Thomson Reuters, SIFMA.

⁷⁹ See, Craig Mounfield, *Synthetic CDOs – Modelling, Valuation and Risk Management*, cit., p.1.

⁸⁰ This might happen because the obligation is down-graded by a credit rating agency or if the spread of reference obligation widen in the market due to worsening credit reputation.

Figure 12(b). Growth in CDO and CDS Markets from 2000 to 2011.



CDO = collateral debt obligations; CDS = credit default swap.

Note: CDS data start in 2004.

Source: Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, Transcript of Speech at the American Economic Association/American Finance Association Joint Luncheon, San Diego, California (January 4, 2013), p. 24.

1.5.3. Single-Tranche Synthetic CDO (STCDO) and Super Senior Tranche Swap

In a naked CDS transaction, the protection buyer is not directly exposed to the referenced credit risk because it does not own the reference debt obligation.

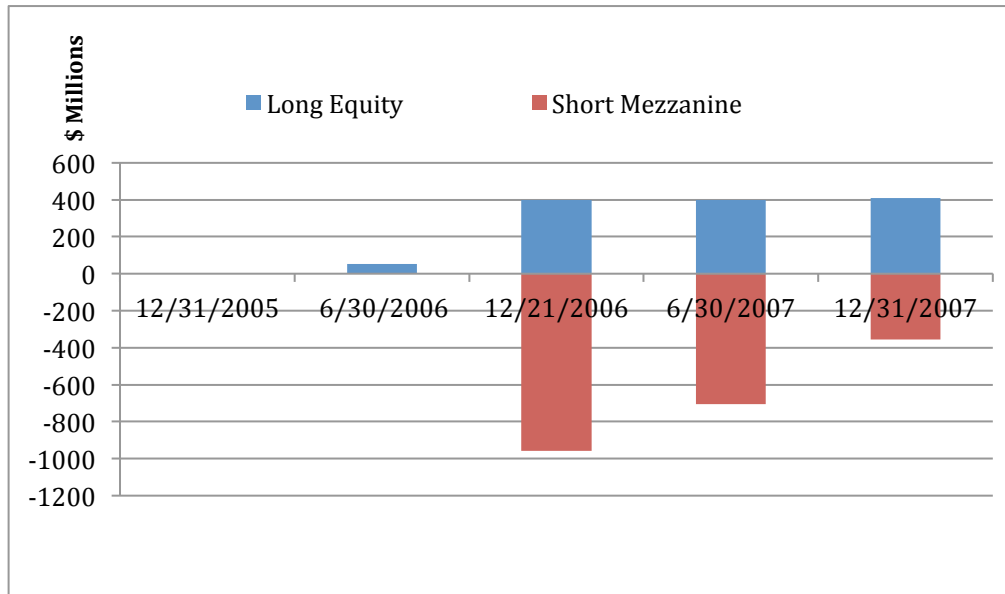
When the US housing bubble began inflating in 2006, the use of naked CDS linked to the performance of residential mortgages and residential mortgage backed securities significantly increased.⁸¹ During the period between late 2006 and early 2007, a number of hedge funds and other market participants came to believe that CDOs primarily backed by BBB-rated subprime RMBS (so-called “mezzanine CDOs”) would soon experience significant losses. In particular, these investors were persuaded that the home prices in the U.S. (mainly in the hottest California and Florida house markets) had already reached very high levels and the upward trajectory could not continue any longer. Because of this, they sought a way to profit from what they anticipated to be a remarkable downturn in the U.S. housing market.⁸² Eventually, they implemented their strategies by using single-tranche synthetic CDOs (STCDOs), which allowed

⁸¹ See, e.g., John C. Hull, *Options, Futures, and other Derivatives*, cit., pp. 184-190; Edward Pekarek and Christopher Lufano, *The Goldman Sachs Swaps Shop*, cit., pp. 20-21.

⁸² See, U.S. Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Commission Preliminary Staff Report – Credit Derivatives and Mortgage-Related Credit Derivatives*, U.S. Financial Crisis Inquiry Commission (2010), p. 4 (explaining that “during the 2000s, a significant shift occurred not only in the volume of credit derivatives but in their users. Hedge funds, which in 2000 represented only 3% of buyers and 5% of sellers of protection, grew to 28% of buyers and 32% of sellers by 2006”). Cfr., also, Kevin Kendra et al., *Quantifying All Sides of Risk - Subprime Mortgage Distress Effect on CDOs*, Derivative Fitch Ratings (2007); Meredith Jones, *Performance Persistence of Short-Biased Hedge Funds*, in Greg N. Gregoriou (ed.), *Handbook of Short Selling*, cit., pp. 403-418.

them to short position on CDO exposure, especially A-rated tranches of mezzanine CDOs originated in 2006 and considered among the most vulnerable tranches related to the residential housing market (see, [Figure 13](#)).⁸³

Figure 13. Second quartile hedge funds' average long/short positions in CDO tranches.



Note: "Second quartile" refers to the quartile of hedge funds with the second highest amount of assets under management (AUM). "Mezzanine" refers to lower-rated tranches still considered investment-grade.

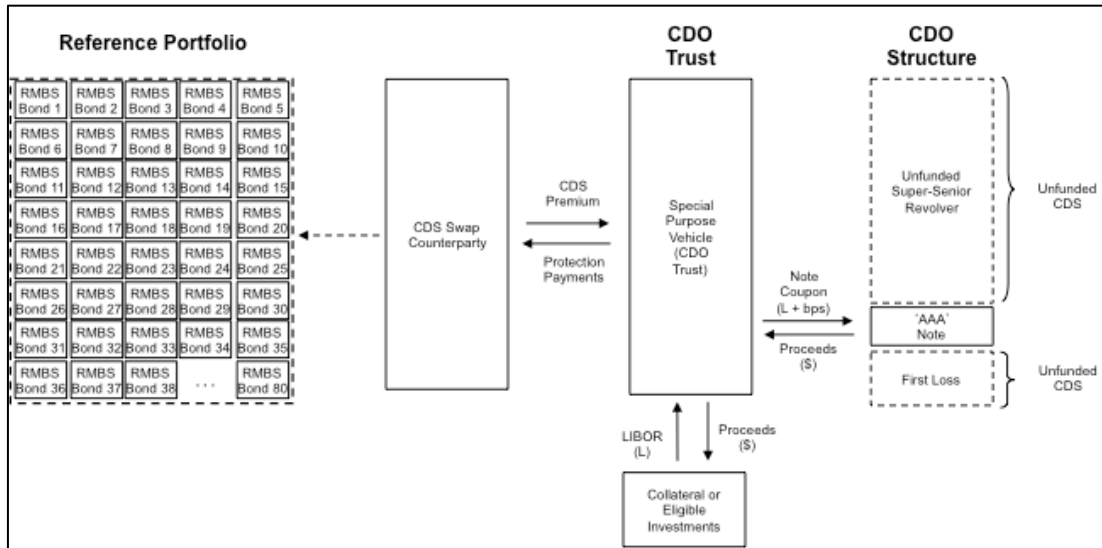
Source: U.S. Financial Crisis Inquiry Commission, *Hedge Fund Market Risk Survey*, Selected Charts from the FCIC Hedge Fund Survey, U.S. Financial Crisis Inquiry Commission (2011), slide #8.

As illustrated in [Figures 14\(a\) and \(b\)](#) below, in a typical single-tranche trading structure, a portfolio of short CDS positions is used as a reference point to define the flows of payments between two parties: one party (party A) buys protection on a specific tranche and pays a spread to counterparty (party B), which in turn pays amounts to party A equal to the correspondent losses on the reference portfolio of CDSs.⁸⁴

⁸³ See, Craig Mounfield, *Synthetic CDOs – Modelling, Valuation and Risk Management*, cit., pp. 18-19.

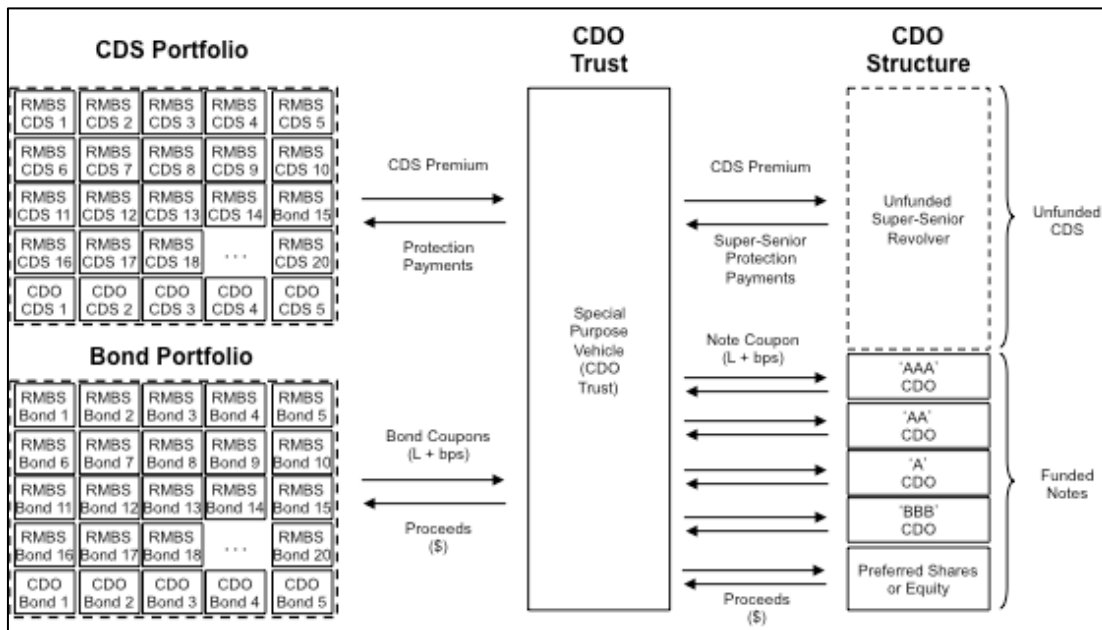
⁸⁴ It is important to recognize that, although in theory single-tranche CDOs can provide investors with greater control over the characteristics of the transaction (e.g., by enabling them to select some or all of the underlying credit and facilitating the restructuring of the instrument upon the occurrence of a credit event), in practice they bring along much greater concentration in exposure than multi-tranche CDOs. See, John C. Hull, *Options, Futures, and other Derivatives*, cit., p. 561.

Figure 14(a). Typical structure of a bespoke ST CDO.



Source: Kevin Kendra, *Quantifying All Sides of Risk - Tranche ABX and Basis Risk in Subprime RMBS Structured Portfolio*, Derivative Fitch, Fitch Ratings (2007), slide #37.

Figure 14(b). Typical structure of a hybrid ST CDO.



Source: Kevin Kendra, *Quantifying All Sides of Risk - Tranche ABX and Basis Risk in Subprime RMBS Structured Portfolio*, cit., slide #40.

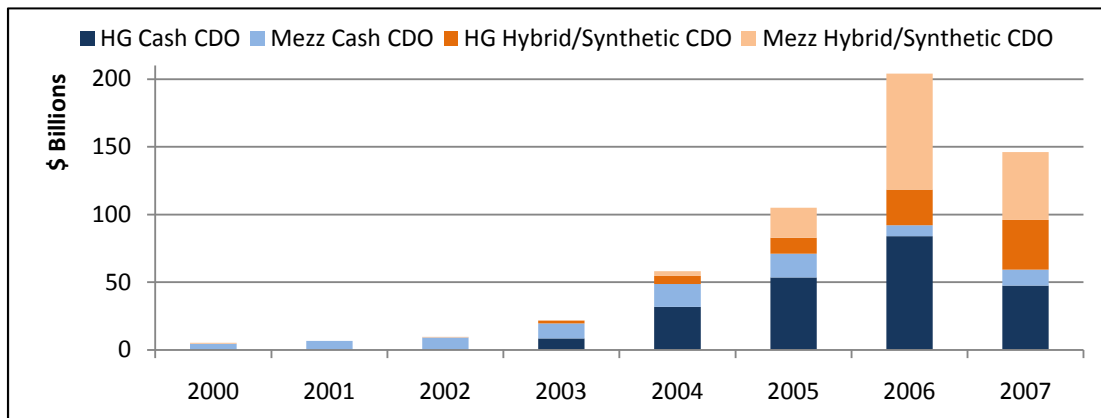
Moreover, during the years immediately preceding the GFC, certain investment banks began to hold an increasing number of subprime-backed super senior tranches of synthetic CDOs to obtain regulatory capital relief and earn related fees. These super senior tranches accounted for approximately 80% of the synthetic CDO capital structures and were generally unfunded. When the U.S. house market started deteriorating, the investment banks retaining these super

senior tranches sought a way to mitigate the increasing risk. To this purpose, they entered into super senior tranche swaps, which allowed them to transfer the risk associated with unfunded super senior tranche of synthetic CDOs to highly rated protection sellers such as American International Group, Inc. (AIG) and monoline insurers.⁸⁵

Figure 15 below shows the volumes of CDO transactions (US\$ Billions) and their subprime exposure from 2000 until 2007. As graphically illustrated:

- Hybrid and synthetic ABS CDO issuance grew from US\$ 10 billion in 2004 to US\$ 35 billion in 2005 and US\$ 117 billion in 2006, and then dropped to US\$ 99 billion in 2007.
- Hybrid and synthetic CDOs represented 17% of the ABS CDO market in 2004, and increased up to 33% in 2005, 54% in 2006 and 61% in 2007.
- Mezzanine synthetic CDOs represented 15% of total hybrid and synthetic ABS CDO issuance in 2003, and increased to 73% in 2006 before dropping to 51% in 2007.

Figure 15. ABS CDO issuance from 2000 to 2007.



Note: CDOs with 10% or more synthetic assets were considered to be hybrid or synthetic CDOs in this figure.

Source: U.S. Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Commission Preliminary Staff Report - Credit Derivatives and Mortgage-Related Credit Derivatives*, U.S. Financial Crisis Inquiry Commission (2010), p. 11; Citigroup; Moody's.

⁸⁵ For a thoughtful discussion on this point, see, U.S. Financial Crisis Inquiry Commission, *AIG/Goldman Sachs Collateral Call Timeline* (2010) (noting that by the end of 2007, the notional value of CDS protection that AIG sold on banks' super senior swaps was US\$78 billion. Around the same time, bond insurers collectively sold US\$125 billion worth of CDS protection on super seniors); Son Hugh, *AIG Plunges as Downgrades Threaten Quest for Capital*, Bloomberg.com, September 16, 2008.

CHAPTER 2: COUNTERPARTY RISK IN OTC DERIVATIVES

The debate on the effects of central clearing is focused on the ability of clearinghouses (or central counterparties (CCPs)) for OTC derivatives (OTC CCPs) to reduce the counterparty credit risk (or counterparty risk) and mitigate the systemic risk associated with the trading of OTC derivatives. The following Chapters will discuss this point in detail: Chapter 2 will analyze counterparty risk, while Chapter 3 will examine systemic risk.

In particular, Chapter 2 will begin by providing a brief conceptualization of counterparty risk. It will, then, discuss how various financial risks can combine to generate counterparty risk, and how mitigating counterparty risk may itself create financial risks. The Chapter will also examine various techniques of counterparty risk mitigation that have been traditionally utilized in the OTC derivatives market, and will explain how such counterparty risk mitigants can be thought of as a progressive evolution towards the use of central clearing of OTC derivatives.

2.1. Counterparty Risk: Combination of Financial Risks and Risk Transformation

OTC derivatives trading create a variety of financial risks. Of particular relevance among them is counterparty risk, meaning the risk that one of the parties to a trade will not fulfill its obligations under the terms of the contract and its non-performance will give rise to a loss to its counterparty.⁸⁶

Depending on the type of deal, counterparty risk can be classified in three broad categories:⁸⁷ default risk (the risk that the counterparty default and fail to meet its payment obligations), settlement risk (the risk that a counterparty involved in the settlement fails and does not meet its obligation to deliver cash or a financial instrument), and replacement risk (the risk that upon default, replacing the deal under same or similar conditions is not possible). Depending on the relevant asset classes and the complexity of the trade, OTC derivatives can carry multiple combinations of these three forms of counterparty risks.

As noted by Prof. Pirrong, in the context of OTC derivatives transactions, three main factors may affect the level of counterpart risk:⁸⁸

- First, the party's derivatives position, whose riskiness depends on the magnitude/size of that position and the risk features of the particular derivatives instrument;
- Second, the assets and liabilities on the party's balance sheet which may contribute additional risks and exposures; and

⁸⁶ See, e.g., Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 25-26 (defining counterparty risk and analyzing key differences between counterparty risk and lending risk); David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 18. For a comprehensive guide to the subject of counterparty risk, see Jon Gregory, *Counterparty Credit Risk: The New Challenge for Global Financial Markets*, John Wiley & Sons (2011); Jon Gregory, *Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets*, John Wiley & Sons, 2nd ed. (2012).

⁸⁷ In this sense, see, e.g., Nils Beier, Holger Harreis, Thomas Poppensieker, Dirk Sojka and Mario Thaten, *Getting to Grips with Counterparty Risk*, McKinsey & Company Working Papers on Risk, No. 20 (2010), p. 2.

⁸⁸ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, CATO Institute, Policy Analysis No. 665 (2010).

- Third, the party's clients' derivatives positions, whose riskiness depends on the magnitude/size of the positions, the risk characteristics of the particular instrument, and the riskiness of customers' balance sheets.⁸⁹

As further observed by Prof. Pirrong, these factors interact to each other and the correlation among them is an important determinant of the aggregate level of counterparty risk.⁹⁰

For the purpose of managing counterparty risk, defining the term structure of the counterparty's default probability is of primary importance. Unlike debt instruments,⁹¹ exposure to derivatives is uncertain and driven by the underlying market risk of the transactions.⁹²

Moreover, it is important not to lose sight of counterparty risk as an intersection of different types of financial risk.⁹³ In particular, counterparty risk can be thought of as a combination of two different risk types, market risk and credit risk:

- Market risk encompasses the risk of financial losses resulting from movements in market prices. Entering into an offsetting contract can mitigate market risk, but it may also generate counterparty risk if the counterparties to offsetting contracts differ (unless the offsetting is achieved via a CCP or trade compression).⁹⁴
- Credit risk is the risk that a party to a transaction may be unable or unwilling to make its promised payment(s) or otherwise fulfill its contractual obligations. This may be due to the default of the party or a significant deterioration of its credit quality leading to an increase in its future default probability and a significant mark-to-market (MTM) loss.

As discussed in detail in the following sections, mitigating counterparty risk may itself create other types of financial risk.⁹⁵ This could occur at least in two ways:

- First, counterparty risk mitigants, such as netting and collateralization, can give rise to operational risk and legal risk (meaning the risk that the contract will not be enforced and will not achieve from the legal perspective what it was intended to achieve, or will only do it with undue delay or at undue cost).⁹⁶

⁸⁹ Id., pp. 6-7.

⁹⁰ Ibidem.

⁹¹ See, Suresh Sundaresan, *Fixed Income Markets and Their Derivatives*, cit., p.15-16, 131-224.

⁹² See, Jon Gregory, *Counterparty Credit Risk: The New Challenge for Global Financial Markets*, cit., pp. 17-18, (noting that the market-to-market value of a derivative at a potential default date will be the net value of all future cash-flows required under the contract. This future value can be positive or negative, and is typically highly uncertain. Since the value of the contract can be positive or negative, counterparty risk is typically bilateral. This means that each counterparty in a derivatives transaction has risk to the other.)

⁹³ In this sense, see, e.g., Jon Gregory, *Counterparty Credit Risk: The New Challenge for Global Financial Markets*, cit., p.10.

⁹⁴ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 56-58; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 18.

⁹⁵ See, Jon Gregory, *Counterparty Credit Risk: The New Challenge for Global Financial Markets*, cit., p. 10.

⁹⁶ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 19-20.

- Second, counterparty risk mitigants, such as collateralization, may become a major source of funding liquidity risk (meaning the risk that a party could not meet a demand for cash because not capable or capable only at excessive costs).⁹⁷

Under certain circumstances counterparty risk may also raise to the level of systemic risk, meaning the risk of the collapse of, or severe turbulence of, the entire financial system.⁹⁸ For instance, if a OTC derivatives market participant has a very large derivatives position, its failure may cause losses that seriously impair the financial conditions of its counterparties, thus leading to a domino effect of multiple failures of many financial institutions. Moreover, the fear itself of failure of a large OTC derivatives market participant may induce its counterparties to rapidly reduce their exposures in the attempt to avoid potential losses, and this, in turn, may further accelerate the failure of that large market participant. In addition, the actual or anticipated failure of a large OTC derivatives market participant may trigger “fire sales” (when its counterparties suddenly attempt to replace their positions) or a “flight to quality” (when its counterparties seek to rapidly sell risky assets in exchange for safer assets), which, in turn, may lead to significant price volatility and price distortions in both derivative markets and underlying asset markets. This, in turn, may cause a cascade of losses threatening the failure of many other market participants.

2.2. Mitigating Counterparty Risk

Market participants have long been concerned about the danger of counterparty risk associated with their trade in OTC derivatives.⁹⁹ To address this concern, they have developed a number of counterparty risk mitigants, the use of which has been refined over time.

As correctly noted by Gregory, counterparty risk mitigants can be thought of as a form of risk transfer:¹⁰⁰ risk mitigants do not eliminate counterparty risk per se, rather they convert counterparty risk into other forms of financial risk.¹⁰¹

⁹⁷ Id., p. 19. OTC derivatives market players face two types of liquidity risk in their trading activities. A first type of liquidity risk relates to the specific derivatives product being traded or its markets (“products or market liquidity risk”) and it manifests when the participant cannot unwind, terminate, or offset a particular position at (or near) the market price because of the size of the position, inadequate market depth, or disruptions in the relevant market. The second types related to the ability of the participants to fund their trading activities and meet its payment obligations on the relevant date(s) (“funding liquidity risk”). For a more comprehensive analyze of liquidity risk, cf., e.g., Rudolf Duttweiler, *Managing Liquidity in Banks. A top Down Approach*, John Wiley & Sons (2009); Markus Brunnermeier and Lasse Heje Perdersen, *Market Liquidity and Funding Liquidity*, The Review of Financial Studies, Vol. 22, No. 6 (2009), pp. 2201-2238; Nicolae Garleanu and Lasse Heje Perdersen, *Liquidity and Risk Management*, NBER Working Paper No. w12887 (2007).

⁹⁸ See, Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit. pp. 4-5.

⁹⁹ See, Federal Reserve Bank of New York, *Statement Regarding Meeting on Credit Derivatives*, September 15, 2005. On September 15, 2005, the Federal Reserve Bank of New York hosted a meeting with representatives of major market participants and their domestic and international supervisors to discuss a range of issues regarding the processing of OTC derivatives. The meeting, subsequently, led to a series of pledges and commitments by OTC derivatives market participants. See, Federal Reserve Bank of New York, *Summary of OTC Derivatives Commitments*, July 31, 2008 (summarizing the commitments to improve management of OTC derivatives activities that market participants made to regulators as of July 31, 2008.).

¹⁰⁰ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 28-29.

¹⁰¹ Id., p. 29 (analyzing the risk transformation process of counterparty risk through the use of xVA terms. The counterparty risk mitigants analyzed above help reduce CVA but they may also lead to an increase in other xVA components. For instance, the requirement to post collateral creates MVA, the need of funding collateral creates FVA, and the optionality inherent in the collateral agreement increase CoVA. Moreover, walkaway features (especially those

Among the most common counterparty risk mitigants utilized in OTC derivatives markets are the following:¹⁰²

Netting – There are two types of netting, payment netting and close out netting.

Payment netting occurs through the life of a derivatives transaction and refers to the process by which cash-flows between parties to a trade are offset by replacing two or more gross payments due on the same day with a single net payment. This typically takes place with respect to payments between two legal entities¹⁰³ and within a specific asset class.¹⁰⁴ Thus, payment netting reduces the number of payments between OTC derivatives market participants, it decreases exposures and helps reduce settlement risk. In addition, when done within a single currency, payment netting also helps remove the risk of dispute over foreign exchange (FX) rate.¹⁰⁵

Close-out netting is a three-step process that takes place at the end of derivatives transactions: the first step is the early termination of the transactions with the defaulting counterparty; the second step is the valuation of defaulted transactions under a contract; and the third step is the calculation of close-out amount as the sum of offsetting positive and negative replacement costs. In the absence of close-out netting, when a party to a derivatives trade defaults, the maximum loss incurred by the other party equals the sum of the positive replacement values (“derivative receivables”). Contrary, if close-out netting arrangements are enforced, a series of gross claims and obligations can be replaced by a single net claim or obligation. As a result, with close-out netting the sum of the replacement values of the contracts with negative values owed by the non-defaulting party to the defaulting party (the “derivative payables”) can be used to offset the derivative receivables. This is intended to give parties to the trade relative certainty regarding their claims and obligations in the event of default of a party to the trade, as well as to prevent the bankruptcy representative of the defaulting party from cherry picking, by seeking to enforce performance on contracts that are most favorable to the defaulting party and reneging on those that are less favorable.

As discussed in detail below, netting can also benefit the derivatives market as a whole. In particular, netting can promote efficiency and enhance liquidity by

linked to downgrade triggers) also create MVA. Finally, counterparty risk hedging creates additional capital requirements that increase KVA, whilst reducing KVA may lead to greater CVA volatility).

¹⁰² See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, Global Financial Stability Report (GFSR) (2010), p. 3.

¹⁰³ Netting may also be structured among three or more parties. See, for instance, UBS vs. Lehman case, discussed in Ian Cuillerier and Yvette Valdez, *Lehman Bankruptcy Court Denies Contractual Right to Triangular Setoff*, *The Journal on the Law of Investment & Risk Management Products*, Vol. 32, No. 2 (2012).

¹⁰⁴ In particular, the ISDA Master Agreements facilitate cross-product bilateral netting: when two parties have bilateral credit exposures across several derivatives products that are covered by a single ISDA Master Agreement, netting provisions thereunder allow the parties to bilaterally net their payment obligations across all their asset classes and transactions.

¹⁰⁵ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 32-33.

allowing market participants to trade frequently and only consider their net exposure.¹⁰⁶

Notwithstanding the benefits described above, netting may also create certain disadvantages. First, netting may increase the losses of other creditors in a default scenario.¹⁰⁷ Second, netting may create distorted *ex ante* incentives by inducing parties to a derivatives trade to reduce due diligence efforts. Third, netting may create legal risk, meaning the risk that netting agreements would not be legally enforced in a particular jurisdiction. The ability of a party to enforce its right to offset against the other party depends on multiple legal factors, including the law(s) governing the derivatives transactions entered into by the parties and the bankruptcy law governing the defaulted party.¹⁰⁸ In practice, most OTC derivative contracts are covered by bilateral master agreements, which combine all exposures between two parties to a derivative trade and allow close-out netting when one of the counterparties defaults. In particular, OTC derivative transactions are most frequently documented through an ISDA master agreement, which specify a set of commonly used definitions and contract terms. Except for certain selected termination events, upon the occurrence of an event of default or termination event (each as defined in the ISDA Master Agreement) in respect of a party to an ISDA Master Agreement, the other party is entitled to terminate all transactions under the relevant ISDA Master Agreement. Where several transactions are terminated at the same time, the ISDA Master Agreement provides for close-out netting to apply. At the time of writing, ISDA has opinions for 55 jurisdictions that close out netting would be respected, including all major OTC derivatives market venues.¹⁰⁹

Collateral – Counterparty risk can be further reduced by requiring the parties to a trade to post collateral against outstanding exposures, which typically consist of cash and/or highly-rated liquid securities.¹¹⁰ Collateral agreements set forth the terms and conditions for the posting, use, and segregation of collateral against market-to-market (MTM) losses. The collateral deposited is designed to ensure that obligations will be honored: in the event of default of the party to the

¹⁰⁶ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 37 (noting that the gross risk exposure is still relevant for two reasons. First, operational risks are dependent on the volume of trades and gross payments. Second, there is no guarantee that the value of a portfolio in close out depends only on its net risk. Hence it may be the case that at the time of closing out a large portfolio no bids on the entire portfolio are available, and thus the portfolio would need to be divided it into multiple parts.).

¹⁰⁷ See, Mark J. Roe, *The Derivatives Market's Payment Priorities as Financial Crisis Accelerator*, *Stanford Law Review*, Vol. 63, No. 3 (2011).

¹⁰⁸ *Id.*, p. 33. See, also, International Swaps and Derivatives Association (ISDA), *Market Review of OTC Derivative Bilateral Collateralization Practices*, ISDA Analysis Paper (2010), p. 10 and accompanying notes.

¹⁰⁹ See, International Swaps and Derivatives Association (ISDA), *Legal & Documentation - Opinions*, available at www2.isda.org/functional-areas/legal-and-documentation/opinions/ (Last visited December 2016); International Swaps and Derivatives Association (ISDA), *The legal enforceability of the close-out netting provisions of the ISDA Master Agreement and their consequences for netting on financial statements*, International Swaps and Derivatives Association (2010) (explaining that [ISDA has] performed a survey of industry participants who are very active in the derivatives markets. This reveals no instances where firms have found that courts do not respect the netting provisions of a master netting agreement where ISDA has a relevant opinion.).

¹¹⁰ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 37-54; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., Chapter 6.

OTC derivatives trade that has posted the collateral, the collateral can be sold and the proceeds from its sale can be used to offset losses on the portfolio.¹¹¹

Furthermore, at the time the parties enter into a derivatives trade, they may agree to make an additional upfront payment to cover potential future exposure and residual risks (e.g., the risk of delays between the time new collateral requirements are calculated and then called and settled).¹¹²

As reported by ISDA, in the very early stages of its development, the OTC derivative market operated on a largely uncollateralized basis.¹¹³ As illustrated in Figure 16 below, the number of collateral arrangements as a proportion of the total OTC derivatives market and their relative features have evolved significantly as the OTC derivatives market itself has grown.¹¹⁴

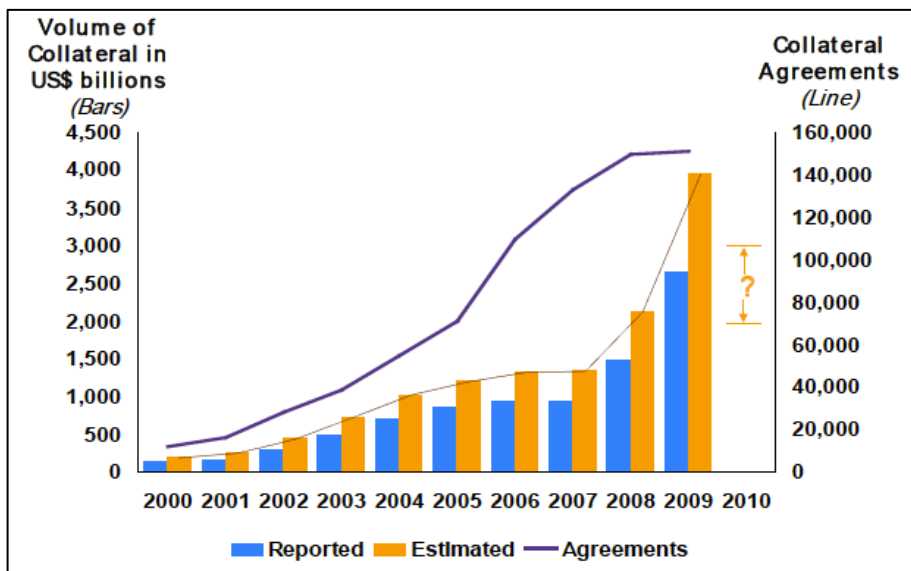
¹¹¹ See, John C. Hull, *Options, Futures, and other Derivatives*, cit., Chapter 23.

¹¹² See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., pp. 4-6 (noting that independent amounts are usually posted at the initiation of a contract only by end-users to dealers, which include investment funds, hedge funds, and other non-dealers. Hence, "market practice is that dealers do not typically post independent amounts to each other. Dealers also do not typically ask for collateral from some types of customers, namely sovereign and quasi-sovereign entities and some corporate clients. Given these practices, exactly how much collateral is currently posted against OTC derivative positions is not known with certainty."); See, International Swaps and Derivatives Association (ISDA), *Market Review of OTC Derivative Bilateral Collateralization Practices*, cit., p. 18 (noting that in 2009 over three-quarters (78%) of all OTC derivatives of any underlying type are collateralized, 16% of which are unilaterally collateralized); European Central Bank (ECB), *Credit Default Swaps and Counterparty Risk*, European Central Bank (2009).

¹¹³ See, International Swaps and Derivatives Association (ISDA), *ISDA Margin Surveys*, available at <https://www2.isda.org/functional-areas/research/surveys/margin-surveys/> (Last visited December 2016). ISDA Margin Surveys are conducted annually to examine the state of collateral use and management among derivatives dealers and end-users.

¹¹⁴ See, International Swaps and Derivatives Association (ISDA), *Market Review of OTC Derivative Bilateral Collateralization Practices*, cit., p. 32. See, also, Manmohan Singh and James Aitken, *Counterparty Risk, Impact on Collateral Flows and Role for Central Counterparties*, International Monetary Fund Working Paper No. 173 (2009); Miguel Segoviano and Manmohan Singh, *Counterparty Risk in the Over-The-Counter Derivatives Market*, International Monetary Fund Working Paper No. 258 (2008); Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act,"* cit., p. 6.

Figure 16. Collateral in circulation (bars and dotted line, LHS) and collateral agreements in use (solid line, RHS) in the bilateral OTC derivatives market from 2000 to 2009.



Source: International Swaps and Derivatives Association (ISDA), *Market Review of OTC Derivative Bilateral Collateralization Practices*, International Swaps and Derivatives Association Analysis Paper (2010), p. 32.

Notwithstanding the benefits in term of mitigation of counterparty risk, the use of collateral also raises a number of issues, including the following:

- First, collateralization may create operational and procedures complexities and legal risk.
- Second, the use of collateral can create dangerous trade-offs between counterparty risk and liquidity risk. For instance, while frequent cash collateral calls (e.g., daily or even intra-daily collateral class) help reduce exposure at default, they also require the parties to the trade to have prompt availability of cash or other liquid assets to timely meet their collateral call obligations.¹¹⁵ Moreover, the right to reuse assets posted as collateral, whether through re-hypothecation or title transfer rights, can create additional friction between counterparty risk and liquidity risk.¹¹⁶ eliminating reuse rights would help decrease counterparty risk, but it would do so at the cost of increasing liquidity needs for the parties to the trade.¹¹⁷ Furthermore, in stressed and illiquid market conditions, the requirement of collateral may significantly increase funding costs for the interested party and collateral itself may experience significant price and FX volatility.

¹¹⁵ Failure of a party to post the required collateral is an event of default, which is commonly referred to as “credit support default.”

¹¹⁶ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 80-82.

¹¹⁷ See, e.g., International Swaps and Derivatives Association (ISDA), *Best Practices for the OTC Derivatives Collateral Process*, International Swaps and Derivatives Association (2010); Manmohan Singh and James Aitken, *The (sizable) Role of Rehypothecation in the Shadow Banking System*, International Monetary Fund Working Paper No. 172 (2010); Manmohan Singh, *Velocity of Pledged Collateral: Analysis and Implications*, International Monetary Fund Working Paper No. 256 (2011).

- Third, collateral can increase the losses of other creditors in a default scenario.¹¹⁸
- Fourth, parties to a derivatives trade may utilize diverse and complex risk management systems, data sources and valuation models. As a result, disputes may arise between them on the valuation of the underlying derivatives positions and the amount of collateral to be posted.¹¹⁹

Walkaways Features – Parties to OTC derivatives transactions typically specify which events constitute an event of default in the master agreement governing their transactions. Events of default generally include failure to make due payments or delivery, failure to comply with or perform under other contracts, agreements or obligations, failure to post the required collateral, or insolvency. In addition to events of default, the parties may agree on specific events that trigger acceleration, reset or early termination of all transactions or a particular subset of transactions. These clauses can help mitigate counterparty risk by causing periodical resetting of MTM values or by terminating transactions early. However, these provisions can also generate operational risk and liquidity risk. Moreover, if the parties agree on certain early termination events (for instance a downgrade), the occurrence of any of such events may have the unintended consequence of exacerbating the conditions of the distressed party.¹²⁰

Hedging – The development of the markets in credit derivatives has allowed the hedging of counterparty and credit risks.¹²¹ Hedging products include CDSs, credit-linked structured notes and options on credit spreads. Although, the use of these products improves the management of counterparty and credit risk, it may also create financial risks, including operational risk and legal risk. Moreover, unless a hedge is executed with the same counterparty as the original transaction being hedged, the hedge simply creates a second credit exposure for the hedging party.

Trade Compression - Trade compression is a mechanism whereby redundant contracts that result from multiple bilateral trades are eliminated.¹²² Although trade compression does not affect the market risk profile, it does help reduce counterparty risk by reducing the overall exposure to multiple counterparties.¹²³

¹¹⁸ See, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 42-44.

¹¹⁹ See, International Swaps and Derivatives Association (ISDA), *Market Review of OTC Derivative Bilateral Collateralization Practices*, cit.

¹²⁰ See, e.g., Jon Gregory, *Counterparty Credit Risk: The New Challenge for Global Financial Markets*, cit., pp. 28-29; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 61-62.

¹²¹ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 41-42.

¹²² See, Darrell Duffie, Ada Li and Theo Lubke, Policy Perspectives on OTC Derivatives Market Infrastructure, cit., p. 25 Figure E; International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., p. 6.

¹²³ See, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 53-54; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 66-71; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 56-60 (noting that compression, also, help reduce "operational costs by reducing the number of transactions; regulatory capital for banks not using advanced models where capital is partially driven by gross notional ...; regulatory capital for banks with advanced model approval where the margin period of risk may otherwise need to be increased; other components such as the leverage ratio since Basel III bases this partially on

Counterparty Risk Intermediation – Counterparty risk can be mitigated through the use of entities that act as intermediaries and/or provide insurance and guarantees in relation to certain default events. Various forms of counterparty risk intermediation are discussed in more details in section 2.3 below.

2.3. Counterparty Risk Intermediation

Over the last two decades, the OTC derivatives market has developed and implemented a number of mechanisms of counterparty risk intermediation, thereby a third party intermediates and/or guarantees the performance of one or both parties to an OTC derivatives trade (see, Figure 17 below).¹²⁴

Figure 17. Basic concept of counterparty risk intermediation between two bilateral counterparties, C1 and C2.



Source: Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 185.

As noted by Gregory, central to the various mechanisms of counterparty risk intermediation is the idea of “default remote entity:” the third party intermediary / guarantor must be of enhanced credit quality compared to the guaranteed party and its default must be a very unlikely event.¹²⁵ As further observed by Gregory, the use of counterparty risk intermediation mechanisms in the OTC derivatives market can be thought of as a progression towards the use of central clearing for OTC derivatives. This is illustrated in Figure 18 below.

gross notional; and legal uncertainty around netting since offsetting transactions are replaced with a net equivalent transaction.”).

¹²⁴ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 185-186.

¹²⁵ Id., p. 186 (noting that the GFC has revealed how the idea of “default remoteness” was badly founded and arguing that “the default-remoteness and the related concept of too-big-to-fail have proved to be the Achilles heel of financial markets with respect to the counterparty risk.”).

Figure 18. Development of counterparty risk intermediation methods.



Source: Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 186.

The following sub-section will discuss various counterparty risk intermediation mechanisms in detail. The analysis of their relative advantages and disadvantages will be instrumental to, and will provide the basis for, a later discussion on OTC CCPs.¹²⁶

2.3.1. Special Purpose Vehicles (SPVs)

A special purpose vehicle (SPV) (or special purpose entity (SPE)) is an off-balance sheet bankruptcy remote entity typically created by a sponsor or originator to obtain funding, transfer risk and perform specific investment activities. In its essence, an SPV can be viewed as a method of isolating a party from counterparty risk by disaggregating the risk of an underlying pool of assets that are transferred from the originating entity to the SPV and, then, reallocated to a group of investors willing to take on that risk.¹²⁷ The SPV typically owns the underlying pool of assets and issues securities to investors backed by those assets.

The isolation of the SPV is of primary importance for its investors. In particular, the SPV is structured to be bankruptcy remote from the originating entity, so that the rights of the investors to the promised cash flows are not affected by the risks involved in the business activities of the originating entity and are not compromised by its financial distress or insolvency. In so doing, a SPV essentially shifts priorities among creditors and gives a counterparty preferential treatment to its investors.¹²⁸

SPVs came under increased regulatory and industry scrutiny during the GFC, when a number of drawbacks associated with the use of SPVs were unveiled, including the following:¹²⁹

¹²⁶ Id., p. 185.

¹²⁷ See, e.g., Gary B. Gorton and Nicholas Souleles, *Special Purpose Vehicles and Securitization*, NBER Working Paper No. 11190 (2005); Allen N. Berger, Phillip Molyneux, John O. S. Wilson (eds.), *The Oxford Handbook of Banking*, Oxford University Press (2012), pp. 210 seq.

¹²⁸ For an interesting analysis of the use of SPVs, see, e.g., Vinod Kothari, *Securitization: The Financial Instrument of the Future*, John Wiley & Sons (2006); Frank J. Fabozzi and Vinod Kothari, *Introduction to Securitization*, John Wiley & Sons (2008); Steven L. Schwarcz, *What is Securitization? And for What Purpose?* Southern California Law Review, Vol. 85, No. 5, pp. 1283-1299 (2012).

¹²⁹ For a thoughtful analysis of the role of SPVs and structured products in the context of the GFC, see, e.g., Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, Minnesota Law Review, Vol.

- First, in the context of the GFC it became increasingly clear that the favorable bankruptcy treatment noted above can only be achieved at the cost of imposing a less favorable treatment on other market participants. This, in turn, means that while SPVs may help reduce risk in one part of the financial system, they can also increase risks in others.
- Second, the GFC revealed how the complexity of SPVs and their assets can make it extremely difficult to monitor the level of risk involved and track its allocation.
- Third, in the context of the GFC it also became clear that SPVs can pose significant challenges by transforming counterparty risk into legal risk. In particular, upon occurrence of an event of default, there exists the danger that the beneficial treatment described above will not be upheld by a bankruptcy court, which instead will consolidate the assets of the SPV with those of the originator. In this scenario, the SPV would be treated as being substantially the same entity as the originator, the assets transferred to the SPV would be treated like those of the originator, and the bankruptcy isolation of the SPV would become irrelevant.¹³⁰
- Finally, the GFC revealed how the underperformance or default of a sponsored or affiliated SPV can negatively impact the perceived credit quality of the originating entity and can negatively affect its ability to access capital and liquidity resources. This, in turn, creates strong incentives for a sponsoring entity not to abandon the SPV in times of difficulty.

2.3.2. Guarantees

A guarantee is a form of counterparty risk intermediation, whereby a third party guarantees the performance by a party to a derivatives trade. Thus, guarantees help reduce expected losses from a transaction by lowering the probability of default, the severity of losses, or both. Common examples of guarantees include intragroup guarantees and letters of credit from a bank.

For a guarantee to be effective as counterparty risk mitigant, the guarantor must have a credit standing higher than the credit standing of the original counterparty. Moreover, key to a guarantee structure is the concept of “double default,” whereby both the original derivative counterparty and the guarantor must fail for a loss to occur.¹³¹

93, No. 2, pp. 373-406 (2008); Steven L. Schwarcz, *Keynote Address: Understanding the Subprime Financial Crisis*, *South Carolina Law Review*, Vol. 60, No. 3, pp. 549-572 (2009); Steven L. Schwarcz, *The Future of Securitization*, *Connecticut Law Review*, Vol. 41, No. 4, pp. 1313-1325 (2009); Steven L. Schwarcz, *The Case for a Market Liquidity Provider of Last Resort*, *Duke Law School Public Law & Legal Theory Paper No. 234* (2009).

¹³⁰ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 188 (noting that legal documentation often evolves through experience, and the enforceability of the legal structure of SPVs was not tested for many years during the years preceding the GFC. When it was tested in the case of Lehman Brothers, there were problems).

¹³¹ See, Global Derivatives Study Group, *Derivatives: Practices & Principles – Appendix III: Survey of Industry Practice*, The Group of Thirty, Washington, D.C. (1994); Global Derivatives Study Group, *Derivatives: Practices & Principles – Follow-Up Surveys of Industry Practice*, The Group of Thirty, Washington, D.C. (1994).

2.3.3. Derivative Product Companies (DPCs)

Derivatives product companies (DPCs) emerged around 1991 to address the need of counterparty risk mitigation in derivatives contracts.¹³²

Among the most notable examples of DPCs are Merrill Lynch Derivative Products (MLDP), Salomon Swapco, Morgan Stanley Derivative Products (MSDP), Lehman Brothers Financial Products (LBFP) and Paribas Derives Garanties (PDG).

DPCs build on the mechanisms of counterparty risk intermediation discussed in the previous sections and add to them capital and operation rules.¹³³ In particular, DPCs are triple-A rating entities wholly owned subsidiaries of financial services companies. Their triple-A rating (which substantially exceed the rating of their parent companies) is generally derived from a combination of capital, financial and credit support, risk management, and activity restrictions. Similar to SPVs described above, DPCs are structured as bankruptcy-remote entities from the parent company. This feature provides external counterparties with a degree of protection against the failure of a DPC's parent company. However, the same feature also poses risks, including legal risk and operating risk.¹³⁴

DPCs manage two basic types of risk: market risk and counterparty risk. With respect to the former, DPCs hedge market risk by entering into "mirror transactions" with their parent financial service companies every time they enter into a transaction with a counterparty. With respect to the latter, DPCs typically manage credit risk through the use of quantitative models, by imposing restrictions on counterparty credit quality and by requiring MTM and collateral posting.

In addition, DPCs provide an orderly workout process in the event of default. DPCs identify what events would trigger their own failure (e.g., rating downgrade of parent) and define the terms and conditions of the resulting workout process. If the parent entity were to default, then the DPC would either pass to another well-capitalized institution or be terminated in an orderly fashion.

As noted by Gregory,¹³⁵ the demand for DPCs started diminishing in late 1990s, due to the increased use of margin and the existence of alternative triple-A structures. During the GFC, the triple-A ratings of DPCs lost any credibility and the lack of autonomy from their parent companies was unveiled. This led to an unprecedented wave of DPCs' ratings withdraws, which further accelerated their decline.¹³⁶

¹³² See, e.g., Eli M. Remolona, William Bassett, and In Sun Geoum, *Risk Management by Structured Derivative Product Companies*, Federal Reserve Bank of New York Economic Policy Review, Vol. 2, No. 1 (1996).

¹³³ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 186.

¹³⁴ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 22-23.

¹³⁵ *Id.*, p. 23.

¹³⁶ See, e.g., Ben S. Bernanke (then Chairman of the Board of Governors of the Federal Reserve System), *Financial Regulation and Financial Stability*, Speech at the Federal Deposit Insurance Corporation's Forum on Mortgage Lending for Low and Moderate Income Households, Arlington, Virginia (July 8, 2008) (discussing the failure of Bear Sterns and its implications). DPC structures may reappear depending on the market and regulatory environment. In this sense, see,

2.3.4. Monoline Insurance Companies

Monoline insurance companies (monolines) are triple-A ratings entities that have traditionally offered their services in the segment of US municipal and local authority bonds. They have capital requirements driven by the possible losses on the structures and dynamically related to their portfolio of assets. Most significantly, monolines do not typically post collateral against their transactions.

Beginning in late 1990s, monolines started expand their activities into the CDS market and began selling CDS protection across a wide range of structured credit products (including mortgage backed securities and CDOs) with the aim of achieving diversification and better returns.

During the GFC, monolines experienced major problems and MTM losses and downgrades on the products that they insured brought their financial strength into question: many monoline insurers shed almost 80% of their value, and eventually lost their AAA rating.¹³⁷ The downgrade of large monoline insurers and the general uncertainty regarding their solvency led to more downgrades of the products that monoline insurers had guaranteed and generated significant spillover effects to money markets funds, bond funds, and banks that found themselves heavily exposed to monolines due to massive increase in the value of the protection they had purchased.¹³⁸

2.3.5. Credit Derivatives Products Companies (CDPCs)

Credit derivatives products companies (CDPCs) are structured finance entities set up to invest in credit derivatives products on a leveraged basis.¹³⁹ CDPCs were first conceptualized in 1999 and evolved as a result of a combination of key features of DPCs and monoline insurance companies described above.

CDPCs differ from DPCs in three main ways.¹⁴⁰ First, contrary to CDPCs that have developed as stand-alone companies, DPCs are mostly subsidiaries of banks and other large financial institutions and act primarily as a conduit for entering into transactions on behalf of their parent companies. Second, unlike a traditional DPC, a CDPC aims at making profit from selling synthetic credit protection on corporate, sovereign and asset-backed securities in single-name or portfolio form as CDS contracts. Third, unlike a traditional DPC, a CDPC does

e.g., Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 190; Lukas Becker, *Return of the DPCs*, Risk.net (December 6, 2012).

¹³⁷ For a thoughtful analysis of the impact of the GFC on the two largest monoline insurers – MBIA and Ambac – see, Dimitris N. Chorafas, *Financial Boom and Gloom: The Credit and Banking Crisis of 2007-2009 and Beyond*, Palgrave Macmillan (2009), pp. 26-30.

¹³⁸ For an in-depth discussion of the spillover effects associated with monoline insurers' downgrades, see, e.g., U.S. Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report - Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States*, U.S. Financial Crisis Inquiry Commission, U.S. Government, Public Affairs (2011), pp. 277 ss; Rainer Masera, *Financial Turbulence and the Capital Standard Paradigm: A Sequel*, in Rainer Masera (ed.), Giancarlo Mazzoni, Elisa Coletti and Patrizio Armeni, *The Great Financial Crisis, Economics, Regulation and Risk*, Bancaria Editrice, pp. 43-82 (2009), pp. 71-76; Dimitris N. Chorafas, *Financial Boom and Gloom: The Credit and Banking Crisis of 2007-2009 and Beyond*, cit., pp. 21-33; Jon Gregory, *A Free Lunch and the Credit Crunch*, Risk Magazine (2008).

¹³⁹ See, e.g., Brian P. Lancaster, Glenn M. Schultz and Frank J. Fabozzi, *Structured Products and Related Credit Derivatives: A Comprehensive Guide for Investors*, John Wiley & Sons (2008), pp. 13-14; Vinod Kothari, *Credit Derivatives and Structured Credit Trading*, John Wiley & Sons (2009), Chapter 15.

¹⁴⁰ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 190-192.

not have mirror offsetting positions and, thus, is exposed to significant market risk.

CDPCs are also similar to monolines in that they are highly leveraged entities, they act as high credit quality counterparties on only one side of the market (as sellers of credit protection), and typically do not post collateral. Moreover, similar to monolines, critical to the success of CDPCs is their triple-A rating, both with respect to the debt securities that CDPCs issues to finance their capital base and their rating when selling credit protection.¹⁴¹ In particular, the triple-A rating allows the CDPC to avoid posting collateral and/or entering into credit support arrangements with its counterparty.¹⁴² Finally, although CDPCs performed somewhat better than monolines during the GFC,¹⁴³ they did show similar weakness: similar to monolines, CDPCs reduce counterparty risk at the costs of increasing other financial risks, including legal risk and wrong-way risk.¹⁴⁴

2.3.6. OTC Derivatives Central Counterparties (OTC CCPs)

A central counterparty or clearinghouse (CCP) is a legal entity that offers clearing services. The market participants that deal directly with a CCP are commonly referred to as clearing members (CMs). As discussed in more detail in Chapter 4 below, after two parties have executed an OTC derivatives transaction, the transaction can be presented to a CCP clearing OTC derivatives (OTC CCP). Assuming that the OTC CCP accepts the trade, then, through a process called novation, the OTC CCP steps in between the original parties and becomes the seller to the original buyer and the buyer to the original seller. Once the OTC CCP has interposed itself between the original parties, the OTC CCP acts as an intermediary by guaranteeing the performance of the parties to the transaction. To this purpose, the OTC CCP establishes and enforces a set of rules and operational arrangements aimed at allocating, managing and reducing counterparty risk associated with the relevant trades. In addition to the above, OTC CCPs also keep track of their CMs' obligations and payments, calculate their net positions, collect trade data, and bring about settlement or other disposition of the CMs' trades.

OTC CCPs share common features with SPVs and DPCs described in the previous sections.¹⁴⁵ First, similar to SPVs and DPCs, OTC CCPs give priority to OTC derivatives investors and, in so doing, they shift priorities across the financial system. Second, similar to SPVs and DPCs, OTC CCPs have the potential for creating significant legal risk: OTC CCPs operate across multiple

¹⁴¹ See, Mayer Brown LLP, *Credit Derivative Product Companies – A Primer*, Derivatives Week (2008).

¹⁴² *Id.*, p. 2 (noting that if a CDPC was required to enter into credit support arrangements with its counterparty “the leverage provided by selling credit protection far in excess of the capital base (the business model which makes CDPCs so attractive) would be destroyed.”).

¹⁴³ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, *cit.*, pp. 191-192 (noting that this is perhaps due to timing reasons as “many CDPCs were not fully operational until after the beginning of the crisis in July 2007. They therefore missed at least the first “wave” of losses suffered by any party selling credit protection (especially super senior)”).

¹⁴⁴ For further discussion on wrong-way risk, see Chapter 6.

¹⁴⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, *cit.*, pp. 24-25.

bankruptcy and financial regulatory regimes and their activities critically rely on sound legal frameworks.

OTC CCPs also present some similarities with monolines and CDPCs described in the previous sections. In particular, similar to monolines and CDPCs, OTC CCPs are high-credit quality entities set up to take on, and manage, counterparty risk and operate as centralized risk absorber.¹⁴⁶ However, different from monolines and CDPCs that take very large and mostly one-way exposures to credit markets, OTC CCPs interpose themselves between the two sides of a bilateral transaction and they do not take any residual market risk on the cleared positions (except when members default).¹⁴⁷ Moreover, unlike monolines and CDPCs that do not typically post margin or other form of collateral, OTC CCPs have strict variation and initial margin requirements.

CCPs have been a critical part of the financial landscape for well over a century.¹⁴⁸ Early CCPs grew up in securities and exchange-traded derivatives markets. Nearly all prominent U.S. stock exchanges (e.g., New York Stock Exchange, NASDAQ, and the Chicago Mercantile Exchange) and international stock exchanges (e.g., the London Stock Exchange and Deutsche Borse) have long relied upon CCPs.¹⁴⁹ Derivatives exchanges have also long been associated with CCPs because their trades must generally be cleared and settled. Relevant examples of derivatives CCPs are CME Clearing, which is part of the CME Group, and ICE Clear U.S., which is associated with the Intercontinental Exchange (ICE).

However, what is relatively new is the use of OTC CCPs. Hence, it is only in the late 1990s that a number of CCPs began offering clearing and settlement services for OTC derivatives contracts and other non-exchange-traded products.¹⁵⁰ Parties to an OTC derivatives trade have traditionally expressed and discussed the intent to clear their trade during negotiation. If the parties reached an agreement on clearing, they then submitted the trade to an OTC CCP. If the transaction were accepted by the OTC CCP, both parties would, then, novate their trade to the OTC CCP.¹⁵¹

¹⁴⁶ See, Craig Pirrong, *Armageddon Time*, Streetwise Professor Blog (April 19, 2011).

¹⁴⁷ See, Chapter 4 for further discussion on this point.

¹⁴⁸ See, e.g., Tina P. Hasenpusch, *Clearing Services for Global Markets*, Cambridge University Press (2009), p. 23 and accompanying notes 29-30; Gary B. Gorton, *Clearinghouses and the Origin of Central Banking in the United States*, *Journal of Economic History*, Vol. 45, No. 2 (1985), pp. 277-283; Peter Norman, *The Risk Controllers: Central Counterparty Clearing in Globalised Financial Markets*, John Wiley & Sons (2011).

¹⁴⁹ See, e.g., Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, Working Paper (2009), pp. 15-16; Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, *Georgetown Law Journal*, Vol. 101, pp. 387-444 (2013), pp. 389-390 and accompanying note 4.

¹⁵⁰ See, e.g., Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 23 and accompanying note 26. Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 25-26; Arshadur Rahman, *Over-the-counter (OTC) derivatives, central clearing and financial stability*, cit., p. 284.

¹⁵¹ See, Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., p. 1 (noting that any derivatives contract, regardless of the way it is executed (either on an exchange or bilaterally), can be cleared through a CCP. While derivatives traded on exchanges have been essentially all centrally cleared, OTC derivatives are cleared when both parties agree to assign the trade to a CCP and the trade is accepted by the CCP).

It is important to note that central clearing of OTC derivatives differs from central clearing of exchange-traded derivatives for a number of reasons:¹⁵²

- First, many OTC derivatives are relatively illiquid compared to exchange-traded derivatives. This means that in stressed conditions closing out a large portfolio of OTC derivatives may be particularly complex and may take a few days. This, also, means that when setting margins, OTC CCPs need to consider a longer period of risk than that typically considered by CCPs clearing more liquid exchange-traded derivatives.
- Second, OTC derivatives have typically much longer maturity than exchange-traded derivatives and they may remain outstanding for years or even decades before being settled. This means that OTC CCPs have to take credit exposure for much longer periods of time compared to exchange-traded derivatives CCPs and that the time horizon for the clearing process of OTC derivatives is longer (years or even decades).
- Third, many CMs of OTC CCPs are (and will likely continue to be) systemically important institutions. This means that the default of a CM may be particularly complex and more threatening to deal with for an OTC CCP, and that the failure of an OTC CCP may itself have severe systemic risk implications.
- Fourth, because OTC derivatives are traded in less transparent and less liquid markets compared to exchange-traded derivatives, it is relatively more difficult for an OTC CCP to quantify the risks inherent in OTC derivatives trades.
- Fifth, while CCPs clearing exchange-traded derivatives have developed slowly and gradually as a result of experience and experimentation,¹⁵³ OTC CCPs have been resisted by market participants for long time and only most recently their use has increased, largely spurred by financial regulatory reforms.¹⁵⁴ This point will be discussed in detail in section 2.4 below.

2.4. Clearing Mandates

Following the GFC, CCPs have been called to assume a more significant role in reducing counterparty risk and mitigating systemic risk posed by OTC derivatives.

¹⁵² See, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 151; Craig Pirrong, *Rocket Science, Default Risk and The Organization of Derivatives Markets*, Houston: Bauer College of Business, University of Houston Working Paper (2006), p. 4 (noting that “[d]ifferences in the characteristics of the products traded in the [OTC and the exchange] markets can explain the adoption of the different default risk allocation mechanisms.”); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 38-39.

¹⁵³ See, Randall S. Kroszner (then Member of the Board of Governors of the Federal Reserve System), *Central Counterparty Clearing: History, Innovation, and Regulation*, Speech at the European Central Bank and Federal Reserve Bank of Chicago Joint Conference on Issues Related to Central Counterparty Clearing, Frankfurt, Germany, (April 3, 2006).

¹⁵⁴ See, Gordon F. Peery, *The Post-Reform Guide to Derivatives and Futures*, cit., pp. 40-41.

In 2009, G20 leaders committed to reform the structure of the OTC derivatives market, improve its transparency and mitigate its systemic risk implications. In particular, at their 2009 meeting in Pittsburgh, G20 leaders made the following commitments to regulate the OTC derivatives market: (i) all standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through CCPs; (ii) OTC derivatives contracts should be reported to central trade repositories; and (iii) non-centrally cleared contracts should be subject to higher capital requirements. The Financial Stability Board (FSB) was provided with the authority to monitor and overview the process of implementation of these commitments.¹⁵⁵

During the past seven years, financial legislative and regulatory reforms guided by the aforesaid principles have been undertaken in many countries around the world. The sub-sections below will discuss these reforms in more details.

2.4.1. Principles for Financial Market Infrastructures (PFMIs)

In April 2012, the Basel Committee on Payment and Settlement Systems (CPSS) and the International Organization of Securities Commissions (IOSCO) jointly published the *Principles for Financial Market Infrastructures* (PFMIs),¹⁵⁶ containing new and more demanding international standards for payment, clearing and settlement systems, including CCPs. The PFMIs apply to all systemically important payment systems, central securities depositories, securities settlement systems, CCPs and trade repositories (collectively, "financial market infrastructures"). They replace the international standards set forth in the *Core Principles for Systemically Important Payment Systems*,¹⁵⁷ the *Recommendations for Securities Settlement Systems*¹⁵⁸ and the *Recommendations for central counterparties*.¹⁵⁹

Following the adoption of the PFMIs, the Committee on Payments and Market Infrastructures (CPMI) (formerly, CPSS) and IOSCO have continued closely monitoring the process of implementation of the PFMIs. They have also provided detailed guidance (based on industry feedbacks and emerging best practices) to ensure that the PFMIs are adhered to around the world and applied in an even manner to level the playing field.

¹⁵⁵ See, Group of Twenty (G20) Meeting, *Press Briefing by Treasury Secretary Tim Geithner on the G20 Meeting Pittsburgh Convention Center*, Group of Twenty (G20) Meeting Press Statements, Pittsburgh (September 24, 2009); Group of Twenty (G20) Meeting, *Leaders' Statement The Pittsburgh Summit*, Group of Twenty (G20) Meeting Statements, Pittsburgh (September 24 – 25, 2009).

¹⁵⁶ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, Bank for International Settlements and International Organization of Securities Commissions (2012). The principles were issued for public consultation in March 2011. The principles issued in April 2012 had been revised and finalized in light of the comments received during that consultation.

¹⁵⁷ See, Committee on Payment and Settlement Systems (CPSS), *Core Principles for Systemically Important Payment Systems*, Bank for International Settlements and International Organization of Securities Commissions (2001).

¹⁵⁸ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Recommendations for Securities Settlement Systems*, Bank for International Settlements and International Organization of Securities Commissions (2001).

¹⁵⁹ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Recommendations for Central Counterparties*, Bank for International Settlements and International Organization of Securities Commissions (2001).

In October 2014, the PFMI were supplemented by a consultative report published by the CPMI and IOSCO, titled *Recovery of Financial Market Infrastructures*, which contains guidance for the development of loss-allocation rules and their role within CCPs' recovery plans.¹⁶⁰ These guidelines have received strong support by regulators and industry participants.¹⁶¹

Most recently, in August 2016 the CPMI and IOSCO published two "twin" reports:¹⁶²

- The first report assesses how a selected group of CCPs have put the PFMI into practice.¹⁶³ The analysis shows that the selected CCPs have made important and meaningful progress in applying the principles, but also identifies a number of gaps and shortcomings. In particular, with respect to the area of recovery planning, the report indicates that a number of CCPs have not yet put in place the full set of recovery rules and procedures envisaged in the PFMI. Moreover, with respect to the areas of credit and liquidity risk management, the reports indicates that some CCPs do not include sufficient liquidity-specific scenarios in their liquidity stress tests and some have yet to adopt sufficient policies and procedures to ensure that they maintain the required level of financial resources on an ongoing basis, including adequate arrangements to ensure a prompt return to the target level of coverage in the event of a breach. Finally, the report identifies a number of dissimilarities in the outcomes of implementation across CCPs, which may reveal differences in interpretation or approach that could materially affect resilience.

- The second report was issued to provide guidance on the principles and key considerations in the PFMI regarding financial risk management for CCPs.¹⁶⁴ The report focuses on the following areas: governance, credit and liquidity stress testing, margin, a CCP's contribution of its financial resources to losses, and its coverage of credit and liquidity resource requirements. It is important to note that the guidance outlined in the consultative report is not intended to create additional standards for CCPs beyond those set out in the PFMI, rather it aims at providing more clarity and granularity on how the CPMI and IOSCO expect CCPs to implement the PFMI. Published with the

¹⁶⁰ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, Bank for International Settlements and International Organization of Securities Commissions (2014).

¹⁶¹ Cf., International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, International Swaps and Derivatives Association technical paper (2015); International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, ISDA technical paper (2014), p. 6 (arguing that "ISDA supports viable CCP recovery plans – a view that is consistent with regulatory objectives.").

¹⁶² See, Benoît Coeuré, Chair of the Committee on Payments and Market Infrastructures (CPMI) and Mr Ashley Alder, Chair of the Board of the International Organization of Securities Commissions (IOSCO), *Systemic Derivatives Reforms Require Greater Vigilance*, Financial Times (August 16, 2016).

¹⁶³ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Implementation monitoring of PFMI: Level 3 Assessment – Report on the Financial Risk Management and Recovery Practices of 10 Derivatives CCPs*, Bank for International Settlements (2016). The CPMI and IOSCO expressed the intent to conduct a follow-up targeted review of CCPs' progress in addressing the most important issues identified in the report in 2017.

¹⁶⁴ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, Bank for International Settlements (2016).

consultative report is also a cover note, which lists some of the specific issues on which the CPMI and IOSCO are soliciting comments.¹⁶⁵

2.4.2. Key Attributes of Effective Resolution Regimes for Financial Institutions

At its plenary meeting in 2011, the Financial Stability Board (FSB) adopted the *Key Attributes of Effective Resolution Regimes for Financial Institutions* (Key Attributes),¹⁶⁶ which set out the core elements that the FSB considers to be necessary for an effective resolution regime. In October 2014, the FSB adopted additional guidance, which elaborates on specific Key Attributes relating to information sharing for resolution purposes, and sector-specific guidance, which sets out how the Key Attributes should be applied for insurers, financial market infrastructures (FMIs) and the protection of client assets in resolution.¹⁶⁷ The Key Attributes together with its annexes set forth the objectives of FMI resolution and a range of powers and tools that should be made available to resolution authorities to resolve a failing FMI in an orderly manner, while maintaining continuity of their vital economic functions.

In 2015, the FSB agreed with the Basel Committee on Banking Supervision (BCBS), the CPMI and IOSCO on a joint workplan to coordinate their actions to enhance resilience, recovery and resolvability of CCPs.¹⁶⁸

Most recently, in August 2016, the FSB issued a discussion note.¹⁶⁹ The discussion note covers a number of aspects of CCP resolution planning, including timing of entry into resolution, adequacy of financial resources, tools for returning to a matched book and allocating default and non-default losses, application of the “no creditor worse off safeguard” and treatment of the CCP’s equity in resolution, and cross-border cooperation and effectiveness of resolution actions. The discussion note also sets out a number of questions on which the FSB seeks comments.¹⁷⁰

¹⁶⁵ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Cover Note to the CPMI-IOSCO Consultative Report on the Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, Bank for International Settlements (2016).

¹⁶⁶ See, Financial Stability Board (FSB), *Key Attributes of Effective Resolution Regimes for Financial Institutions*, Financial Stability Board (2011).

¹⁶⁷ See, Financial Stability Board (FSB), *The Annexes to the Key Attributes of Effective Resolution Regimes for Financial Institutions*, Financial Stability Board (2014). The guidance documents have been incorporated as annexes into the 2014 version of the Key Attributes document. No changes were made to the text of the twelve Key Attributes of October 2011, which remain the umbrella standard for resolution regimes covering financial institutions of all types that could be systemic in failure.

¹⁶⁸ See, Financial Stability Board (FSB), Committee on Payments and Market Infrastructures (CPMI), Board of the International Organization of Securities Commissions (IOSCO) and Basel Committee on Banking Supervision (BCBS), *2015 CCP Workplan*, Bank for International Settlements (2015).

¹⁶⁹ See, Financial Stability Board (FSB), *Essential Aspects of CCP Resolution Planning - Discussion Note*, Financial Stability Board (2016).

¹⁷⁰ Responses to the discussion note will assist the FSB in developing standards or guidance for CCP resolution planning, resolution strategies and resolution tools by early 2017.

2.4.3. Dodd-Frank Wall Street Reform and Consumer Protection Act

On 21 July 2010, President Obama signed into law a major U.S. financial legislative reform named Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act).¹⁷¹ OTC derivatives and the market for OTC derivatives are the subject of a significant proportion of the Dodd-Frank Act. In particular, the derivatives legislation is set forth in Title VII and Title VIII of the Dodd Frank Act.¹⁷² The primary goals of the new legislation and the related rulemaking on OTC derivatives are to increase the transparency and efficiency of the OTC derivatives market, reduce the potential for counterparty risk and mitigate the systemic risk that they may pose.¹⁷³

Title VII of Dodd-Frank Act requires that so-called “swaps”¹⁷⁴ be cleared by CCPs regulated by the Commodity Futures Trading Commission (CFTC) or the Securities and Exchange Commission (SEC). More precisely, under the Dodd-Frank Act framework, the SEC is given regulatory authority over “security-based swaps”¹⁷⁵ and firms that are “security-based swaps dealers”¹⁷⁶ and “major security-based swaps participants;”¹⁷⁷ the CFTC is given regulatory authority over all other “swaps,” “swap dealers,”¹⁷⁸ and “major swap participants;”¹⁷⁹ and

¹⁷¹ Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203, 124 Stat. 1376 (2010).

¹⁷² Provisions set forth under other titles of the Dodd Frank Act (directly and indirectly) affect OTC derivatives markets. Among them are provisions set forth in Title VI on banking organizations, in particular the so-called “Volcker Rule” (see Dodd-Frank Act Section 619; 12 U.S.C. 1851).

¹⁷³ For an introduction to Title VII and Title VIII of the Dodd-Frank Act, see, e.g., Gordon F. Peery, *The Post-Reform Guide to Derivatives and Futures*, cit., pp. 134ss; Lynn A. Stout, *Derivatives and the Legal Origin of the 2008 Credit Crisis*, Harvard Business Law Review, Vol. 1 (2011), pp. 1-38; Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the “Dodd-Frank Wall Street Reform and Consumer Protection Act,”* cit.; Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, University of Cincinnati Public Law, Faculty Articles and Other Publications, Paper No. 218 (2014). For reports, statistics and memoranda discussing the Dodd-Frank Act and its rulemaking process, see, e.g., Davis Polk & Wardwell LLP, Dodd-Frank Resource Center, available at <http://www.davispolk.com/dodd-frank/> (Last visited December 2016); Simpson Thacher & Bartlett LLP, Dodd-Frank Resource Center, available at <http://www.stblaw.com/other/dodd-frank> (Last visited December 2016); Skadden, Arps, Slate, Meagher & Flom LLP and Affiliates, *The Dodd-Frank Act: Commentary*, available at <https://www.skadden.com/insights/dodd-frank-act-commentary> (Last visited December 2016); Shearman & Sterling LLP, *Dodd-Frank, UK, EU & Other Regulatory Reforms*, Dodd-Frank, UK, EU & Other Regulatory Reforms, available at <http://www.shearman.com/en/services/key-issues/doddfrank-uk-eu--other-regulatory-reforms?section=publications&page=all> (Last visited December 2016).

¹⁷⁴ See, Dodd Frank Act Section 721(a)(21). “Swaps” are defined broadly as any agreement, contract or transaction that (a) is a put, call, cap or similar option of any kind, (b) provides for any purchase, sale, payment or delivery that is dependent on the occurrence or non-occurrence of any event related to a potential financial, economic or commercial consequence (excluding dividends on an equity security), (c) is an instrument commonly know as an interest rate swap, foreign exchange swap, basis swap or credit default swap, among others, (d) are commonly known to the trade as a swap, (e) meets the definition of “swap agreement” as defined in Section 206A of the Gramm-Leach-Bliley Act¹¹ or (f) is any combination or permutation of items (a) – (e). On August 13, 2012, the CFTC and the SEC published final rules that define “swap,” “security-based swap” and other terms and concepts critical to the implementation of the provisions of the Dodd-Frank Act reforming the OTC derivatives trading and market structure. See, Further Definition of “Swap,” “Security-Based Swap,” and “Security-Based Swap Agreement”; Mixed Swaps; Security-Based Swap Agreement Recordkeeping, 77 Fed. Reg. 48208 (Aug. 13, 2012). For an in-depth analysis of the terms “security-based swaps dealers,” “major participants in security-based swaps,” “swap dealers,” and “major swap participants,” see, e.g., Gordon F. Peery, *The Post-Reform Guide to Derivatives and Futures*, cit., pp. 154-163ss.

¹⁷⁵ See, Dodd-Frank Act Section 721(a)(19). A “security-based swap” is defined as a swap based on a single security or loan or a narrow-based group or index of securities (including any interest therein or the value thereof), or events relating to a single issuer or issuers of securities in a narrow-based security index. Security-based swaps are included within the definition of “security” under the Securities Exchange Act of 1934 and the Securities Act of 1933.

¹⁷⁶ See, Dodd-Frank Act Section 721(a)(19).

¹⁷⁷ See, Dodd-Frank Act Section 721(a)(16).

¹⁷⁸ See, Dodd-Frank Act Section 721(a)(21).

¹⁷⁹ See, Dodd-Frank Act Section 721(a)(16).

the CFTC and the SEC share authority over “mixed swaps.”¹⁸⁰ When making their determinations the CFTC and the SEC are required to take into account various factors, including the total notional exposures outstanding, the availability of pricing data, trading liquidity, operational and credit infrastructures to support product clearing, and systemic risk.

Under the Dodd-Frank Act, CCPs must register either with the SEC as “clearing agencies”¹⁸¹ or the CFTC as “derivatives clearing organizations” (DCOs).¹⁸² At the time of writing, there are sixteen active registered DCOs with the CFTC, and six active registered clearing agencies with the SEC. The Dodd-Frank Act delegates authority to the CFTC and the SEC to mandate clearing for a derivatives class on an ongoing basis, so long as it is accepted for clearing by a DCO (in the case of a swap) or a clearing agency (in the case of a security-based swap), unless an exemption applies.¹⁸³ DCOs and clearing agencies are required under the Dodd-Frank Act to comply with certain “core principles,” including principles relating to financial resources, admission and ongoing eligibility requirements for CMs and cleared financial products, risk management, settlement procedures, default resolution procedures, reporting and recordkeeping, and disclosure and sharing of information.

The trades of all swaps subject to the clearing mandate must be executed electronically on designated contract markets or swap execution facilities (SEFs) and reported to a trade repository.

Title VIII of the Dodd-Frank Act further defines “financial market utility” (FMU) as “any person that manages or operates a multilateral system for the purpose of transferring, clearing, or settling payments, securities, or other financial transactions among financial institutions or between financial institutions and the person.” A newly created Financial Stability Oversight Council (FSOC) is given the authority to designate by a two-thirds vote which FMUs are or are likely to become “systemically important.”¹⁸⁴ If the designated FMU is a CCP already regulated by the CFTC or SEC, those regulators are charged with the primary administration of any new rules. The Federal Reserve Board, however, is given ultimate oversight authority and may intercede if it deems existing regulations insufficient to mitigate systemic risk.¹⁸⁵ Designated FMUs will also be subject to

¹⁸⁰ See, Dodd-Frank Act Section 712(a)(8). A “mixed swap” is defined as a subset of “security-based swaps” that also are based on the value of one or more interest or other rates, currencies, commodities, instruments of indebtedness, indices, quantitative measures, other financial or economic interest or property of any kind (other than a single security or a narrow-based security index), or the occurrence, non-occurrence, or the extent of the occurrence of an event or contingency associated with a potential financial, economic, or commercial consequence (other than the occurrence, non-occurrence, or extent of the occurrence of an event relating to a single issuer of a security or the issuers of securities in a narrow-based security index, provided that such event directly affects the financial statements, financial condition, or financial obligations of the issuer).

¹⁸¹ Information on the criteria, procedures, and requirements for registration as clearing agency with the SEC is available at <https://www.sec.gov/divisions/marketreg/mrclearing.shtml> (Last visited December 2016).

¹⁸² Information on the criteria, procedures, and requirements for registration as a DCO with the CFTC is available at <http://www.cftc.gov/IndustryOversight/ClearingOrganizations/index.htm> (Last visited December 2016).

¹⁸³ Significantly, section 723(a)(2) of the Dodd-Frank Act provides an important exclusion known as the “commercial end user exemption”, under which swaps need not be submitted for mandatory clearing if one of the parties is a non-financial firm using the swap to hedge or reduce risk, provided that the firm notifies the CFTC or SEC and explains how it meets its financial obligations arising from the non-cleared swap.

¹⁸⁴ See, Dodd-Frank Act Section 804.

¹⁸⁵ See, Dodd-Frank Act Section 805.

examination by their primary regulator at least once a year.¹⁸⁶ Significantly, the Dodd-Frank Act gives systemically important FMU access to the Federal Reserve discount window, subject to a number of restrictions. In particular, the borrowing from the Federal Reserve is limited to “unusual or exigent circumstances” and requires the approval of a majority of Federal Reserve Governors. In addition, the FMU must demonstrate that it “is unable to secure adequate credit accommodations from other banking institutions.”¹⁸⁷

2.4.4. European Market Infrastructure Regulation

The European Regulation on OTC Derivatives is contained in the European Market Infrastructure Regulation (EMIR), which came into force on August 16, 2012.¹⁸⁸ Similar to the Dodd-Frank Act, EMIR aims, among others, at reducing systemic risk posed by OTC derivatives, increasing the transparency of the market, and enhancing its integrity.

EMIR provides for the prudential regulation of OTC CCPs, including the requirements for OTC CCPs’ authorization, capital, margining, organizational rules and the establishment of a default fund. The approach for clearing and reporting of OTC derivative transactions is broadly similar to that adopted by the Dodd-Frank Act.

OTC derivatives-related provisions set forth in EMIR apply to any entity established in the European Union (EU) that has entered into a derivatives contract, whether they do so for trading purposes, hedging purposes or for investment strategies. In addition, certain provisions of EMIR will also apply to non-EU entities entering into derivatives trades with certain EU parties. Two are the main categories of counterparty to a derivatives contract identified under EMIR: “financial counterparties” (FCs), which include insurers, banks, investment firms and fund managers; and “non-financial counterparties” (NFCs), which refer to any counterparty that is not classified as a financial counterparty, including entities not involved in financial services. EMIR requires all counterparties with outstanding derivative contracts to report to an authorized trade repository the details of those trades, including information about the derivatives contract and counterparty data. The European Securities and Markets Authority (ESMA) is given the authority to impose mandatory clearing obligations for OTC derivatives of a particular type once a CCP has been authorized under EMIR for that type of contract. In case of derivatives transactions that are not cleared via a CCP, all counterparties to such transactions are subject to risk mitigation techniques requirements. For FCs, contracts not cleared through a CCP will also be subject to bilateral collateral requirements. NFCs will be subject to clearing and bilateral collateral requirements if their OTC derivatives positions exceed certain

¹⁸⁶ See, Dodd-Frank Act Section 807.

¹⁸⁷ See, Dodd-Frank Act Section 806. For further discussion on this point, see Chapter 8.

¹⁸⁸ Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

thresholds and are not directly reducing commercial risks or related to treasury financing activity.¹⁸⁹

The process of implementation of EMIR has been extremely complex and articulated, involving numerous consultations and negotiations among member countries and ESMA. ESMA and the European Commission (EC) have decided to phase in the application of the clearing obligation depending on the EMIR categorization of counterparties and the size of their trading activities. In particular, the clearing obligation for the most commonly used interest rate swaps denominated in any of the so-called G4 currencies (Euro, British Pound, Yen and US dollar) for “Category 1” firms has an effective start date on June 21, 2016, with a phased introduction for other categories of counterparty until December 21, 2018. A similar approach has been adopted for certain credit derivative swaps, with a phase-in period running from February 9, 2017, through May 9, 2019.

2.4.5. Mutual Recognition of US-EU OTC Derivative Clearing Frameworks

On 10 February 2016, the CFTC and the European Commission (EC) published a joint statement announcing a common approach regarding requirements for CCPs (the “Common Approach”).¹⁹⁰ The Common Approach includes the following commitments:

- A commitment by the EC to shortly propose for adoption of an equivalence decision with respect to CFTC requirements for US CCPs, which will allow ESMA to recognize US CCPs as soon as practicable.¹⁹¹ Once recognized by ESMA, US CCPs may continue to provide services in the EU whilst complying with CFTC requirements, and will also become qualifying CCPs for the purpose of the EU Capital Requirements Regulation, thus lowering costs for EU banks and their subsidiaries. The proposed determination of equivalence is based on the condition that CFTC-registered US CCPs seeking recognition in the EU confirm that their internal rules and procedures ensure (a) for clearing members' proprietary positions in exchange traded derivatives, the collection of initial margins that are sufficient to take into account a two day liquidation period; (b) that initial margin models include measures to mitigate the risk of procyclicality; and (c) the maintenance of “Cover 2” default resources.¹⁹² In addition, the EC

¹⁸⁹ For a thoughtful analysis, see, e.g., Linklaters LLP, *Guide to the European Market Infrastructure Regulation (EMIR)*, Linklaters Publications (2013); Allen & Overy LLP, *Understanding EMIR: A guide for funds and their managers*, Allen & Overy LLP Publications (2013); Clifford Chance, *European Market Infrastructure Regulation (EMIR)*, Clifford Chance Topic Guides, available at <https://financialmarketstoolkit.cliffordchance.com/en/topic-guides/european-market-infrastructure-regulation--emir-.html> (Last visited December 2016).

¹⁹⁰ See, The U.S. Commodity Futures Trading Commission and the European Commission: Common Approach for Transatlantic CCPSI, Joint Statement (February 10, 2016).

¹⁹¹ The Common Approach references only the CFTC's requirements for derivatives clearing organizations. It does not reference the U.S. SEC's requirements for clearing agencies, which is a separate and distinct regime. In this respect, the Common Approach indicates that the EC will continue to be in constructive and progressive discussions with SEC staff regarding the SEC's requirements, in the context of the EC's analysis of equivalence. The conditions will not apply with respect to US agricultural commodity derivatives traded and cleared domestically within the US, in consideration of the significant nexus of these US contracts with the US economy, their importance to US farmers and ranchers and the low degree of systemic interconnectedness of these markets with the rest of the financial system.

¹⁹² See Chapter 4 for further discussion on this point.

undertook the commitment to shortly propose for adoption of an equivalence decision under EMIR to determine that US trading venues are equivalent to regulated markets in the EU, providing a level playing field between EU and US trading venues for the purposes of the Markets in Financial Instruments Directive (MIFID) I framework.

- A commitment by the CFTC to propose a determination of comparability with respect to EU requirements. This determination will provide a basis for both EU CCPs already registered with the CFTC as derivatives clearing organizations and those seeking registration to meet certain CFTC requirements by complying with the corresponding requirements as set forth in EMIR. In addition, the CFTC staff undertook the commitment to streamline the registration process for EU CCPs wishing to register with it, reflecting these similar requirements.

The Common Approach provides an important foundation for cooperation in the oversight of CCPs between US and EU regulators. As stated by Jonathan Hill, European Commissioner for Financial Stability, Financial Services and Capital Markets Union, “[the Common Approach] is an important step forward for global regulatory convergence. It means that European CCPs will be able to do business in the United States more easily and that US CCPs can continue to provide services to EU companies ... we are now able to provide certainty for the marketplace.”¹⁹³ As further stated by Timothy Massad, CFTC Chairman, “[the Common Approach] is critical to ensuring that our global derivatives markets remain robust, while keeping our financial system as stable and resilient as possible. It is a significant milestone in harmonizing regulation of these markets.”¹⁹⁴

Following the joint statement, on March 15, 2016, the EC adopted an equivalence decision/implementing act with respect to the US regulatory framework for CCPs authorized and supervised by the CFTC (the “Decision”).¹⁹⁵ The Decision aims at ensuring that both EU CCPs and US CCPs operate to the same high standards and at a comparable level of cost to their participants. It is expected to alleviate the regulatory burden for US CCPs and EU CCPs and encourage market certainty and cross-border activity, avoiding fragmentation of markets and liquidity.

In particular, under the Decision, CCPs registered with the CFTC will be able to obtain recognition in the EU subject to their internal rules and procedures meeting certain conditions set out in the Decision relating to the calculation of initial margins and the default fund. Market participants will be able to use them to clear standardized OTC derivative trades as required by EU legislation, while the CCPs will remain subject solely to the regulation and supervision of their home jurisdictions. Moreover, CCPs that have been recognized under the EMIR

¹⁹³ See, The U.S. Commodity Futures Trading Commission and the European Commission: Common Approach for Transatlantic CCPSI, cit.

¹⁹⁴ Ibidem.

¹⁹⁵ See, European Commission, *The European Commission Grants the USA the Equivalent Regulatory Regime for Central Counterparties as the European Union*, European Commission Press Release, Brussels, Belgium (March 15, 2016). The text of the EC implementing decision 2016/377 is published at <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016D0377>.

process will also obtain “qualifying CCP” status across the EU under the Capital Requirements Regulation. This means that EU banks’ exposures to these CCPs will be subject to a lower risk weight in calculating their regulatory capital.

On March 16, 2016, the CFTC announced that it had unanimously approved a substituted compliance framework for dually-registered CCPs located in the EU, together with a comparability determination with respect to certain EU rules (the “Determinations”).¹⁹⁶ The CFTC published its Determinations in the Federal Register on March 22, 2016.¹⁹⁷ The Determinations reflect the CFTC’s efforts to ensure that CCPs on both sides of the Atlantic are held to high standards, thereby promoting financial stability.¹⁹⁸ Under the Determinations, CCPs that are authorized in the EU under EMIR and registered with the CFTC may comply with certain CFTC requirements for financial resources, risk management, settlement procedures, and default management rules and procedures by complying with the corresponding requirements under the EMIR. In addition, the CFTC provided for a streamlined approach for EU CCPs that may wish to register with the CFTC in the future, which will further harmonize the U.S. and EU regimes.

On March 16, 2016, the CFTC’s Division of Clearing and Risk (DCR) also published a no-action letter providing derivatives clearing organizations (DCOs) /CCPs limited and enumerated relief from the application of CFTC regulations to discrete aspects of DCO /CCP’s non-U.S. clearing activities.¹⁹⁹

2.4.6. The United Kingdom: The Impact of Brexit on the Derivatives Market

On June 23, 2016, a referendum was held in the United Kingdom (UK) in which 52% of votes were cast in favor of leaving the EU (“Brexit”). Following the referendum, UK Prime Minister, Theresa May, announced that the UK Government would officially commence the “departure process” by invoking Article 50 of the Treaty on European Union by the end of March 2019. This, in turn, would activate a 2-year negotiation process between the UK and the EU. At the date of writing, the specific terms of the post-Brexit relationship between the UK and the EU remain unclear.

The resulting legal, political and economic uncertainty created by the Brexit vote has relevant implications for the derivatives markets for a number of reasons, including the following:

¹⁹⁶ See, The U.S. Commodity Futures Trading Commission, *CFTC Approves Substituted Compliance Framework in Follow-up to the Recent Equivalence Agreement between the US and the EU*, Press Release No. 342-16, Washington, DC (March 16, 2016).

¹⁹⁷ See, The U.S. Commodity Futures Trading Commission, *Comparability Determination for the European Union: Dually-Registered Derivatives Clearing Organizations and Central Counterparties*, Federal Register, available at <http://www.cftc.gov/idc/groups/public/@lrfederalregister/documents/file/2016-06261a.pdf>.

¹⁹⁸ See, Christopher J. Giancarlo (Commissioner of the U.S. Commodity Futures Trading Commission), *Comparability Determination for the European Union: Dually-Registered Derivatives Clearing Organizations and Central Counterparties*, Statement (March 16, 2016); Timothy Massad (Chairman of the U.S. Commodity Futures Trading Commission), *Substituted Compliance Determination for the European Union*, Statement (March 16, 2016).

¹⁹⁹ See, The U.S. Commodity Futures Trading Commission, *No-Action Relief for EU-Based Registered Derivatives Clearing Organizations that are Authorized to Operate in the European Union, from Certain Requirements under Part 22 and Part 39 of Commission Regulations*, The U.S. Commodity Futures Trading Commission No-Action Letter, Washington, DC (March 16, 2016).

- London (UK) has long been a prominent financial center for OTC derivatives activity both in the EU and globally.
- The three major CCPs for the EU derivatives market (LCH Limited, CME Clearing Europe Limited and LME Clear Limited) are located in London (UK) and are supervised by the Bank of England.
- As a member state of the EU, the UK is subject to the regulation of the derivatives market under EMIR discussed in the prior section.
- Businesses established in the UK use EU financial services regulation to “passport” their derivatives services throughout the European Economic Area (“EEA”).²⁰⁰
- Businesses established outside the UK can use a UK “passport” (e.g., by setting up a subsidiary or a local branch in the UK) to access the UK and/or the EEA derivatives markets.
- A large number of agreements regulating OTC derivatives transactions are governed by English law and include a submission to the jurisdiction of the English courts.
- In the context of derivatives transactions, Sterling and UK assets are often used as collateral.
- A large number of derivatives contracts reference, or are settled in, Sterling or UK assets.

The remaining part of this section identifies some of the areas in which Brexit may impact the derivatives markets and may affect their participants:

- Counterparty Creditworthiness and Credit Ratings - Brexit may adversely affect the (actual and/or perceived) creditworthiness and credit ratings of a derivatives counterparty. Deterioration in a counterparty’s creditworthiness and credit ratings, in turn, may make it more difficult for the derivatives counterparty to enter into new derivatives transactions and to maintain existing positions. In particular, the deterioration may result in more expensive financing costs and/or new or additional collateral posting obligations (with respect to both existing and future transactions). In an extreme scenario, termination rights could also be triggered, if ratings-related or arising out of an actual default of the credit-impaired derivatives counterparty.

- Sovereign Downgrade - In the aftermaths of the Brexit referendum, the UK’s sovereign rating was downgraded by Standard & Poor’s and Fitch.²⁰¹ A sovereign downgrade may cause the creditworthiness of counterparties with UK exposures to be adversely affected. This, in turn, may have severe negative repercussions as discussed above.

²⁰⁰ The European Economic Area (“EEA”) aggregates the EU Member States and the three EEA EFTA States (Iceland, Liechtenstein and Norway) into an internal market governed by the same basic rules. Switzerland is not part of the EEA but has a bilateral agreement with the EU

²⁰¹ See, e.g., Moody’s Investors Service, *Moody’s changes outlook on UK sovereign rating to negative from stable, affirms Aa1 rating*, Moody’s Investors Service Global Credit Research (June 24, 2016); Andy Bruce, *Rating agencies rip into UK’s credit score after Brexit vote*, Reuters (June 27, 2016).

- **Fluctuations in Exposures** - An immediate result of the Brexit vote was a period of high economic volatility, coupled with a significant devaluation of Sterling. Increased economic volatility and fluctuations in relevant markets may create new (or increase existing) mark-to-market (MTM) exposures under derivative transactions. This, in turn, may result in new (or increased) collateral posting obligations, which can make derivatives transactions more expensive. In an extreme scenario, termination rights could also be triggered.

- **Collateral Valuation Fluctuations** - A combination of rating downgrades, high economic volatility and/or large currency fluctuations may result in additional collateral posting requirements, increased haircuts and certain collateral assets becoming ineligible. These negative repercussions may be significant if the value of UK-linked collateral (e.g., UK gilts or Sterling cash) declines or if exposures in other currencies increase relative to Sterling.

- **Derivatives Documentation** - At the date of writing is difficult to assess the full impact of Brexit on derivatives documentation. A number of provisions in the 1992 and 2002 ISDA Master Agreements and ISDA definitions booklets could be impacted by Brexit, including tax provisions, provisions relating to representations and agreements, provisions regulating events of default and termination events, as well as governing law, jurisdiction and arbitration clauses.²⁰²

- **Derivatives-Related Regulation** - It is currently uncertain whether EU legislation and regulation relating to derivatives transactions will continue to apply. If, under the final terms regulating the post-Brexit relationship between the UK and the EU, the UK is classified as a “third country” for the purposes of EMIR and no longer continues to benefit under the existing EU regime, then the UK will need to negotiate equivalence agreements with the EU, the United States and other third country jurisdictions. These negotiations could be time-consuming, complex and could lead to a long period of uncertainty until the equivalence is granted.

Legal and regulatory uncertainty is certainly problematic for UK derivatives market participants, including UK CCPs and trade repositories, as well as their clients. Thus, there is an urgent need for EU and UK governmental authorities to negotiate appropriate transitional arrangements to allow UK derivatives market participants to continue operating under the existing EU regime, until the legislation and regulation relating to derivatives transactions are properly repealed or amended.

- **Location Policy** - In the wake of the result of Brexit referendum, a number of politicians, including François Hollande, President of the Republic of

²⁰² For insights, briefings and updates on the impact of Brexit on derivatives documentation and derivatives-related regulation, see, e.g., Linklaters LLP, *The EU Referendum*, available at <http://www.linklaters.com/Insights/EU-Referendum-microsite/Pages/Index.aspx> (Last visited December 2016); Allen & Overy, *Brexit Law – the way ahead*, available at www.allenoverly.com/Brexit-Law/Pages/default.aspx (Last visited December 2016); and Clifford Chance, *Brexit – Topic Guides*, available at <https://financialmarketstoolkit.cliffordchance.com/en/topic-guides/brexit.html#undefined> (Last visited December 2016).

France,²⁰³ have argued that when the UK leaves the EU, it will be open to the European Central Bank (ECB) to exclude CCPs in the UK from clearing euro-denominated financial instruments. Their position is predicated on the basis of a policy statement by the ECB that systemically important euro-denominated clearing should occur in a Eurozone member state.

Significantly, a first attempt by the ECB to impose a Eurozone “location policy” failed in the European Union General Court in 2015.²⁰⁴ The European Union General Court found that the ECB does not have the power to regulate the location of CCPs under the Treaty on the Functioning of the European Union (“TFEU”) and its establishment statute (the “ECB Statute”). In the context of such decision, however, the European Union General Court left open the question of whether a location policy would, for example, undermine the fundamental freedoms of the single market. In particular, the European Union General Court acknowledged that there exist very close linkages between payment systems and clearing systems and that disruption to the latter could have severe repercussions for the former. The European Union General Court, thus, commented that it would be open to the ECB to request an amendment to the ECB Statute or for the European Commission to propose such an amendment to give the ECB the power to regulate the location of CCPs.²⁰⁵

Although the re-opening of the location policy seems questionable, it is reasonable to argue that Brexit increases the possibility that a meaningful volume of derivatives trading and derivatives clearing activity will gradually move out of the UK.

²⁰³ See, Jim Bruntsden and Anne-Sylvaine Chassany, *François Hollande Rules Out City’s Euro Clearing Role. French President Moves to Strip London of Crucial Stage in Derivatives and Equities Trading*, Financial Times (June 28, 2016) (quoting Mr. François Hollande, President of the Republic of France, saying “The City, which thanks to the EU, was able to handle clearing operations for the eurozone, will not be able to do them...It can serve as an example for those who seek the end of Europe ... It can serve as a lesson.”).

²⁰⁴ On July 5, 2011, the ECB published on its website the Eurosystem Oversight Policy Framework (“The Policy Framework”). See, European Central Bank, *Eurosystem Oversight Policy Framework*, European Central Bank (2011). The Policy Framework would require CCPs with a daily net credit exposure of more than Euro 5 billion in one of the main euro-denominated categories of derivative to be located in the Eurozone (the “Location Policy”). The UK, supported by Sweden, challenged the Location Policy in the European Union General Court. On March 4, 2015, the European Union General Court found in favor of the UK on the ground that the ECB has no competency to impose a location requirement for CCPs. According to the European Union General Court, the relevant provisions of the establishment statute of the ECB Statute gave the ECB the power to adopt regulations in relation to payment systems alone, but not in relation to the clearing of securities or derivatives. The ECB did not appeal the judgment. Following that judgment, the ECB and the Bank of England announced that they had agreed to enhanced information exchange and cooperation arrangements for UK CCPs with significant euro-denominated business and that both the ECB and the Bank of England would extend the scope of their standing swap line order to facilitate the provision of multi-currency liquidity support by both central banks to CCPs established in the UK and the Eurozone respectively. In addition, in September 2015, the ECB published a revised version of the Policy Framework, removing the references to the Eurosystem Location Policy for CCPs. See, European Central Bank, *Eurosystem Oversight Policy Framework*, European Central Bank (2015).

²⁰⁵ See, Article 129(3) TFEU. The TFEU provides that an amendment to the relevant parts of the ECB Statute could be passed by an “ordinary legislative procedure,” which would require the approval of a qualified majority of member states and the approval of the European Parliament. For this purpose, a “qualified majority” is achieved if two conditions are met: (a) 55% of member states vote in favor; and (b) the proposal is supported by member states representing at least 65% of the total European Union population.

2.5. Central Clearing of OTC Derivatives Post Clearing Mandates

2.5.1. Regulatory Implementation Process

At the date of writing the process of implementation of the reforms to the OTC derivatives market agreed by the G20 discussed above is continuing.²⁰⁶ Table 3 provides an overview of the status of reform implementation across all 24 Financial Stability Board (FSB) jurisdictions as at end-June 2016.

Table 3. Summary of jurisdictional progress of OTC derivatives market reforms as at end-June 2016.

		Trade Reporting	Central Clearing	Capital	Margin	Platform Trading
Argentina	AR	3	3		1	3
Australia	AU				2+	+
Brazil	BR				1	1
Canada	CA		3		+	2
China	CN			1		3
EU	France	FR			2	
	Germany	DE			2	
	Italy	IT			2	
	The Netherlands	NL			2	
	Spain	ES			2	
	United Kingdom	UK			2	
Hong Kong	HK	3	3+		2+	1
India	IN		3		2+	1
Indonesia	ID		3	1	1	3+
Japan	JP				3+	
Republic of Korea	KR		3	3	1+	
Mexico	MX		+	+	1	+
Russia	RU		2		2	1+
Saudi Arabia	SA		1		1	1
Singapore	SG				2	1
South Africa	ZA	2	2		2	1
Switzerland	CH	3+	+		+(a)	+
Turkey	TR	2+	1	+	1	1
United States ⁽¹⁾	US			3	+	
TOTALS						
		-	-	-	1	1
	1	-	2	2	7	9
	2	2	2	-	12	1
	3	3	6	2	1	2
		19	14	20	3	11

(+) Indicates positive change in reported implementation status from end-September 2015.

²⁰⁶ Cfr., Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, Financial Stability Board (2016).

(a) On 6 July 2016, the Swiss Financial Market Supervisory Authority published additional guidance including on margin requirements for non-centrally cleared derivatives (NCCDs), which extended certain phase-in periods relevant to margin requirements in line with forthcoming deadlines in the EU.

(*) Information regarding the US included in Table 3 above reflects the overall progress of US regulatory reforms undertaken by multiple regulatory authorities. Note that the CFTC has rules in force with respect to trade reporting, central clearing and platform trading; the estimate of over 90% regulatory coverage is based on the completion of rules by the CFTC, which regulates over 90% of the notional volumes transacted in the US swaps market.

Legend

	No existing authority to implement reform and no steps taken to adopt such authority.
1	<p><i>All reform areas:</i> Legislative framework or other authority is in force^(*) or has been published for consultation or proposed.</p> <p>(*) The term “in force” means a final statute/regulation/rule/policy statement/standard/etc. is operative and has effect as at the indicated date; in contrast, where a final statute/regulation/etc. has been enacted or published but it is not yet operative and does not have effect, for the purposes of this analysis this is treated as not yet in force.</p>
2	<p><i>Trade reporting:</i> Legislative framework or other authority is in force and, with respect to at least some transactions, standards/requirements have been published for public consultation or proposal.</p> <p><i>Central clearing and platform trading:</i> Legislative framework or other authority to implement reform is in force and, with respect to at least some transactions, standards/criteria for determining when transactions should be centrally cleared/platform traded have been published for public consultation or proposal.</p> <p><i>Capital and margins for NCCDs:</i> Legislative framework or other authority is in force and, with respect to at least some transactions, standards/requirements have been published for public consultation or proposal.</p>
3	<p><i>Trade reporting:</i> Legislative framework or other authority is in force and, with respect to at least some transactions, public standards/requirements have been adopted.</p> <p><i>Central clearing and platform trading:</i> Legislative framework or other authority is in force and, with respect to at least some transactions, public standards/criteria for determining when products should be centrally cleared/platform traded have been adopted.</p> <p><i>Capital and margins for NCCDs:</i> Legislative framework or other authority is in force and, with respect to at least some transactions, public standards/requirements have been adopted.</p>
	<p><i>Trade reporting:</i> Legislative framework or other authority is in force and, with respect to over 90% of transactions, standards/requirements are in force.</p> <p><i>Central clearing and platform trading:</i> Legislative framework or other authority is in force and, with respect to over 90% of transactions, standards/criteria for determining when products should be centrally cleared/platform traded are in force. An appropriate authority regularly assesses transactions against these criteria.</p> <p><i>Capital for NCCDs:</i> Legislative framework or other authority is in force and, with respect to over 90% of transactions, standards/requirements are in force.</p> <p><i>Margins for NCCDs:</i> Legislative framework or other authority is in force and, with respect to over 90% of the transactions covered consistent with the respective BCBS–IOSCO Working Group on Margin Requirements (WGMR) phase in periods, standards/requirements are in force.</p>

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, Financial Stability Board (2016), pp. 3-4.

With respect to central clearing-related reforms, [Table 4](#) below shows that as of end-June 2016, 14 FSB member jurisdictions had in force both a legislative framework or other authority, and, for over 90% of the OTC derivatives transactions in their jurisdiction, standards or criteria for making specific central clearing determinations.

Table 4. Status of central clearing regulatory implementation.

	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	H1 2017	H2 2017
AR	3	3	3	3	3	3	3	3
AU								
BR								

CA		3	3	3	3	3	3		
CN									
EU	FR								
	DE								
	IT								
	NL								
	ES								
	UK								
HK		2	2	3	3				
IN		3	3	3	3	3	3	3	
ID		3	3	3	3	3	3	3	
JP									
KR		3	3	3	3	3			
MX		1	1	1					
RU		2	2	2	2	2	2	3	
SA		1	1	1	1	1	1	1	
SG									
ZA		1	1	1	2	2	2	3	
CH		1	1						
TR		1	1	1	1	1	1	2	
US									

For jurisdiction codes see Table 3 above; for legend see table "Legend" above.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 14.

Table 5 below provides further details on regulatory steps taken by the US and EU jurisdictions in implementing a central clearing framework for OTC derivatives.

Table 5. Implementation timetable: central clearing of standardized transactions in Europe (EU) and United States (US).

	Europe (EU)
Q3 2015	<ul style="list-style-type: none"> On 6 August 2015, the European Commission adopted a delegated regulation that makes it mandatory for certain OTC interest rate derivative contracts (IRS) to be cleared through central counterparties.
Q4 2015	
Q1 2016	<ul style="list-style-type: none"> On 1 March 2016, the European Commission adopted a delegated regulation that makes it mandatory for certain OTC credit default derivative contracts (CDS) to be cleared through CCPs.
Q2 2016	<ul style="list-style-type: none"> On 10 June 2016, the European Commission adopted a delegated regulation that makes it mandatory for additional classes of IRS to be cleared through CCPs. Entry into force of the clearing obligation for IRS according to a phase-in starting June 21.
Q3 2016	
Q4 2016	
H1 2017	<ul style="list-style-type: none"> Entry into force of the clearing obligation for certain CDS. Expected entry into force of the clearing obligation for additional classes of IRS.
H2 2017	
	United States (US)

Q3 2015	
Q4 2015	
Q1 2016	
Q2 2016	In June 2016 the CFTC proposed regulations to require certain additional interest rate swaps to be centrally cleared, making the CFTC's clearing requirements consistent with those proposed or finalized in 2015 and 2016 by Australia, Canada, the EU, Hong Kong, Mexico, and Singapore.
Q3 2016	
Q4 2016	
H1 2017	
H2 2017	

For legend see table "Legend" above.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., pp. 44 at seq.

2.5.2. Domestic and Cross-Border Availability of OTC CCPs

As shown in [Table 6](#) below, as at end-June 2016, 19 FSB jurisdictions had at least one CCP that was authorized to clear at least some OTC interest rate derivatives, while overall availability of CCPs for other asset classes was more limited.

Table 6. Availability of OTC derivatives CCPs in FSB member jurisdictions as at end-June 2016.

	Commodity	Credit	Equity	FX	Interest Rate
AR					
AU			1		3
BR	1	1	1	1	1
CA	4	2	2	1	4
CN	1			1	1
EU	10	6	7	6	16
HK				1	1
IN				1	1
ID					
JP		1			3
KR					1
MX					2
RU	1	1	1	1	1
SA					
SG	3	1		2	3
ZA					
CH	1		1	1	2
TR					
US	5	4	2	2	10

Note: "IR" = interest rates; "CDS" = credit default swap; and "FX" = foreign exchange.

✕ indicates the number of CCPs clearing at least some OTC derivatives sub-products in given asset class that are authorized or pending authorization (or have a temporary exemption from authorization requirements) to offer direct and/or indirect clearing services in given jurisdiction.

For jurisdiction codes see [Table 3](#) above.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 19.

A detailed listing of CCPs currently authorized and operating in FSB member jurisdictions is provided in Table 7 below.

Table 7. OTC derivatives CCPs authorized and operating in FSB member jurisdictions as of end-June 2016.

CCP Name	Location	Jurisdictions in which CCP is authorized to operate ^(a)	CO	CR	EQ	FX	IR
Asigna	Mexico	EU ^(*) , (MX)					
ASX Clear	Australia	AU, EU					
ASX Clear (Futures)	Australia	AU, EU, US					
BME Clearing	Spain	EU					
BM&F BOVESPA	Brazil	BR, (EU)					
CCIL	India	(EU), IN, (US)					
CDCC	Canada	CA, EU ^(*)					
CME Clearing Europe	UK	{AU} ^(*) , CA, EU, (US)					
CME Group Inc.	US	AU, CA, (EU), MX ^(*) , SG ^(*) , US					
Eurex Clearing	Germany	{AU} ^(*) , EU, CH, US ^(*)					
ECC	Germany	EU					
OTC Clearing Hong Kong Limited	Hong Kong	{AU} ^(*) , EU, HK, US ^(*)					
ICE Clear Credit LLC.	US	CA, (EU), US					
ICE Clear Europe Ltd.	UK	(EU), US					
ICE Clear Netherlands	The Netherlands	EU					
JSCC	Japan	{AU} ^(*) , EU, JP, US ^(*)					
KDPW CCP	Poland	EU					
Korea Exchange	Korea	EU, JP, KR, US ^(*)					
LCH.Clearnet LLC	US	CA, (EU), US					
LCH.Clearnet Ltd	UK	AU, CA, EU, JP, SG ^(*) , CH, US					
LCH.Clearnet SA	France	EU, US					
LME Clear Ltd	UK	EU					
Nasdaq OMX Stockholm	Sweden	{AU} ^(*) , EU					
CJSC JSCB National Clearing Centre	Russia	RU					
Natural Gas Exchange	Canada	CA, EU ^(*) , US					
OCC	US	CA, (EU), US					
OMI Clear	Portugal	EU					
SGX Derivatives Clearing Limited	Singapore	EU, SG, US					
Shanghai Clearing House	China	CN					
Total currently in operation			12	7	8	8	18

() indicates application/exemption request is pending/under consideration in indicated jurisdiction; { } indicates prescription in place for these CCPs in Australia; these CCPs are only authorized to be used to satisfy Australian mandatory central clearing obligations in certain circumstances.

(a) As at end-June 2016. In some cases authorization in a particular jurisdiction is only for a subset of products, and/or for only direct participation or only client clearing.

(*) Indicates change in authorization status since September 2015.

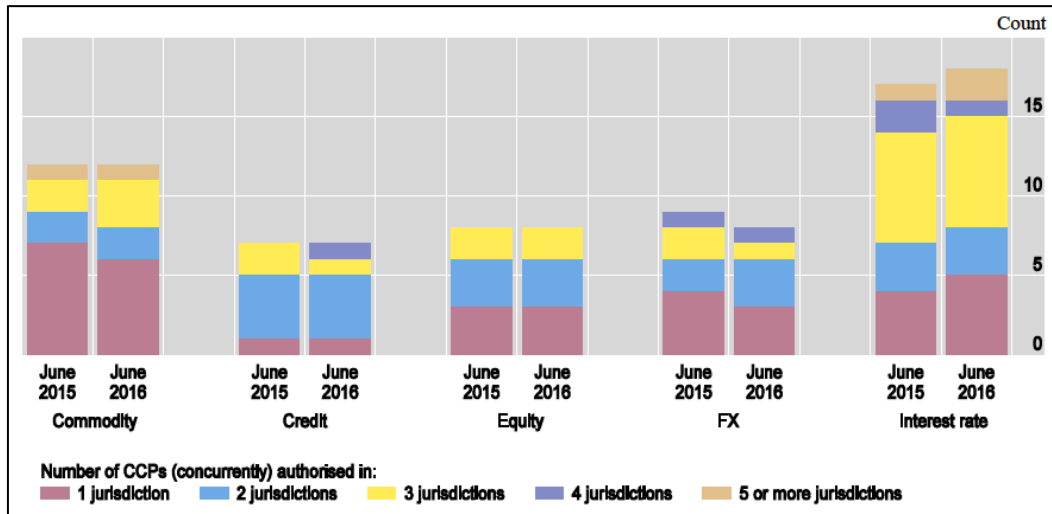
CO = commodity; CR = credit; EQ = equity; FX = foreign exchange; IR = interest rate.

For jurisdiction codes see Table 3 above.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 59.

Figure 19 and Table 8 below show that, since June 2015, there has been a progressive expansion in the cross-border availability of CCPs, with the majority of CCPs authorized to clear products in a given asset class in two or more jurisdictions. Significantly, cross-border availability has increased in the case of interest rate derivatives, with three CCPs concurrently authorized in four or more jurisdictions. Increased cross-border availability of CCPs may contribute to a further expansion of central clearing of OTC derivatives and may enhance the multilateral netting, collateral efficiencies and other risk management benefits associated with central clearing. However, increased cross-border availability of CCPs may also pose additional risk in term of systemic relevance of a particular CCP.

Figure 19. Number of CCPs concurrently authorized in one or more jurisdictions.



Each category indicates the number of FSB member jurisdictions in which a given CCP clearing at least some OTC derivatives sub-products in the indicated asset class has been concurrently authorized or pending authorization (or have a temporary exemption from authorization requirements) to offer direct and/or indirect clearing services. No CCP is currently available in more than 7 FSB member jurisdictions in a given asset class.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 20.

Table 8. Cross-border availability of CCPs by asset class as at end-June 2016.

Asset Class	Number of CCPs concurrently available in indicated number of jurisdictions						
	1 jurisdiction	2 jurisdictions	3 jurisdictions	4 jurisdictions	5 jurisdictions	6 jurisdictions	7 jurisdictions
Commodity	6	1	3	1	1	-	-
Credit	1	4	1	1	-	-	-
Equity	3	3	2	-	-	-	-
FX	3	3	1	-	1	-	-
Interest Rate	5	3	7	1	-	1	1

The figure in each cell is the number of individual CCPs clearing at least some OTC derivatives sub-products in given asset class that are concurrently authorized or pending authorization (or have a temporary exemption from authorization requirements) to offer direct and/or indirect clearing services in the indicated number of jurisdictions. No CCP is currently available in more than 7 jurisdictions in a given asset class.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 60.

2.5.3. Centrally Cleared OTC Derivatives

As illustrated in [Table 9](#) below, there has been a progressive increase in the number of regulatory determinations specifying the type of OTC derivatives contracts that should be centrally cleared.

Table 9. Central clearing determinations.

	Determinations in force as at end-June 2016	Determinations that have been made and are anticipated to be in force by H1 2017
AU	(*) <i>Interest rate</i> : certain fixed-floating and basis swaps, FRAs and OIS denominated in AUD, EUR, GBP, JPY and USD.	
CN	<i>Interest rate</i> : fixed-floating swaps denominated in CNY.	
EU	(*) <i>Interest rate</i> : certain fixed-floating and basis swaps, FRAs and OIS denominated in EUR, GBP, JPY and USD.	(*) <i>Credit</i> : by early H1 2017, selected Europe (iTraxx) indices. (*) <i>Interest rate</i> : by early 2017, certain fixed-floating and basis swaps and FRAs denominated in NOK, PLN and SEK.
HK		(*) <i>Interest rate</i> : by Sep 2016, certain fixed-floating and basis swaps denominated in EUR, GBP, HKD, JPY and USD and OIS denominated in EUR, GBP and USD.
IN	<i>FX</i> : INR-USD forwards.	
ID	<i>Equity</i> : all derivative products related to capital market (in particularly equity derivatives) are required to be traded on exchange and centrally cleared.	
JP	<i>Credit</i> : selected Japan (iTraxx) indices. <i>Interest rate</i> : fixed-floating and basis swaps denominated in JPY.	
KR	<i>Interest rate</i> : fixed-floating swaps denominated in KRW.	
MX	(*) <i>Interest rate</i> : certain fixed-floating swaps denominated in MXN.	
US	<i>Credit</i> : selected North America (CDX) and Europe (iTraxx) indices. <i>Interest rate</i> : fixed-floating and basis swaps, FRAs and OIS denominated in EUR, GBP, JPY and USD.	

(*) indicates change since September 2015.

For jurisdiction codes see [Table 3](#) above.

Source: Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 22.

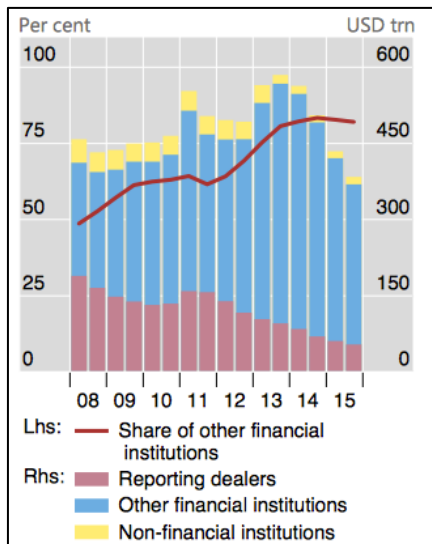
2.5.4. Market Use of OTC CCPs

According to data published by BIS, since 2010 the volume of OTC derivatives centrally cleared has grown significantly.²⁰⁷

With respect to OTC interest rate, [Figure 20](#) shows that the notional amount of interest rate contracts between derivatives dealers declined to US\$ 70 trillion at end-December 2014 and then further to US\$ 54 trillion at end-December 2015. Contracts between dealers and other financial institutions, including OTC CCPs, increased to US\$ 421 trillion at end-December 2014, and then went down to US\$ 315 trillion at end-December 2015. As noted by BIS, this sharp decline is likely to have been accounted for by the move of trades to OTC CCPs and related compression activity, which is facilitated by central clearing. Contracts with financial institutions other than dealers continued to account for the majority (82%) of interest rate derivatives contracts as of end-December 2015.²⁰⁸

Figure 20. OTC Interest rate derivatives.

Notional principal^(*) by sector of counterparty.



(*) At half-year end (end-June and end-December). Amounts denominated in currencies other than the US dollar are converted to US dollars at the exchange rate prevailing on the reference date.

Source: Bank for International Settlements (BIS), *OTC derivatives statistics at end-December 2015*, Bank for International Settlements Monetary and Economic Department (2016), p. 8.

Most recent data published by BIS²⁰⁹ indicates that, as of end-June 2016, 75% of dealers' outstanding OTC interest rate derivatives contracts were against central counterparties, compared to 37% for credit derivatives and less than 2% for

²⁰⁷ Cfr. Bank for International Settlements (BIS), *OTC derivatives statistics at end-June 2016*, Bank for International Settlements Monetary and Economic Department (2016); Bank for International Settlements (BIS), *OTC derivatives statistics at end-December 2015*, Bank for International Settlements, Monetary and Economic Department (2016); Bank for International Settlements (BIS), *OTC derivatives statistics at end-December 2014*, Bank for International Settlements, Monetary and Economic Department (2015). For additional data e statistics on main milestones and outstanding issues relating to the Dodd-Frank derivatives reforms, see, e.g., International Swaps and Derivatives Association (ISDA), *The Dodd-Frank Act: Five Years On*, International Swaps and Derivatives Association Briefing Notes (2015).

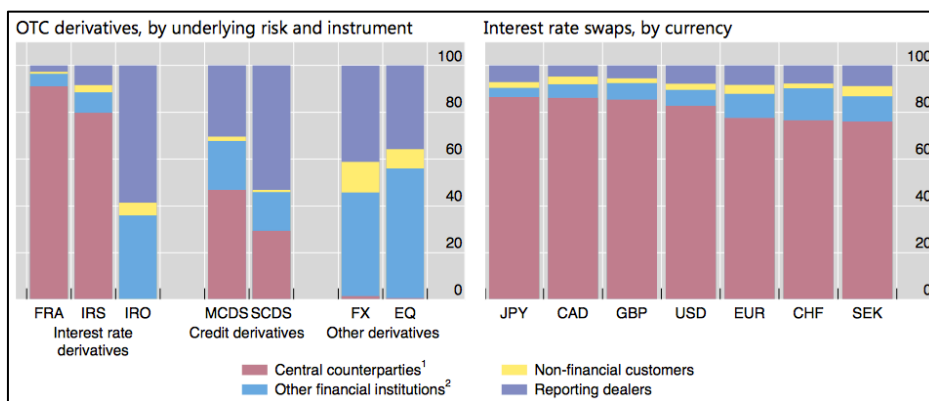
²⁰⁸ See, Bank for International Settlements (BIS), *OTC derivatives statistics at end-December 2015*, cit., p. 3.

²⁰⁹ See, Bank for International Settlements (BIS), *OTC derivatives statistics at end-June 2016*, cit., p. 4.

foreign exchange and equity derivatives.²¹⁰ Overall, 62% of the US\$ 544 trillion in notional amounts outstanding reported by dealers was centrally cleared.²¹¹

Interestingly, the left-hand panel in [Figure 21](#) below indicates that among interest-rate instruments, the share of positions booked against CCPs is highest for forward rate agreements and interest rate swaps, at 91% and 80%, respectively. For interest rate options, the share of CCPs is close to zero. The right-hand panel in [Figure 21](#) below shows that the importance of CCPs does not vary significantly across major currencies, ranging from 76% for interest rate swaps denominated in Swedish krona to 86% for those in Canadian dollars and Japanese yen, with US dollars in between at 83%.

Figure 21. Types of counterparties, as a percentage of notional amounts outstanding at end-June 2016.



FRA = forward rate agreements; FX = foreign exchange derivatives; IRS = interest rate swaps; IRO = interest rate options; EQ = equity-linked derivatives; MCDS = multi-name credit default swaps; SCDS = single-name credit default swaps.

⁽¹⁾ Contracts between reporting dealers that are subsequently novated to CCPs are recorded twice (reported once by each dealer). ⁽²⁾ Excluding central counterparties and reporting dealers.

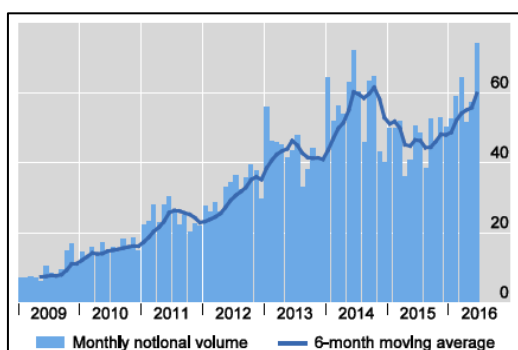
Source: Bank for International Settlements (BIS), *OTC derivatives statistics at end-June 2016*, cit., p. 7.

Additional data published by the Financial Stability Board (FSB) highlights a scenario consistent with the findings provided by BIS. [Figure 22](#) shows that the aggregate clearing volume for newly executed OTC interest rate derivative transactions has averaged around US\$ 59 trillion in notional amounts per month in the six months to June 2016 for two of the largest CCPs currently authorized to offer central clearing in several jurisdictions, compared with around US\$ 47 trillion in the six months to June 2015.

²¹⁰ Id., p. 6 and accompanying note (explaining that “[the 75%] share refers to the outstanding positions of reporting dealers and not the share of trades cleared through CCPs; as a share of outstanding positions, contracts with CCPs are counted twice, whereas as a share of trades each contract would be counted once.”).

²¹¹ Ibidem. Significantly, of the US\$ 544 trillion in notional amounts outstanding at end-June 2016, US\$ 512 trillion (94%) was reported by dealers from the 13 countries that participate in the BIS’s semiannual survey, and US\$ 32 trillion by dealers that participate only in the Triennial Central Bank Survey.

Figure 22. Central clearing volumes in OTC derivatives for selected EU and US CCPs. Monthly notional amounts,^(a) US\$ trillions. Interest rate.^(b)



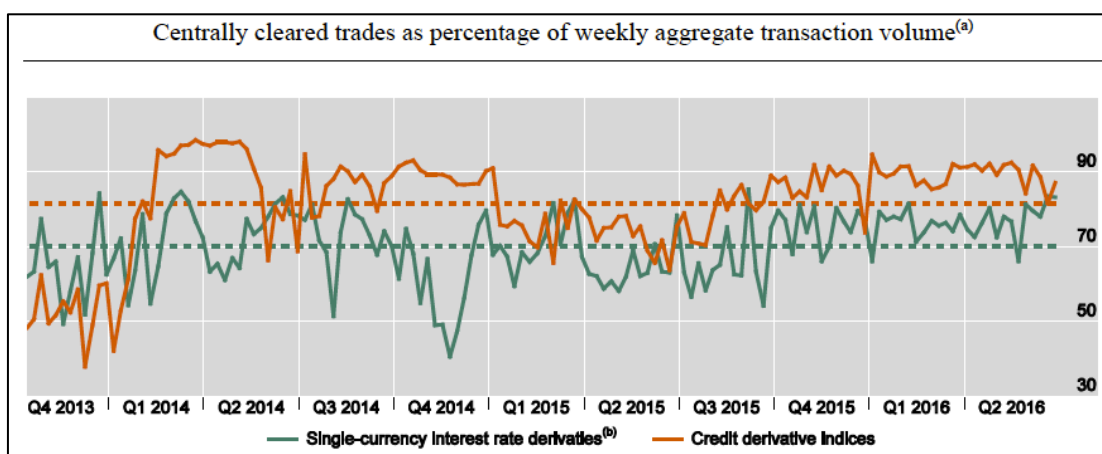
^(a) Newly cleared transactions, gross of subsequent netting or compression.

^(b) All OTC interest rate derivative transactions cleared by CME Clearing and LCH.Clearnet Ltd (SwapClear).

Source: Financial Stability Board (FSB), *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 24.

In addition, Figure 23 shows that, among the single-currency interest rate OTC derivatives transactions reported under CFTC trade reporting rules, the centrally cleared trades as a percentage of weekly aggregate transaction volume have averaged 76% over the first half of 2016.

Figure 23. Central clearing of new OTC derivatives transactions in the US.



Dotted line indicates average from October 2013 to June 2016.

^(a) Transactions reported to CME Group SDR, DTCC Data Repository and ICE Trade Vault in accordance with CFTC trade reporting rules. Amounts cleared include both transactions subject to CFTC mandatory clearing requirements and those cleared voluntarily. Data are aggregated by notional principal amounts.

^(b) Includes both single-currency and cross-currency transactions.

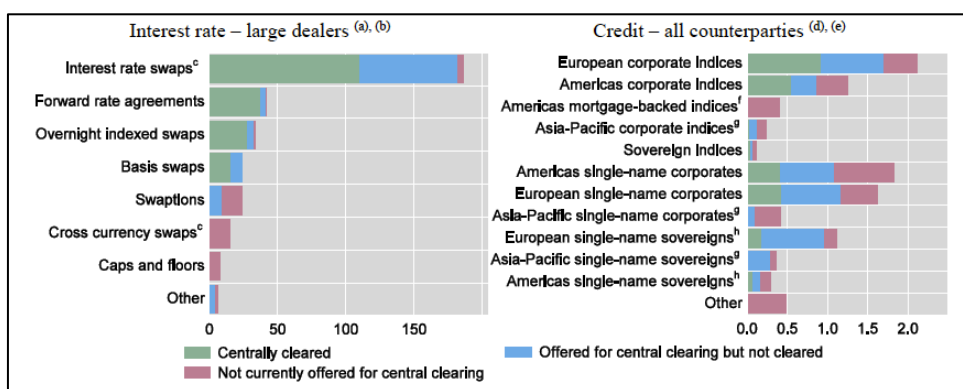
Source: Financial Stability Board (FSB), *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 25.

Based on transactions reported to the Depository Trust & Clearing Corporation (DTCC) by a group of large dealers as at end-June 2016,²¹² Figure 24 shows

²¹² See, Depository Trust & Clearing Corporation, *Global Trade Repository Reports*, available at <http://www.dtcc.com/repository-otc-data.aspx?tbid=0#rates>. The dealers that voluntarily report interest rate derivatives

that the gross notional outstanding amount of centrally cleared positions was approximately US\$188 trillion across all sub-product types. As noted by the FSB, this amount represented around 65% of the estimated notional outstanding amount of transactions that could theoretically be centrally cleared, based on the current availability of CCPs that offer clearing services for OTC interest rate derivatives transactions globally, and 56% of all estimated notional outstanding amounts.²¹³ On the other hand, as of end-June 2016 there was around US\$103 trillion in notional outstanding amounts of transactions that had not been centrally cleared, but theoretically could be. As further noted by the FSB, these data suggest the possibility of scope for further uptake of central clearing.²¹⁴

Figure 24. Central Clearing of OTC Interest Rate and Credit Derivatives by Product Type. Outstanding notional amounts, USD trillions, as at end-June 2016.



(a) Estimates based on public TR information and present central clearing offerings of Asigna, ASX, BM&F BOVESPA, CCIL, CME, Eurex Clearing, HKEx, JSCC, KDPW, KRX, LCH.Clearnet Ltd, Nasdaq OMX, Moscow Exchange, SCH and SGX. Amounts cleared include transactions subject to mandatory clearing requirements in certain jurisdictions and those cleared voluntarily.

(b) Adjusted for double-counting of dealers' centrally cleared trades; amounts reported to DTCC by 16 large dealers.

(c) Includes vanilla (> 98% of total) and exotic (< 2% of total) products as classified by DTCC.

(d) Estimates based on public TR information and present central clearing offerings of CME, Eurex Clearing, ICE Clear Credit, ICE Clear Europe, JSCC and LCH.Clearnet SA. Amounts cleared include transactions subject to mandatory clearing requirements in certain jurisdictions and those cleared voluntarily.

(e) Adjusted for double-counting of centrally cleared trades; amounts reported to DTCC for all counterparties.

(f) Includes both residential and commercial mortgage-backed indices.

(g) Includes corporates for Japan, Asia ex-Japan and Australia/NZ.

(h) Includes sovereigns, sub-sovereign states and state-owned enterprises.

Source: Financial Stability Board (FSB), *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 26.

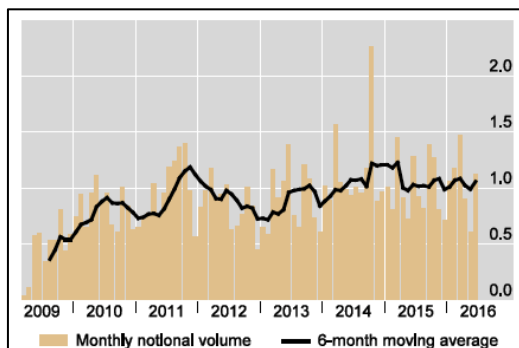
With respect to credit derivatives, [Figure 25](#) shows that central clearing volumes for credit derivatives have been fairly steady in recent years, averaging around US\$1 trillion in notional amounts per month since the start of 2014 for the largest CCPs clearing credit derivatives in the EU and the US.

information to DTCC Derivatives Repository Ltd.'s Global Trade Repository for OTC interest rate derivatives products are the following: Barclays Capital; BNP Paribas; Bank of America – Merrill Lynch; Citibank, Credit Suisse; Deutsche Bank; Goldman Sachs; HSBC; J.P. Morgan; Morgan Stanley; Nomura Securities; Royal Bank of Canada; Royal Bank of Scotland; Société Générale; UBS; and Wells Fargo Bank.

²¹³ See, Financial Stability Board, *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, Financial Stability Board (2016), p. 25 and accompanying notes.

²¹⁴ *Ibidem*.

Figure 25. Central clearing volumes in OTC derivatives for selected EU and US CCPs. Monthly notional amounts,^(a) USD trillions. Credit.^(b)



^(a) Newly cleared transactions, gross of subsequent netting or compression.

^(b) All credit derivative transactions cleared by ICE Clear Credit and ICE Clear Europe.

Source: Financial Stability Board (FSB), *OTC Derivatives Market Reforms: Eleventh Progress Report on Implementation*, cit., p. 24.

The proportion of outstanding CDSs cleared through CCPs has increased from 10% at end-June 2010 to 23% at end-June 2013 and 37% at end-June 2016. The share of CCPs is higher for multi-name products than for single-name products: 47% versus 29% (see, [Figure 21](#) above). This can be explained considering the fact that multi-name products, which consist primarily of contracts on CDS indices, tend to be more standardized than single-name products and, thus, more suitable to central clearing. As CDSs become more standardized, CCPs' share of newer contracts is likely to increase. CDSs with remaining maturity of one year or less have a lower share of central clearing (27%) than those maturing in one to five years (41%).

In addition, [Figure 23](#) above indicates that the rate of central clearing of OTC credit derivative indices as percentage of weekly aggregate transaction volume has averaged 89% over the first half of 2016.

CHAPTER 3: SYSTEMIC RISK AND OTC DERIVATIVES

Chapter 3 will begin by providing a brief conceptualization of systemic risk in the context of financial markets. Next, the Chapter will focus on the structural interconnectedness and linkages existing among financial institutions and markets as key mechanisms of transmission of systemic risk. The Chapter will, then, discuss recent studies on systemic risk that have identified and analyzed alternative channels of propagation of systemic risk, and will explain why the findings of these studies are of critical importance for the implementation of central clearing mandates of OTC derivatives.

3.1. Conceptualization of Systemic Risk

Engineers are fond of saying that you can't control, fix or improve, what you can't measure; and you can't accurately measure anything for which there is no minimum uniformly accepted conceptualization. This is certainly true for systemic risk. Hence, notwithstanding a call by regulators and international organizations for improving regulation of systemic risk following the GFC, at the date of writing there is still a widespread uncertainty as per what constitutes systemic risk and what causes this risk.²¹⁵

Alternative definitions of systemic risk and interpretations of its sources have been offered by various scholars, financial institutions and regulators.²¹⁶ As noted by Prof. Schwartz,²¹⁷ the proposed conceptualizations of systemic risk are often inconsistent. For example, significant divergences exist with respect to the identified systemic risk-generating event(s): the trigger event is alternatively defined as a mere "event",²¹⁸ or a "modest economic shock,"²¹⁹ or a "failure of a part of the financial sector,"²²⁰ or a "default by one market participant."²²¹

²¹⁵ See, Alan Greenspan (then Chairman of the Board of the Governors of the Federal Reserve System), *Risk Measurement and Systemic Risk*, Remarks at a Conference on Research Conference on Risk Measurement and Systemic Risk, Washington D.C. (November 16, 1995).

²¹⁶ For a review of systemic risk-related literature, see, e.g., Gabriele Galati and Richhild Moessner, *Macroprudential policy - a literature review*, Bank of International Settlements Working Paper No. 337 (2011); European Central Bank (ECB), *The Concept of Systemic Risk*, European Central Bank, Financial Stability Review, pp. 134-142 (2009); European Central Bank (ECB), *Financial Stability Review* (2010), pp. 147 ss; Dimitrios Bisias, Mark Flood, Andrew W. Lo, Stavros Valavanis, *A Survey of Systemic Risk Analytics*, U.S. Department of Treasury, Office of Financial Research Working Paper No.0001 (2012); Darryll Hendricks, *Defining Systemic Risk*, Pew Financial Reform Project Briefing No. 1 (2009); Steven L. Schwarcz, *Systemic Risk*, 97 *Georgetown Law Journal* Vol. 97, pp. 193-204 (2008); George G. Kaufman and Kenneth E. Scott, *What Is Systemic Risk, and Do Bank Regulators Retard or Contribute to It?*, *The Independent Review*, Vol. 7, No. 3, pp. 371-391 (2003); Pawel Smaga, *The Concept Of Systemic Risk*, *The London School of Economics and Political Science, Systemic Risk Centre Special Paper No. 5* (2014).

²¹⁷ See, Steven L. Schwarcz, *Systemic Risk*, cit., pp. 196-197 and note 11 – 13.

²¹⁸ See, e.g., George G. Kaufman, *Bank Failures, Systemic Risk, and Bank Regulation*, *Cato Journal*, Vol. 16, No.1, pp. 17-45 (1996), p. 20; George G. Kaufman, *Comment on Systemic Risk*, in George G. Kaufman (ed.), *Research in Financial Services: Banking, Financial Markets, and Systemic Risk*, JAI Press, Vol. 7, pp. 47-52 (1995) (defining systemic risk as "the probability that cumulative losses will occur from an event that ignites a series of successive losses along a chain of institutions or markets comprising a system."); Bank for International Settlements (BIS), *Annual Report, 1993—1994*, Bank for International Settlements (1994), pp. 177-190 (defining systemic risk as "the risk that the failure of a participant to meet its contractual obligations may in turn cause other participants to default, with the chain reaction leading to broader financial difficulties"); Group of Ten (G10), *Report on Consolidation in the Financial Sector*, (2001), Group of Ten (G10) (2001), p. 126 (defining systemic financial risk as "a risk that an event will trigger a loss of confidence in a substantial portion of the financial system that is serious enough to have adverse consequences for the real economy.").

²¹⁹ See, e.g., Paul H. Kupiec and David B. Nickerson, *Assessing Systemic Risk Exposure from Banks and GSEs Under Alternative Approaches to Capital Regulation*, *Journal of Real Estate Finance and Economics*, Vol. 28, No. 2, pp. 123-145 (2004) (arguing that "[a] key feature in the propagation of such a systemic shock is acute uncertainty regarding an

Moreover, different views have been expressed with respect to the consequences of the triggering event and the type of negative effects that shall occur for a risk to be deemed “systemic” in nature: some definition of systemic risk focus on “a series of successive losses along a chain of institutions or markets;”²²² others emphasize the resulting chain of financial institutions’ failures²²³ and the repercussions on other market or interlocking market participants;²²⁴ others highlight the “loss of confidence in a substantial portion of the financial system” caused by the triggering event “that is serious enough to have adverse consequences for the real economy;”²²⁵ some emphasize the resulting “substantial volatility in asset prices, significant reductions in corporate liquidity, potential bankruptcies and efficiency losses;”²²⁶ others point out the resulting decline in liquidity in financial markets, the impairment on payment system, and their cumulative impact on the real sectors of the economy;²²⁷ some highlight the increases in the cost of capital or decreases in its availability as the main consequences of systemic risk;²²⁸ and others focus the attention on the “major disruption to the global financial system” caused by systemic risk.²²⁹

institution’s ability to satisfy its immediate payment obligations and a simultaneous inability of counterparties to hedge such risk.”).

²²⁰ See, Viral V. Acharya, Lesse H. Pedersen, Thomas Philippon and Matthew Richardson, *Regulating Systemic Risk*, in Viral V. Acharya and Matthew Richardson (eds.), *Restoring Financial Stability: How to Repair a Failed System*, John Wiley & Sons (2009), pp. 283-303 (defining systemic risk as “the failure of a significant part of the financial sector – one large or many smaller ones – leading to a reduction in credit availability that has the potential to adversely affect the real economy.”); Tobias Adrian and Markus K. Brunnermeier, *CoVar*, Federal Reserve Bank of New York, Staff Report No. 348 (2014) (defining systemic risk as “the risk that the intermediation capacity of the entire financial system is impaired, with potentially adverse consequences for the supply of credit to the real economy.”); Robert Parry, *Global Payments in the 21st Century: A Central Banker’s View*, Federal Reserve Board San Francisco Economic Letter No. 15 (1996) (defining systemic risk as “the risk that one bank’s default may cause a chain reaction of payments system failures and even threaten the solvency of institutions.”).

²²¹ See, e.g., U.S. Commodity Futures Trading Commission, *CFTC Glossary*, available at <http://www.cftc.gov/ConsumerProtection/EducationCenter/CFTCGlossary/index.htm> (Last visited December 2016) (defining systemic risk as “[t]he risk that a default by one market participant will have repercussions on other participants due to the interlocking nature of financial markets. For example, Customer A’s default in X market may affect Intermediary B’s ability to fulfill its obligations in Markets X, Y, and Z.”); Bank for International Settlements (BIS), *Annual Report, 1993–1994*, cit., p. 177 (defining systemic risk as “the risk that the failure of a participant to meet its contractual obligations may in turn cause other participants to default, with the chain reaction leading to broader financial difficulties.”).

²²² See, e.g., George G. Kaufman, *Bank Failures, Systemic Risk, and Bank Regulation*, cit.; George G. Kaufman, *Comment on Systemic Risk*, in George G. Kaufman (ed.), cit.

²²³ See, e.g., Robert Parry, *Global Payments in the 21st Century: A Central Banker’s View*, cit.; Bank for International Settlements (BIS), *Annual Report, 1993–1994*, cit.

²²⁴ See, e.g., U.S. Commodity Futures Trading Commission, *CFTC Glossary*, cit.

²²⁵ See, e.g., Group of Ten (G10), *Report on Consolidation in the Financial Sector*, cit.

²²⁶ Paul H. Kupiec and David B. Nickerson, *Assessing Systemic Risk Exposure from Banks and GSEs Under Alternative Approaches to Capital Regulation*, cit.

²²⁷ See, e.g., Viral V. Acharya, Lesse H. Pedersen, Thomas Philippon and Matthew Richardson, *Regulating Systemic Risk*, cit.; Tobias Adrian and Markus K. Brunnermeier, *CoVar*, cit.

²²⁸ See, e.g., William J. McDonough (President Federal Reserve Bank of New York), *Private-Sector Refinancing of the Large Hedge Fund, Long-Term Capital Management*, Statement Before the United States House of Representatives Committee on Banking and Financial Services (October 1, 1998) (stating that the most important direct consequence of systemic risk brought on by a failure of Long-Term Capital Management would have been “increases in the cost of capital to American businesses”); see also E. Philip Davis, *Debt, Financial Fragility, and Systemic Risk*, Oxford University Press (1995), p. 117 (describing the worst consequence of systemic risk as “disrupt[ing] the payments mechanism and capacity of the system to allocate capital”); Steven L. Schwarcz, *Systemic Risk*, cit., p. 204 (defining systemic risk as “(i) an economic shock such as market or institutional failure triggers (through a panic or otherwise) either (X) the failure of a chain of markets or institutions or (Y) a chain of significant losses to financial institutions, (ii) resulting in increases in the cost of capital or decreases in its availability, often evidenced by substantial financial-market price volatility.”).

²²⁹ See, e.g., Frank J. Fabozzi, *Capital Markets: Institutions, Instruments, and Risk Management*, MIT Press, 5th ed. (2015), p. 51 (defining systemic risk as the risk that “the interconnectedness of financial institutions throughout the world can through contagion cause major disruption to the global financial system”); Philip Bartholomew and Gary Whalen,

3.2. Institution Systemic Risk and Market Systemic Risk: An Integrated Perspective

Initial conceptualizations of systemic risk have mainly focused on scenarios characterized by multiple failures of financial institutions, in particular banking institutions severely hit by deposit runs.²³⁰ Most recent researches on systemic risk, however, have moved from an institution-centric approach to a market-centric approach, and have paid increased attention to the systemic effects associated with capital markets' activities.²³¹

As noted by Prof. Schwarcz, there are at least three similarities between institutional systemic risk and market systemic risk: first, institutions and markets can be involved in both scenarios; second, in both cases failures can be transmitted through linkages in a chain of structural and functional relationships;²³² and third, both financial institutions and financial markets can be at the same time triggers and transmitters of systemic risk.²³³ Because of these similarities - Prof. Schwarcz argues - institutional systemic risk and market systemic risk should not be viewed in isolation, rather they should be analyzed together.²³⁴

The integrated approach suggested by Prof. Schwarcz has a number of important implications. First, this approach helps understand why the term "financial institutions," for purposes of systemic risk-related regulation, should be construed as to encompass not only commercial banks, but also hedge funds, investment banks, money market funds, insurance firms, and other financial intermediaries whose activities may become a source of instability for the financial system.²³⁵ Second, the proposed integrated perspective helps understand why the focus of a regulation that aims at mitigating systemic risk should be both on financial institutions *and* capital markets.²³⁶ Hence, any systemic-risk related regulation that narrowly focuses on individual institutions is

Fundamentals of Systemic Risk, in George G. Kaufman (ed.), *Research in Financial Services: Banking, Financial Markets, and Systemic Risk*, JAI Press, Vol. 7, 3-17 (1995); Frederic Mishkin, *Comment on Systemic Risk*, in George G. Kaufman (ed.), *Research in Financial Services: Banking, Financial Markets, and Systemic Risk*, JAI Press, Vol. 7, 31-45 (1995).

²³⁰ See, e.g., Douglas W. Diamond and Philip H. Dybvig, *Bank Runs, Deposit Insurance, and Liquidity*, *Journal of Political Economy*, Vol. 91, No. 3, pp. 401-419 (1983); Gerald P. Jr. Dwyer and Gilbert R. Alton, *Bank Runs and Private Remedies*, *Federal Reserve Bank of St. Louis Review*, pp. 43-61 (1989); Charles W. Calomiris and Gary B. Gorton, *The Origins of Banking Panics: Models, Facts and Bank Regulation*, in Charles W. Calomiris (ed.), *U.S. Bank Deregulation in Historical Perspective*, Cambridge University Press (2006), pp. 93-163.

²³¹ See, e.g., Steven L. Schwarcz, *Enron and the Use and Abuse of Special Purpose Entities in Corporate Structures*, *University of Cincinnati Law Review*, Vol. 70, pp. 1309-1318 (2006); Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, *Wisconsin Law Review*, No. 3, pp. 815-840 (2012) (arguing that "the ongoing trend towards disintermediation—enabling companies to directly access the ultimate source of funds, the capital markets, without going through financial intermediaries—is making financial markets themselves increasingly central to any examination of systemic risk."); Steven L. Schwarcz, *Systemic Risk*, cit., pp. 200-202 (noting that "[s]ystemic disturbances can erupt outside the international banking system and spread through capital-market linkages, rather than merely through banking relationships" and that "[a]s disintermediation increases, therefore, systemic risk should increasingly be viewed by its impact on markets, not institutions per se.").

²³² See, e.g., Steven L. Schwarcz, *Systemic Risk*, cit., pp. 200-202 and accompanying notes.

²³³ See, e.g., Steven L. Schwarcz, *Identifying and Managing Systemic Risk: An Assessment of Our Progress*, Keynote Address at George Mason University AGEP Advanced Policy Institute on Financial Services Regulation (May 10, 2011), p. 4.

²³⁴ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 202.

²³⁵ *Ibidem*. See, also, Viral V. Acharya, Lesse H. Pedersen, Thomas Philippon and Matthew Richardson, *Regulating Systemic Risk*, cit., pp. 284-286.

²³⁶ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 202.

seriously flawed: such regulation would encourage financial institutions to pass their risks of failure around the system to unregulated entities, with the effect that any individual institution's risk of failure will be either hidden in the unregulated sector or aggregated – in either case, will likely become systemic in nature.²³⁷

3.3. Systemic Risk and Externalities

By its very nature, systemic risk can be thought of as a negative free-riding externality imposed by individual financial institutions and other market participants on the system.²³⁸ This is because, when making risk-taking decisions, financial institutions and other market participants tend to be self-regarding: they are motivated to achieve individual profits and protect themselves, but they do not necessarily have the incentive to protect the entire financial system.²³⁹ As a result, financial institutions and other market participants may decide to engage in profitable transactions even though doing so could create or increase systemic instability.²⁴⁰

For example, when an individual firm decides to hold large amounts of illiquid assets, concentrate its investments into few selected assets, and/or significantly increase its own leverage, its goal is to efficiently manage its own risk/return trade-off, and not necessarily to minimize the risk of systemic-wide instability.

Due to the direct and indirect linkages existing among financial institutions and other market participants, decisions undertaken by individual participants may have spillover effects.²⁴¹ In particular, the failure of a financial institution or an individual market participant may trigger liquidity spirals, lower asset prices, and create a hostile funding environment. This, in turn, may cause the failures of many other financial institutions and market participants and lead to further price drops and funding illiquidity.²⁴² These repercussions are all examples of dangerous externalities.

Furthermore, additional externalities may arise due to the possibility of rescue of a failed firm: when a firm fails individually, other financial institutions and other market participants (or even the government) may step in and acquire the troubled firm or otherwise take on most of its lending and related activities. As a

²³⁷ See, e.g., Viral V. Acharya, Thomas Philippon, Matthew Richardson and Nouriel Roubini, *Prologue: A Bird's-Eye View. The Financial Crisis of 2007-2009: Causes and Remedies*, in Viral V. Acharya and Matthew Richardson (eds.), *Restoring Financial Stability: How to Repair a Failed System*, John Wiley & Sons (2009), p. 29.

²³⁸ See, e.g., Viral V. Acharya, Lasse H. Pedersen, Thomas Philippon and Matthew Richardson, *Measuring Systemic Risk*, New York University Stern School of Business Working Paper (2010); James Bullard, Christopher J. Neely and David C. Wheelock, *Systemic Risk and the Financial Crisis: A Primer*, Federal Reserve Bank of St. Louis Review, Vol. 91, No. 5, pp. 403-417 (2009), p. 410 note 20 (noting that “[s]ystemic risk constitutes a “negative externality” in the sense that the actions of one firm harm others. The situation is analogous to a firm that pollutes the environment. Because others bear at least some of the costs of the pollution, the firm will tend to pollute more than it would if it had to compensate others for these costs. Negative externalities are an example of a market failure that may require government intervention to ameliorate.”); Xavier Freixas, Luc Laeven and José-Luis Peydró, *Systemic Risk, Crises, and Macroprudential Regulation*, MIT Press (2015).

²³⁹ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 206 and accompanying notes.

²⁴⁰ See, Steven L. Schwarcz, *Keynote Address: Understanding the Subprime Financial Crisis*, cit., p. 562 (further explaining that “[t]herefore, even in a simple financial system with no conflicts and hyper-diligent market participants, systemic risk is theoretically possible.”).

²⁴¹ See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, Notre Dame Law Review, Vol. 86, No. 4, pp. 1349-1412 (2011), pp. 1375.

²⁴² Cf., e.g., Markus Brunnermeier and Lasse Heje Pedersen, *Market Liquidity and Funding Liquidity*, cit.; Nicolae Garleanu and Lasse Heje Pedersen, *Liquidity and Risk Management*, cit.

result, system-wide losses can occur when many financial institutions and other market participants fail simultaneously and their collective failure cannot be promptly resolved.²⁴³

As observed by Prof. Schwarcz, the described externalities give rise to a “type of tragedy of the commons,”²⁴⁴ whereby the benefits of exploiting finite capital resources accrue to individual firms and other market participants, each of whom has a strong incentive to maximize its own use of the common resources, whereas the costs of exploitation are distributed among an even wider group of market participants.²⁴⁵ This is an important observation:

- First, the type of tragedy of the commons described by Prof. Schwarcz helps explain the failure by market participants to identify the nature of the correlations existing in the system, assess the extent and relevance of such correlations, and ultimately appreciate the risk that such correlations could generate a systemic crisis.²⁴⁶
- Second, the observation that the costs of the systemic failure will extend far beyond single market participants helps understand why market participants might lack sufficient incentives to internalize their externalities, even if they do understand that incurring certain risks may contribute to systemic instability.²⁴⁷
- Third, the type of tragedy of the commons described by Prof. Schwarcz also helps understand why any attempt to mitigate systemic risk should first and foremost seek to create the right incentives for market

²⁴³ See, Vital V. Acharya, *A Theory of Systemic Risk and Design of Prudential Bank Regulation*, New York University Stern School of Business, Working Paper (2009). In addition, implicit government guarantees can create moral hazard problem and, thus, increase the need for regulating systemic risk. See, e.g., Acharya, Viral V. and Tanju Yorulmazer, *Too Many to Fail - An Analysis of Time-inconsistency in Bank Closure Policies*, Journal of Financial Intermediation, Vol. 16, No. 1, pp. 1-31 (2007); Viral V. Acharya, Lesse H. Pedersen, Thomas Philippon and Matthew Richardson, *Regulating Systemic Risk*, cit., pp. 288-289; Emmanuel Farhi and Jean Tirole, *Collective Moral Hazard, Maturity Mismatch and Systemic Bailouts*, NBER Working Paper No. w15138 (2009); Gary H. Stern and Ron J. Feldman, *Too Big to Fail: The Hazards of Bank Bailouts*, Brookings Institution Press (2004); William Poole (then President of the Federal Reserve Bank of St. Louis), Financial Stability, Remarks at the Council of State Governments Southern Legislative Conference Annual Meeting, New Orleans, Louisiana (August 4, 2002); William Poole (then President of the Federal Reserve Bank of St. Louis), Reputation and the Non-Prime Mortgage Market, Remarks at the St. Louis Association of Real Estate Professionals, St. Louis, Louisiana (July 20, 2007); John B. Taylor, *Getting Off Track: How Government Actions and Intervention Caused, Prolonged, and Worsened the Financial Crisis*, Hoover Institution Press (2009).

²⁴⁴ The original concept of a tragedy of the commons can be traced back to Aristotle (See, Aristotle, *Politics*, (Benjamin Jowett translation), Dover Publications (2000) (“[t]hat which is common to the greatest number has the least care bestowed upon it. Every one thinks chiefly of his own, hardly at all of the common interest.”). Externalities that can give rise to a type of tragedy of the commons are most familiar in the environmental system. For instance, a typical example of a tragedy of the commons is an overgrazed pasture resulting from common ownership where no individual owner has the right to exclude use by other owners. See, Garret Hardin, *The Tragedy of the Commons*, Science, New Series, Vol. 162, No. 3859, pp. 1243-1248 (1968).

²⁴⁵ See, e.g., Steven L. Schwarcz, *Systemic Risk*, cit., p. 206 and accompanying notes 66; Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, Wisconsin Law Review, No. 3 (2012), p. 821 accompanying note 21; Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., p. 1375 and accompanying note 105; Steven L. Schwarcz, *Keynote Address: Understanding the Subprime Financial Crisis*, cit., p. 562; Steven L. Schwarcz, *A Regulatory Framework for Managing Systemic Risk*, Keynote Address at the European Central Bank Seminar on Regulation of Financial Services in the EU: Surveillance—Resilience—Transparency (October 20, 2011). Prof. Schwarcz explains that systemic risk gives rise to a type of tragedy of the commons insofar as market participants suffer from the actions of other market participants; and it is a more standard externality insofar as non-market participants suffer from the actions of market participant.

²⁴⁶ See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., p. 1375.

²⁴⁷ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 206.

participants to internalize their externalities.²⁴⁸ This is important when considering clearing mandates for OTC derivatives. As discussed in detail in the following Chapters, OTC CCPs seek to create the necessary incentives for their CMs to internalize systemic externalities associated with their trading in OTC derivatives by requiring CMs to contribute to a mutual default fund and participate in coordinated default management procedures.

3.4. Mechanisms of Transmission of Systemic Risk: Interconnectedness and Domino Effect

The most general way to conceive the process of transmission of systemic risk is that of a trigger event that causes a chain of bad economic consequences, which, in turn, impact financial institutions, markets, or both.²⁴⁹ This scenario is often referred to as “domino effect” or “knock-on reaction:”²⁵⁰ when a major financial institution fails, its failure hits others institutions, thus causing them to fail as well; the failures of these other institutions, then, cascade through the interconnected financial structure in a chain of failures, which ultimately knocks down the entire financial system.²⁵¹

Significantly, the domino effect described above involves a rapid widespread of failures of large institutions or markets directly and/or indirectly connected to each other.²⁵² The existence (and perceived existence) of these direct and indirect connections is a key point.

²⁴⁸ See, e.g., Schwarcz, *Systemic Risk*, cit., p. 206 (arguing that “[w]ithout regulation, the externalities caused by systemic risk would not be prevented or internalized”); Steven L. Schwarcz, Keynote Address: Understanding the Subprime Financial Crisis, cit., p. 566; Steven L. Schwarcz, *Regulating Complexity in Financial Markets*, Washington University Law Review, Vol. 87, No. 2, p. 211-268 (2011), pp. 212-213 and accompanying note 3; Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., p. 1375 and accompanying note 106 (explaining that “the tragedy of the commons can be viewed as a conflict between individual firms and broader financial-market interests”); Patricia A. McCoy, Andrey D. Pavlov and Susan M. Wachter, *Systemic Risk Through Securitization: The Result of Deregulation and Regulatory Failure*, Connecticut Law Review, Vol. 41, No. 4, pp. 1327-1375 (2009), p. 1366 (noting that one of the surprising phenomena of the expansion of non-prime mortgage lending from 2002-2006 was that “as systemic risk increased, risk premia did not”); Rodrigo Cifuentes, Gianluigi Ferrucci and Hyun Song Shin, *Liquidity Risk and Contagion*, Bank of England, Working Paper No. 264 (2005), pp. 17-18; Clifford De Souza and Mikhail Smirnov, *Dynamic Leverage: A Contingent Claims Approach to Leverage for Capital Conservation*, Journal of Portfolio Management, Vol. 31, No. 1, pp. 25-28 (2004); Richard Bookstaber, *Systemic Risk: Examining Regulators’ Ability to Respond to Threats to the Financial System*, Hearing Before the Congress of the United States, House Financial Services Committee (October 2, 2007) (arguing that the threats to the financial system stem largely from two increasingly dominant market characteristics: first, the complexity of the markets; and second, the tendency for the markets to move rapidly into a crisis mode with little time or opportunity to intervene. Referring to the latter market characteristic, by analogy to engineering, as “tight coupling.”).

²⁴⁹ In this sense, see, e.g., Steven L. Schwarcz, *Systemic Risk*, cit., p. 197; Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., p. 1 (defying systemic risk as “the risk of a significant reduction in the effectiveness of the financial system, cause for example by a chain reaction of failures of major institutions.”).

²⁵⁰ See, Mark J. Roe, *Clearinghouse Overconfidence*. California Law Review, Vol. 101, No. 6, pp. 1641-1703 (2013), p. 1691.

²⁵¹ See, e.g., Markus Brunnermeier, Andrew Crockett, Charles Goodhart, Avinash Persaud and Hyun Shin, *The Fundamental Principles Of Financial Regulation*, ICMB International Center for Monetary and Banking Studies (2009), pp. 13-24; Jean-Charles Rochet and Jean Tirole, *Interbank Lending and Systemic Risk*, Journal of Money, Credit and Banking, Vol. 28, No. 4, pp. 733-762 (1996); Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, Brooklyn Journal of Corporate, Financial, and Commercial Law, Vol. 10, No. 1, pp. 129-154 (2015), p. 146 (noting that although interconnectedness is not the only source of systemic risk, it is an important aspect of it.).

²⁵² Even financial institutions and market participants that do not transact directly with the troubled financial institution can be exposed to losses through their dealings and transactions with affected third parties. See, e.g., Roger Lagunoff and

Financial innovation that preceded the GFC, in particular securitization and derivatives markets, has significantly contributed to increase the number, types, and complexity of network connections in the financial system to the point that complex links among financial market participants and institutions have become “a hallmark of the modern global financial system.”²⁵³

Interconnectedness could be a double-edge sword. On one hand, there are numerous benefits associated with increased interconnectedness. For example, connections among financial institutions and markets can be a source of strength for these institutions and can help increase liquidity and availability of credit. Moreover, connections among market participants can increase investment opportunities and facilitate management and diversification of risks.

On the other hand, increased interconnectedness can make the financial system fragile and vulnerable to systemic shocks. In particular, as acknowledged by the then Federal Reserve Vice Chair Janet Yellen, “experience--most importantly, our recent financial crisis--as well as a growing body of academic researches”²⁵⁴

Stacey L. Schreft, *A Model of Financial Fragility*, *Journal of Economic Theory*, Vol. 99, No. 1-2, pp. 220-264 (2001); Gianni De Nicoló and Myron L. Kwast, *Systemic Risk and Financial Consolidation: Are they Related?*, *International Monetary Fund, IMF Working Paper No. 55*, 2002.

²⁵³ See, Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, Speech at the American Economic Association/American Finance Association Joint Luncheon, San Diego, California (January 4, 2013). See, also, Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds, and the Perils of Financial Innovation*, John Wiley & Sons (2007), p. 5 (arguing that “financial markets have seen a tremendous amount of engineering in the past 30 years but the result has been more frequent and severe breakdowns. These breakdowns come about not in spite of our efforts at improving market design, but because of them. The structural risk in the financial market is a direct result of our attempts to improve the state of the financial markets; its origins are in what we would generally chalk up as progress.”).

²⁵⁴ See, e.g., Franklin Allen and Douglas Gale, *Financial Contagion*, *The Journal of Political Economy*, Vol. 108, No. 1, pp. 1-33 (2000) (Franklin Allen and Douglas Gale provide detailed insights on how the banking system responds to contagion when banks are connected under different network structure. In their model, systemic risk arises from liquidity shocks propagated from one bank to another through interbank deposits. Allen and Gale show that a “complete network” (meaning network where all banks lend to and borrow from all other banks) is more prone to contagion than an “incomplete network” (meaning a network where each bank borrows from only one neighbor and lends to only one other neighbor) and that greater connectivity reduces the likelihood that a liquidity shock at one bank would cause widespread defaults of other banks.); Douglas W. Diamond and Philip H. Dybvig, *Bank Runs, Deposit Insurance, and Liquidity*, *Journal of Political Economy*, Vol. 91, No. 3, pp. 401-419 (1983) (Douglas Diamond and Philip Dybvig apply the formal methods of game theory to bank runs. In their model Diamond and Dybvig show that banks issuing demand deposits can improve risk sharing among people who need to consume at different random times, but they may also experience multiple Nash equilibria, one of which is a bank run. In particular, the “bad equilibrium” may occur when bank account holders expect most other bank account holders to rush quickly to withdraw their deposits and close their account so they have the incentive to rush quickly to withdraw their deposits and close their accounts, too.); Xavier Freixas, Bruno M. Parigi and Jean-Charles Rochet, *Systemic Risk, Interbank Relations, and Liquidity Provision by the Central Bank*, *Journal of Money, Credit and Banking*, Vol. 32, No. 3, pp. 611-638 (2000) (Freixas, Parigi, and Rochet model systemic risk in an interbank market. As illustrated in their study, interbank credit lines can allow banks to manage customers’ liquidity needs and help them reduce the cost of holding liquidity. However, the combination of interbank credit and the payments system also makes the overall banking system prone to experience dangerous coordination failure (gridlock equilibrium) triggered by uncertain withdrawals by customers even when all banks are solvent. Moreover, as illustrated by Freixas, Parigi, and Rochet, the structure of financial flows may affect the stability of the banking system with respect to solvency shocks, as well. Hence, although interbank connections enhance the “resiliency” of the system when one bank is insolvent, interbank connections may also allow an insolvent bank to continue operating through the implicit guarantee generated by the interbank credit lines, thus diminishing the incentives to close inefficient banks.); Hyun Song Shin, *Financial Intermediation and the Post-Crisis Financial System*, *Bank for International Settlements, BIS Working Paper No. 304* (2010) (Shin focuses his analysis on the interconnectedness among financial institutions. In particular, in his study Shin illustrates how this interconnectedness is further extended by financial institutions taking on more leverage during a boom period, and how it exacerbates the negative and destabilizing effects of a sharp deleveraging by financial intermediaries.); Ricardo J. Caballero and Alp Simsek, *Fire Sales in a Model of Complexity*, *Massachusetts Institute of Technology Department of Economics Working Paper No. 09-28* (2009) (In their study, Ricardo Caballero and Alp Simsek illustrate how the complexity of the linkages among modern financial institutions cause a lack of information about cross-exposure and the structure of interbank credit relationships, which, in turn, can influence and channel systemic risk in financial networks. In particular, in their model Caballero and Simsek note that although banks have knowledge of their own exposures, they are typically uncertain about cross exposures of other financial institutions that are farther away from

suggests that interconnections among financial intermediaries are not an unalloyed good. Complex interactions among market actors may serve to amplify existing market frictions, information asymmetries, or other externalities.²⁵⁵

Moreover, extensive interconnectedness among institutions or markets can exacerbate the losses associated with their failures and facilitate their spread across the system. A recent study by Gai, Haldane, and Kapadia²⁵⁶ shows that highly interconnected firms can transmit shocks widely, impairing the rest of the financial system and the economy. Further researches conducted by Haldane also show that the modern financial network displays a “robust-yet-fragile” structure: higher liability interconnectedness operates as a shock-absorber and facilitates innocuous absorption of most shocks, thus reducing the overall probability of systemic failure; however, when low-probability high impact events occur, interconnections operate as shock-amplifiers, which spread and potentiate failures more than in less connected networks.²⁵⁷

The findings of the above studies are important because the domino effect is precisely the form of systemic risk that central clearing mandates for OTC derivatives seek to mitigate.²⁵⁸ As further discussed in the following Chapters, the belief that central clearing of OTC derivatives can reduce systemic risk is largely based on the idea that systemic crises are most likely to spark from the failure of a single institution, which leads to a chain of failures of other institutions via a domino mechanism.²⁵⁹ OTC CCPs are, thus, relied on to break the chain of

them in the network. While this uncertain is a dormant factor in normal times, it does become a critical factor when liquidity shocks hit parts of the financial network. Upon the occurrence of a liquidity shock, the lack of information about cross-exposure and the structure of interbank credit relationships increases the counterparty risk perceived by banks and exacerbates their concerns about spillover and domino effects of banks' failure. As shown in the study, banks seek to deal with this uncertainty by adopting more conservative liquidity strategies, selling more of their illiquid assets, and withdrawing more of their funding resources from their counterparties than they would if they had access to complete and accurate information about the structure of interbank credit relationships. The resulting excessive deleveraging, in turn, can generate vicious cycles that magnify the effects of the initial shock.); Prasanna Gai, Andrew Haldane and Sujit Kapadia, *Complexity, Concentration and Contagion*, Journal of Monetary Economics, Vol. 58, No. 5, pp. 453-470 (2010) (Gai, Haldane, and Kapadia develop a network model of interbank lending that illustrates how greater complexity and concentration in the financial network may amplify the fragility of the network itself by increasing the frequency and harshness of funding contagion.); Rama Cont, Amal Moussa and Edson B. Santos, *Network Structure and Systemic Risk in Banking Systems*, in Jean-Pierre Fouque and Joe Langsam (eds.), *Handbook of Systemic Risk*, Cambridge University Press (2013), pp. 327-368 (In their empirical study, Cont, Moussa, and Santos investigate metrics and indicators for localizing the source of systemic risk within the financial network. Their research shows that institutions with larger interbank exposures tend to be more systemically important and that a financial institution's position within the financial network is a critical factor to determine its systemic impact in the network).

²⁵⁵ See, Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit.

²⁵⁶ See, Prasanna Gai, Andrew Haldane and Sujit Kapadia, *Complexity, Concentration and Contagion*, Journal of Monetary Economics, Vol. 58, No. 5, pp. 453-70 (2011). See, also, Prasanna Gai and Sujit Kapadia, *Contagion in Financial Networks*, Bank of England Working Paper No. 383 (2010) (The authors develop an analytical model of contagion in financial networks with arbitrary structure. Their findings suggest that financial systems exhibit a “robust-yet-fragile” tendency: while the probability of contagion may be low, the effects can be extremely widespread when problems occur.).

²⁵⁷ See, Andrew G. Haldane, *Rethinking the Financial Network*, Speech at the Financial Student Association, Amsterdam (April 28, 2009); Andrew G. Haldane, *Why Institutions Matter (More Than Ever)*, Speech delivered at Centre for Research on Socio-Cultural Change (CRESC) Annual Conference, School of Oriental and African Studies, London (September 4, 2013); Andrew G. Haldane and Robert M. May, *Systemic Risk in Banking Ecosystems*, Nature, Vol. 469, No. 7330, pp. 351-355 (2011); Andrew G. Haldane, *Managing Global Finance As A System*, Speech delivered at the Maxwell Fry Annual Global Finance Lecture at Birmingham University, Birmingham (October 29, 2014).

²⁵⁸ See, Mark J. Roe, *Clearinghouse Overconfidence*, California Law Review, cit., pp. 1651-1652.

²⁵⁹ In this sense, see Craig Pirrong, *You Can't Mutualize, Insure, or Diversify Systematic Risk*, StreetWise Professor Blog (August 2, 2011).

failures and avoid the domino effect by assuring that, upon the default of one of their CMs, its counterparties are insulated and default losses minimized.²⁶⁰

3.5. “Alternative” Mechanisms of Transmission of Systemic Risk

More recent studies have raised the question of whether the interconnected nature of the financial system discussed in the previous section is the most relevant mechanism of propagation of systemic risk. In answering this question, these studies have revealed the existence of alternative (and perhaps more dangerous) mechanisms of propagation of systemic risk. The sub-sections below will review some of these studies, and will explain why their findings are of critical importance for the implementation and enforcement of central clearing mandates of OTC derivatives.

3.5.1. Asset Price Movements, Volatility, and Market Liquidity

Prominent among the scholars challenging the general approach to systemic risk described in the previous section is Prof. Pirrong. In a recent study, Prof. Pirrong argues that major periods of crisis (e.g., the Black Monday in 1987, the Asian and Russian crises in 1998, and the recent GFC) have all resulted from common shocks hitting many financial institutions simultaneously, and not from an initial idiosyncratic shock to a major institution triggering a chain of failures of other institutions.²⁶¹

In particular, Prof. Pirrong identifies three dangerous common shocks:

- Large Price Movements - During the GFC, months before the collapse of Lehman Brothers, some prices across asset classes moved by huge amounts and a number of financial institutions (allegedly) experienced high-sigma events.²⁶² For instance, in August 2007, Goldman Sachs' CFO David Viniar lamented that there had been several 25 standard deviation moves in multiple markets.²⁶³
- Volatility - Significant changes in volatilities can affect exposures on non-linear positions, while significant increases in volatilities tend to intensify the risk that exposures and creditworthiness will move substantially.
- Poor Market Liquidity - Sharp declines in market liquidity can increase volatility and can make it more difficult to manage the risk on exposures and to transfer or close positions in order to reduce exposures.

The analysis proposed by Prof. Pirrong is important because it helps identify dangerous channels and mechanisms of propagation of systemic risk that

²⁶⁰ Ibidem. See, also, Stephen G. Cecchetti, Jacob Gyntelberg and Marc Hollanders, Central Counterparties for Over-The-Counter Derivatives, Bank of International Settlements (BIS) Quarterly Review, pp. 45–58 (2009), p. 45; Andrew G. Haldane, *Lead Comment on Counterparty Risk*, Journal of Risk Management in Financial Institutions Vol. 5, No. 3, pp. 224–226 (2012); Alistair Milne, *OTC Central Counterparty Clearing: Myths and Reality*, Journal of Risk Management in Financial Institutions, Vol. 5, No. 3, pp. 335–346 (2012).

²⁶¹ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 24 and accompanying note 64.

²⁶² See, Craig Pirrong, *You Can't Mutualize, Insure, or Diversify Systematic Risk*, cit.

²⁶³ Reported in the Financial Times, August 13, 2007. See, also, Bill Bonner, *25 Standard Deviations in a Blue Moon*, MoneyWeek (November 11, 2007); Kevin Dowd, John Cotter, Chris Humphrey and Margaret Woods, *How Unlucky is 25-Sigma?*, The Journal of Portfolio Management, Vol. 34, No. 4, pp. 76–80 (2008).

proponents of clearing mandates for OTC derivatives might have not properly considered. As previously mentioned, central clearing mandates for OTC derivatives have primarily focused on reducing structural interconnectedness within the financial system based on the idea of systemic risk as a “domino effect.” Not enough attention, however, seems to have been paid to the danger of large asset price movements, significant changes and increased volatility and/or poor liquidity identified by Prof. Pirrong. As further discussed in Chapter 6 below, the concern is that should an OTC CCP take on a defaulting CM’s position under the stressed market conditions identified by Prof. Pirrong, the OTC CCP’s safeguards might be inadequate, and might even become a source of additional systemic instability. Under such circumstances, margins would be severely impacted, CMs would likely incur extreme difficulties in meeting their margins calls and the OTC CCP’s mutualized default fund would be at risk of even greater losses.²⁶⁴

3.5.2. Funding and Liquidity Contagion

Consistent with the analysis proposed by Prof. Pirrong are the findings of a recent study by Hal S. Scott and the staff of the Committee on Capital Markets Regulation.²⁶⁵ Their report evaluates the issue of systemic risk in the context of the recent GFC, with focus on the Lehman Brothers’ failure and the AIG’s debacle.

Scott et al. debunk the “conventional narrative” according to which the GFC was the result of a “domino effect” via an “asset interconnectedness” (meaning, the scenario where the failure of one financial institution directly triggers the failure of other financial institutions that have direct credit exposures to the first failed institution) and a “liability interconnectedness” (meaning, the event where one institution, which provides short-term funding to other institutions, stops funding those institutions, thus causing their failure). Contrary to this traditional view, Scott et al. show that exposures to Lehman Brothers through asset interconnectedness and liability interconnectedness did not prove to be as systemically destabilizing as feared. The authors argue that the GFC was caused by a financial “contagion,” described as a run-like behavior that hits a large number of financial institutions (regardless of any direct or indirect interconnections or relations among them) and causes funding to be rapidly withdrawn from such institutions due to a fear of widespread imminent failures.

In particular, as the authors observe, before its failure, Lehman Brothers faced increased collateral requirements and margin calls, which quickly exhausted its liquidity resources and exposed it to a severe liquidity crisis. Moreover, the authors note that Lehman Brothers’ failure sent a strong signal to the market: it raised concrete concerns about the availability of government bailouts of large financial institutions and created uncertainty as per the severity of losses

²⁶⁴ See, e.g., Nicolae Garleanu and Lasse Heje Perdersen, *Liquidity and Risk Management*, cit.; Craig Pirrong, *You Can’t Mutualize, Insure, or Diversify Systematic Risk*, cit. (noting that “[i]n a “normal” (Gaussian) world, 25 sd moves don’t occur ... So when such moves occur—and they occur in the real, non-normal world— margins get blown through. Meaning that if someone defaults, they’re well into the default fund, and the protection of the “deductible” is gone”).

²⁶⁵ See, Hal S. Scott, *Interconnectedness and Contagion*, Committee on Capital Markets Regulation (2012).

incurred by Lehman Brothers and other financial institutions. These concerns and the overall uncertainty about the potential risks of asset interconnectedness, then, raised doubts about the solvency of many financial institutions and resulted in a run on these institutions as well.²⁶⁶ These runs, in turn, spurred a contagious liquidity crisis in the short-term funding market, which propagated rapidly across the entire financial system and the global economy.

Similarly to the Lehman Brothers' case, Scott et al. further argue that the systemic instability associated with AIG's failure was more the result of a funding/liquidity contagion, rather than the result of actual direct losses.

Based on the analysis of the Lehman Brothers' case and AIG's case, the authors argue that the financial system is particularly vulnerable to liquidity/funding contagion because of its dependence on short-term borrowing by banks and non-bank financial intermediaries. Moreover, the authors observe that, different from other causes of systemic instability, the possibility for contagious runs to spread across institutions and markets exists regardless of whether such institutions or markets are healthy, solvent, or not.

The findings of the report by Scott et al. are of critical importance to understand the impact of OTC CCPs on systemic risk. As previously mentioned, clearing mandates for OTC derivatives are largely predicated on the belief that connections among financial institutions and markets are the most relevant source of systemic crises. Contrary, the report shows that, although the configuration of the financial network does affect its vulnerability to systemic crisis, it is the funding/liquidity contagion channel that plays a more critical role in generating systemic crisis.²⁶⁷ These findings, thus, raise the concern that OTC CCPs may not be financial equipped to withstand and survive a liquidity/funding contagion scenario, and that key features of OTC CCPs, such as margin and assessment rights, may turn OTC CCPs themselves into a source of liquidity/funding contagion.

²⁶⁶ Perceptions of risk are affected by availability. For example, availability of effects helps explain why after disasters people increase insurance and that individuals and governments tend to adopt more protective measures targeted to the worst scenario. See, e.g., Howard Kunreuther, Mark V. Pauly and Stacey McMorrow, *Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry*, Cambridge University Press (2013); Howard Kunreuther, *Reflections on U.S. Disaster Insurance Policy for the 21st Century*, in John Quigley and Larry Rosenthal (eds.), *Risking Houses and Home*, Berkeley Public Policy Press (2008). Perceptions about the frequency of events tend to be distorted by the prevalence of, and the emotional intensity with which, the message is conveyed. For instance, studies on availability biases conducted by Paul Slovic have shown that estimates of tragedy are exacerbated by media coverage, which, in turn, is biased toward novelty and poignancy. As a result, unusual events that attract disproportionate media coverage are consequently perceived as being less unusual than they actually are. See, e.g., Paul Slovic, Melissa Finucane, Ellen Peters, and Donald G. MacGregor, *The Affect Heuristic*, in Thomas Gilovich, Dale Griffin and Daniel Kahneman (eds.), *Heuristics and Biases: The Psychology of Intuitive Judgment*, Cambridge University Press (2002), pp. 397-420; Paul Slovic, Melissa Finucane, Ellen Peters and Donald G. MacGregor, *Risk as Analysis and Risk as Feelings: Some Thoughts About Affect, Reason, Risk, and Rationality*, *Risk Analysis*, Vol. 24, No. 2, pp. 311-322 (2004); Paul Slovic, *Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield*, *Risk Analysis*, University of Chicago Legal Forum, Vol. 1997, No.1, pp. 59-99 (1997); Paul Slovic et al., *Facts Versus Fears: Understanding Perceived Risk*, in Daniel Kahneman, Paul Slovic and Amos Tversky (eds.), *Judgment Under Uncertainty: Heuristics and Biases*, Cambridge University Press, pp. 463-490 (1982). See, also, Daniel Kahneman and Dale T. Miller, *Norm Theory: Comparing Reality to its Alternatives*, *Psychological Review*, Vol. 93, No. 2, pp. 136-153 (1986) (explaining that events appear normal because "they recruit the original episode, retrieve it from memory, and are interpreted in conjunction with it.").

²⁶⁷ See, Hal S. Scott, *Interconnectedness and Contagion*, cit., p. 4. See, also, Lasse H. Pedersen, *When Everyone Runs to the Exit*, *The International Journal of Central Banking*, Vol. 5, No. 4, pp. 177-199 (2009).

3.5.3. System-Wide Asset Price Deterioration and Information Opacity

In line with the analysis offered by Prof. Pirrong are also the studies on systemic risk and OTC derivatives conducted by Prof. Roe. In a recent publication, Prof. Roe argues that the GFC was driven deeply by two factors: system-wide asset price deterioration and wide information opacity.²⁶⁸

With respect to the former factor, Prof. Roe notes that a financial institution hit by large losses may be forced to reduce its risk exposure by selling assets at distressed or fire-sale prices. If the asset sales by the troubled financial institution are large enough, then the market price for those assets will decline significantly. This, in turn, forces other financial institutions holding similar assets to revalue their assets at temporarily low market values. Severe revaluations may, then, force such financial institutions to raise new funding, cut their lending activities, or sell their own assets. As a result, the asset sale by the first troubled financial institution may result into a cascade of fire sales that further deteriorates the asset values and inflicts losses on many financial institutions, thus reducing the financial system's capacity to manage risk and channel capital through the economy.²⁶⁹

With respect to the latter factor, Prof. Roe notes that in an opaque market, disclosure of financial problems at some institutions may generate uncertainty about negative impacts on their counterparties, the solvency and liquidity of other financial institutions, and/or the nature and extent of (direct and indirect) exposures. This uncertainty, in turn, may have economy-wide implications. In a context of uncertainty of risk exposures, many market players may become increasingly reluctant to trade with each other, and may have the strong incentive to rush for the exits.²⁷⁰ This, in turn, may increase the danger to all market participants and the fragility of the entire financial system: markets will

²⁶⁸ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., 1652-1654.

²⁶⁹ Ibidem. See, also, Gary B. Gorton and Andrew Metrick, *Securitized Banking and The Run on Repo*, Journal of Financial Economics, Elsevier, Vol. 104, No.3, pp. 425-451 (2012); Antoine Martin, David Skeie and Erst-Ludwig Von Thadden, *Repo Runs*, Federal Reserve Bank of New York Staff Report, No. 444 (2012); Brian Begalle, Antoine Martin, James McAndrews and Susan McLaughlin, *The Risk of Fire Sales in the Tri-Party Repo Market*, Federal Reserve Bank of New York Staff Report No. 616 (2013); Gaetano Antinolfi, Francesca Carapella, Charles Kahn, Antonio Mart, David Mills and Ed Nosal, *Repos, Fire Sales and Bankruptcy Policy*, Federal Reserve Bank of Chicago Working Paper No.15 (2012); Squam Lake Working Group on Financial Regulation, *Credit Default Swaps, Clearinghouse, and Exchange*, Council on Foreign Relations, Center for Geoeconomic Studies, Working Paper (2009), p. 3; Franklin Allen and Douglas Gale, *Understanding Financial Crises*, Oxford University Press (2009); Gary B. Gorton and Andrew Metrick, *Securitized Banking and the Run on Repo*, Journal of Financial Economics, Vol. 104, pp. 425-451 (2012); Fernando Duarte and Thomas M. Eisenbach, *Fire-Sale Spillovers and Systemic Risk*, Federal Reserve Bank of New York, Staff Report No. 645 (2015); James Bullard, Christopher J. Neely and David C. Wheelock, *Systemic Risk and the Financial Crisis: A Primer*, cit., pp. 403, 408. For rapid asset price deterioration as a major systemic risk, see generally Carmen M. Reinhart and Kenneth S. Rogoff, *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press (2011); Andrei Shleifer and Robert Vishny, *Fire Sales in Finance and Macroeconomics*, Journal of Economic Perspectives, Vol. 25, No. 1, pp. 29-48 (2011).

²⁷⁰ Studies on psychology of causality show that people are prone to assign causality and to ascribe intentions and personalities to objects and events in their surroundings. For illustrations of automatic search for causality, see, e.g., Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, Random House Publishing Group, 2nd ed. (2010), pp. 74 seq.; Albert Michotte, *The Perception of Causality*, Basic Books (1963); Fritz Heider and Mary-Ann Simmel, *An Experimental Study of Apparent Behavior*, The American Journal of Psychology, Vol. 57, No. 2, pp. 243-259 (1944).

not only fail to perform their primary function in channeling capital, but they will also become conduits of systemic instability.²⁷¹

The analysis offered by Prof. Roe is critical to understand the impact of OTC derivatives clearing mandates on systemic risk. As mentioned above, promoters of clearing mandates have largely focused on the risk that the failure of a single institution could trigger a cascade of failures due to the existence of direct and indirect structural connections among financial institutions and markets. Little attention has been paid on downward asset price spirals and information opacity and their impact on the stability of the financial system. Thus, there is now a concern that OTC CCPs may not be targeted to contain these other channels of systemic crisis. Even worse, OTC CCPs may exacerbate the system-wide effects of downward asset price spirals and information opacity. In particular, as discussed in detail in Chapter 6, the risk is that increasing and rigorous collateralization requirements and margin calls together with the activation of OTC CCPs' unfunded liquidity arrangements or other recovery instruments may cause CMs to suffer significant funding and liquidity pressure. This pressure, in turn, may force CMs to engage in asset "fire" sales, which may depress asset prices further and force even more sales, thus generating a "loss spiral." Widespread financial strains, in turn, may raise serious doubts about CMs' solvency, may increase the incentive to run on CMs and other big financial institutions directly or indirectly connected to them, and may cause funding and liquidity to dry up. The actual insolvency, and the illiquidity driven by widespread fears of their potential insolvency, may eventually have destabilizing effects across the entire financial system.

3.5.4. Conflicts of Interest, Complacency, Complexity, and Tragedy of the Commons

In a recent publication,²⁷² Prof. Anabtawi and Prof. Schwarcz analyze mechanisms of transmission of systemic risk. In particular, the authors argue that two otherwise independent correlations can combine to transform localized economic shocks into broader systemic crises.²⁷³ The first of these correlations is an "intra-institutional correlation" between a firm's financial integrity and its exposure to the risk of low-probability adverse events that either constitute or could lead to economic shocks.²⁷⁴ The second correlation is an "inter-institutional correlation" among financial firms and markets. Significantly, the identification of this second correlation is based on the acknowledgement that transmission of

²⁷¹ Cf., e.g., Jeffrey N. Gordon and Christopher Muller, *Confronting Financial Crisis: Dodd-Frank's Dangers and the Case for a Systemic Emergency Fund*, Columbia Law and Economics Working Paper No. 374 (2010); Toni Ahnert and Co-Pierre Georg, *Information Contagion and Systemic Risk*, Working Paper (2015); Viral V. Acharya and Tanju Yorulmazer, *Information Contagion and Inter-Bank Correlation in a Theory of Systemic Risk*, London Business School Working Paper (2002).

²⁷² See, Iman Anabtawi & Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit.

²⁷³ Id., pp. 1376-1380.

²⁷⁴ Id., p. 1354 (By "low-probability" events, the authors mean events that are rare but nevertheless predictable. These events are often referred to as "gray swans" events, as the term is defined in the book "The Black Swan" by Nassim Nicholas Taleb. "Gray swans" events differ from the so-called "black swans" events, as the former can be identified ex ante and are susceptible to measurement and prediction.). See, also, Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, cit.; Nassim Nicholas Taleb and George A. Martin, *How to Prevent other Financial Crises*, SAIS Review, Vol. 32, No. 1, pp. 49-60 (2012).

risk through a network can help absorb shocks by spreading risks among various market participants, but it can also intensify shocks and lead to systemic crisis.²⁷⁵

Based on an analysis of four financial crises - the Great Depression, the collapse of Long-Term Capital Management (LTCM), the failure of Enron, and the GFC - Prof. Anabtawi and Prof. Schwarcz show how the described two correlations have combined to exacerbate the transmission of initially localized financial shocks throughout the entire financial system. Building on this analysis, the authors, then, identify the following four interrelated factors that help explain the inability and unwillingness of market participants to address the described correlations and/or to prevent them to combine and produce systemic instability: conflicts of interest, complacency, complexity, and a type of tragedy of the commons.²⁷⁶ Among these four factors, of particular interest are complacency and complexity.

With respect to the “complacency” factor, Prof. Anabtawi and Prof. Schwarcz note that certain behavioral biases can affect the ability of market participants to assess risks when making decisions in a context of uncertainty and limited data.²⁷⁷ Among these behavioral biases, the authors identify “optimism bias” and “availability bias” (or “availability heuristic”).²⁷⁸ Optimism bias refers to the observed tendency of people to be overly optimistic about the outcomes of uncertain events, either by over-estimating positive outcomes or under-estimating negative ones. Availability bias refers to the observed tendency of people to judge frequency by the ease²⁷⁹ with which instances comes to mind.²⁸⁰

²⁷⁵ Id., p. 1355 (noting that “[t]he financial system is comprised of institutions [meaning both firms and markets] that are highly interrelated. In this sense, it is a “network”).

²⁷⁶ See, Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, cit., p. 404.

²⁷⁷ See, Daniel Kahneman, *Thinking, Fast and Slow*, Farrar, Straus and Giroux (2013), p. 25 (discussing a two-systems approach to judgment and choice: on one hand, the intuitive System 1, which does the “fast thinking, generates impressions, feelings and inclinations; on the other hand, the effortful “System 2,” which does the “slow thinking” and monitors System 1. Explaining the concept of bias as “systemic errors that [System 1] is prone to make in specified circumstances.”).

²⁷⁸ Id., p. 98 (explaining the concept of “heuristic” as “a simple procedure that helps find adequate, though often imperfect, answers to difficult questions. The word comes from the same root as eureka.”). Thus, in their essence, heuristics involve a process of substitution of one (complex) question for another (less complex) question, and this process of substitution, in turn, leads to systematic errors of judgment).

²⁷⁹ Id., pp. 59ss (describing “cognitive ease” as a “more comfortable effort, which leads to illusions.” In particular, in his studies, Daniel Kahneman shows how visual or any other memory can lead to a false sense of familiarity, which, in turn, “has a powerful quality of “pastness” that seems to indicate that it is a direct reflection of prior experience. This quality of pastness is an illusion.”). See, also, Larry L. Jacoby, Colleen Kelley, Judith Brown, and Jennifer Jasechko, *Becoming Famous Overnight: Limits on the Ability to Avoid Unconscious Influences of the Past*, *Journal of Personality and Social Psychology*, Vol. 56, No. 3, pp. 326-338 (1989); Bruce W.A. Whittlesea, Larry J. Jacoby and Krista Girard, *Illusions of Immediate memory: Evidence of an Attributional Basis for Feelings of Familiarity and Perceptual Quality*, *Journal of Memory and Language*, Vol. 29, pp. 716-732 (1990). For instance, an individual experience greater cognitive ease (that is, she can read more easily and more quickly) with respect to words that she has seen before, and this sense of ease, in turn, gives the individual the impression of familiarity on which she relies to assess the truth and falsity of a statement. See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 64-67.

In general, factors that help reduce cognitive strain can also help generate truth illusions: maximizing legibility, using simple language, repetition, memorable illustrations, and easily pronounced sources can induce cognitive ease and a comforting feeling of familiarity, which, in turn, can help make a statement more persuasive. See, Robert B. Zajonc, *Attitudinal effects of Mere Exposure*, *Journal of Personality and Social Psychology*, Vol. 9, No. 2, pp. 1-27 (1968); Robert B. Zajonc and D. W. Rajecki, *Exposure and Affect: A Field Experiment*, *Psychonomic Science*, Vol. 17, No. 4, pp. 216-217 (1969); Jennifer L. Monahan, Sheila T. Murphy and Robert B. Zajonc, *Subliminal Mere Exposure: Specific, General, and Diffuse Effects*, *Psychological Science*, Vol. 11, No.6, pp. 462-466 (2000); and Robert B. Zajonc, *Mere Exposure: A Gateway to the Subliminal*, *Current Directions in Psychological Science*, Vol. 10, No. 6, pp. 224-227 (2001).

²⁸⁰ Cognitive studies show that people tend assess the probability of an event by asking whether relevant examples are cognitively “available,” that is they can be easily remembered. Various factors can affect memory retrieval, including salient events, dramatic events, and personal experiences. Studies of the psychology of availability conducted by a group

As noted by the authors, optimism bias and availability bias play a critical role in explaining a phenomenon known as "disaster myopia:" due to optimism bias and availability bias individuals tend to underestimate the probability and the potential adverse consequences of rare extreme events, and they tend to be overly optimistic when thinking about rare but potentially devastating events that occurred in the past and with which they have no recent experience.²⁸¹ Significantly, the longer the period since the low-probability adverse event occurred, the lower the subjective probability that individuals will attached to it.²⁸²

Related to the concept of availability heuristic is also the concept of "illusion of validity," whereby the coherence of the underlying story (rather than the quality or completeness of the data available) causes an individual to overrate his/her ability to accurately interpret and predict the outcomes when analyzing a set of data.²⁸³ The resulting confidence is, thus, more a subjective feeling, than a reasoned evaluation of the probability that the judgment is correct.²⁸⁴ This is a key point as it means that when an individual experiences "illusion of validity," neither the quality nor the accuracy or completeness of the data and information available will be relevant.

As noted by Prof. Anabtawi and Prof. Schwarcz, the described associative processes assume particular relevance in the context of information scarcity and information opacity. In particular, when information is limited, individuals tend to "jump to conclusions"²⁸⁵ and experience a number of biases of judgment and choice, including "overconfidence" about belief and abilities,²⁸⁶ "optimism bias,"²⁸⁷ "framing effect,"²⁸⁸ and "base-rate neglect."²⁸⁹

of German psychologists led by Norton Schwarz tested people to see what effect requiring them to list a specified numbers of instances of an event would have on their impressions of the frequency of that event. See, Norbert Schwarz, Herbert Bless, Fritz Strack, Gisela Klumpp, Helga Rittenauer-Schatka, Annette Simons, *Ease of Retrieval as Information: Another Look at the Availability Heuristic*, *Journal of Personality and Social Psychology*, Vol. 61, No. 2, pp. 195-202 (1991). Schwarz and his colleagues showed that unexpected progressive low fluency in producing instances led people to conclude they were unassertive. Schwarz and his colleagues also showed that heuristic can be reverted and judgments are no longer influenced by the ease with which instances come to mind when an explanation for the unexpected low fluency is presented. These findings led Daniel Kahneman to the conclusion that the described heuristic might be better described as "unexplained unavailability heuristic." See Daniel Kahneman, *Thinking, Fast and Slow*, cit. p. 133.

²⁸¹ See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., p. 1367.

²⁸² For an analysis of disaster myopia in the context of financial crises, see, e.g., Jack M. Guttentag and Richard J. Herring, *Disaster Myopia in International Banking*, Princeton University Essays in International Finance, No. 164 (1986); Richard J. Herring, *Credit Risk and Financial Instability*, *Oxford Review of Economic Policy*, Vol. 15, No. 3, pp. 63-79 (1999).

²⁸³ See, Daniel Kahneman and Amos Tversky, *On the Psychology of Prediction*, *Psychological Review*, Vol. 80, No. 4, pp. 237-251 (1973); Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 85-88.

²⁸⁴ See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 212ss (explaining that cognitive illusions (e.g., illusion of validity and illusion of skills) are deeply entrenched when supported by a powerful professional culture.).

²⁸⁵ *Id.*, pp. 85, 87.

²⁸⁶ *Id.*, pp. 212-220, 237-244 (observing the tendency by investors to exaggerate their own skills, knowledge and ability to control events, and to underestimate the role of chance). See, also, Brad M. Barber and Terrance Odean, *The Behavior of Individual Investors*, in George Constantinides, Hilton Harris and Rene Stulz (eds.), *Handbook of Economics of Finance*, Volume 2, Elsevier Publishing (2013), pp. 1533-1570.

²⁸⁷ See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 255-285.

²⁸⁸ The language used to describe the possible gains and losses influences the decision made by the individuals. See, e.g., Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 88, 363-374; Daniel Kahneman and Amos Tversky, *Choices, Values and Frames*, *American Psychologist*, Vol. 39, No. 4, pp. 341-350 (1984).

²⁸⁹ See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 88, 147-151.

Related to the “complacency” factor described above is the “complexity” factor.²⁹⁰ Prof. Anabtawi and Prof. Schwarcz argue that complexity can cause failures to identify or fully appreciate both the infra-institutional correlation and the inter-institutional correlation:

- With respect to the infra-institutional correlation, the authors observe that individuals faced with complexity tend to rely excessively on simplifying heuristics (e.g., credit ratings or mathematical models) as substitutes for their own analysis.²⁹¹ This, in turn, causes market participants to underestimate the risk of remote shocks to the financial condition of their portfolios: complexity essentially makes the risk “less salient, more opaque, and more difficult to model.”²⁹²
- With respect to the inter-institutional correlation, Prof. Anabtawi and Prof. Schwarcz note that in highly complex financial markets, firms are constantly adjusting their risk exposures in condition of information uncertainty. In such conditions, localized shocks may well spread throughout the entire system even if market participants are not directly contractually linked to each other and even if they do not engage in “fire sales.” Complexity increases information opacity, which, in turn, can cause a firm’s financial problems to extent to other part of the system by making it extremely difficult to assess the nature of its losses and direct and cross exposures. Faced with this uncertainty, market participants may become extremely reluctant to extend credit to other market participants based on “similarity” concerns.²⁹³ These negative effects are intensified by technological innovation, which can make financial markets more “temporally” complex.²⁹⁴

Similar to the studies on systemic risk discussed in the previous sections, the study by Prof. Anabtawi and Prof. Schwarcz is of great importance for the

²⁹⁰ See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., p. 1368 (defining complexity in the financial system as “the elaborate web of financial and legal relationships that increasingly underlies financial assets, investment securities, and financial markets”).

²⁹¹ Id., p. 1370. See, also, Steven L. Schwarcz, *Conflicts and Financial Collapse: The Problem of Secondary-Management Agency Costs*, Yale Journal on Regulation, Vol. 26, No. 2, pp. 457-470 (2009), pp. 461-462; Steven L. Schwarcz, *Disclosure's Failure in the Subprime Mortgage Crisis*, Utah Law Review, No. 3, pp.1109-1122 (2008), pp. 1109, 1114-15; Steven L. Schwarcz, *Regulating Complexity in Financial Markets*, cit., p. 223 and accompanying note 59; M. Granger Morgan, Max Henrion and Mitchell Small, *Uncertainty: A Guide To Dealing With Uncertainty In Quantitative Risk And Policy Analysis*, Cambridge University Press (1992), p. 102; Anuj K. Shah and Daniel M. Oppenheimer, *Heuristics Made Easy: An Effort-Reduction Framework*, Psychological Bulletin, Vol. 134, No. 2, pp. 207-222 (2008), p. 207 (explaining behavioral psychology experiment demonstrating when individuals employ heuristics); Cass R. Sunstein, *A Behavioral Analysis of Law*, The University of Chicago Law Review, Vol. 64, No.4, pp. 1175-1195 (1997) (discussing biases and heuristics in the legal context); Christine Jolls, Cass R. Sunstein and Richard Thaler, *A Behavioral Approach to Law and Economics*, Stanford Law Review, Vol. 50, pp. 1471-1550 (1998); Rainer Masera, *Valuation, Liquidity and Capital in Financial Industry under Stress: a Fallacy of Composition*, in Rainer Masera (ed.), Giancarlo Mazzoni, Elisa Coletti and Patrizio Armeni, *The Great Financial Crisis, Economics, Regulation and Risk*, Bancaria Editrice (2009), pp. 83-104.

²⁹² See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, p. 1370.

²⁹³ Id., p. 1373 and accompanying note 96 (explaining that “[i]n economic terms, this can be seen as a variant on adverse selection.”). See, also, George A. Akerlof, *The Market for “Lemons”: Quality Uncertainty and the Market Mechanism*, The Quarterly Journal of Economics, Vol. 84, No. 3. (Aug., 1970), pp. 488-500.

²⁹⁴ See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, p. 1373-1374. See, also, Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, cit., pp. 215, 232 (explaining that temporal complexity exists within markets when events move too rapidly for there to be sufficient time or opportunity for parties to intervene).

analysis of the effects of central clearing of OTC derivatives. Proponents of central clearing mandates for OTC derivatives do not seem to have fully appreciated the relevance of behavioral aspects. Contrary, Prof. Anabtawi and Prof. Schwarcz have shown that behavioral biases, irrational behavior and risk perception have a strong influence in the domain of systemic risk. The findings of their study suggest the opportunity to rethink the design of OTC CCPs' risk sharing mechanisms to create correct incentives for all CMs and properly account for the systemic effects of their behavior. Chapters 6 and 7 will discuss this point in detail.

3.5.5. Intellectual Hazard: Complexity Bias, Incentive Bias, and Asymmetry Bias

Drawing on research in behavioral finance,²⁹⁵ Miller and Rosenfeld have analyzed the role of human rational failures and the dynamics through which such failures can generate pervasive system-wide effects in the context of financial markets. In particular, in a recent study, Miller and Rosenfeld argue that “intellectual hazard” played a key role in the GFC, which they define as the “tendency of behavioral biases to interfere with accurate thought and analysis within complex organizations.”²⁹⁶ According to the authors, intellectual hazard caused a number of actors in complex organizations to fail to properly search, acquire, communicate, process, transmit, and implement risk-related information.²⁹⁷

²⁹⁵ Most conventional economic theories are based on the premise that individuals are rational and act motivated by self-interest. Moreover, although economics acknowledge that some individual market participants may manifest a less than rational behavior at times, economists describe the behavior of irrational market participants as a “random behavior” and posit that rational market participants will correct any mispricing or other outcomes that might arise from such behavior. See, e.g., Peter J. Hammond, *Rationality in Economics*, Rivista Internazionale di Scienze Sociali Anno CV, pp. 247–288 (1997). A number of psychologists, however, have advanced a different approach to human rationality. Prominent among them are Prof. Kahneman and Prof. Tversky, who are credited for being among the pioneers of a dynamic economic discipline known as “behavioral finance.” This discipline focuses on the influence of psychology on the behavior of investors and other financial market participants, and analyze the related effect on financial markets. In particular, contrary to economists, behavioralists believe that individuals act irrationally and that they are prone to deviate in a systematic way from rationality when making judgments amid uncertainty. Thus, according to behavioralists, irrational behaviors on the part of investors significantly affect both financial markets and market prices. For a thoughtful analysis of the researches conducted by Prof. Kahneman and Prof. Tversky, see, e.g., Amos Tversky and Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, Science, New Series, Vol. 185, No. 4157, pp. 1124-1131 (1974); Amos Tversky and Daniel Kahneman, *Availability: A Heuristic for Judging Frequency and Probability*, Cognitive Psychology, No. 4, pp. 207-232 (1973); Daniel Kahneman, *Maps of Bounded Rationality: Psychology for Behavioral Economics*, The American Economic Review, Vol. 93, No. 5, pp. 1449-1475 (2003). For a review of important studies by leading behavioral economists, see, e.g., Zeynep Copur, *Handbook of Research on Behavioral Finance and Investment Strategies: Decision Making in the Financial Industry*, IGI Global, (2015); Edwin Burton and Sunit Shah, *Behavioral Finance: Understanding the Social, Cognitive, and Economic Debates*, John Wiley & Sons (2013); H. Kent Baker and John R. Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets*, John Wiley & Sons (2010); Morris Altman (ed.), *Handbook of Contemporary Behavioral Economics: Foundations and Developments*, Routledge (2015); Michael M. Pompian, *Behavioral Finance and Investor Types: Managing Behavior to Make Better Investment Decisions*, John Wiley & Sons (2012); Robert J. Shiller, *From Efficient Market Theory to Behavioral Finance*, Journal of Economic Perspectives, Vol. 17, No. 1, pp. 83-104 (2003); George A. Akerlof and R. J. Shiller, *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*, Princeton University (2009).

²⁹⁶ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, Harvard Journal of Law and Public Policy, Vol. 33, pp. 807-840 (2010).

²⁹⁷ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., pp. 811-813. Miller and Rosenfeld acknowledge that other scholars and market participants have significantly contributed to the study and research of various aspects of intellectual hazard in financial markets. For a review of this studies, see, e.g., Richard H. Thaler (ed.), *Advances in Behavioral Finance*, Russell Sage Foundation (1993); Cass R. Sunstein (ed.), *Behavioral Law & Economics*, Cambridge University Press (2000); Henry Kaufman (Author), Paul A. Volcker (Foreword), *On Money and Markets: A Wall Street Memoir*, McGraw-Hill Companies

To explain how this occurred, Miller and Rosenfeld start by identifying key similarities between the concepts of intellectual hazard and moral hazard. First, the authors observe that both moral hazard and intellectual hazard result from a structural feature of the markets that is otherwise highly beneficial: on one hand, moral hazard comes from the shifting of risk to market players that can bear the risks more efficiently; on the other hand, intellectual hazard results from the division of responsibility among specialized instrumentalities.²⁹⁸ Second, the authors note that both moral hazard and intellectual hazard have extremely pervasive effects: similar to moral hazard that is generated whenever a risk is transferred away from the actor whose actions are the source of that risk, intellectual hazard arises whenever production becomes segmented into complex organizational forms. Third, like moral hazard, intellectual hazard affects large and interconnected organizations and can, therefore, pose a threat to the stability and efficient functioning of the entire financial system.

Based on the understanding of the described features of intellectual hazard, Miller and Rosenfeld, then, identify three main categories of intellectual hazard: complexity bias, incentive bias, and asymmetry bias.²⁹⁹

Complexity bias refers to a type of intellectual hazard that “arises from an actor’s tendency to analyze a situation wrongly because the actor has a limited ability to interpret complex sets of information within the time period needed for decision.”³⁰⁰ Complexity bias can, thus, manifest in different forms, including “tunnel vision,”³⁰¹ “confirmation bias,”³⁰² “representative bias”³⁰³ (and the related phenomenon of “recency bias”),³⁰⁴ “oversimplification bias,”³⁰⁵ and “authoritarian bias.”³⁰⁶

(2000); Michael M. Pompian, *Behavioral Finance and Wealth Management: How to Build Optimal Portfolios that Account for Investor Biases*, John Wiley & Sons, 2nd ed. (2012); Richard H. Thaler and Cass R. Sunstein, *Nudge: Improving Decisions About Health, Wealth, and Happiness*, Penguin Books (2008); Richard H. Thaler, *Quasi Rational Economics*, Russell Sage Foundation (1994).

²⁹⁸ Id., p. 812.

²⁹⁹ Id., p. 813.

³⁰⁰ Ibidem.

³⁰¹ Ibidem (describing “tunnel vision” as a situation where “[a]n actor tasked with carrying out a particular function within a complex organization tends to see only the information apparently necessary to carry out that task. All other information is excluded, even if it is available.”).

³⁰² See, Michael M. Pompian, *Behavioral Finance and Wealth Management: How to Build Optimal Portfolios that Account for Investor Biases*, cit., p. 187 (describing confirmation bias as “a type of selective perception that emphasizes ideas that confirm our beliefs while devaluing whatever contradicts our beliefs”). Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., p 814 note 15 (comparing confirmation bias to “conservatism bias,” meaning in the context of behavioral finance “the tendency of investors to under-react to new information, maintaining impressions from a previous estimate rather than acting on updated information.”).

³⁰³ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., p. 814 (defining “representative bias” as a cognitive problem that “that occurs when a person wrongly assumes that a sample is a reliable measure of an unobserved variable.”). For a thoughtful analysis of the concept of “representative bias”, see, e.g., Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 146-165 (discussing their experiments showing the tendency of people to use similarity or representativeness as a proxy for a sound probabilistic thinking, which they define with the term of “representative heuristic.”). For an interesting example of how people tend to estimate the probability of an event by representativeness, see, also, Michael Lewis, *Money Ball: The Art of Winning an Unfair Game*, W. W. Norton & Company (2004). A number of other biases in judgment are related to “representative bias,” including the “base-rate bias”.

³⁰⁴ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., p. 814, note 16 (defining “recency bias” as the “tendency to recall and emphasize recent events more prominently than events that occurred long ago.”). See, also, Daniel T. Gilber, *How Mental Systems Believe*, *American Psychologist*, Vol 46, No. 2, pp. 107-119 (1991); Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp.

The second category of intellectual hazard – incentive bias – deals with the self-interest of the actors in the financial system and their incentives to see the world in accordance with their self-interest.³⁰⁷ Examples of incentives bias include “herding behavior,”³⁰⁸ “cognitive dissonance,”³⁰⁹ “complacency,”³¹⁰ “loss aversion,”³¹¹ and “self-serving behavior.”³¹²

The third type of intellectual hazard is asymmetry bias, which occurs when “actors in a complex organization bring pre-formed and fixed ideas, judgments, or attitudes to bear in the analysis of information” and, thus, “act in ways that give inappropriate or unequal weight to information and analysis supporting certain conclusions.”³¹³ There are various examples of asymmetry bias;³¹⁴

79 ss (discussing the tendency of System 1 (meaning the system that does the “fast thinking,” operates automatically and quickly, with little or no effort, and no sense of voluntary control) to generate first interpretations, mostly guided by experience. In particular, the author shows that recent events and current context appear to “have the most weight in determining an interpretation,” while, in absence of such events, “more distant memories govern.” Once System 1 has generated a first interpretation, System 2 is in charge of doubting and unbelieving the interpretation. Judgment and choice problems, however, arise because the operation of associative memory contributes to a general confirmation bias. Moreover, when System 2 is otherwise engaged, people become extremely prone to believe almost anything. Furthermore, System 2 tends to test a hypothesis by applying a “positivist test strategy,” which causes suggestions to be uncritically accepted).

³⁰⁵ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., p. 814 (defining oversimplification bias as the cognitive failure thereby “[p]eople in complex situations do not have the time, energy, or capacity to analyze all of the available information. They need to use simplified rules of thumb to enable them to operate ... Because rules of thumb are simplified, however, they introduce error. And because rules of thumb tend, for obvious reasons, to be developed as means for coping with normal and expected situations, they are likely to operate poorly when an actor confronts abnormal or unexpected conditions.”).

³⁰⁶ Id., pp. 814-815 (defining “authoritarian bias” as the tendency to overvalue information from authoritative sources). See, also, Robert J. Shiller, *Irrational Exuberance*, Irrational Exuberance, Princeton University Press, 2d ed. (2005).

³⁰⁷ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., p. 815 seq.

³⁰⁸ Id., p. 815 (discussing “herd behavior,” and noting that “[a]n actor in a complex organization ... has a choice between following the crowd or dissenting and offering a different view of the situation.” If the actor decide to conform to the consensus opinion, “he is unlikely to receive criticism, even if the conventional view turns out to be wrong, because nearly everyone else was making the same mistake.” Contrary, if the actor decides to dissent, he “calls potentially unfavorable attention to himself” and even if the decision turns out to be right the actor “may suffer adverse consequences in the short term, and the long-term rewards he can anticipate from being right may well be outweighed by the sanctions he can anticipate from being wrong.”). For a discussion of herd behavior in the context of the financial system, see, e.g., Steven L. Schwarcz, *Marginalizing Risk*, Washington University Law Review, Vol. 89, No. 3, pp. 487-518 (2012), p. 505 and accompanying note 110; Steven L. Schwarcz, *Regulating Financial Change: A Functional Approach*, Minnesota Law Review, Forthcoming (2015), p. 16; Steven L. Schwarcz, *Systemic Risk*, cit., p. 217 and accompanying notes; H. Kent Baker and John R. Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets*, John Wiley & Sons (2010); Steven L. Schwarcz, *Rethinking the Disclosure Paradigm in a World of Complexity*, University of Illinois Law Review, Vol. 2004, No. 1, pp. 1-38 (2004); Sam Segal, *Tulips Portrayed: The Tulip Trade in Holland in the 17th Century*, in Michiel Roding and Hans Theunissen (eds), *The Tulip: A Symbol of Two Nations*, Turco- Dutch Friendship Association (1993), pp. 17-20; Deryn Darcy, *Credit Rating Agencies and the Credit Crisis: How the “Issuer Pays” Conflict Contributed and What Regulators Might Do About It*, Columbia Business Law Review, pp. 605-641 (2009); Sanford M. Jacoby, *Finance and Labor: Perspectives on Risk, Inequality, and Democracy*, IRLE Working Papers, No.001 (2009); Timothy E. Lynch, *Deeply and Persistently Conflicted: Credit Rating Agencies in the Current Regulatory Environment*, Case Western Reserve Law Review, Vol. 59, No. 2, pp. 227-302 (2009); Charles Mackay, *Extraordinary Popular Delusions and the Madness of Crowds*, Harriman House (2003); Robert J. Shiller, John Pound, *Survey Evidence on Diffusion of Investment Among Institutional Investors*, NBER Working Paper No. 1851 (1996); Gustav Le Bon, *The Crowd: A Study of the Popular Mind*, Dodo Press (2007).

³⁰⁹ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., p. 816 and accompanying note 22 (describing “cognitive dissonance” as the incentive of an actor working in a complex organization to ignore available information that supports interpretations inconsistent with his/her own self-interest.).

³¹⁰ Id., p. 816 and accompanying note 23.

³¹¹ Id., pp. 816-817 (describing “loss aversion” as the incentive of an actor in complex organizations to avoid the recognition of a loss for which the actor may have some responsibility.”) See below for further discussion on this point.

³¹² Id., p. 817.

³¹³ Ibidem.

³¹⁴ Examples of asymmetry bias also include the ostrich effect and the outcome bias and optimism bias. Id., p. 818 and accompanying notes 29 and 30.

particularly relevant among them are “loss aversion bias,” “endowment effect”³¹⁵ and “status quo bias.”³¹⁶

The concept of “loss aversion” was first demonstrated by Prof. Kahneman and Prof. Tversky. Prof. Kahneman and Prof. Tversky challenged Bernoulli’s expected utility theory³¹⁷ and, by building on Markowitz’s studies on utilities and wealth,³¹⁸ they formulated a different theory denominated “Prospect Theory.”

Prospect Theory accurately describes the psychological process behind human judgment and decision-making in the face of risky scenarios where there are prospects of gains and losses.³¹⁹ According to Prospect Theory, utilities shall be assessed based on “changes of wealth” rather than “states of wealth.” Three are the core principles underlying this theory:³²⁰

- Principle of reference dependence - The carriers of value are gains and losses defined relative to a selected “neutral reference point.” The “neutral reference point” (also referred to as “adaptation level”) is typically the *status quo*, but can also be the outcome that an individual seeks to achieve or which he/she feels entitled to.³²¹
- Principle of diminishing sensitivity - Individuals experience diminished sensitivity to changes in wealth and the marginal value of both gains and losses decreases with their size.

³¹⁵ Id., p. 817 notes 27-28.

³¹⁶ Id., p. 817 (quoting Professors William Samuelson and Richard Zeckhauser and describing “status quo bias” as the tendency of actors in complex organizations to “overvalue the status quo even if evidence and analysis suggests another course of action more strongly.”) See, William Samuelson and Richard Zeckhauser, *Status Quo Bias in Decision Making*, *Journal of Risk & Uncertainty*, Vol. 1, pp. 7-59 (1988).

³¹⁷ Bernoulli’s expected utility theory has long dominated the analysis of the decision-making process under risk and is central to much of modern economic theory. The theory relies on the concept of “utility” of state of wealth: when faced with the choice between a gamble and a certain amount of money people’s choices are based on the psychological values of the possible outcomes (that is, their utilities), and not on their corresponding dollar values. This means that the psychological value of a gamble is the average of the utilities associated with the various possible outcomes weighted by their own probability. Bernoulli’s expected utility theory further posits that there is a diminishing marginal value of wealth, which helps explain individuals’ risk aversion. Moreover, according to Bernoulli’s expected utility theory the utility of decision outcomes is determined by the ultimate state of endowment, and, in this sense, it lacks the idea of “reference point. See, e.g., John Von Neumann and Oscar Morgenstern, *Theory of Games and Economic Behavior*, Princeton University Press, 60th anniversary ed. (2004); Milton Friedman and Leonard J. Savage, *The Utility Analysis of Choices Involving Risk*, *The Journal of Political Economy*, Vol. 56, No. 4., pp. 279-304 (1948); Leonard J. Savage, *The Foundations of Statistics*, Dover Publications (1972); Kenneth Arrow, *Essays on the Theory of Risk Bearing*, *The Journal of Business*, Vol. 47, No. 1, pp. 96-98 (1974); Ralph L. Keeney and Howard Raiffa, *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*, Wiley (1976); David M. Kreps, *Notes on the Theory of Choice*, Westview Press (1988); Christian Gollier, *The Economics of Risk and Time*, MIT Press (2001).

³¹⁸ See, e.g., Harry Markowitz, *The Utility of Wealth*, *The Journal of Political Economy*, Vol. 60, No. 2, pp. 151-158 (1952); Matthew Rabin, *Risk Aversion and Expected Utility: A Calibration Theorem*, *Econometrica*, Vol. 68, No. 5, pp. 1281-1292 (2000); Mark J. Machina and W. Kip Viscusi, *Handbook of the Economics of Risk and Uncertainty*, Elsevier (2014).

³¹⁹ See, Daniel Kahneman and Amos Tversky, *Prospect Theory: An Analysis of Decision under Risk*, *Econometrica*, Vol. 47, No. 2, pp. 263-292 (1979). See, also, Morris Altman, *Prospect Theory and Behavioral Biases*, in H. Kent Baker and John R. Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets*, John Wiley & Sons (2010), pp. 191-210; Michael Lewis, *The Undoing Project – A Friendship That Changed Our Minds*, W. W. Norton & Company (2016), pp. 247-267.

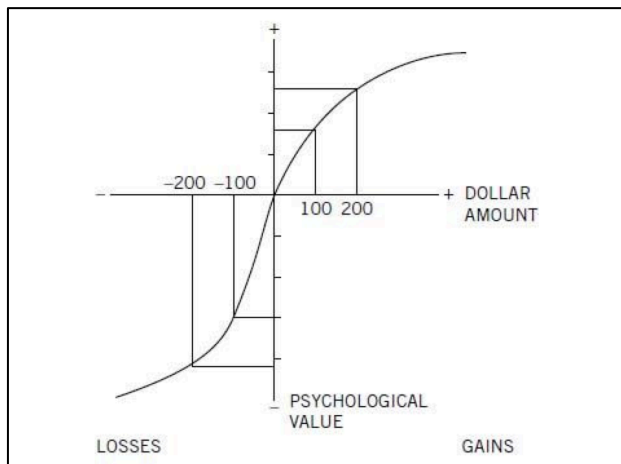
³²⁰ See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., 282 seq.

³²¹ Id., pp. 279-281, 302-304. See, also, Daniel Kahneman, *Reference Points, Anchors, Norms, and Mixed Feelings*, *Organizational Behavior and Human Decision Processes*, Vol. 51, No. 2, pp. 296-312 (1992).

- Principle of loss aversion - When directly compared or weighted against each other, losses feel larger than gains. As a result, losses are considered more undesirable than equivalent gains are desirable.³²²

The above principles are illustrated by the asymmetric S-shaped value function in [Figure 26](#).

Figure 26. Prospect Theory.



Source: Daniel Kahneman, *Thinking, Fast and Slow*, Farrar, Straus and Giroux (2013), p. 283.

In [Figure 26](#), the x-axis shows gains and losses in term of “real value,” while the y-axis shows their psychological value. The graph consists of two parts relative to a neutral reference point: the part left to the reference point is the value function for losses (the “loss curve”); and the part right to the reference point is the value function for gains (the “gain curve”). The graph is concave in the gain domain and is convex in the negative domain. The resulting S-shape reflects the principle of diminished sensitivity described above and it suggests that there is no linear function between actual losses (actual gains) and the psychological value of those losses (gains). Thus, the S-shape helps understand why, for instance, in “bad choices” (that is, a scenario where a sure loss is compared to a larger loss that is probable) diminishing sensitivity causes risk seeking.

The loss curve and the gain curve are asymmetrical: the loss curve is steeper than the gain curve. This reflects the loss aversion principle described above: the response to a loss is stronger than the response to a corresponding gain and the disutility of giving up an asset is, therefore, greater than the utility associated with acquiring it. Thus, a comparison of the slopes of the loss curve and the gain curve helps explain why a choice between two options has a greater impact if it is framed as a difference between two disadvantages (losses), rather than as a difference between two advantages (gains). Moreover, a comparison of the

³²² See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 283-286, 304-309. See, also, Daniel Kahneman et al., *Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias*, *The Journal of Economic Perspectives*, Vol. 5, No. 1, pp. 193-206 (1991); Nathan Novemsky and Daniel Kahneman, *The Boundaries of Loss Aversion*, *Journal of Marketing Research*, Vol. 42, pp. 119-128 (2005); Richard H. Thaler, *The Winner's Curse: Paradoxes and Anomalies of Economic Life*, Princeton University Press (1992), pp. 70 ss; John W. Pratt, *Risk Aversion in the Small and in the Large*, *Econometrica*, Vol. 32, No. 1-2, pp. 122-136 (1964); Stephen A. Ross, *Some Stronger Measures of Risk Aversion in the Small and in the Large*, *Econometrica*, Vol. 49, No. 3, pp. 621-638 (1981).

slopes of the loss curve and the gain curve also helps understand why in mixed games (that is, games where both a gain and a loss are possible) loss aversion causes individual to make extremely risk-averse choices.

Related to the loss-averse value function discussed above is the concept of “endowment effect” that Miller and Rosenfeld describe as a further example of asymmetry bias. In this respect, the Prospect Theory discussed above suggests that an individual’s willingness to buy or sell an asset depends on the reference point. Said it differently, individual’s willingness to buy or sell an asset depends on whether or not the individual owns the asset at issue.³²³ If the individual owns it, the individual perceives the pain of selling the asset as a “loss”; contrary, if he doesn’t own it, the individual perceives the pleasure of buying the asset as a “gain”. Because of the loss aversion, the pain of selling the asset (the “loss”) is stronger than the pleasure of buying the asset (the “gain”). This difference, in turn, translates into a quantitative difference between the price at which the individual is willing to sell the asset and the price at which he is willing to buy it: the former will be higher (sometimes significantly higher) than the latter.³²⁴ Further studies have, then, shown the existence of two main sets of circumstances where the endowment effect can be neutralized.³²⁵ First, no endowment effect is found when individuals, who own the assets, view their assets as carriers of value for future exchanges, that is, they “think like a trader.”³²⁶ Second, no endowment effect is found in case of decision making under poverty.³²⁷ All choices for the poor (meaning those individuals who live below their own reference point) are between losses; they are always “in the losses.”³²⁸ Thus, if the poor receive a small amount of money (an amount

³²³ See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 289-29; Richard H. Thaler, *Toward a Positive Theory of Consumer Choice*, *Journal of Economic Behavior and Organization*, Vol. 1, pp. 39-60 (1980); Richard H. Thaler, *The Winner's Curse*, cit. For a discussion of laboratory demonstrations of the endowment effect, see, e.g., Jack L. Knetsch and J. A. Sinden, *Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value*, *Quarterly Journal of Economics*, Vol. 99, No. 3, pp. 507-521 (1984); Jack L. Knetsch, *The Endowment Effect and Evidence of Nonreversible Indifference Curves*, *The American Economic Review*, Vol. 79, No. 5, pp. 1277-1284 (1989); Daniel Kahneman, Jack L. Knetsch, and Richard H. Thaler, *Experimental Tests of the Endowment Effect and the Coase Theorem*, *The Journal of Political Economy*, Vol. 98, No. 6, pp. 1325-1348 (1990); Alan B. Krueger, *Supply and Demand: An Economist Goes to the Super Bowl*, *Milken Institute Review: A Journal of Economic Policy*, Vol. 3, No. 2, pp. 22-29 (2001).

³²⁴ See, e.g., Amos Tversky and Daniel Kahneman, *Loss Aversion in Riskless Choice: A Reference-Dependent Model*, *Quarterly Journal of Economics*, Vol. 106, No.4, pp. 1039-1061 (1991); Jack L. Knetsch, *The Endowment Effect and Evidence of Nonreversible Indifference Curves*, cit.; Jack Knetsch, *Preferences and Nonreversibility of Indifference Curves*, *Journal of Economic Behaviour & Organization*, Vol. 17, No.1, pp. 131-139 (1992); Brett Inder and Terry O'Brien, *The Endowment Effect and the Role of Uncertainty*, *Bulletin of Economic Research*, Vol. 55, No. 3, pp. 289-301 (2003); Moshe Levy, *Loss Aversion and the Price of Risk*, *Quantitative Finance*, Vol. 10, No. 9, pp. 1009-1022 (2010).

³²⁵ Additional studies sought to determine whether the endowment effect could be reduced, or even eliminated, when individuals gain market experience, face market discipline, and have the opportunity to learn. See, e.g. Jack L. Knetsch and J. A. Sinden, *The Persistence of Evaluation Disparities*, *Quarterly Journal of Economics*, Vol. 102, No.3 pp. 691-696 (1987); Daniel Kahneman, Jack L. Knetsch, and Richard Thaler, *Experimental Tests of the Endowment Effect and the Coase Theorem*, cit.

³²⁶ See, e.g., Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 294-299 (noting that in routine commercial transactions, the seller does not suffer the endowment when trading a good and no loss aversion is found on either side of the exchange. Moreover, the author notes that evidence indicates that sellers perceive selling the asset as a loss if the asset is “for use”, to be consumed or otherwise enjoyed, and not an asset intended to be traded. In addition, buyers do seem to value the money they spend on normal purchases as a loss, so long as the prices are not perceived as being too high); John A. List, *Does Market Experience Eliminate Market Anomalies?* *Quarterly Journal of Economics*, Vol. 118, No. 1, pp. 47-71 (2003); Jack L. Knetsch, *The Endowment Effect and Evidence of Nonreversible Indifference Curves*, cit.

³²⁷ See, e.g., Marianne Bertrand, Sendhil Mullainathan and Eldan Shafir, *Behavioral Economics and Marketing in Aid of Decision Making Among the Poor*, *Journal of Public Policy & Marketing*, Vol. 25, No.1, pp. 8-23 (2006).

³²⁸ See, e.g., Daniel Kahneman, *Thinking, Fast and Slow*, cit., p. 298.

insufficient to achieve their own reference point), they will perceive it as a reduced loss, and not as a gain. Moreover, for the poor costs are losses: the money spent to purchase an asset is equivalent to the loss of the asset(s) that could have otherwise been purchased.³²⁹

One important implication of the principle of loss aversion and the endowment effect discussed above is the “*status quo*” bias, the third example of asymmetry bias identified by Miller and Rosenfeld. Status quo bias refers to the preference for the current state that biases individuals against buying and selling an asset.³³⁰ Because the disadvantages of selling an asset loom larger than the advantages of acquiring the asset, individuals are prone to remain at the *status quo*.³³¹ This, in turn, means that loss aversion implies the *status quo*.³³²

Building on the analysis of the three main categories of intellectual hazard discussed above, in the second part of their study, Miller and Rosenfeld illustrate how intellectual hazard has manifested itself within the structure of major financial institutions before and during the GFC. In particular, the authors argue that the combination of complexity bias, incentive bias, and asymmetry bias substantially impaired the ability of complex organizations to appropriately process and act on information and analysis in a number of ways:³³³

- First, over-reliance and over-confidence of investment banks and other market participants on mathematical or computer models were a critical source of intellectual hazard during the crisis.³³⁴ Mathematical and computer models were based on historical data, which, although useful in ordinary times, tend to be less reliable during a period of crisis. Investment banks and other market participants failed to account for the fact that mathematical and computer models perform poorly in presence of complex dynamic systems where outcomes tend to be path dependent and sensitive to differences in initial conditions, and where variations in

³²⁹ Ibidem.

³³⁰ William F. Samuelson and Richard Zeckhauser introduced the term “status quo” to describe this effect of reference position. See, William F. Samuelson and Richard Zeckhauser, *Status Quo Bias In Decision Making*, Journal of Risk and Uncertainty, Vol. 1, pp. 7-59 (1988). For experimental demonstrations of the status quo bias, see, e.g., Jack L. Knetsch and J. A. Sinden, *Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value*, Quarterly Journal of Economics, cit.; Jack Knetsch, *The Endowment Effect and Evidence of Nonreversible Indifference Curves*, cit.; W. Kip Viscusi, Wesley A. Magat and Joel Huber, *An Investigation of the Rationality of Consumer Valuation of Multiple Health Risks*, The RAND Journal of Economics, Vol. 18, No.4, pp. 465-479 (1987).

³³¹ See, Richard H Thaler, *The Winner's Curse*, cit., pp. 68-70 (discussing the finding of various experiments on status quo bias).

³³² Loss aversion, however, is not the sole factor explaining the status quo bias. Studies have shown that several factors, including costs of thinking, transaction costs, and psychological commitment to prior choices, can induce a status quo bias even in the absence of loss aversion. See, e.g., William F. Samuelson and Richard Zeckhauser, *Status Quo Bias In Decision Making*, Journal of Risk and Uncertainty, cit.; Ilana Ritov and Jonathan Baron, *Status-Quo and Omission Bias*, Journal of Risk and Uncertainty, Vol. 5, No. 1, pp. 49-61 (1992); Mark Spranca, Elisa Minsk, and Jonathan Baron, *Omission and Commission in Judgment and Choice*. Journal of Experimental Social Psychology, Vol. 27, pp. 76-105 (1991).

³³³ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., pp. 825-828, 830-834 (discussing forms of intellectual hazard affecting regulators and supervisory authorities, including the Federal Reserve, the Basel Committee on Banking Supervision and the Securities Exchange Commission).

³³⁴ Id., pp. 821 seq.

incentives and risk can trigger significant changes in actors' behavior.³³⁵ In this respect, Miller and Rosenfeld argue that over-reliance and over-confidence in mathematical and computer models were largely driven by self-serving bias, authoritarian bias, complacency bias, recency bias, oversimplification bias, and tunnel vision.³³⁶

- Second, banks and other financial institutions, facing significant pressures to generate profits, also manifested intellectual hazard in form of herding behavior,³³⁷ self-serving bias, cognitive dissonance bias, and authoritarian bias.³³⁸
- Third, rating agencies were both vulnerable to, and a source of, intellectual hazard failures. On one hand, similar to investment banks and other financial institutions, credit rating agencies appear to have excessively relied on models and to have experienced complexity bias, recency bias, and self-serving bias.³³⁹ On the other hand, credit ratings provided by rating agencies generated intellectual hazard, as many actors in the financial sector over-relied on such ratings to perform their activities.³⁴⁰

Based on the above analysis, Miller and Rosenfeld, then, note that intellectual hazard may become particularly acute and harmful during periods of unprecedented and prolonged asset price increases and subsequent declines in asset prices.³⁴¹ In particular, according to the authors, intellectual hazard has the effect of both “magnifying and extending the duration of asset price increases on the way up, and enhancing and extending asset price collapses on the way down.”³⁴² During the boom period, intellectual hazard typically manifests itself in the form of “optimism bias ... and also herding behavior, self-serving bias, policy bias, confirmation bias, tunnel vision, and authority bias.”³⁴³ In times of market stress, a combination of undue attraction to the *status quo*, endowment effect, herding behavior and loss aversion bias inhibits complex organizations from taking actions that are in their economic best interest.³⁴⁴ Because of this, the authors conclude that intellectual hazard is a form of systemic risk that “can

³³⁵ Id., p. 822 note 40 (noting that “this factor makes the task of prediction even more daunting by introducing game - theoretical behavior into the mix.). See, Uday Rajan, Amit Seru and Vikrant Vig, *The Failure of Models that Predict Failure: Distance, Incentives and Defaults*, Chicago GSB Research Paper No. 08-19 (2008).

³³⁶ See, Geoffrey P. Miller and Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, cit., pp. 821-823.

³³⁷ Id., p. 824 (quoting former Citicorp CEO Chuck Prince’s comment “[w]hen the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you got to get up and dance.”). See, also, John Cassidy, *Rational Irrationality: The Real Reason that Capitalism is so Crash - Prone*, *The New Yorker* (October 5, 2009).

³³⁸ Id., pp. 824-825.

³³⁹ Id., pp. 828-830.

³⁴⁰ Id., p. 829.

³⁴¹ Id., pp. 818-819.

³⁴² Id., pp. 818, 820 (noting that “these biases tend to be pro-cyclical.”).

³⁴³ Id., p. 819.

³⁴⁴ Id., p. 820 and note 32 (discussing the contents of Bear Stearns’s quarterly filing with the SEC in the quarter following its failure in March 2008, stating that “[h]uman error in times of extreme difficulty and turmoil, such as the Company recently experienced and continues to experience, can occur. Moreover, control and process breakdowns may be more frequent when a company is operating under duress and its employees become distracted by crisis management and the uncertainty surrounding the viability of the enterprise. These events and potential impacts may have had and may have an adverse impact on the efficacy of our disclosure controls and procedures and our internal controls over financial reporting.” See, Bear Stearns Co., Quarterly Report (Form 10 - Q), at 80 (Feb. 29, 2008).).

metastasize into a serious threat to the stability of the system as a whole in unusual times.”³⁴⁵

The Prospect Theory discussed above helps understand the observations made by Miller and Rosenfeld. As previously discussed, people attach values to gains and losses (rather than to wealth), and the decision weights that people assign to outcomes are different from the probabilities of these outcomes. This leads to a particular pattern of preference known as “four-fold pattern,” illustrated in Table 10 below.

Table 10. The Fourfold Pattern.

	GAINS	LOSSES
HIGH PROBABILITY <i>Certainty Effect</i>	95% chance to win US\$ 10,000 Fear of disappointment RISK AVERSE	95% chance to lose US\$ 10,000 Hope to avoid loss RISK SEEKING
LOW PROBABILITY <i>Possibility Effect</i>	5% chance to win US\$ 10,000 Hope to large gain RISK SEEKING	5% chance to lose US\$ 10,000 Fear of large loss RISK AVERSE

Note: Rows in each cell are organized as follows:³⁴⁶

- Top row = Illustrative prospect.
- Second row = focal emotion that the prospect provokes.
- Third row = how most people behave when offered a choice between a gamble and a sure gain (or loss) that corresponds to its expected value.

Source: Daniel Kahneman, *Thinking, Fast and Slow*, cit., p. 317.

In the fourfold pattern of preferences:

- **Top Left Cell** - In this scenario, individuals weight outcomes that are almost certain less than the probabilities of such outcomes would otherwise justify (the “certainty effect”).³⁴⁷ This means that people are risk averse when they look at the prospects with a substantial chance to achieve a large gain. In this case, they prefer to lock in a sure gain and accept a less than expected value of the gamble as they experience attraction of a sure gain and fear of disappointment and regret if they reject the sure gain and lost the gamble.
- **Bottom Left Cell** - In this scenario, individuals weight highly unlikely outcomes disproportionately more than they deserve (the “possibility effect”).³⁴⁸ As a result, people tend to be indifferent to the fact that their chance of winning is extremely small: the hope of large gain is great and people are more risk seeking.

³⁴⁵ Ibidem.

³⁴⁶ The four-fold pattern illustrated by Daniel Kahneman also contains a fourth row describing the expected attitudes of a defendant and a plaintiff as they discuss a settlement of a civil suit. The defendant will have the incentive to accept an unfavourable settlement in the top left scenario and the bottom right scenario; while he/she will have the incentive to reject a favorable settlement in the top right scenario and the bottom left scenario.

³⁴⁷ See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., p. 311.

³⁴⁸ Ibidem (explaining the possibility effect and noting that “people who buy lottery tickets in vast amounts show themselves willing to pay much more than expected value for very small chances to win a large prize.”).

- Bottom Right Cell - In this scenario, individuals tend to overestimate the probabilities of unlikely events of large losses and to overweight the unlikely events in their decisions.³⁴⁹ This means that when faced with unlikely events of large losses, people experience fear and become particularly risk averse.
- Top Right Left - In this scenario, individuals are faced with the choice between a sure loss and a gamble with a high probability of a large loss. Two factors operate in this case. First, diminishing sensitivity makes the sure loss more aversive; second, the certainty effect discussed above reduces the averseness of the gamble. The combination of these factors, in turn, makes people increasingly risk-seeking when faced with the choice between a sure loss and a gamble with a high probability of a large loss. In such a scenario, individuals become prone to take desperate gambles, accepting a high probability of making the losses even worse in exchange for a very small probability of avoiding a large loss.³⁵⁰ This pervasive risk-seeking behavior, in turn, may exacerbate losses and lead to disasters. As noted by Prof. Kahneman “[r]isk taking of this kind often turns manageable failures into disasters. The thought of accepting the large sure loss is too painful, and the hope of complete relief too enticing, to make the sensible decision that it is time to cut one’s losses ... because defeat is so difficult to accept, the losing side in wars often fights long past the point in which the victory of the other side is certain, and only a matter of time.”³⁵¹

In conclusion, the above analysis explains how heuristics and biases may affect risk-related decision-making processes by market participants. Acknowledgement of these heuristics and biases and the resulting cognitive errors is critical:³⁵² as pointed out by Miller and Rosenfeld, cognitive errors caused by heuristics and biases are not only costly in the long run, but they may also become a dangerous source of instability for the entire financial system. Contributions by psychology of judgment and choice are, therefore, relevant for

³⁴⁹ Id., pp. 315-316, 323-333 (explaining this heuristic and noting that “[a]lthough overestimation and overweighting are distinct phenomena, the same psychological mechanisms are involved in both: focused attention, confirmation bias, and cognitive ease.”).

³⁵⁰ Committing a “sunk-cost fallacy” is a typical example of risk-related choice that falls into the top-right cell of the fourfold pattern. This fallacy occurs when an individual decide to invest additional resources in a losing investment (or a loosing project), notwithstanding the availability of better investments (or better projects). When the decision is taken by an individual in the context of a larger organization, sunk-costs fallacy may also create agency costs. See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 345-346 (noting that “the escalation of commitment to failing endeavors is a mistake from the perspective of the firm but not necessarily from the perspective of the executive who “owns” a floundering project. Cancelling the project will leave a permanent stain on the executive’s record, and his personal interests are perhaps best served by gambling further with the organization’s resources in the hope of recouping the original investment – or at least in an attempt to postpone the day of reckoning. In the presence of sunk costs, the manager’s incentives are misaligned with the objectives of the firm and its shareholders, a familiar type of what is known as the agency problem.”). Behavioralists also argue that emotions such as pride and regret can significantly affect investors’ behavior. See, e.g., Terrance Odean, *Are Investors Reluctant to Realize Their Losses?*, *The Journal of Finance*, Vol. 53, No. 5, pp. 1775-1798 (1998); Daniel Kahneman, *Thinking, Fast and Slow*, cit., pp. 344-345 (discussing the “disposition effect”, meaning the reluctance by investors to realize losses and their resulting tendency to hold loosing investments too long and sell winning investments too soon.).

³⁵¹ Id., p. 319.

³⁵² See, e.g., Burton G. Malkiel, *A Random Walk Down Wall Street*, W. W. Norton & Company, 11th ed. (2012), pp. 235-238, 258-259 (arguing that “[t]he first step in dealing with the pernicious effects of our behavioral foibles is to recognize them.”).

the design and implementation of systemic risk-related regulation and policies, including OTC derivatives central clearing mandates.³⁵³

³⁵³ See, e.g., Timur Kuran and Cass R. Sunstein, *Availability Cascade and Risk Regulation*, *Stanford Law Review*, Vol. 51, No.4, pp. 683-768 (1999) (Timur Kuran and Cass R. Sunstein have argued that biased reactions to risks often lead to erratic and misplaced priorities in risk policies and regulations. In particular, the authors have referred to “availability cascade” to define the process through which media reports of relatively minor events translate into public panic and, eventually, flow into policy and regulatory reforms. They also coined the phrase “probability neglect” to describe a type of cognitive bias, whereby small risks tend to be either neglected entirely or hugely overrated. The combination of availability cascade and probability neglect, then, they argue may lead to large-scale and exaggerated government interventions.).

CHAPTER 4: MECHANICS AND FUNCTIONS OF OTC CCPS

Chapter 4 will provide an overview of the operations and functions of OTC CCPs, covering aspects such as novation, margin, multilateral netting and coordinated default management process.

4.1. Overview of OTC CCPs

Central clearing is a process that occurs during the period between execution and settlement of a transaction, whereby a CCP interposes itself between the parties to a trade to guarantee their performance.³⁵⁴

An OTC CCP performs a number of related functions, including the following:

- Trade Confirmation - Trade confirmation is the first step in the clearing process, whereby the trade details of the sell and buy instructions are compared and their consistency is assessed in order to identify and link the related transactions.³⁵⁵
- Novation - Novation refers to the legal process whereby an OTC CCP is positioned between the original buyer and seller to a derivative trade. Through novation the original contract is replaced with one or more other contracts.³⁵⁶
- Transaction/Position Management - Until the relevant legal obligations are successfully fulfilled, positions need to be processed and managed. Key features of OTC derivatives mentioned in Chapter 1 above (e.g., relative longer maturity, limited standardization, and poor liquidity compared to exchange-traded derivatives) may significantly affect the intensity and complexity of this process.³⁵⁷
- Delivery Management - Assuming that a position has not been closed out prior to the expiration of the contract, the final stage in the clearing cycle is the delivery management, that is the process of preparing the settlement instructions and sending them to the respective settlement institutions.³⁵⁸
- Multilateral Netting - Multilateral netting is the process through which the OTC CCP nets all offsetting positions of its counterparties and reduces all outstanding residuals to a single debit/credit between itself and each counterparty.³⁵⁹
- Membership Requirements - Members of an OTC CCP (CMs) are subject to strict admission criteria and periodic monitoring of their risk management policies and procedures. These requirements aim at ensuring that CMs have the necessary expertise and operational competency to appropriately value

³⁵⁴ See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 18; Robert S. Steigerwald, *Central Counterparty Clearing and Systemic Risk Regulation*, in Anastasios G. Malliaris and William T. Ziemba (eds.), *The World Scientific Handbook of Futures Markets*, World Scientific (2016), pp. 181-246.

³⁵⁵ See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 20 and notes 9-10.

³⁵⁶ Id., p. 22 note 31. See, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 28.

³⁵⁷ See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 21.

³⁵⁸ Id., p. 22.

³⁵⁹ Id., pp. 25-26. See, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 29.

and manage risk, engage in clearing, and reduce the probability of their default.³⁶⁰

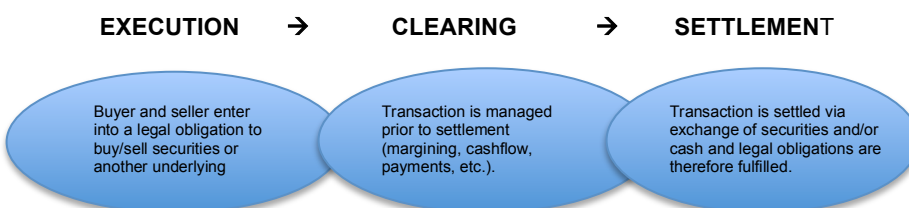
- Risk Management - An OTC CCP typically collects both variation and initial margins from its CMs to ensure that the obligations of CMs (and their clients) are collateralized and cover losses in case of their default in “normal” market conditions. An OTC CCP also requires its CMs to contribute to a default fund, which is utilized to cover possible extreme losses in excess of margins.³⁶¹
- Default Management - An OTC CCP sets forth defined and transparent emergency rules and procedures. In addition, it provides a centralized management process in the event of default of one of its CMs, which typically involves holding a centralized auction of open positions and macro-hedging key risks in the defaulting CM's portfolio. Finally, an OTC CCP typically applies a pre-defined waterfall to absorb related losses.³⁶²

The functions described above will be analyzed in more detail in the following sections.

4.2. Novation

Contract novation refers to the process whereby an OTC CCP interposes itself between two counterparties of a derivatives transaction and assumes their respective rights and legal obligations (See, [Figure 27](#) below). Thus, via novation an OTC CCP essentially becomes the buyer to the original seller and the seller to the original buyer. The process of novation replaces the contractual bilateral obligations between the original parties with new obligations with the OTC CCP, so that the original contract ceases to exist. As a result of the trade being cleared, original parties do no longer have counterparty risk to one another because the OTC CCP assumes the associated risks of counterparty default and essentially acts as an insurer of counterparty risk in both directions.³⁶³

Figure 27. Role of clearing in financial transactions.



Source: Gregory, Jon, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, John Wiley & Sons (2014), p. 27.

³⁶⁰ See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 28. See, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 135-136.

³⁶¹ See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 28.

³⁶² Ibidem. See, also, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, International Swaps and Derivatives Association technical paper (2015), p. 3.

³⁶³ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 28-29. See, also, Ben S. Bernanke, *Clearing and Settlement during the Crash*, *Review of Financial Studies*, Vol. 3, No. 1, pp. 133-151 (1990) (arguing that “in some of its operations a clearinghouse is like a bank; in others, it is like an insurance company.”).

Novation critically relies on the legal enforceability of the new contract and the legal certainty that the original parties will not be held legally obligated to each other once the novation process is completed.

As discussed above, an OTC CCP stands between the original buyer and seller and has both sides of the trade. This means that the OTC CCP takes on the counterparty risk of all cleared trades and concentrates counterparty risk within its structure (See, Figure 28 (a) and (b) below). As a result, the OTC CCP has a “matched book” and is balanced on a market risk basis (except in the event of default of one or more of its CMs).³⁶⁴

Figure 28. From non-centrally cleared (Figure 28(a)) to centrally-cleared exposure (Figure 28(b)).

Figure 28(a).

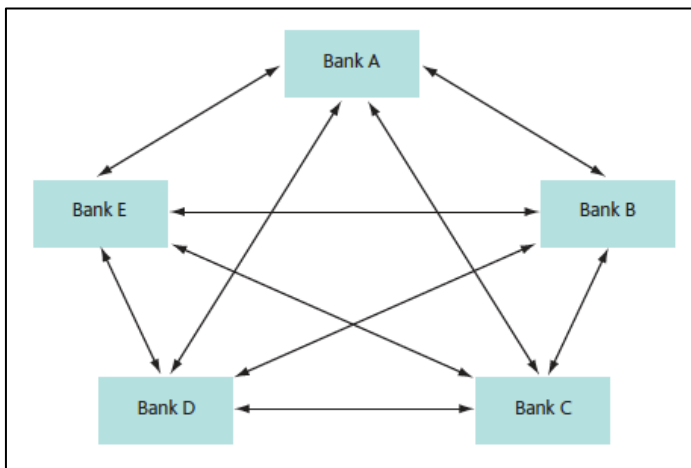
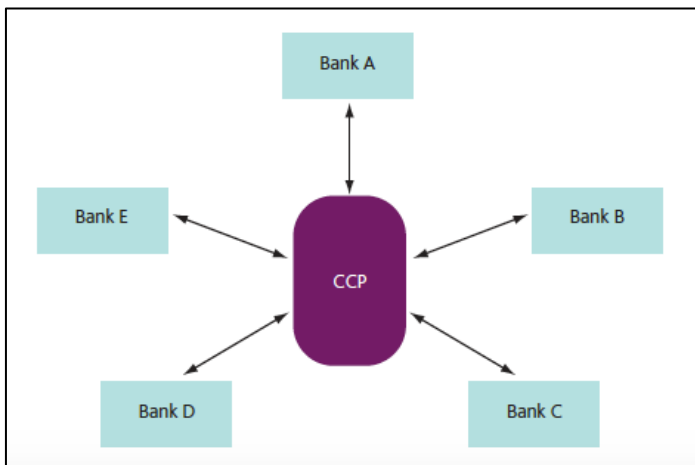


Figure 28(b).



Source: Dan Nixon and Amandeep Rehlon, *Central Counterparties: What are They, Why Do They Matter, and How Does the Bank Supervise Them?*, Bank of England Quarterly Bulletin (2013), p. 1.

³⁶⁴ See, e.g., David Elliott, *Central Counterparty Loss-Allocation Rules*, Bank of England Financial Stability Paper No. 20 (2013), p. 5; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 29.

4.3. Multilateral Netting

Bilateral trading may lead to the proliferation of overlapping and potentially redundant contracts. This, in turn, may increase counterparty risk and may significantly contribute to the complexity and interconnectedness of the derivatives markets and the financial system, as a whole.³⁶⁵

As discussed in Chapter 2, market participants have historically developed netting mechanisms, whereby parties can enter into a number of offsetting trades with the same underlying and attributes. In particular, there are two basic forms of netting:

- Payment netting, which refers to the ability to combine cash-flows occurring on the same day into a single net payment. This helps reduce settlement risk and enhance operational efficiency.³⁶⁶
- Close-out netting, which assumes relevance in case of a default of a counterparty. Close-out netting consists of two components.³⁶⁷ First, the right to immediately terminate all trades between an insolvent and solvent counterparty and cease any contractual payment between them. Second, the right to offset all transaction values and amounts due at termination and reduce them to a net balance. This helps mitigate counterparty risk.³⁶⁸

As further discussed in Chapter 2, netting has played a very critical role in fostering the growth and increasing the liquidity of the OTC derivatives market.³⁶⁹ In particular, upon default of a party to a trade, netting mechanisms can be applied to reduce the total number of trades to replace and to decrease the complexity involved in the close-out of such trades. Netting mechanisms also allow the overall credit exposure in the OTC derivatives market to grow at a lower rate than the notional growth of the market itself.³⁷⁰ In addition, netting can affect the way market participants react to an increase (or perceived increase) in the default risk of a particular counterparty. In absence of netting, all market participants trading with such counterparty would have a strong incentive to immediately close outstanding positions and stop any further trading, which may trigger very destabilizing effects. With netting, the concern of market participants may be mitigated and the potential systemic market disturbance reduced.³⁷¹

Depending on the number of parties involved, netting can be structured as either bilateral netting or multilateral netting.³⁷²

³⁶⁵ Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 59 seq.

³⁶⁶ See, e.g., Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 50-51; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 60.

³⁶⁷ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 60-61.

³⁶⁸ *Id.*, pp. 51-52.

³⁶⁹ *Id.*, pp. 55-56. Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 62-63.

³⁷⁰ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 62.

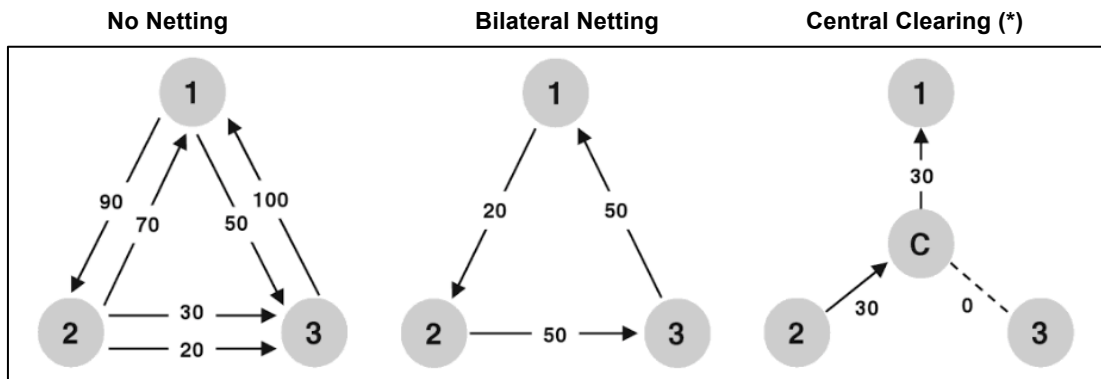
³⁷¹ *Id.*, p. 63.

³⁷² See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 25.

- In case of bilateral netting, netting arrangements are undertaken between two counterparties, whose respective trades are consolidated into a single net amount to be paid by one party to the other. Therefore, the impact of netting in reducing overall credit exposure is limited to the relevant pair of counterparties.
- In case of multilateral netting, netting arrangements are entered into among three or more parties, whose positions are all combined with the effect of further reducing the aggregate exposure.³⁷³ OTC CCPs provide an efficient way to achieve multilateral netting.³⁷⁴ In particular, when an OTC CCP replaces counterparties via novation, multiple parties' positions can be netted off against each other with the effect of reducing the overall exposure.³⁷⁵

A comparison of no netting, bilateral netting, and central netting is illustrated in Figure 29 and Table 11 below.

Figure 29. Comparison of no netting, bilateral netting, and central clearing.



(*) The OTC derivatives central counterparty is represented by C.

Source: Gregory, Jon, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 70.

Table 11. Illustration of the reduction in exposure from bilateral netting and central clearing as shown in Figure 29.

	No Netting	Bilateral Netting	Central Clearing
Counterparty 1	170	50	30
Counterparty 2	90	20	0
Counterparty 3	100	50	0
OTC CCP (C)	-	-	30
TOTAL	360	120	60

Source: Gregory, Jon, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 70.

³⁷³ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 65 seq.

³⁷⁴ An additional way to achieve multilateral netting benefits is through trade compression.

³⁷⁵ See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., pp. 91–117.

As illustrated above, in absence of netting, the three participants (Counterparty 1, Counterparty 2, and Counterparty 3) have liabilities marked by the directions of the arrows as follows:

- Counterparty 1 is exposed to Counterparty 2 by an amount of 90, and to Counterparty 3 by an amount of 50.
- Counterparty 2 is exposed to Counterparty 1 by an amount of 70 and to Counterparty 3 by an amount of 20 and an amount of 30.
- Counterparty 3 is exposed to Counterparty 1 by an amount of 100.

Bilateral netting reduces exposure as follows:

- The aggregate liabilities to be paid by Counterparty 1 to Counterparty 2 equal 20.
- The aggregate liabilities to be paid by Counterparty 2 to Counterparty 3 equal 50.
- The aggregate liabilities to be paid by Counterparty 3 to Counterparty 1 equal 50.

The above means that bilateral netting reduces the total exposure of the system by a factor of three (360 down to 120).

Under central clearing, all assets and liabilities are taken over by the OTC CCP (C) and total exposure is reduced even further to 60.

4.4. Membership Requirements

OTC CCPs employ robust and transparent requirements for their CMs, which are generally based on an evaluation of the creditworthiness of the prospective CM, as well as its ability to meet liquidity requirements (e.g., margin calls) and adhere to the OTC CCP's rules (e.g., auction procedure).³⁷⁶

Membership requirements typically include the following:

- **Capital Base** - CMs must have a minimum core capital base. In the United States, the CFTC caps the capital requirements for CM dealers to a maximum of US\$ 50 million. The rationale behind this restriction is to facilitate the access to OTC CCPs by smaller CMs and prevent domination from largest banks. Thus, for instance, SwapClear³⁷⁷ and ICE Clear Credit³⁷⁸ require a minimum adjusted net capital of US\$ 50 million, which applies outside the United States, as well.
- **Rating** – CMs must satisfy a minimum rating requirement (e.g., single A). Major OTC CCPs have also adopted internal credit score that considers

³⁷⁶ See, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 147; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 33-34, 127-129.

³⁷⁷ See, SwapClear, *Our Clearing Services - Becoming a Member*, available at <http://www.swapclear.com/service/becoming-a-member.html> (Last visited December 2016).

³⁷⁸ See, ICE Clear Credit, *Regulation*, available at <https://www.theice.com/clear-credit/regulation> (Last visited December 2016).

factors such as external market data, financial position, and the existence of explicit or implicit support arrangements.

- Operational Requirements - A CM must conform to the OTC CCP's operational requirements and have all the necessary credit and banking arrangements in place to support clearing activities.
- Financial Commitments - A CM must contribute onto the OTC CCP's default fund a certain minimum amount determined by the OTC CCP. For instance, SwapClear's clearing members must contribute a minimum of £10 million per member for SwapClear Global Services, and a minimum of £15 million per member for SwapClear US-domiciled services.³⁷⁹ CMs are also required to make additional contributions to the default fund, which are typically capped at their current contribution. For instance, SwapClear's clearing members are obliged to provide additional unfunded default fund contributions limited to one unfunded assessment per member default to a maximum of three in six months.³⁸⁰ Contributions by CMs are generally risk weighted and re-calculated each month.³⁸¹
- Regulatory Status – Typically, CMs are required to have within their corporate group at least one banking institution, credit institution, securities firm, investment banking firm or similar entity licensed by the competent authorities in the United States or a member state of the EU, or the equivalent of a banking institution, credit institution, securities firm, investment banking firm or similar entity licensed by other competent authority in another region and which is subject to prudential rules considered by the OTC CCP to be at least as stringent as those applicable to those entities within the United States or the EU.
- Default Management - All CMs must participate in periodic “fire drills” or “driving test” to test their ability to deal with default scenarios and to timely load, price and bid on a certain number of trades so to ensure readiness in such event.
- Due Diligence - The application process typically includes an extensive business, financial, legal and operational due diligence of the prospective CM. Furthermore, a prospective CM may be required to provide additional documentation or information that the OTC CCP may reasonably requested to verify the ability of such prospective CM to satisfy its obligations as CM.

Compliance with membership requirements is first assessed at the time of admission of the CM. Thereafter, each CM shall continue to comply with the required membership requirements and shall promptly notify the OTC CCP if it has breached any of such requirements.

³⁷⁹ See, SwapClear, Our Clearing Services - Becoming a Member, available at <http://www.swapclear.com/service/becoming-a-member.html> (Last visited December 2016).

³⁸⁰ Ibidem.

³⁸¹ For further discussion on this point, see section 4.9 below.

In addition, OTC CCPs define rigid rules and procedures regulating the process of resignation by a CM, a CM's suspension and expulsion, as well as the transfer of client and proprietary positions.³⁸²

It is important to note that many OTC derivatives market participants either cannot meet the requirements to be a CM or do not want to be a CM, because of the costs involved or the contingent liabilities to which a CM is exposed. Either the case, OTC derivatives market participants may still have access to an OTC CCP's clearing services as "clients" of CMs. In particular, two are the most common paradigms used for client clearing: the principal-to-principal model (largely utilized outside the United States) and the agency model (most commonly utilized in the United States). In the principal-to-principal model, the client faces the CM as principal and the CM, in turn, faces the OTC CCP as principal. There is no direct relationship between the OTC CCP and the client and there are identical trades on either side of the CM. Contrary, in the agency model, the CM acts as agent for the client vis-à-vis the OTC CCP and guarantees the client's performance to the OTC CCP.

Clients of CMs may interact with various CMs and have trades cleared at various OTC CCPs. Moreover, clients may also have clients of their own, which are commonly referred to as "client-of-client" or "indirect clients."

4.5. Margining

Margins are the OTC CCP's first line of defense against default risk and represent a critical instrument of the OTC CCPs' risk control and management process.³⁸³

OTC CCPs require CMs to post two types of margins: variation margins and initial margins.³⁸⁴ Their key features are summarized below.

Variation margins cover MTM changes in the value of a CM's portfolio and are calculated via a revaluation of all underlying positions on (at least) a daily basis.³⁸⁵ CMs whose net positions have declined in value shall pay to the OTC CCP the value of the decreases; these variation margins are then paid by the OTC CCP to those CMs whose net positions have increased in value. The fact that an OTC CCP has a matched book and is balanced on a market risk basis means that any variation margin movements simply flow through the OTC CCP: whenever a CM loses and has to post variation margin to the OTC CCP, there is another CM that wins and receives such margin.³⁸⁶ CMs must deposit variation margins in cash.³⁸⁷ Significantly, the process of daily variation margin determination requires daily estimates of the fair-market prices of each type of derivatives cleared by the OTC CCP. This, in turn, requires timely and reliable

³⁸² See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., pp. 9-10.

³⁸³ See, e.g., Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 76; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., Chapter 6.

³⁸⁴ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 69-70.

³⁸⁵ *Id.*, p. 33.

³⁸⁶ Cf., Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, International Swaps and Derivatives Association Discussion Papers Series No.1 (2011).

³⁸⁷ See, e.g., Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 30 note 87-88.

price data and, when price data is not directly available, market standard valuation methods.

Initial margins are an additional amount that CMs are required to post to cover the risk of non-performance in relatively “normal market conditions,” as well as the possibility that shifting market prices will leave the counterparty with a credit risk.³⁸⁸ As observed by Prof. Murphy, initial margins are taken to cover “close-out risk,” defined as the risk that the close out value of the portfolio of derivatives that the CCP has with a counterparty differs from its mark to market value. This could occur, for instance, because of a time gap between the last successful margin call prior to default and the close out of the portfolio, during which the relevant portfolio changes in value.³⁸⁹

CMs are usually required to post initial margins in an account with the OTC CCP promptly after execution of the trade. In case of client clearing, CMs must pay required margins to the OTC CCP irrespective of whether or not they have received the margins from their clients. When CMs post margin in advance, they essentially offer short-term liquidity to their clients. Initial margins may change frequently with market conditions and must be provided in cash or liquid assets (e.g. government treasury bonds).³⁹⁰

Significantly, initial margins are estimated based of the risk of the transactions held in each CM’s portfolio.³⁹¹ The appropriate amount of initial margin tend to reflect both the daily volatility of the market value of the derivatives and the number of days that is likely to be needed for an orderly unwind of the position.³⁹² This methodology helps explain why thinly traded and complex derivatives instruments may not be a good fit for central clearing: the costs of analyzing the risks involved in these instruments would be too high; the costs of setting up pricing methods would be similarly preclusive; the time to unwind open positions in these instruments would likely be excessive; and, the OTC CCP clearing these instruments would face the risk of incurring severe fire-sale losses.³⁹³

CMs’ margin requirements are generally computed based on a measure of the risks for the CM’s positions over the risk horizon.³⁹⁴ Common risk measures for OTC CCPs’ margin include the following: scenario based approaches (e.g., the Standard Portfolio Analysis (SPAN)), which evaluates the worst loss of the

³⁸⁸ See, David Elliott, Central Counterparty Loss-Allocation Rules, cit., p. 5.

³⁸⁹ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, Rivast Consulting (2012), pp. 1-2.

³⁹⁰ See, Tina P. Hasenpusch, *Clearing Services for Global Markets*, cit., p. 30.

³⁹¹ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and Their Implications for Policy*, cit., p. 2.

³⁹² See, Darrell Duffie, *How Big Banks Fail and What to Do about It*, Princeton University Press (2011), p. 65 (discussing an hypothetical example of the determination of the initial margin for a given derivatives position).

³⁹³ Id., pp. 65-66.

³⁹⁴ See, Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, Working Paper (2015), p. 9. Initial margin calculations for OTC derivatives typically utilize the historical simulation approach, which takes a period of historical data containing risk factor behavior across the entire portfolio in question and re-simulates over many periods how the current portfolio would behave when subjected to the same historical evolution.). See, e.g., Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit.; Giovanni Barone-Adesi, Kostas Giannopoulos and Les Vospe, *Estimating the joint tail risk under the filtered historical simulation. An application to the CCP’s default and waterfall fund*, Swiss Finance Institute Research Paper No. 15-12 (2015).

portfolio across a range of scenarios; and statistical risk measures (e.g., Value at Risk (VaR), Expected Shortfall (ES), or variants of these such as the “Truncated Tail Conditional Expectation”). The margin requirement is, then, computed as the worst-case loss (in the SPAN method), a loss quantile (VaR), or expected shortfall (tail conditional expectation) at a certain confidence level, which typically range between 99% to 99.75%.³⁹⁵ The margin level is interpreted as the amount of collateral that need to be posted to absorb losses in a proportion of scenarios given by the confidence level.³⁹⁶

The above means that initial margins are generally calculated to be sufficient to cover with a high degree of confidence the potential exposure that may arise in a scenario of default of one or more CM over a pre-defined time period (often referred to as the “margin period of risk” or “liquidation period”) while the OTC CCP performs default procedures. In practice, the intended coverage of OTC CCP initial margins tend to be above the 99% confidence interval of 5-day liquidation period.³⁹⁷

Regulators and international supervisory authorities have provided some guidance to OTC CCPs with respect to margin calculation. For instance, the European Securities and Markets Authority (ESMA) has specified a minimum confidence level of 99.5% for CCPs clearing OTC derivatives (compared to the 99% level for exchange type products). Similarly, the internationally agreed Principles for Financial Market Infrastructures (PFMIs), jointly published by the Basel Committee on Payment and Settlement Systems (CPSS) and the International Organization of Securities Commissions (IOSCO),³⁹⁸ set a minimum size of initial margin in Principle 6 as follows:

“A CCP should adopt initial margin models and parameters that are risk-based and generate margin requirements sufficient to cover its potential future exposure to participants in the interval between the last margin collection and the close out of positions following a participant default.”³⁹⁹ Initial margin should meet

³⁹⁵ Cf., e.g., John C. Hull, *Risk Management and Financial Institutions*, John Wiley & Sons, 4th ed. (2015), Chapter 12 and Chapter 18; Robert L. McDonald, *Derivatives Markets*, cit., Chapter 26.

³⁹⁶ Ibidem.

³⁹⁷ When calculating initial margins OTC CCPs generally use a five-day assumption compared to a minimum of ten days under Basel III for bilateral transactions. This is due to a number of factors, including the ability of OTC CCPs to reduce the margin period of risk by marking daily and even intra-daily collateral calls in cash only, their full authority over all calculations, the strict enforcement of margin requirements by OTC CCPs, as well as the their orderly default management processes. See, e.g., Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 198; Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., pp. 6-8, 23.

³⁹⁸ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, Bank for International Settlements and International Organization of Securities Commissions (2012).

³⁹⁹ Cf., Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, Principle 6, Key Consideration 1 and paragraph 3.6.3 (providing that the appropriate closeout period may vary among products and markets, depending upon the product’s liquidity, price and other characteristics) and paragraph 3.6.5 (indicating that the closeout period should account for the impact of a participant’s default on prevailing market conditions); Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 28, Guidance No. 5.2.4 (explaining that, “[a]s a general matter, the assumed [Margin Period of Risk (MPOR)] or closeout period should incorporate the market depth and characteristics of the products cleared and should be justified analytically by the CCP. Where a CCP clears products with different market characteristics, the CCP should consider multiple MPOR assumptions or seek to ensure that a single MPOR assumption is appropriate for all cleared

*an established single-tailed confidence level of at least 99% with respect to the estimated distribution of future exposure.*⁴⁰⁰

Principle 6 of the internationally agreed Principles for Financial Market Infrastructures (PFMIs) also provides that:

*“A CCP should have a margin system that establishes margin levels commensurate with the risks and particular attributes of each product, portfolio, and market it serves.”*⁴⁰¹

For this purpose, an OTC CCP should implement a margin system (including margin and pricing models) that appropriately captures the characteristics and complexity of the products it clears.⁴⁰²

A related concern is the degree of reliance that an OTC CCP may have on sources of price data. In this respect, Principle 6 of the internationally agreed Principles for Financial Market Infrastructures (PFMIs) indicates that:

*“A CCP should have a reliable source of timely price data for its margin system. A CCP should also have procedures and sound valuation models for addressing circumstances in which pricing data are not readily available or reliable.”*⁴⁰³

As further clarified by CPMI and IOSCO, a CCP should evaluate the reliability and consistency of prices that it receives to detect both stale and erroneous data.⁴⁰⁴ In addition, a CCP should maintain appropriate policies and procedures to address such problems, which may include estimating prices or adjusting margin requirements if data become unreliable or even unavailable.

Principle 6 of the internationally agreed Principles for Financial Market Infrastructures (PFMIs) further provides that:

“A CCP should analyse and monitor its model performance and overall margin coverage by conducting rigorous daily backtesting and at least monthly, and more frequent where appropriate, sensitivity analysis. A CCP should regularly conduct an assessment of the theoretical and empirical properties of its margin model for all products it clears. In conducting sensitivity analysis of the model’s coverage, a CCP should take into account a wide range of parameters and assumptions that reflect possible market conditions, including the most-volatile

products.”) and Guidance No. 5.2.5 (clarifying that “[a]s a general starting point, the assumed MPOR or closeout period should be consistent with market conditions likely to be present upon the default of any of the CCP’s participants. Such conditions may include the level of product standardisation in the market, whether the product is exchange- or OTC-traded, and general indications of the degree of market liquidity such as the degree of concentration in market-makers and liquidity providers.”).

⁴⁰⁰ Id., Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit., Principle 6, Key Consideration No.3.

⁴⁰¹ Id., Principle 6, Key Consideration No.1.

⁴⁰² See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 27, Guidance No. 5.2.1.

⁴⁰³ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit., Principle 6, Key Guidance No.2.

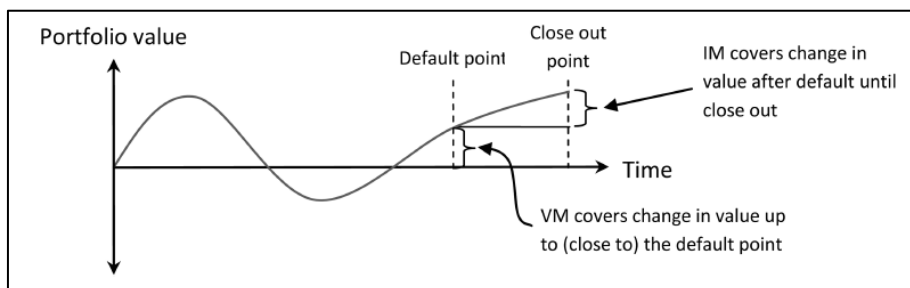
⁴⁰⁴ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 31, Guidance No. 5.2.21.

periods that have been experienced by the markets it serves and extreme changes in the correlations between prices.”⁴⁰⁵

“A CCP should regularly review and validate its margin system.”⁴⁰⁶

Figure 30 below illustrates how variation margin and initial margin are used.⁴⁰⁷

Figure 30. Initial and variation margins.



Source: Murphy, David, *The Systemic Risks of OTC Derivatives Central Clearing*, Journal of Risk Management in Financial Institutions, Vol. 5, No. 3, pp. 319–334 (2012), p. 322.

Significantly, when considering initial margin calculation, it is important to understand that VaR and similar methodologies discussed above provide information that is only partially complete: these methodologies provide an estimation of the probability of occurrence of extreme losses, but they do not tell how large losses conditional on the relevant boundary being breached could be. This is critical in the clearing context. It essentially means that, when assessing the resilience of an OTC CCP and determining its necessary financial resources, one should evaluate both the relevant margin level (to ensure that the probability that price moves will breach margins is sufficiently low) and the magnitude of the potential loss conditional on margins being breached relative to the OTC CCP’s financial resources.⁴⁰⁸

Moreover, experience with VAR models and similar methodologies suggests that models based on historical data may significantly underestimate the occurrence of very extreme losses, and that calibrating the relevant model can create significant challenges, often exacerbated by the lack of readily available benchmarks.

When calculating margins it is also important to understand that there is no unanimous consensus on models, nor there is a unanimous consent on underlying assumptions or parameter choices. This is a key point as the absence of such consent may result into different values for margins and lead to a scenario where high confidence levels do not necessarily imply high margin

⁴⁰⁵ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit., Principle 6, Key Guidance No.6.

⁴⁰⁶ Id., Principle 6, Key Guidance No.7.

⁴⁰⁷ See, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 44-45; David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, Journal of Risk Management in Financial Institutions, Vol. 5, No. 3, pp. 319–334 (2012), p. 322; David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 1.

⁴⁰⁸ See, Craig Pirrong, *VaR and Margins*, Streetwise Professor Blog (September 25, 2010).

requirements. Moreover, the described valuation methodologies are highly sensitive to inputs and underlying assumptions, which, in turn, may be subject to uncertainty and estimation errors.⁴⁰⁹

In addition, it is worth noting that OTC CCPs' margin requirements have not historically been part of bilateral markets. Hence, prior to the GFC, parties to a bilateral OTC derivatives trade typically agreed on posting only variation margins and their concerns were mainly that variation margins reflect the market-to-market (MTM) of the relevant derivatives portfolio as accurately as possible.⁴¹⁰ Contrary, in a centrally cleared market, both parties to a trade are required to post both initial margins and variations margins, and margins cannot typically be reutilized. As a result, following the implementation of central clearing mandates for OTC financial derivatives, margin requirements are much stricter and the amounts at stake have increased significantly, up to approximately US\$ 2–4 trillion according to recent estimates.⁴¹¹

Finally, it is important to understand that the implementation and enforcement of new margin requirements for OTC derivatives result into profound changes in the liquidity dynamics of the financial system. Chapter 6 will discuss this point in detail.

4.6. Coordinated Default Management Process

Broadly speaking, an OTC CCP could fail due to losses arising from the default of one or more CM(s), or non default-related losses, including investment losses, operational losses, or fraud.⁴¹²

As noted by Prof. Duffie,⁴¹³ there exists a danger that failure of a major OTC CCP could occur during periods of extremely stressed markets, as such a failure

⁴⁰⁹ See, Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., P. 13 (noting that “[a] common approach to the validation of margin requirements is historical back testing: the margin requirements are computed for a set of portfolios [...] every day using historical data and compared with the subsequent (out of sample) T-day realized, where T is the risk horizon. [...] This procedure, similar to the one used for backtesting risk models for bank portfolios, leads to a result which is comparable across models if the same historical data set is used. [...] Historical backtesting, though necessary and useful, yield an incomplete assessment of the adequacy of margin requirements: they are restricted to a set of historical scenarios which may or may not be representative of potential stress scenarios facing the CCP, and only consider current positions of Clearing Members. A more comprehensive validation should involve not just current Clearing Member portfolios but also hypothetical ‘test’ portfolios, which may represent possible positions that members may bring to the CCP. This allows to track potential weaknesses in the margin calculations and identify “worst-case portfolios” whose risk may not be captured by the margin requirements.”). See, also, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 197-198.

⁴¹⁰ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 70 (noting that “historically, the bilateral OTC derivative market has used collateral almost entirely in the form of variation margin, and initial margin has been rare.”).

⁴¹¹ See, e.g., International Swaps and Derivatives Association (ISDA), *ISDA Margin Surveys*, available at <https://www2.isda.org/functional-areas/research/surveys/margin-surveys/>. See, also, Paul E. Rowady, Jr., *The Global Risk Transfer Market: Developments in OTC and Exchange-traded Derivatives*, TABB Group (2010); Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market*, International Monetary Fund (IMF) Working Paper No. 10-99 (2010).

⁴¹² There are a number of issues that could generate losses for an OTC CCP even in absence of a member default or that may contribute to losses in a default scenario. For instance, there could be margin losses caused by market risk, credit risk, FX risk or liquidity risks; losses arising from investments of cash or securities held as margin; losses from operational risks, including delayed margin calls, inability to make relevant valuations or fraud; or losses caused by the resignation of large OTC CCP members. See, Stephen J. Lubben, *Failure of the Clearinghouse: Dodd-Frank's Fatal Flaw?*, Virginia Law & Business Review, Forthcoming (2016), p. 3 and accompanying note 12 (referring to this scenario as a “jump-to-default.”).

⁴¹³ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, Graduate School of Business, Stanford University, Working Paper No. 3256 (2014), p. 3.

is most likely to be triggered by the default of systemically important CM(s), who would also have failed to fulfill their payment obligations to other major financial entities. Furthermore, as observed by Elliott, the increased complexity and the larger volume of OTC derivatives that are now cleared by OTC CCPs have made the ability of an OTC CCP to stand losses caused by the failure of one or more of its CMs even more critical.⁴¹⁴ This, in turn, has created the need for OTC CCPs to have comprehensive and effective recovery plans and measures to manage threats to their viability and financial strength.⁴¹⁵

The sections below will address this point in more detail and will analyze a typical OTC CCP's coordinated management process in the event of default of one or more CM(s).

4.7. Hedging and Auction Process

Default of a CM may occur when a CM is insolvent, fails to make margin payments, or fails to make other contractual payment to the OTC CCP. In theory, as soon as a CM fails to perform its obligations, the OTC CCP should declare its default and activate the default management process. Moreover, due to variation margin practices of OTC CCPs being at a minimum daily (and potentially even intra-daily), the time window between the last payment of variation margins before the default of the CM and the moment the CM is declared in default should be very short. In practice, however, an OTC CCP has discretion and might delay its decision before declaring a large CM in default.⁴¹⁶

Once a CM's default is declared, the next step for the OTC CCP is to manage the market risk associated with the outstanding contracts of the defaulted CM and to re-establish a matched book.⁴¹⁷ This is normally achieved through macro hedging (which facilitate the default management process by creating less directional portfolios) and an auction process.⁴¹⁸

⁴¹⁴ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 1.

⁴¹⁵ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of financial market infrastructures*, cit., p. 3 (defining "recovery" as "...actions of an FMI, consistent with its rules, procedures and other ex ante contractual arrangements, to address any uncovered loss, liquidity shortfall or capital inadequacy, whether arising from participant default or other causes (such as business, operational or other structural weaknesses), including actions to replenish any depleted pre-funded financial resources and liquidity arrangements, as necessary to maintain the FMI's viability as a going concern and the continued provision of critical services.").

⁴¹⁶ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 139.

⁴¹⁷ In this sense, see Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 194 (arguing that CCPs introduce two features beyond those seen in bilateral markets: loss mutualization and the coordinated default management process). *But*, see, e.g., Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 31-32 (arguing that this function might be unbundled from the other functions performed by OTC CCPs); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 249 (noting that "[b]ilateral markets have shown their ability to design such initiatives when the credit derivative market achieved something broadly similar via the 'big bang protocol' in 2009, which paved the way for auction settlement for credit events."). See, also, Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., pp. 2-3; International Swaps and Derivatives Association (ISDA), *ISDA Announces Successful Implementation of 'Big Bang' CDS Protocol*, Determinations Committees and Auction Settlement Changes Take Effect, International Swaps and Derivatives Association Press Releases (April 8, 2009).

⁴¹⁸ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 3, 13 and accompanying note 28 (explaining that typically "a portfolio auction is administered by the CCP among its CMs. However, the industry is considering whether the auction process could be broadened to include other clearing participants.").

The design of the auction mechanism is of critical importance.⁴¹⁹ A number of issues could affect the efficiency of the auction and, thus, require close attention. Among them are the following:

- First, an important question to address is whether to hold auction(s) for the actual defaulted positions or auctions for standardized products that market participants could participate in to replace defaulted positions. The former option poses a number of problems: the portfolio of the defaulter CM might be extremely complex with a large number of heterogeneous contracts; the portfolio of the defaulter CM might need to be split into multiple parts; and/or counterparty matching issues may arise. In contrast, the latter option might facilitate the orderly matching of counterparties, thus, avoiding externalities and price disruptions.
- Second, an additional question is whether auctions should occur simultaneously or sequentially. This issue is important because counterparty exposures would build if auctions for different products were conducted sequentially.⁴²⁰
- Third, critical is also the question of what type(s) of orders can be submitted.⁴²¹ Available options include submission of limit orders (i.e., orders with a specified price and quantity) and submission of non-priced noncompetitive orders that are then crossed at the winning auction price.
- Fourth, important is the question of who should be allowed to participate in the auction(s). One option could be to allow participation to CMs only; a different option could be to allow participation to both CMs and non-CMs, the latter subject to the consent of a minimum number of CMs and satisfaction of certain financial requirements.⁴²² The choice of eligible participants has a number of implications. In fact, single-price auction mechanisms tend to work poorly when the creditworthiness of auction participants is heterogeneous.⁴²³ Moreover, when the default of a CM creates the need for a large number of counterparties to replace positions

⁴¹⁹ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 29-32 (discussing auction design).

⁴²⁰ Id., p. 39 note 72.

⁴²¹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 140 (noting that typically when an OTC CCP auctions the defaulted CM's positions, the surviving CMs will submit two-way prices for sub portfolios (divided, for example, by currency) and the CCP member bidding the best price will win a given portfolio.).

⁴²² See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, BlackRock ViewPoints (2014), p. 5 (arguing that “[a]uction participants should be expanded beyond clearing members as well as to other market participants who are judged able to honor their bids. A larger number and diversity in auction participants and open participation would result in a more transparent process and result in a more fair and accurate market price.”); BlackRock, *Response to Consultative Report of the Committee on Payments and Market Infrastructure and International Organization of Securities Commissions re: Resilience and recovery of central counterparties (CCPs): Further guidance on the PFMI dated August 2016 (“CPMI-IOSCO Consultative Report”)*, BlackRock (October 18, 2016), p. 10 (noting “[e]xpanding the participants eligible to bid in the auction process is highly likely to improve auction results. The criteria for broader market participation in the auction process should be established and published as part of the CCP’s resolution and recovery plans, which would allow both the CCPs to identify potential participants and allow those participants to take preparatory actions in a measured fashion rather than during the midst of a crisis.”); BlackRock, *Response to Discussion Note of the Financial Stability Board re Essential Aspects of CCP Resolution Planning*, BlackRock (October 17, 2016), p. 3..

⁴²³ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 30 (suggesting that this problem could fix this problem by adopting a more elaborate buyer-seller matching mechanism, which permits participants to specify counterparty credit exposures.).

or hedge exposures, allowing direct participation by any and all may be problematic.⁴²⁴

- Fifth, the question of who will act as auctioneer also deserves particular attention. The auction could be organized and run by the OTC CCP, or a private organization (e.g., ISDA) or a regulator.⁴²⁵

Significantly, in the context of a default management process, an OTC CCP has typically more flexibility than counterparties in bilateral markets. The OTC CCP can macro-hedge risk, close out and transfer the positions of a defaulted CM throughout an auction process without the danger of the defaulted CM challenging the nature of any losses incurred.⁴²⁶ Moreover, the OTC CCP has the discretion to determine if the prices achieved during the auction(s) are economically acceptable,⁴²⁷ to split the portfolio into sub portfolios, to apply relevant market risk hedges and auction trades in the manner considered optimal, to accept any bid in the auction, and to declare the auction failed if it considers the best bid not high enough. If the auction process is not successful, then the OTC CCP may require the auction to be rerun or consider alternative measures.

To maximize the efficiency of the auction, the process is typically practiced via periodic (e.g. twice a year) “fire drills.” New CMs are also generally required to take “driving tests” to demonstrate their ability to process, price, and bid on relatively large portfolios of trades in a short period of time (e.g., few hours).⁴²⁸

4.8. Default Waterfall

When implementing hedging strategies and conducting the auction process, an OTC CCP can incur several costs.⁴²⁹ First, while macro-hedging the risk, the OTC CCP may be exposed to market volatility and potential bid-offer hedging costs for large positions. Second, during the auction process, the OTC CCP may be exposed to liquidation costs, including bid-offer costs, and downward price movements due to “fire sale”-like dynamics.⁴³⁰

⁴²⁴ Id., p. 31 (arguing that a way to address this issue could be to have qualified dealer firms represent customer orders in the auctions).

⁴²⁵ See, section 4.7 and accompanying notes, discussing how under the aegis of ISDA, major swap dealers have designed and implemented an auction protocol for the settlement of credit default swaps written on companies that experienced credit events.

⁴²⁶ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 140.

⁴²⁷ Ibidem.

⁴²⁸ Id., pp. 140-141.

⁴²⁹ Id., pp. 183-184.

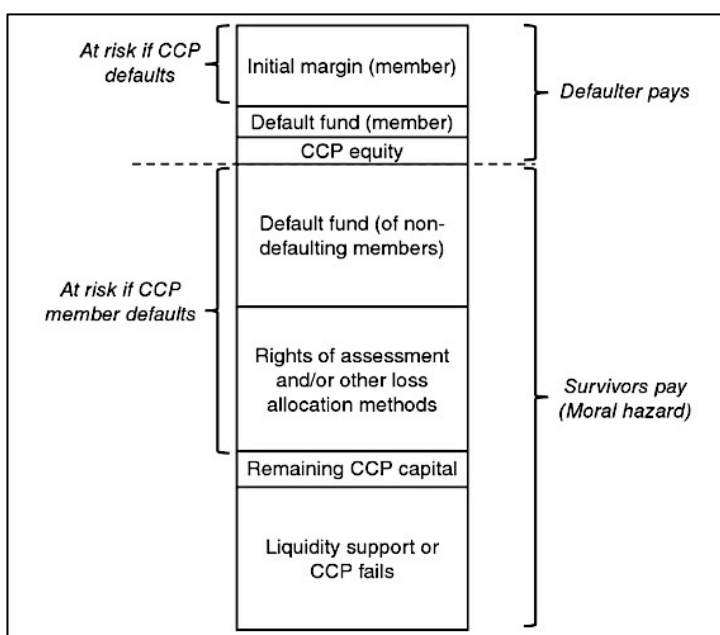
⁴³⁰ Id., p. 183 (noting a key difference between losses due to market volatility and risk premium experienced as liquidation costs. Contrary to losses related to market volatility, bid-offer costs and/or risk premiums are costs that are not balanced by equivalent gains in the opposite cleared trades. As a result, their allocation tends to be more complex. Moreover, although highly volatile products may create challenges, illiquid products (or those that become illiquid in the aftermath of a major default) will be even more difficult to manage during the default management process. This would explain, for instance, why default management process might be very costly for thinly traded and less liquid OTC derivatives.)

To manage the costs of unwinding open positions of a defaulted CM, OTC CCPs maintain a pool of resources that are typically organized and utilized in the order of a pre-defined default waterfall.⁴³¹

In theory, the ideal way for CMs to contribute financial resources is in a “defaulter pays” approach, whereby any CM would contribute all the necessary resources to pay for the costs associated with its own default. This approach, however, may not be efficient: each CM would need to contribute an extremely high amount of financial resources, which would make clearing services too expensive. Because of this, in practice, most OTC CCPs require each CM to contribute enough financial resources to cover losses caused by its default to a high level of confidence, whilst the remaining extreme and unlikely losses will be shared among other CMs.⁴³²

A typical OTC CCP’s default waterfall is represented in [Figure 31](#) below.⁴³³

Figure 31. Illustration of a typical OTC CCP default waterfall, defining the way in which the default of one or more OTC CCP members is absorbed.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 142.

As illustrated in [Figure 31](#), the first line of safeguards is represented by the variation margin, initial margin and default fund contribution paid by the defaulted CM.

⁴³¹ The term “default waterfall” refers to the safeguards available to a CCP to cover losses arising from the default of a CCP member, and the order in which such financial resources may be utilized. The term “end-of-the-waterfall” refers to scenario following the exhaustion of all such financial resources.

⁴³² See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 148.

⁴³³ For an example of how the various financial resources of a CCP are engaged in a scenario with multiple failures of clearing members, see, e.g., Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., pp. 21-22; Darrell Duffie, *How Big Banks Fail and What to Do about It*, cit., pp. 67-69.

In the scenario, where the above resources are not sufficient to cover all default losses, exceeding losses may be taken from some equity contributed by the OTC CCP onto the default waterfall. The use of OTC CCP's own financial resources ensures that the OTC CCP has sufficient "skin in the game" and is incentivized to set appropriate level of initial margins and default fund contributions. As discussed in detail below, the equity contribution by the OTC CCP is typically divided in two tranches: the first tranche (Tranche 1) is placed senior to the default resources contributed by the defaulted CM and junior to any mutualized default resources contributed by non-defaulting CMs; and the second tranche (Tranche 2) is placed senior to mutualized default resources contributed by non-defaulting CMs. As long as the financial resources taken from the defaulted CM and the first layer of the OTC CCP's equity resources are sufficient to cover the default losses, then the "defaulter pays" approach is fulfilled.

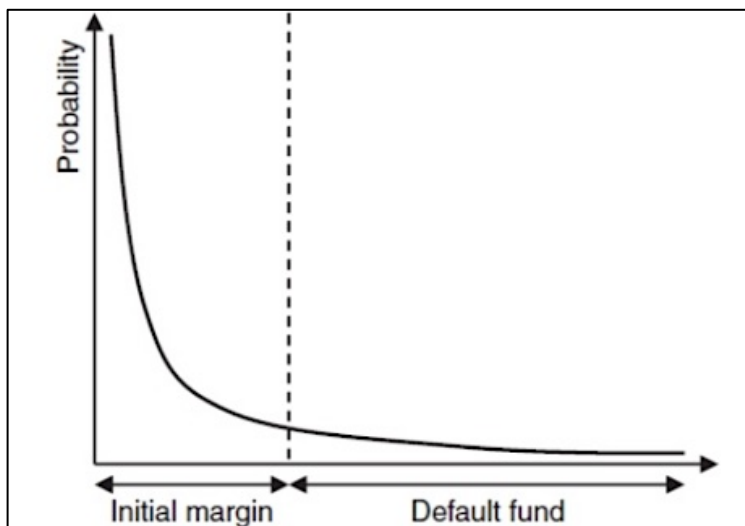
Beyond the defaulter pays point, improbable but extreme losses are shared among non-defaulting CMs through mechanisms of loss mutualization. There are two common risk-sharing mechanisms: a pre-funded mutualized default fund (also known as "guarantee fund" or "default fund") and contributions by CMs of additional non-prefunded resources. These risk-sharing mechanisms will be discussed in detail below.

4.9. Pre-Funded Mutualized Default Fund

4.9.1. The Role of the Pre-Funded Mutualized Default Fund

When default losses are more extreme than anticipated in the margin calculations, an OTC CCP remains exposed to tail risks. In such scenario, loss distribution is likely to be heavily tailed and very large losses may occur. The role of the pre-funded mutualized default fund is exactly to absorb these remote but extreme losses (see, [Figure 32](#)).

Figure 32. Relationship between initial margin and default fund.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 175.

All CMs must contribute resources onto the pre-funded mutualized default fund. The loss mutualization inherent in the default fund is a key feature, since it allocates extreme losses arising from the default of a single CM across all other CMs.⁴³⁴

In this respect, two points are worth noting. First, non-defaulting CMs can suffer default losses through their contributions to the pre-funded mutualized default fund even if they have never traded with the defaulted CM, they have no net position with the OTC CCP, or they have a net position with the OTC CCP in the same direction as the defaulted CM.⁴³⁵ Second, because losses are shared among the CMs, CMs' clients bear no direct default losses as long as the OTC CCP remains solvent. This means that CMs effectively insure their clients against default.⁴³⁶

For the reasons discussed above, the mechanism of loss mutualization through the pre-funded mutualized default fund can be thought of as a form of insurance, whereby tail default risks above the initial margins are insured through a risk pooling mechanism.⁴³⁷ A number of scholars have investigated this point.

For instance, Culp notes that OTC CCPs' pre-funded mutualized default funds are economically equivalent to "industry mutuals" in the traditional insurance arena.⁴³⁸ In such mutuals, all participants make initial contributions, and large losses by any individual CM in excess of its margin (i.e., deductible) is then covered by payments from the mutual.⁴³⁹

Similarly, Prof. Murphy argues that, from a risk-management point of view, the function of OTC CCPs can be thought of as a combination of two activities: first, OTC CCPs call for, and clear, margin movements on cleared portfolios; and second, OTC CCPs guarantee counterparty performance on cleared portfolios.⁴⁴⁰ The former activity is essentially that of a central margin custodian,⁴⁴¹ while the latter activity is that of a mutual credit guarantor⁴⁴² (or,

⁴³⁴ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., pp. 5-6; Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act,"* cit., p. 18 and accompanying note (arguing that "[c]learing default funds financed by clearing members are economically equivalent to "industry mutuals" in the traditional insurance arena. In such mutuals, all participants make initial contributions. A large loss by any individual member in excess of its margin (i.e., deductible) is then covered by payments from the mutual. As long as risk exposures are imperfectly correlated across clearing members and positions, a smaller amount of total risk capital must be collected from individual members to achieve a given desired level of risk coverage vis-à-vis a situation when all members had to provide their own risk capital to cover each of those potential losses in isolation.").

⁴³⁵ See, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., p. 17.

⁴³⁶ Id. pp. 17-18; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 12, 21 (arguing that customers are the primary beneficiaries of clearing in this model. Hence, "[t]hey receive a larger portion of the payments promised them in a cleared market than in an uncleared one because solvent dealers step in to cover what insolvent dealers owe their customers but are unwilling to pay. This consideration is relevant in interpreting end-user opposition to mandatory clearing.").

⁴³⁷ In this sense, see, Thorsten V. Koepl and Cyril Monnet, *The Emergence and Future of Central Counterparties*, Federal Reserve Bank of Philadelphia Working Paper No. 10-30 (2010); Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, Working Paper (2012).

⁴³⁸ Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act,"* cit., p. 18.

⁴³⁹ *Ibidem*.

⁴⁴⁰ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 3.

⁴⁴¹ Id., p. 3 and accompanying note 4.

more precisely, a derivatives product company). In particular, with respect to the second activity, Prof. Murphy observes that an OTC CCP can be thought of as “mutual guarantee company,” whereby credit risk above initial margin is mutualized and covered by the OTC CCP’s financial resources comprising the default fund, the OTC CCP’s own equity, and additional unfunded resources to be contributed by CMs (e.g. rights of assessment).⁴⁴³ Based on the insight that the risk mutualization function of OTC CCPs is essentially that of a credit guarantor, Prof. Murphy, then, suggests that assessing the adequacy of OTC CCPs’ financial resources would be equivalent to ask how a well-informed party would rate a credit guarantor that insured all the derivatives receivables cleared by an OTC CCP and that had as financial resources the OTC CCP’s equity, default fund, and capital call ability.⁴⁴⁴ If the answer to this question is positive (that is, the OTC CCP receives “the highest rating”), the OTC CCP will have appropriate resources for the risks that it is taking. Contrary, if the answer is negative (that is, the OTC CCP receives a poor rating), additional resources will need to be contributed onto the OTC CCP.

4.9.2. Size of the Pre-Funded Mutualized Default Fund

As discussed in the previous section, the pre-funded mutualized default fund covers extreme but improbable losses above the defaulted CM’s financial resources and the first tranche of the OTC CCP’s equity. This means that the adequacy of default fund resources is determined by the exposure conditional on the occurrence of changes in price that are large enough to exhaust the margins of the defaulting CM(s), its contribution to the pre-funded mutualized default fund and the first tranche of the OTC CCP’s equity.⁴⁴⁵

Calculating the size of a default fund is extremely complex because the exposure of the default fund is linked to events involving fat tail behavior, complex dependencies and wrong-way risk.⁴⁴⁶ As correctly observed by Prof. Pirrong, tail events occur infrequently and are very challenging to model. Moreover, even if an appropriate model is found, estimating or calibrating the parameters necessary to calculate the distribution of conditional exposures and evaluating the ability of the model to accurately represent these distributions can be difficult.⁴⁴⁷ In addition, the exposure of an OTC CCP and its non-defaulting CMs to default losses via the default fund depends on the impact of replacement trades on prices, and the time required to replace defaulted positions, which, in turn, depends on market liquidity.⁴⁴⁸ This is relevant because an OTC CCP’s default fund will most likely be hit during turbulent periods, which are often

⁴⁴² Id., pp. 10-11 and accompanying note 8.

⁴⁴³ Ibidem.

⁴⁴⁴ Id., p. 11.

⁴⁴⁵ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 22; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 227 note 412 (noting that “[i]f clearing member default comovement is higher, a much higher default fund is required to provide the same degree of CCP safety.”).

⁴⁴⁶ See, e.g., Claudio Albanese, *The Cost of Clearing*, Working Paper (2015), pp. 3-4. See Chapter 6 below for further discussion on wrong-way risk.

⁴⁴⁷ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 23.

⁴⁴⁸ Ibidem.

characterized by extreme price movements and very low liquidity. As a result, OTC CCPs tend to make conservative assumptions about liquidity when evaluating the adequacy of default fund resources.⁴⁴⁹ Finally, dependencies can also pose significant challenges in quantifying adequate default resources.⁴⁵⁰

In light of the described complexities, recent regulatory initiatives have sought to provide OTC CCPs with some guidance on the structure and adequacy of their loss-absorbing resources. Many of these regulatory initiatives are based on the Principles for Financial Market Infrastructures (PFMIs) jointly published by the Basel Committee on Payment and Settlement Systems (CPSS) and the International Organization of Securities Commissions (IOSCO).⁴⁵¹

In particular, Principle 4 of the Principles for Financial Market Infrastructures (PFMIs) requires CCPs involved in activities with a more-complex risk profile or CCPs that are systemically important to maintain default fund resources sufficient to cover, at a minimum, losses from the simultaneous default of the two CMs that would potentially cause the largest aggregate credit exposure to the CCP in extreme but plausible market conditions (so-called “Cover 2” requirement).⁴⁵²

The “Cover 2” requirement is now an internationally agreed minimum standard for the amount of financial resources that systemically important OTC CCPs must possess. For instance, both the regulatory framework in the EU⁴⁵³ and the regulatory framework in the United States⁴⁵⁴ contain a “Cover 2” requirement for systemically important CCPs.⁴⁵⁵

The impact of the “Cover 2” requirement can be significant. In a recent study, Heller and Vause examine G14 dealers and estimate that an OTC CCP’s default fund may need to be about 50% larger to cover losses that could arise from default of the two most important IRS or CDS dealers, rather than just the single most important dealer.⁴⁵⁶

Interesting studies have also been conducted to determine optimal level of default fund contributions relative to margin payments. For instance, in a recent

⁴⁴⁹ Ibidem.

⁴⁵⁰ See Chapter 6 for further discussion on this point.

⁴⁵¹ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit.

⁴⁵² See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit., Principle 4. See, also David Murphy and Paul Nahai-Williamson, *Dear Prudence, Won't You Come Out To Play? Approaches to the Analysis of Central Counterparty Default Fund Adequacy*, Bank of England, Financial Stability Paper No. 30 (2014), p. 5 (noting that “cover 2 is a pure ‘stressed conditions’ requirement, whereas initial margin is primarily a ‘current conditions’ measure.”).

⁴⁵³ European Union, Regulation (EU) No. 648/2012 of the European Parliament and of the Council, OTC Derivatives, Central Counterparties and Trade Repositories (July 2012).

⁴⁵⁴ Commodity Futures Trading Commission (CFTC), Enhanced risk management standards for systemically important derivatives clearing organizations’, Final Rule 17 CFR Part 39 (August 2013).

⁴⁵⁵ The regulatory requirements for CCP management affect the relative size of the default fund and initial margin. Moreover, CMs are subject to capital adequacy requirements, which could have an indirect impact on the size of the CCP’s default fund and the allocation of its default resources.

⁴⁵⁶ See, Daniel Heller and Nicholas Vause, *Collateral Requirements For Mandatory Central Clearing Of Over-The-Counter Derivatives*, Bank of International Settlements (BIS) Working Papers No. 373 (2012). See, also, Daniel Heller and Nicholas Vause, *Expansion of Central Clearing*, Bank of International Settlements (BIS) Quarterly Review (2011), pp. 67-81.

study, Paul Nahai-Williamson, Tomohiro Ota, Mathieu Vital and Anne Wetherilt propose a simplified model to investigate the impact of selected factors on an OTC CCP's optimal choice of resources, in the absence of regulatory requirements.⁴⁵⁷ The results of their simulations support the belief that OTC CCPs should have discretion over how to set the optimal level and composition of their default resources, based on the risk characteristics of the market(s) that they serve and the portfolios that they clear.⁴⁵⁸

Further studies conducted by Prof. Murphy and Williamson have assessed the question of how prudent the "Cover 2" standard is for different sizes of CCPs.⁴⁵⁹ The authors present two approaches for analyzing the prudence of the "Cover 2" standard in a particular clearing service: the first approach is based on actual "stressed losses over initial margins (SLOIMs)" and a market consistent copula; and the second approach is based on theoretical loss distributions. Their results show that CCPs meeting the "Cover 2" standard are not highly risky: both approaches indicate that the "Cover 2" standard is a prudent standard for the risk distributions most likely to occur in practice. However, the findings of their study also illustrate that certain distributions of risk among CMs – in particular the case where tail risks are distributed too uniformly among CMs – can give rise to scenarios where the "Cover 2" standard is less prudent for CCPs with many CMs and, thus, additional financial resources may be needed to ensure the safety of the CCPs. Based on these findings, the authors conclude that it would be appropriate for CCPs and their supervisors to monitor the whole of the loss distribution and directly address this weakness in future revision of the international standards for systemically important CCPs.⁴⁶⁰

4.9.3. Fire Drills and Stress Tests

As mentioned in section 4.7 above, OTC CCPs typically conduct default simulations in the form of "fire drills" and stress tests.

All CMs are required to participate in periodic "fire drills" or "driving test" to test their capability to timely load, price and bid on a certain number of trades in the event of default and to practice the actions they need to perform in such a scenario.⁴⁶¹

With respect to stress testing, OTC CCPs tend to calibrate the aggregate size of the pre-funded mutualized default fund qualitatively via pre-defined stress tests. The amount of the pre-funded mutualized default fund so calculated is then

⁴⁵⁷ See, Paul Nahai-Williamson, Tomohiro Ota, Mathieu Vital and Anne Wetherilt, *Central Counterparties and Their Financial Resources — A Numerical Approach*, Bank of England Financial Stability Paper No. 19 (2013).

⁴⁵⁸ *Ibidem*.

⁴⁵⁹ See, David Murphy and Paul Nahai-Williamson, *Dear Prudence, Won't You Come Out To Play? Approaches to the Analysis of Central Counterparty Default Fund Adequacy*, *cit.*

⁴⁶⁰ *Id.*, p. 17 (noting that "[p]erhaps a simple backstop to cover 2 could be considered, such as demanding that the default fund in addition meets the requirement that it is larger than some fixed percentage of the 'cover all' requirement. One basic requirement for calibrating this percentage would be knowledge of the ratio of cover 2 to cover all, so a reasonable first step would be the disclosure of both measures by all systemically important CCPs.").

⁴⁶¹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, *cit.*, p. 241 (noting that OTC CCPs are in a "better position to 'war game' and resolve potential problems in OTC derivative markets"); Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, *cit.*, p.24 (discussing inherent limitations of default simulations).

allocated among CMs, typically pro-rata based on their initial margins (sometime averaged over a time period) or the total size of positions (often subject to a floor).

Increasing analysis and debates among regulators and market players have focused on stress testing for systemically important OTC CCPs.⁴⁶²

Currently, regulators are considering the introduction of a standardized stress testing framework, which will allow comparison of OTC CCP risk profiles. In particular, CPMI and IOSCO are considering a stress-testing framework for OTC CCPs that could incorporate minimum or consistent benchmark stress scenarios across OTC CCPs that clear the same asset class.

Market participants have also stressed the importance that OTC CCPs disclose the details of their stress-testing framework (including scenarios, inputs and methodologies) and make this information available to clearing participants, stakeholders, and regulators.⁴⁶³ Standardization and transparency of OTC CCP stress tests are necessary pre-conditions for clearing participants and regulators to determine with a high level of confidence the adequacy of OTC CCPs' resources and effectively compare OTC CCPs from a risk perspective.⁴⁶⁴ Moreover, to be effective in assessing the systemic implications associated with an OTC CCP's failure, OTC CCP stress tests should account for the increasing interconnectedness among different OTC CCPs.⁴⁶⁵ This, in turn, would require data sharing procedures among OTC CCPs, monitoring of cross-margin agreements, cross-membership and OTC CCP interoperating agreements by supervisory authorities,⁴⁶⁶ and harmonization of risk management practices across OTC CCPs.⁴⁶⁷

⁴⁶² See, Daniel K. Tarullo (Member of the Board of Governors of the U.S. Federal Reserve System), *Advancing Macroprudential Policy Objectives*, Speech at the Office of Financial Research and Financial Stability Oversight Council's 4th Annual Conference on Evaluating Macroprudential Tools: Complementarities and Conflicts, Arlington, Virginia (January 30, 2015).

⁴⁶³ See, e.g., International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, p. 7 note 19; International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., pp. 2-3; BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., pp. 1-2 (arguing that "CCPs should be subject to rigorous uniform stress testing to be overseen by regulators ... increased transparency by CCPs ... will provide market participants sufficient information to permit independent analysis as to the risk of clearing with a particular CCP"); BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R's for Central Clearing Counterparties*, BlackRock ViewPoints (2016), pp. 2,4; BlackRock, *Response to Consultative Report of the Committee on Payments and Market Infrastructure and International Organization of Securities Commissions re: Resilience and recovery of central counterparties (CCPs): Further guidance on the PFMI dated August 2016* ("CPMI-IOSCO Consultative Report"), cit., pp. 4-5; PIMCO, *Setting Global Standards for Central Clearinghouses*, PIMCO ViewPoints (2014), p. 3 (arguing that "[s]tandardized stress tests should be performed periodically and consistently by CCPs. While we do not see value in making these stress tests public, we do believe the results should be reviewed and approved by regulators."); J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, J.P. Morgan Chase & Co., Office of Regulatory Affairs, Perspectives (2014), pp. 2-3 (arguing that "[s]tandardized regulatory stress testing and disclosure should be mandatory to determine the size of required loss absorbing resources.").

⁴⁶⁴ See, Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, Working Paper (2015), p. 2.

⁴⁶⁵ See, Sean D. Campbell and Ivan Ivanov, *Empirically Evaluating Systemic Risks in CCPs: The Case of Two CDS CCPs*, Working Paper (2016).

⁴⁶⁶ See, Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., p. 26 (noting that performance of a CCP stress test on a single CCP may fail to capture the big picture and provide an accurate determination of the levels of strain CCP members may be subject to in the event of the default of one or more CCP members.).

⁴⁶⁷ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3.

Interestingly, in a recent publication, BlackRock has analyzed relevant disclosure requirements for CCPs and has identified relative strengths and weaknesses (see, [Table 12](#)).

Table 12. Existing CCP disclosure requirements.

	Principles for financial market infrastructures (PFMI)	Principles for financial market infrastructures: Disclosure framework and assessment methodology (PFMI Disclosures)	Public quantitative disclosure standards for central counterparties (Quantitative Disclosures)
Date	April 2012	December 2012	February 2015 (implemented January 2016)
Purpose	<ul style="list-style-type: none"> Sets principles-based standards that in some cases incorporate specific minimum requirements, such as in the credit, liquidity, and general business risk principles, to ensure a common base level of global risk management across FMI. 	<ul style="list-style-type: none"> Promotes the disclosure of risk management information by all FMIs (including CCPs) to facilitate implementation and ongoing observance of the PFMI. The disclosure framework is intended to promote a common base level of global transparency across FMIs. 	<ul style="list-style-type: none"> Enables market participants to: <ul style="list-style-type: none"> compare CCP risk controls. have a clear, accurate and full understanding of the risks associated with a CCP. understand and assess a CCP's systemic importance. understand and assess the risks of participating in CCPs.
Key strengths	<ul style="list-style-type: none"> Established standards for sizing loss absorbing resources (must be sufficient to cover the largest or the two largest CM defaults). Set 99th percentile initial margin calculation standard. Established liquidity risk management standards. 	<ul style="list-style-type: none"> Provides first ever framework for CCP risk disclosures. Provides some standardization to market participants. Provides some details on risk policies, such as how many CM defaults the CCP assumes when sizing its loss absorbing resources. 	<ul style="list-style-type: none"> Builds upon the qualitative exposures and provides specific information on margin models and quantum of loss absorbing resources. Provides a mostly uniform data set to allow for comparison and trend analysis. Provides some details on stress loss numbers and concentration metrics.
Key weaknesses	<ul style="list-style-type: none"> Lacks specificity with respect to governance, stress testing, transparency and disclosure. Does not address how much capital a CCP should commit. 	<ul style="list-style-type: none"> Required only every two years. Not subject to any audit / review standard and not maintained in any central location. Disclosures tend to be principle based with little specificity in the actual document. Often refers back to rule books or other documents, rather than directly addressing the issue. 	<ul style="list-style-type: none"> Lacks explanatory text to meaningfully describe data elements and/or provide rationale for changes. Not subject to any audit / review standard and not maintained in any central location. Disclosure is generally in unformatted spreadsheets with multiple tabs.

Source: BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R's for Central Clearing Counterparties*, BlackRock ViewPoints (2016), p. 6.

4.10. Liquidity Resources

Principle 7 of the internationally agreed Principles for Financial Market Infrastructures (PFMIs) provides that:

*“A CCP should maintain sufficient liquid resources in all relevant currencies to settle securities-related payments, make required variation margin payments, and meet other payment obligations on time with a high degree of confidence under a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions. In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should consider maintaining additional liquidity resources sufficient to cover a wider range of potential stress scenarios that should include, but not be limited to, the default of the two participants and their affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions.”*⁴⁶⁸

As clarified by CPMI and IOSCO, the “Cover 1” and “Cover 2” requirements for liquidity risk set forth in Principle 7 of the internationally agreed Principles for Financial Market Infrastructures (PFMIs) are minimum standards.⁴⁶⁹ A CCP should maintain its required level of prefunded liquid resources on an ongoing basis and should conduct stress testing for liquidity risk in order to assess observance with its coverage requirements.⁴⁷⁰

In addition, Principle 7 of the internationally agreed Principles for Financial Market Infrastructures (PFMIs) provides that, for the purpose of meeting a CCP’s minimum liquid resource requirement:

*“ [CCP]’s qualifying liquid resources in each currency include cash at the central bank of issue and at creditworthy commercial banks, committed lines of credit, committed foreign exchange swaps, and committed repos, as well as highly marketable collateral held in custody and investments that are readily available and convertible into cash with prearranged and highly reliable funding arrangements, even in extreme but plausible market conditions. If a [CCP] has access to routine credit at the central bank of issue, the [CCP] may count such access as part of the minimum requirement to the extent it has collateral that is eligible for pledging to (or for conducting other appropriate forms of transactions with) the relevant central bank. All such resources should be available when needed.”*⁴⁷¹

⁴⁶⁸ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit., Principle 7, Key Guidance No. 4.

⁴⁶⁹ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 24, Guidance No. 4.2.1.

⁴⁷⁰ *Id.*, p. 25, Guidance No. 4.2.5.

⁴⁷¹ See, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit., Principle 7, Key Guidance No.5.

“A [CCP] may supplement its qualifying liquid resources with other forms of liquid resources. If the FMI does so, then these liquid resources should be in the form of assets that are likely to be saleable or acceptable as collateral for lines of credit, swaps, or repos on an ad hoc basis following a default, even if this cannot be reliably prearranged or guaranteed in extreme market conditions. Even if a [CCP] does not have access to routine central bank credit, it should still take account of what collateral is typically accepted by the relevant central bank, as such assets may be more likely to be liquid in stressed circumstances. An FMI should not assume the availability of emergency central bank credit as a part of its liquidity plan.”⁴⁷²

Paragraph 4.3.2 of the Recovery of Financial Market Infrastructures further acknowledges that forms of liquidity that would qualify as “supplementary liquidity” may be useful in some scenarios, such as those where a CCP or market conditions are not highly stressed.⁴⁷³ Paragraph 4.3.2 also notes that “these less reliable forms of liquidity may not represent sufficient tools to address uncovered shortfalls in extreme but plausible market conditions. Hence, a recovery plan that contains such tools should also contain tools that will be effective in highly stressed environments.”⁴⁷⁴

4.11. OTC CCP’s Equity Contribution (“Skin in the Game”)

As illustrated in [Figure 31](#) above, OTC CCPs generally make contributions to the waterfall from their own capital. To finance its cash/cash equivalent contribution, an OTC CCP can issue equity, debt or a combination thereof.⁴⁷⁵

Contributions from OTC CCPs onto their default waterfalls serves a number of purposes: first, OTC CCPs’ contributions supplement the pool of financial resources available to absorb losses;⁴⁷⁶ second, they create the incentives for OTC CCPs to maintain robust risk management and default management practices;⁴⁷⁷ third, when risk-based, they help OTC CCPs maintain a broader and diverse clearing member group and manage concentrated exposure to a single CM;⁴⁷⁸ and, fourth they help align incentives between OTC CCPs, CMs, and market participants.⁴⁷⁹

⁴⁷² Id., Principle 7, Key Guidance No.6.

⁴⁷³ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraph 4.3.2.

⁴⁷⁴ Ibidem.

⁴⁷⁵ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 42, Guidance No. 6.2.5; BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3;

⁴⁷⁶ See, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., pp. 2, 5-6.

⁴⁷⁷ See, PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 1 (noting that “the more contributed capital that the CCP is required to post to the guarantee fund, the more the CCP is inclined to ensure that the margin buffers from clearing members are sufficient and that clearing members’ risk management process are sufficiently robust”); Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 9.

⁴⁷⁸ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 2; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 4.

⁴⁷⁹ See, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 2, 5-6; David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 9.

It is worth noting that contributions by OTC CCPs onto their default waterfalls must be “balanced,” so that they do not become cost-prohibitive for OTC CCPs and they do not discourage CMs from carefully manage their risk exposures.

Contributions by an OTC CCP are often divided in two tranches.⁴⁸⁰ The first tranche (Tranche 1) is placed senior to the default resources contributed by a defaulted CM and junior to any mutualized default resources contributed by non-defaulting CMs. The second tranche (Tranche 2) is placed senior to mutualized default resources and represents the remaining resource to absorb losses, when all other default resources have been exhausted and no mechanisms to allocate losses among CMs are available.⁴⁸¹

Regulatory approaches to the sizing of an OTC CCP’s contributions to loss-absorbing resources are not uniform. For instance, the CFTC has largely remained silent on the issue, whilst the European Banking Authority/European Securities and Markets Authority require CCPs to maintain contributions into the default fund equal to a fixed percentage (25%) of their CCP EMIR regulatory capital requirements.⁴⁸²

Thus, in absence of a uniform regulatory approach, OTC CCPs have made very different determinations with respect to the aggregate amount of their equity contributions and their size relative to CMs’ financial resources. Significantly, recent studies have shown that OTC CCPs’ exposures are still very limited, they are somehow negligible when compared to the default fund contributions by CMs, and most often they do not scale to risk.⁴⁸³

Given the increasing importance of OTC CCPs’ activities, industry participants have encouraged global regulatory bodies (e.g., FSB, CPMI, and/or IOSCO) to undertake more rigorous quantitative analysis of the modeling of OTC CCPs’ capital and their contributions to default resources, and to communicate their position to the market.⁴⁸⁴

In addition, industry participants have advanced proposals for strengthening OTC CCPs’ equity contributions to default loss-absorbing resources. For instance, some market participants have requested that OTC CCPs’ contributions be fully funded.⁴⁸⁵ Other market participants have suggested a number of alternative approaches to calibrate the size of an OTC CCP’s equity contribution: a first option could be to quantify the OTC CCP’s equity contribution as a fixed percentage of the pre-funded mutualized default fund (e.g., in a range

⁴⁸⁰ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 42, Guidance No. 6.2.4

⁴⁸¹ In this sense, see, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 5 (arguing that a properly sized two-tranche structure “would encourage CCPs to maintain robust risk management practices, while incentivizing CMs to prudently manage their own risks by not relying excessively on [skin in the game].”).

⁴⁸² Article 45(4) of EMIR.

⁴⁸³ See, The Clearing House Association, *Central Counterparties: Recommendations to Promote Financial Stability and Resilience*, The Clearing House Banking Brief White Paper Series (2012).

⁴⁸⁴ See, e.g., BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R’s for Central Clearing Counterparties*, cit., p. 5; BlackRock, *Response to Consultative Report of the Committee on Payments and Market Infrastructure and International Organization of Securities Commissions re: Resilience and recovery of central counterparties (CCPs): Further guidance on the PFMI dated August 2016 (“CPMI-IOSCO Consultative Report”)*, cit., pp. 2-3.

⁴⁸⁵ See, PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 2.

from 5% to 12%); another option could be to calculate the OTC CCP's equity contribution as to equal the aggregate financial resources contributed by the largest (or second largest) CM(s); a third option could be to calculate the OTC CCP's equity contribution as a multiple (e.g., 2X or 3X) of the OTC CCP's annual earnings;⁴⁸⁶ and a final option could combine one or more of the described approaches.⁴⁸⁷ Although the range of views expressed by market participants is quite wide, it is important to note that they all agree on that an OTC CCP's contribution must be material and substantial in order to effectively align the incentives between the OTC CCP and its CMs, to encourage the OTC CCP and its CMs to enhance their risk management and governance, to ensure the strength of OTC CCP membership requirements, and to limit to the extent possible concentration risk.

4.12. End-of-the-Waterfall Rules

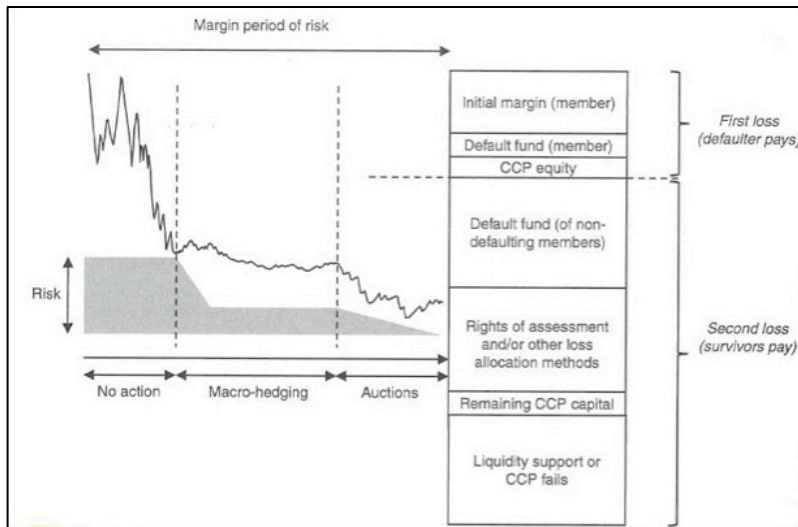
A severe and costly default (or series of defaults) of one or more CMs can potentially deplete the default fund and all other pre-funded financial resources available to an OTC CCP. The situation characterized by the exhaustion of the default fund and all other pre-funded financial safeguards available to an OTC CCP is commonly referred to as “end-of-the-waterfall”⁴⁸⁸ (see, [Figure 33](#)).

⁴⁸⁶ Cf., International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit.

⁴⁸⁷ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 4 (“[w]e recommend that CCPs contribute the greater of 10% of member contributions or the largest single clearing member contribution”); BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3 (noting that “the CCP should be required to contribute more than a minimal amount that is risk-based and measured by the lower of either a fixed percentage of the fund or the largest single CM contribution. We estimate that the contribution by the CCP would likely be in the range of 8% to 12% of the fund”); PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 2 (suggesting that “[m]inimum contribution from CCPs should be the highest of 5%, US\$20 million or the third-largest clearing member contribution.”).

⁴⁸⁸ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, ISDA technical paper (2013), pp. 8-9 (identifying three main scenarios where end-of-the-waterfall can arise: “(1) MTM losses on the CCP's open risk positions exhaust the resources in the default waterfall before the auction process can be completed and an auction settlement price determined; (2) An auction has been finalized so that the CCP determines a market-clearing auction settlement price for its open risk positions, but the price at which clearing participants would be willing to assume the CCP's open risk position exceeds the remaining resources in the default waterfall and aggregate VM gains haircut from the CM default; and (3) The auction process fails, i.e. after repeated attempts, the CCP does not receive a bid and is unable to determine a market-clearing price for its open risk positions.”).

Figure 33. Illustration of the default waterfall and potential risk in the event losses exceed the primary financial resources of the OTC CCP.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 182.

Assuming that the default management process is determined to be effective, upon exhaustion of pre-funded resources an OTC CCP may decide to call for additional non-prefunded resources from its CMs and to implement alternative loss allocation methods.⁴⁸⁹ These actions are not mutually exclusive, and rather, when allowed, they tend to be undertaken sequentially.⁴⁹⁰

The sections below will discuss the use of non-prefunded resources and loss allocation methods in more details.

4.13. Non-Prefunded Resources

One way for an OTC CCP to raise additional non-prefunded resources is through the exercise of rights of assessment (also referred to as “assessment power”), thereby an OTC CCP can call upon CMs to contribute further financial resources if the default fund is exhausted.⁴⁹¹ When cash calls are expressly incorporated and regulated into the OTC CCP rulebook, they constitute mandatory commitments of CMs. This means that failure to fund such commitments would constitute an event of default for a CM. In such a scenario, the OTC CCP would place the relevant CM into default and would be even allowed to utilize its initial margin on deposit as a temporary measure.⁴⁹²

⁴⁸⁹ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraph 4.

⁴⁹⁰ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 7.

⁴⁹¹ By virtue of its ultimate assessment power on its members to contribute additional funds to cover the losses arising from a member’s default, a CCP is said to be “good to the last drop” and able to offer a reasonable credible guarantee. Most CCPs nowadays operate under this system. Alternatively, a CCP may operate under the “live another day” system, whereby CMs receive protection primarily with guarantee funds and the CCP is not committed to satisfying all obligations. See, Gordon F. Peery, *The Post-Reform Guide to Derivatives and Futures*, cit., p. 108.

⁴⁹² See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 10, note 22.

Cash calls can be either unlimited (uncapped) or subject to an upper limit (cap), which is often based on a CM's pre-funded mutual default fund contribution.⁴⁹³

Although uncapped cash calls on CMs could provide an OTC CCP with greater flexibility in deciding the allocation of losses among its CMs,⁴⁹⁴ most often loss-allocation rules do not allow for uncapped cash calls. This is due to a number of reasons.⁴⁹⁵ First, a cap can help mitigate moral hazard arising from the fact that, through cash calls, stronger credit quality CMs are implicitly subsidizing weaker CMs. Second, a cap can help limit CMs' exposure and avoid destabilizing effects. Third, unlimited cash calls might induce a cascade of CMs resigning or defaulting, which in turn might further precipitate a stressed scenario and force the OTC CCP itself into failure. Fourth, exposures resulting from unlimited cash calls may have implications for bank capital requirements, and, thus, might disincentive membership in an OTC CCP by banking related entities.⁴⁹⁶ Fifth, the uncertainty regarding the ability of CMs to contribute unfunded liquidity through uncapped cash calls in turbulent markets may cause non-defaulting CMs to be exposed to significant contagion risk, which, in turn, may undermine the objective of central clearing of mitigating interconnection risks and promoting transparency.⁴⁹⁷ Sixth, when CMs clear on two or more OTC CCPs, simultaneous uncapped cash calls from multiple OTC CCPs might exacerbate CMs' liquidity strains under stressed market conditions.⁴⁹⁸ Finally, regulation may prohibit unlimited default fund contributions: for example, EMIR requires that the CMs of an OTC CCP have limited exposures toward the OTC CCP.⁴⁹⁹

Even when capped, cash calls can still raise concerns. A first concern is that cash calls could become a significant source of pro-cyclicality and could threaten the viability of non-defaulting CMs during period of market turbulence.⁵⁰⁰ Moreover, cash-calls might create significant funding and liquidity constraints in times of severe market distress. To address these concerns, international regulators have suggested that cash calls be proportional to pre-paid default resources, or be marked to the market value of the positions a direct participant brings to a CCP on a given day, or be calculated based on combination of these or other metrics.⁵⁰¹ In addition, ISDA has recommended CMs to consider any

⁴⁹³ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 7; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 148; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, p. 9 and accompanying note 7 (observing that "[m]any CCPs create the cap implicitly by permitting members to relinquish their membership once they have met a capital call equal to their initial default fund contribution.").

⁴⁹⁴ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 7 (noting that "for example, uncapped cash calls can be used to extend the 'mutuality principle' — that the CMs should collectively bear losses according to some reasonable distribution — beyond the default fund to a loss of any size.").

⁴⁹⁵ Ibidem.

⁴⁹⁶ See, Bank of International Settlements (BIS), *Capital Requirements for Bank Exposures to Central Counterparties*, Bank of International Settlements (2012).

⁴⁹⁷ See, Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, cit., p. 11.

⁴⁹⁸ See, Froukelien Wendt, *Central Counterparties: Addressing their Too Important to Fail Nature*, International Monetary Fund (IMF) Working Paper No. 15/21 (2015).

⁴⁹⁹ Article 43(3) EMIR.

⁵⁰⁰ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 4 note 9.

⁵⁰¹ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraph 4.2.4 (noting that these features "will reduce the maximum loss that may fall on any individual non-defaulting participant by mutualising the loss amongst direct participants, generally in rough proportion to the risk they bring to the CCP.") and paragraph 4.2.8.

unfunded commitments in their ongoing funding, capital and liquidity assessments, and has strongly advocated for cash calls to be pre-defined, limited, and reasonable quantifiable.⁵⁰² Similarly, numerous market participants have requested that all loss absorbency resources be pre-funded in order to reduce uncertainty.⁵⁰³

On the other hand, however, there exists the concern that pre-funding assessments may significantly increase capital costs (directly to CMs and indirectly to their clients and other market participants).⁵⁰⁴ For this reason, market participants have stressed the importance to strike a balance between the cost of clearing and the relative size of the default fund and pre-funded assessment amounts, as needed to protect the OTC CCP.⁵⁰⁵

4.14. Loss Allocation Methods

Most common loss allocation methods adopted by OTC CCPs include variation margin haircutting (VMH) and pro-rata reduction in unpaid payment obligations of the OTC CCP.⁵⁰⁶ Less common allocation methods include initial margin haircutting (IMH), novation, and bilateralization. These methods are analyzed in detail below.

Variation Margin Haircutting (VMH). Under the VMGH approach, if the default fund and (capped) rights of assessment are insufficient, the OTC CCP has the power to reduce (“haircuts”) pro-rata the variation margin payments due to CMs whose positions have increased in value since the date of default.⁵⁰⁷ The rationale behind VMGH is that cumulative gains that have accumulated since the beginning of the default management process shall be reduced pro-rata to absorb the amounts owing to the OTC CCP by the defaulted CM. This means that in-the-money CMs whose positions have increased in value since the default will not receive the full margin to cover their gain. On the other hand, out-of-the-money CMs whose positions have decreased in value are still required to pay variation margin in full.

There are a number of key attractive features that may justify the use of VMGH, including the following:⁵⁰⁸

- If all positions are valued consistently at a mid-price and the OTC CCP can close out the defaulter’s positions at that mid-price, VMGH should almost always be enough to absorb default losses. This is due to the fact that, as discussed in previous sections, an OTC CCP has a matched

⁵⁰² Ibidem. See, also, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 6.

⁵⁰³ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 3; PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 3.

⁵⁰⁴ See, e.g., Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, Bank of International Settlements (BIS) Quarterly Review, pp. 59-76 (2015), p. 70 (acknowledging the existence of a trade-off “between CCP prefunded resources, which represent self-insurance for the CCP and a cost for clearing members, and the reliance on unfunded liquidity provisions, which could put providers (whether participants or not) under pressure.”).

⁵⁰⁵ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3.

⁵⁰⁶ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., pp. 11 seq.

⁵⁰⁷ Id., p. 11 and accompanying note 3.

⁵⁰⁸ Id., pp. 9-10.

book, which means that to any losses on the defaulted CM's positions there are equivalent increases in the value of the positions of non-defaulting CMs.⁵⁰⁹

- VMGH in its essence mimics the economics of insolvency while ensuring continuity of the OTC CCP's services and avoiding the disruptive effects and high costs associated with a resolution.⁵¹⁰
- VMGH preserves netting and (especially when capped) creates a limited exposure for CMs.⁵¹¹
- With VMGH losses are borne by those CMs who may control their loss allocation by flattening or changing their trade positions.⁵¹²
- VMGH may create a strong incentive among CMs to support the OTC CCP during the default management process.⁵¹³
- VMGH can help spread losses widely and leads to a more heterogeneous allocation of losses.⁵¹⁴
- VMGH may also create strong incentives of trading with more creditworthy counterparties.⁵¹⁵
- The inclusion of VMGH in the default waterfall may reduce the need for central bank liquidity and create the right incentives for OTC CCP and CMs to use more sound risk management policies.⁵¹⁶
- The use of VMGH may help reduce the systemic risk arising from an OTC CCP's failure because it enables CMs to manage and measure their exposure to the OTC CCP at any stage of its lifecycle, and creates the incentive for all CMs to provide hedges to the OTC CCP in its default management process and actively participate in the default management auctions.

⁵⁰⁹ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 7; Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., pp. 31-32.

⁵¹⁰ Ibidem (noting that VMGH allocates losses across surviving CCP members similarly to what would occur in a resolution in bilateral markets and parties with claims on the defaulter loose in a pro rata fashion). See, also, See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraph 4.2.5.

⁵¹¹ See, e.g., David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 7; International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 19 (noting that "VMGH without a cap is similar to bilateral credit risk on an uncleared swap trade. On the default of its swap counterpart, a firm's losses will appear as a loss of recent mark-to-market gains, and its claim on the estate will result in an eventual rateable haircut to claimed gains. If a cap on VMGH were imposed, residual losses would be realised at the time contracts were torn up. Participants would also be subject to replacement costs on their trades.")

⁵¹² See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 11.

⁵¹³ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 7 (noting that "CMs can in principle model the size of their own in-the-money claims on the CCP, and manage and control these claims by trading with other CMs to reduce their position at the CCP. Indeed, such trading by CMs may also aid the CCP in closing out the defaulter's positions by providing liquidity in the affected contracts").

⁵¹⁴ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 20.

⁵¹⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 189.

⁵¹⁶ See, Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, cit., p. 5.

- VMGH can facilitate a wide allocation of losses, thus preventing concentration of uncontrollable losses on any one category of CMs.⁵¹⁷
- The loss allocation achieved via VMGH appears consistent with the Basel III capital requirements for bank exposures to OTC CCPs.⁵¹⁸

On the other hand, however, VMGH raises a number of concerns:⁵¹⁹

- VMGH has the disadvantage of creating unpredictable loss allocation.⁵²⁰
- Allocation of losses via VMGH may undermine the confidence of participants (CMs and CM's clients) in the OTC CCP⁵²¹ and may be perceived as being inappropriate/unfair since a CM could lose simply because the market has moved in its favor right at the time of the default of another CM.⁵²²
- VMGH could trigger a CM's default, and, thus, affect other OTC CCPs and bilateral counterparties with whom this CM has traded.⁵²³
- VMGH may create uncertainty for CMs as per their risk-exposures and as to whether a hedge could be effective during the default management process.⁵²⁴
- VMGH may also create the distorted incentive for CMs to periodically realize profits from in-the-money position in order to reduce their variation margin exposure to the OTC CCP, thus increasing transaction costs.⁵²⁵
- VMGH may cause pro-cyclicality.⁵²⁶

⁵¹⁷ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 11.

⁵¹⁸ Ibidem.

⁵¹⁹ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraphs 4.2.21-4.2.23.

⁵²⁰ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, cit., pp. 6-7 (noting that "[t]here are no clear incentive benefits associated with disproportionate and unpredictable loss sharing by clearing members who happen to be buyers, or who happen to be sellers. Moreover, economic principles suggest that it is better for a clearing member to suffer a moderate loss with certainty when a CCP fails to meet its clearing obligations, than to "flip a coin" to determine whether the size of the loss is zero or not. The marginal cost to a clearing member of bearing an incremental unit of unexpected loss is normally increasing in the total amount of loss, a "convexity effect" that suggests sharing losses across all clearing members, pro rata to the loss exposures they impose on the CCP".).

⁵²¹ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraph 4.2.2.

⁵²² See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 189; BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R's for Central Clearing Counterparties*, cit., p. 8; BlackRock, *Response to Consultative Report of the Committee on Payments and Market Infrastructure and International Organization of Securities Commissions re: Resilience and recovery of central counterparties (CCPs): Further guidance on the PFMI dated August 2016 ("CPMI-IOSCO Consultative Report")*, cit., p. 3.

⁵²³ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 189; BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R's for Central Clearing Counterparties*, cit., p. 7; BlackRock, *Response to Consultative Report of the Committee on Payments and Market Infrastructure and International Organization of Securities Commissions re: Resilience and recovery of central counterparties (CCPs): Further guidance on the PFMI dated August 2016 ("CPMI-IOSCO Consultative Report")*, cit., p. 3.

⁵²⁴ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 20; BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 4; Matt Gibson, *Recovery and Resolution of Central Counterparties*, Reserve Bank of Australia, Quarterly Bulletin (2015), pp. 39-48.

⁵²⁵ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 4.

⁵²⁶ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 2 (noting that VMGH may create distorted incentives for end users that expected cash payments since these end users would be incentivized to liquidate assets in order to raise funds. The liquidation, in turn, would depress the value of these assets and weaken the market, thus creating a pro-cyclical scenario that could further destabilize a collapsing market.).

The existence of the described benefits and disadvantages of VMGH help explain the absence of unanimous consent on their use among market participants and scholars.⁵²⁷

In addition, market participants and scholars have expressed the view that losses incurred by non-defaulting CMs through VMGH should be somehow compensated. Compensation could take the form of new shares or senior convertible debt instruments, backed by the OTC CCP's recovery on the defaulted CM's estate, and/or a pro-rata share in the current and future OTC CCP's revenues/profits.⁵²⁸

Pro-Rata Reduction In Unpaid Payment Obligations (PRO). Another method to allocate extreme losses related to the default of a CM is via pro-rata reduction of outstanding payment obligations of the OTC CCP to in-the-money CMs that arise under cleared contracts (often referred to as PRO).⁵²⁹ This method is essentially a modified form of VMGH, which improves upon it.⁵³⁰ As advocated by ISDA, the utilization of PRO should be strictly limited to payment obligations arising following to the commencement of the default management process and should not be used beyond the pre-defined time period of the default management process. In addition, PRO should not permit claw-back of mark-to-market (MTM) profits of a CM already settled nor it should affect CMs' entitlement to full return of initial margin.⁵³¹

Initial Margin Haircutting (IMH). Recent discussions among market participants and regulators have advanced the idea to use initial margin haircutting (IMH), as a further source of resources to facilitate an OTC CCP's recovery.⁵³² The idea is that IMH would help spread losses among a larger number of CMs and reduce uncertainty of exposure.⁵³³

That said, IMH does present some flaws and is not currently utilized by major OTC CCPs.⁵³⁴ Among the problems created by the use of IMH are the following:

⁵²⁷ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 20; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., pp. 2-3 (advocating for the use of VMGH as a step toward resolution and continuity through recapitalization). *But*, see BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 4 (arguing that VMGH would be useless in the context of a resolution process).

⁵²⁸ See, e.g., International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., pp. 16-17; International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 10; Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., p. 31; International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 6.

⁵²⁹ For an analysis regarding the utilization and requisite conditions under which PRO could be an effective component of the CCP's recovery framework, see International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 3-4,7 and accompanying notes 6, 11].

⁵³⁰ Cf., International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit.

⁵³¹ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 10.

⁵³² See, e.g., David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 8; PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 2 (arguing that "If client assets must be used, they should only be used through the pro-rata haircutting of client margin, which should take place on the "total value" of client margin, not only on variation margin, as some have suggested. Using only variation margin goes against the concept of "mutualization" among all members, while total equity is more equitable and defrays the impact on any individual account. Therefore, if there is any haircutting of client margin, it should be on both initial and variation margin across all clients.").

⁵³³ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, cit., p. 6.

⁵³⁴ See, e.g., See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraph 4.2.26;

- IMH may distort segregation and “bankruptcy remoteness”.⁵³⁵
- IMH may create disincentives for general participation in the OTC CCP default management process.⁵³⁶
- Because it ultimately removes the separation between initial margin and default fund contributions, IMH may increase risk uncertainty and make any risk analysis much more complex and less reliable.⁵³⁷
- The use of IMH creates the subsequent need for CMs to replace initial margins and CMs may incur delay and/or experience significant costs in replacing initial margins. This, in turn, would leave the OTC CCP under-protected and even trigger the default of other major CMs.⁵³⁸
- Regulation may prohibit IMH. For example, EMIR forbids CCPs from using initial margin of non-defaulted CMs to cover default losses.⁵³⁹

Novation and Bilateralization. In addition to the loss allocation mechanisms described above, an OTC CCP could attempt to novate trades to other OTC CCPs. These other OTC CCPs would likely agree to port the selected portfolio of positions in exchange of significant fees and margin posting.⁵⁴⁰ Alternatively, an OTC CCP may consider executing a bilateralization, thereby centrally cleared trades are returned to being bilateral trades. This reverse clearing process, however, is not without flaws. In particular, the danger is that bilateralization could create significant wrong-way, legal and operational risks.⁵⁴¹

4.15. Alternative Forms of Position Allocation

As noted in the previous sections, the primary mechanism for an OTC CCP to reestablish a matched book is through an auction (generally combined with market hedges). In extreme but still possible circumstances, the auction process may fail: after repeated attempts, the OTC CCP may not receive a bid and no market-clearing price for its open risk positions may be determined.⁵⁴² In such a scenario, an OTC CCP may consider alternative forms of position allocation.

BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 4 (arguing that “initial margin of non-defaulting customers should be sacrosanct.”).

⁵³⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 192.

⁵³⁶ See, e.g., Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 192; Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., p. 34 (noting that pro rata application of IMH would result in allocation of losses mostly on those CCP members whose initial margin contribution is largest. This, in turn, may lead towards a “race to the bottom” and provide distorted incentives to clear with CCPs whose margin levels are low.); BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R’s for Central Clearing Counterparties*, cit., pp. 7-8

⁵³⁷ See, Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., p. 34.

⁵³⁸ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 8.

⁵³⁹ Article 45(4) EMIR (providing that a CCP shall not use the margins posted by non-defaulting members to cover the losses resulting from the default of another clearing member).

⁵⁴⁰ See, e.g., Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 192.

⁵⁴¹ Ibidem. See, also, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 38 and accompanying note 47.

⁵⁴² See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 8-9.

There are two possible courses of action for reestablishing an OTC CCP's matched book when the auction process is not successful: a forced allocations of contracts that cannot be auctioned and a termination of open contractual positions ("tear-up").⁵⁴³

Forced contract allocation obliges CMs to accept certain positions at a price determined by the OTC CCP. This, however, creates the risk that an OTC CCP could force its CMs to take on unwanted and unmanageable positions at a time of stress, and could therefore subject them to potentially greater risks than contract termination. Because of this, there is a strong consensus among international authorities and market participants against the utilization of this mechanism.⁵⁴⁴

An alternative option would be a "tear-up" of unmatched contracts with non-defaulting CMs. In this case, contracts could be terminated via cash settlement. The cash settlement price can be based on the current mid-market price, the equivalent price at the time of the default, the price at which the most recent variation margin has been calculated, or a lower priced.⁵⁴⁵

A fundamental distinction can be drawn between complete (full) tear-up and partial (selective) tear-up.⁵⁴⁶

In a complete tear-up, an OTC CCP terminates all affected contracts, calculates the net obligation to all its CMs, and, then, cash settles these amounts pro-rata. At that point, it is likely that CMs would not want to continue doing business with the OTC CCP. Thus, a complete tear-up would be typically followed by closure of the OTC CCP's activities, and repayment of initial margins to non-defaulting CMs. This process has the advantage that risks can be quantified *ex ante* and also helps incentivize parties to arrive at voluntary solutions.⁵⁴⁷ Moreover, as noted by ISDA, a complete tear-up may be unavoidable in certain situations.⁵⁴⁸ On the other hand, however, a complete tear-up can have very drastic and

⁵⁴³ In this sense, see, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions, *Recovery of Financial Market Infrastructures*, cit.

⁵⁴⁴ See, e.g., Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraphs 4.5.2-4.5.3; International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., pp. 12-13.

⁵⁴⁵ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., pp. 8-9.

⁵⁴⁶ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, cit., paragraphs 4.5.14-4.5.20.

⁵⁴⁷ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 20.

⁵⁴⁸ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 13 (noting that VMGH is subject to limitation. For instance, there is the possibility (although a remote one) that even if all variation margins owed by the CCP to in-the-money CCP members were subject to a full haircut, the aggregate amount so raised would still be insufficient to cover the cost of returning to a matched book. This problem could occur when the bid-offer spread on the auctioned positions is very large and the CCP is required to pay a significant premium over the mid-price of those positions.); International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 20 (ISDA has generally promoted the use of VMGH to achieve recovery and continuity of the CCP, except into two scenarios. First exception is the scenario where an auction has been finalized so that the CCP determines a market-clearing auction settlement price for its open risk position, but remaining financial resources and VMGH do not generate enough funds to liquidate the defaulted CCP member's positions. In this case, ISDA believes there should be a full tear up of all derivatives in the class of derivatives that had failed to be rebalanced. Second exception where after repeated attempts, the auction process has definitely failed, the CCP does not receive a bid and is unable to determine a market-clearing price for its open risk positions (for instance, this may happen when the product has become totally illiquid and losses are not quantifiable). In this scenario, ISDA recommend moving directly to voluntary partial tear-up or full tear-up, irrespective of whether the default waterfall has been exhausted).

irreversible consequences, and should, therefore, be implemented only as extreme *ratio*.⁵⁴⁹ Moreover, a complete tear-up may involve significant contract replacement costs,⁵⁵⁰ and it may also cause extreme market dislocation.⁵⁵¹ Finally, a full tear-up does not appear to be compatible with the ultimate objective of systemic stability and central clearing services continuity.⁵⁵²

A somewhat less disruptive alternative is a partial (selective) tear-up, whereby only a subset of open contracts is cash settled.⁵⁵³ The set of trades to tear-up can be identified in a number of ways:⁵⁵⁴ voluntary tear-up (CMs voluntarily accept trades), original counterparties (positions are identified as the original opposing trades to the defaulted CM (assuming they are still open and can be identified), by bidder tear-up (tear up depends on the bids received in the auction), random tear-up (trades are identified arbitrarily from the portfolio of any CM(s) with offsetting positions to the defaulted CM), same class tear-up (trades are selected from across all CMs with open positions in the same class as those of the defaulted CM, regardless of whether or not their original trades were with the defaulter),⁵⁵⁵ or product tear-up (trades to tear-up are selected among the affected products).⁵⁵⁶

It is important to note that, although a partial (selective) tear-up would minimize the disruption effect associated with complete (full) tear-up and increase loss mutualization, it still poses a number of problems. First, partial tear up leads to an asymmetric treatment of CMs that may generate distorted incentives during the default management process.⁵⁵⁷ Second, partial tear up may affect netting, with further significant implications for bank capital requirements.⁵⁵⁸ Third, partial tear-up may trigger additional initial margin requirements if the tear-up results in a less diversified portfolio and alter the OTC CCP exposure.⁵⁵⁹ Fourth, non-defaulting CMs whose trades have been subject to tear-up may incur severe losses because the price they are paid may be (significantly) lower than the market price at which they can enter into replacement transactions.⁵⁶⁰ Finally,

⁵⁴⁹ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 8 (advocating the use of a full tear up only when the sole available alternative is a disorderly insolvency of the CCP).

⁵⁵⁰ Id., p. 9 (noting that “[m]embers who have had contracts selectively torn up may face a greater loss than those subject only to variation margin haircuts, since the replacement cost of the affected positions may be greater than the cash settlement price, especially if the latter is haircut.”).

⁵⁵¹ Id., p. 8 (noting that a complete tear-up of positions in a clearing service could have serious implications for financial stability as members’ and clients’ hedged positions become unhedged and participants attempt to replace many positions in a short space of time).

⁵⁵² See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 191-192.

⁵⁵³ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 15-16.

⁵⁵⁴ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 190-192.

⁵⁵⁵ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 8 accompanying note 3.

⁵⁵⁶ Id., p. 9.

⁵⁵⁷ Ibidem.

⁵⁵⁸ Ibidem.

⁵⁵⁹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 190-191.

⁵⁶⁰ Ibidem.

CMs would have to hedge their exposure from trades subject to partial tear-up, and this, in turn, could exacerbate instability and even trigger further defaults.⁵⁶¹

A number of market participants have expressed a preference for voluntary partial tear-up of problematic positions or a subset (or product type within).⁵⁶² The predominant approach supports the idea that CMs should be permitted to voluntarily contribute above their mandated amounts, and any direct (or indirect) clearing participant should be allowed to offer to tear.⁵⁶³ Moreover, the industry seems to agree that the use of partial tear-up should be considered only if accounting treatment for netting and capital purposes is preserved, commensurate compensation for affected participants is addressed, and no systemic instability is generated.⁵⁶⁴ Subject to these conditions - ISDA observes - the industry supports the use of partial tear-up that is “a) performed on a pro-rata basis across all clearing participants that have a position opposite to those of the defaulted CM’s positions (so as to not violate the OTC CCP as a principal, as required by accounting guidance); b) conducted at the last settlement price of the position (i.e., the prevailing market value); and c) not utilized as a means of loss allocation but rather as a method to re-establish a matched book.”⁵⁶⁵

4.16. Impact on Client Trades

The loss allocation mechanisms described above may also impact the clients of CMs. Hence, it is likely that CMs will try to align their bilateral relationship with a client to the OTC CCP’s rules. As a result, CMs’ clients could be (indirectly) exposed to loss allocation methods employed by the OTC CCP.⁵⁶⁶ Regulation may also encourage this alignment.⁵⁶⁷

4.17. Third-Party Liquidity Support

When available financial resources have been exhausted and the losses persist, assuming that the default management process and/or further recovery measures have remained effective, an OTC CCP might consider the use of external liquidity resources.

⁵⁶¹ Ibidem.

⁵⁶² See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 16.

⁵⁶³ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., 15-16; David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 9-10.

⁵⁶⁴ See, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, p. 6 and accompanying note 14.

⁵⁶⁵ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 15-16 (noting that industry participants have also supported the use of partial tear-up performed for a subset of (or product type within) the clearing service as long as the described conditions are satisfied and the entire subset (or product type) of the clearing service is torn up.”).

⁵⁶⁶ For a detailed discussion of major issues involved in client clearing, including client margin and segregation, portability, interoperability and collateral transformation, see, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 158-163; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 30-34.

⁵⁶⁷ For example, under the EU’s Capital Requirement Regulation article 306(1)(c), a clearing member will have to pass on the impact of actions such as VMGH to get appropriate capital relief.

One option could be for an OTC CCP to access to bank lines of credit and/or liquidity resources extended by other commercial providers of liquidity.⁵⁶⁸ Although they would help an OTC CCP cover liquidity shortfalls, these sources of liquidity have considerable drawbacks:

- First, these sources are likely to be very expensive due to the Basel III requirements for capital associated with their provision. Because committed lines impose a large capital charge on the issuing banks, the issuing banks will likely pass capital costs onto OTC CCPs.⁵⁶⁹
- Second, reliance on global settlement banks would further increase concentration within the financial system.⁵⁷⁰
- Third, the market turbulence that causes the OTC CCP's strain might have simultaneously impacted banks and other financial institutions, including those extending the lines of credit to the OTC CCP. This means that the third party liquidity providers may face financial constraints right at the time the OTC CCP needs access to their facilities. In such a scenario, the OTC CCP would not only be unable to access the needed liquidity, but would also be exposed to significant risk of default contagion from the banking sector.⁵⁷¹

As another option, an OTC CCP might consider investing in a short-term fund or other short-term third-party investment vehicles. This choice, however, might have a number of negative effects: it may increase systemic risk, may reduce diversification and, in the event of default of an OTC CCP during a period of stressed markets, it may trigger a spiral of asset liquidations.⁵⁷²

In addition to the resources discussed above, some liquidity support could be provided by a central bank.⁵⁷³ In particular, OTC CCPs could be granted access to central banks for cash deposits and repurchase agreements for securities.⁵⁷⁴ Using a central bank's liquidity in these two ways would have significant advantages: first, OTC CCPs could count on this sources of liquidity even (and especially) when liquidity in the market is scarce and most expensive; second,

⁵⁶⁸ See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., pp. 19-20 (suggesting that all CCPs should have access to liquidity facilities from private sector institutions who are not (or are not affiliate with) clearing members).

⁵⁶⁹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 142-143.

⁵⁷⁰ See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., pp. 19-20.

⁵⁷¹ See, Craig Pirrong, *VaR and Margins*, cit.; Craig Pirrong, *All Pain, No Gain: The CFTC's Rule on CCP Qualifying Liquid Resources*, Streetwise Professor Blog (November 22, 2013) (arguing that "[b]anks become stressed during crisis situations, and face a higher risk of being unable to perform on credit lines under these circumstances. ... Banks fighting for survival but which can perform might try to evade this performance during stressed market conditions, which in a tightly coupled system (and clearing is a source of tight coupling) can be extremely disruptive: a few minutes delay in performing could cause a huge problem. And if the banks do perform, doing so poses the substantial risk of increasing their risk of financial distress. That is, committed lines are positive beta from a liquidity perspective: that is, they pose wrong way risks. If drawn upon, these lines can be an interconnection that is a source of contagion from a derivatives default to systemically important banks, precisely at the time that they are least able to withstand the shock.").

⁵⁷² See, PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 3.

⁵⁷³ Title VIII of the Dodd-Frank Act allow designated U.S. CCP to access secured financing from the Federal Reserve, provided that private-market sources of liquidity have been exhausted. See, Chapter 8 below for further discussion on this point.

⁵⁷⁴ See, PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 3.

dangerous linkages between OTC CCPs and banking entities acting as liquidity providers would not be created; and third, because the OTC CCPs would interact with the central bank as counterparty, there would be less turbulence and fewer knock-on effects in the market.⁵⁷⁵ Chapter 8 will consider the provision of liquidity to OTC CCPs by central banks in detail.

4.18. Failure of an OTC CCP's Management Default Process

Previous sections have discussed loss-allocation rules and recovery arrangements. If an OTC CCP has been successful in covering losses and its clearing service can be reasonably resumed, then the OTC CCP's services will be reactivated. At that point, CMs that wish to continue their clearing services with the OTC CCP should be requested to replenish the default fund following a cooling-off period.⁵⁷⁶ On the other hand, CMs that wish to withdraw their membership should be given the opportunity to do so at the end of the cooling-off period, subject to the closing of all of their positions and fulfillment of all of their obligations.⁵⁷⁷

Although in a remote case, it is still possible that an OTC CCP's default management process fails. This occurs when the default management process cannot reduce the exposure of the (unmatched) portfolio, cannot transfer open positions to solvent CM(s), and cannot re-establish a matched book.⁵⁷⁸

As observed by ISDA, a primary indicator of a failed default management process is a failed auction,⁵⁷⁹ aggravated by the inability or lack of market capacity to provide pre-auction risk-reducing hedges to the OTC CCP at any price.⁵⁸⁰ Importantly, ISDA observes that the failure of the auction should not be made contingent on whether pre-funded default resources have been exhausted or not; rather the relevant test is whether the auction is effective in attracting enough bids to cover the open positions.⁵⁸¹ This means two things:

- An auction that attracts enough bids to cover the entire CM's portfolio, but does so at a cost exceeding pre-defined default resources, does not constitute a failed auction.⁵⁸² In such a case, the OTC CCP should first utilize available prefunded default resources and, if these resources are exhausted, recovery tools should be considered to raise additional resources.⁵⁸³
- Regardless of the amount of default resources that have been used (or that remain available), the auction fails when insufficient or no bids are

⁵⁷⁵ Ibidem.

⁵⁷⁶ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 18.

⁵⁷⁷ Ibidem.

⁵⁷⁸ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 8-11.

⁵⁷⁹ Id., p. 11. See, also, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 7.

⁵⁸⁰ Ibidem.

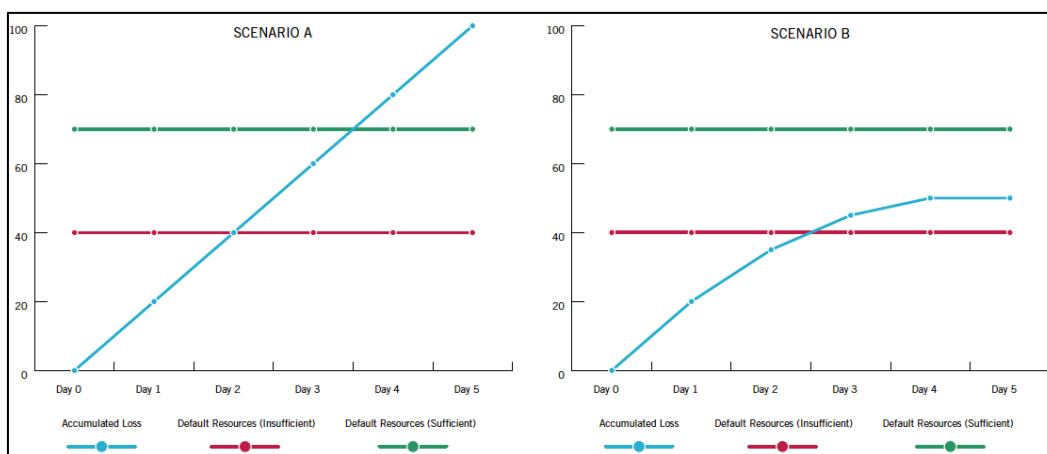
⁵⁸¹ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 8-9.

⁵⁸² Ibidem.

⁵⁸³ Ibidem.

received to transfer the entire portfolio(s), or no auction price can be established, or a matched book cannot be re-established.⁵⁸⁴ In these scenarios, the OTC CCP can decide to run subsequent auction if the default management process allows; or consider alternative forms of position allocations discussed in section 4.14 above. If, however, further auctions are unsuccessful and the alternative forms of position allocations are also ineffective, or are unfeasible, or pose substantial risk of systemic instability, then the clearing service will likely be deemed no longer viable.⁵⁸⁵ At this point, the sustainability of the OTC CCP's clearing services will be seriously threatened and the OTC CCP will need to consider a termination of its service.⁵⁸⁶ Figure 34 below helps understand this point.

Figure 34. DMP timeline vs. loss accumulation (default losses).



Source: International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, International Swaps and Derivatives Association technical paper (2015), p. 11.

Figure 34 illustrates two scenarios - Scenario A and Scenario B – that compare different potential loss accumulations against the amount of available pre-funded default resources. In each scenario, the horizontal axis represents a five-day default management process timeline, while the vertical axis shows the accumulation of losses. Each scenario displays two horizontal lines: a green line, representing the case where available default resources are sufficient, and a red line, indicating the case where available default resources are insufficient.

- Scenario A – The Default Management Process Has Failed: The default management process cannot control the accumulation of losses exceeding pre-funded default resources and does not show any ability to neutralize such accumulation. In this scenario, irrespective of the amount

⁵⁸⁴ Id., p. 11 note 26 (explaining that “[t]here are numerous circumstances that may lead to a failed auction – for example, if the current exposure of the portfolio or risk premium for a CM to accept an auctioned portfolio is far too excessive and/or exceeds capacity.”).

⁵⁸⁵ See, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 7 and accompanying note 17.

⁵⁸⁶ See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 5, 11.

of default resources available, the clearing service is likely to be assessed as being no longer viable.

- Scenario B - The Default Management Process Is Successful: The default management process has been successful in neutralizing and constraining the accumulation of losses. In this scenario, the clearing service will be likely deemed viable, regardless of the exhaustion of the OTC CCP's available default resources. Said it differently, the clearing service will be likely deemed viable both in the case where available default resources are sufficient (green line) and the case where available default resources are insufficient (red line).

Assuming that the default management process has failed, careful scrutiny will need to be paid to the OTC CCP's resolution process.

Resolution procedures of OTC CCPs have become particularly challenging due to changes in ownership and corporate governance structures undertaken by major OTC CCPs, which have moved from being utilities owned by members to private for-profit institutions.⁵⁸⁷

There is a general agreement among scholars and market participants that resolution procedures should be designed to minimize distress costs and to avoid the breakup of netting sets.⁵⁸⁸ Moreover, there exist a widespread agreement that resolution procedures should be defined in OTC CCPs' rulebook to provide CMs with adequate transparency and predictability so that the relative risks can be better managed and priced into contracts.⁵⁸⁹ Predictability and transparency would have a number of benefits: they can help reduce the risk of sudden runs or fire sales by CMs, can create the right incentives for CMs to lower their exposures to the OTC CCP by entering offsetting positions cleared at that OTC CCP, and ultimately can help mitigate the systemic consequences of an OTC CCP's failure.⁵⁹⁰

A first procedure of resolution may involve the liquidation of the failed OTC CCP and termination of all its clearing services. This process raises a number of issues. First, the final determination of losses could take a considerable long period of time.⁵⁹¹ Second, during the time necessary to coordinate and complete a full tear-up and/or liquidation process, there could be significant uncertainty

⁵⁸⁷ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 1 (noting that "[t]his model introduces an inherent tension (and possible conflict) between a CCP's role as a market utility and its commercial objectives to increase revenues and market share."); BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3.

⁵⁸⁸ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, cit., pp. 9-10 (noting that "[t]his raises particular concerns with the resolution of a CCP silo by transferring its assets to a "bridge" CCP, The concern is greater to the extent that CCP capital is held at the parent level relative to the CCP "silo" level. If the CCP must be resolved via a bridge at the parent level in order to take advantage of netting, then its other silos can be affected, adding to contagion risk").

⁵⁸⁹ See, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 2, 7; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 1; David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 4 (noting that "[o]ne of the key ways in which CCPs are distinguished from most other financial firms is that their obligations to their members, and vice versa, are governed by a central rulebook ... This could have the advantages, relative to the counterfactual of the disorderly insolvency of the CCP, of offering transparency and predictability to participants; providing for a quick and orderly allocation of losses; and potentially allowing the CCP to continue providing critical services to the market."); International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., pp. 1, 4-5.

⁵⁹⁰ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, cit., p. 8.

⁵⁹¹ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 6.

over the risk and status of open cleared contracts,⁵⁹² counterparties would be exposed to extended period of uncertainty,⁵⁹³ CMs would not be able to access their margin and any remaining default fund contributions,⁵⁹⁴ and closed-out trades would not be replaced on the business day following a failure.⁵⁹⁵ Third, liquidation may also have the effect of creating asymmetry of risk across market participants, thus resulting in extreme price volatility and unpredictable levels of gain and loss on any individual portfolio.⁵⁹⁶ Fourth, liquidation of a failed OTC CCP may generate fire-sale problems, by triggering a rapid collapse in the price of many types of assets typically posted as initial margin in cleared and non-cleared markets.⁵⁹⁷ This, in turn, would create a significant risk of trading disruption in the markets that the OTC CCP clears.⁵⁹⁸

Because of the described complexities, market participants have expressed mixed opinions with respect to the idea of liquidating a failing OTC CCP. For instance, ISDA has argued that the primary goal in a default situation should be recovery and continuity of the OTC CCP.⁵⁹⁹ Similarly, J.P. Morgan has expressed the opinion that maintaining critical operations of the OTC CCPs should be the driving principal in a default scenario and that, therefore, OTC CCPs should be recapitalized rather than liquidated upon failure, to continue systemically important activities.⁶⁰⁰ Pimco has also expressed the view that the recovery of OTC CCPs should be preferred to their liquidation, as recovery allows the market to continue to function in a more continuous manner.⁶⁰¹ Contrary, BlackRock, has taken the position that recovery and continuity of OTC CCPs' operations should not be paramount. In particular, according to BlackRock, when faced with a failing OTC CCP, end-user market participants would prefer being "money good" than "position good," that is they would rather prefer having the OTC CCP immediately wound down than being exposed to an OTC CCP with a heavily impaired guarantee fund.⁶⁰² As a result, according to BlackRock, a preferable option would be a rapid and complete winding-down of the failing OTC CCP's positions combined with an orderly repayment of margins.⁶⁰³

When the liquidation of a failing OTC CCP is not feasible and/or efficient, alternative resolution measures should be considered. These measures may include a reorganization (to be implemented through a combination of new

⁵⁹² Ibidem.

⁵⁹³ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 2.

⁵⁹⁴ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 6.

⁵⁹⁵ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 2.

⁵⁹⁶ Ibidem.

⁵⁹⁷ Ibidem.

⁵⁹⁸ See, David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 6.

⁵⁹⁹ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., p. 7; International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 3; International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., pp. 2, 6-7.

⁶⁰⁰ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 1.

⁶⁰¹ See, PIMCO, *Setting Global Standards for Central Clearinghouses*, cit., p. 3.

⁶⁰² See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 4; BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R's for Central Clearing Counterparties*, cit., pp. 2, 8-9; BlackRock, *Response to Discussion Note of the Financial Stability Board re Essential Aspects of CCP Resolution Planning*, cit., pp. 2-3.

⁶⁰³ Ibidem.

capital injections and restructuring of the OTC CCP's clearing obligations) and a transfer of the failed OTC CCP's clearing obligations to another existing OTC CCP or to a "bridge" entity. Market participants have expressed a variety of views on these mechanisms.

For instance, J.P. Morgan has advocated for a recapitalization as preferred outcome in the event of an OTC CCP's failure, which should take place only after all default losses have been allocated. The reorganization would allow OTC CCP's systemically important activities to continue, with the additional benefits of avoiding the uncertainty and reducing the likelihood and impact of fire-sale risk on collateral associated with liquidation and/or tear-up.⁶⁰⁴ To this purposes, J.P. Morgan has suggested that both the OTC CCP and CMs be required to contribute recapitalization resources into a trust fund (the "recap fund").⁶⁰⁵ This, would help align their shared interest more effectively. Recapitalization resources should be pre-funded and held in escrow at a central bank or government agency. Once an OTC CCP resolution process has been activated, recapitalization contributions would be "bailed in" and exchanged for equity in a "bridge" recapitalized OTC CCP. The resources would be used to set up a new guarantee fund, which would allow a failed OTC CCP to open on the following business day, thus limiting the potential for market contagion or further destabilization.⁶⁰⁶

Similar to the view expressed by J.P. Morgan, Blackrock has taken the position that, if authorities believe it is prudent to re-start the clearing services of the OTC CCP in a timely manner, then the OTC CCP resolution can contemplate a prefunded recapitalization plan.⁶⁰⁷ According to Blackrock, in such a scenario, a new management structure and a fully recapitalized default fund would create significant advantages: first, they can create the necessary incentive for market participants to use (or continue using) the services of the recapitalized OTC CCP; second, they can help contain the costs of re-establishing positions; and third, they can help avoid bilateral conversions of positions, which might not be allowed, or might not be practical, or even if allowed and possible might be excessively expensive and time consuming.⁶⁰⁸

Unrelated (non CMs) investors could also be allowed to contribute pre-funded resources into an OTC CCP recapitalization trust fund through debt instruments similar to those proposed by J.P. Morgan.⁶⁰⁹ The opportunity of participation of unrelated investors may be particularly attractive.⁶¹⁰ First, new investors would provide fresh new financial resources. Second, because unrelated investors would not be directly exposed to the risk faced by the OTC CCP, they would likely be in a better position to provide the necessary resources compared to existing CMs. Third, participation by unrelated investors to the recap fund could

⁶⁰⁴ See, J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 3.

⁶⁰⁵ Id., p. 4.

⁶⁰⁶ Ibidem.

⁶⁰⁷ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 5.

⁶⁰⁸ Ibidem.

⁶⁰⁹ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, cit., p. 10.

⁶¹⁰ See, BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 5.

essentially operate as a form of insurance, which would have the benefit of increasing loss sharing. On the other hand, participation of unrelated investors may have the negative effect of creating moral hazard problems on the part of the OTC CCP and its CMS.

4.19. Resolution Regimes

If the clearing services are assessed as being no longer viable, it is likely that an impartial resolution authority will also be called in.⁶¹¹ As noted by ISDA, the resolution authority can assist in evaluating which course of action be most appropriate, can help prevent dangerous conflict of interests, and can help ensure that the utilization of any recovery measure be effective in preserving financial stability.⁶¹²

The increased systemic relevance of large OTC CCPs also creates the need to evaluate the interaction of loss-allocation rules with resolution regimes for systemic relevant entities.⁶¹³ These regimes could provide a resolution authority with the necessary powers to stabilize a failing OTC CCP, including the authority to attest to the viability of the clearing service and the absence of conflicts of interest motivating the continuity of the clearing service,⁶¹⁴ as well as the authority to transfer a failed OTC CCP's ownership and/or its positions to another entity.⁶¹⁵

During the past five years, international organizations have drafted various consultative documents to guide the creation of statutory resolution regimes.⁶¹⁶ For instance, a recent report by the Financial Stability Board's (FSB) analyzes this scenario and concludes that at this stage a resolution authority should be involved to evaluate whether a resolution would be viable and whether it could be effective in restoring the viability of the clearing service.⁶¹⁷

Financial legislative and regulatory reforms have also address this point:

⁶¹¹ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., pp. 10-11; International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 10; BlackRock, *Response to Discussion Note of the Financial Stability Board re Essential Aspects of CCP Resolution Planning*, cit., p. 3 (noting that "in terms of the timing of entry into resolution, we would strongly recommend that resolution authorities play a role early in the recovery process before all CCP assets and default resources are exhausted.")..

⁶¹² See, International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit., p. 10.

⁶¹³ See, International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, cit., p. 7.

⁶¹⁴ Ibidem.

⁶¹⁵ See, e.g., David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 10; Committee on Payment and Settlement Systems (CPSS) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery and Resolution of Financial Market Infrastructures*, Bank of International Settlements and International Organization of Securities Commissions Consultative Report (2012).

⁶¹⁶ See, e.g., Financial Stability Board (FSB), *Key Attributes of Effective Resolution Regimes for Financial Institutions*, Financial Stability Board (2014); European Commission, *Consultation on a Possible Recovery and Resolution Framework for Financial Institutions other than Banks*, European Commission (2012); Committee on Payment and Settlement Systems (CPSS) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, Bank of International Settlements and International Organization of Securities Commissions Consultative Report (2013); Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery of Financial Market Infrastructures*, Bank of International Settlements and International Organization of Securities Commissions (2014).

⁶¹⁷ Cf., Financial Stability Board (FSB), *Key Attributes of Effective Resolution Regimes for Financial Institutions*, cit.

- In the United States, Title II of the Dodd-Frank Act assigns the administration of the failure resolution process of systemically important CCPs to the Federal Deposit Insurance Corporation (FDIC).⁶¹⁸ If Title II applies, then the FDIC can become the receiver of a CCP and could liquidate the CCP, or assign its assets and obligations to another CCP or to a “bridge” CCP.
- The European Commission is currently finalizing legislation on CCPs’ recovery.⁶¹⁹ In addition, under the EMIR, a CCP is required to establish a risk committee (RC) with advisory and overseeing functions, as well as a default management committee (DAC) to advise and assist in the event of a CM’s default. As observed by ISDA, both the RC and the DMC have advisory functions only, and, therefore, would not be in a position to conclusively decide whether or not a default management process has failed.⁶²⁰ Nevertheless, both the DMC and RC should have the right to recommend that the management of the CCP terminate the default management process.⁶²¹ Recommendations by a DMC or RC should be based on objective and transparent criteria defined in the CCP’s rulebook and, with such a DMC or RC recommendations, authorities should then consider whether or not to intervene in the process.⁶²²
- The United Kingdom has recently adopted a resolution regime for CCPs.⁶²³

When a resolution authority is given the power to stabilize a failed OTC CCP, losses will be allocated according to statutory loss-allocation mechanisms. These mechanisms may be modeled on the loss-allocation rules analyzed above. Significantly, statutory loss-allocation mechanisms should be designed to ensure that the services of the OTC CCP are continued (or terminated) in an orderly way and that moral hazard problems and cost to taxpayers are minimized.⁶²⁴ Moreover, if the resolution authority decides for a failure resolution of the relevant OTC CCP, it is critical that no creditor would suffer more losses than in

⁶¹⁸ Dodd-Frank Act Sections 201–214, 12 U.S.C. Sections 5381–5394. For further discussion on this point, see, e.g., Robert Steigerwald and David DeCarlo, *Resolving Central Counterparties after Dodd-Frank: Are CCPs Eligible for “Orderly Liquidation,”* Federal Reserve Bank of Chicago Working Paper (2014); Skadden, Arps, Slate, Meagher & Flom LLP and Affiliates, *Analysis of the Orderly Liquidation Authority, Title II of the Dodd-Frank Wall Street Reform and Consumer Protection Act*, Skadden, Arps, Slate, Meagher & Flom LLP and Affiliates Oversight and Systemic Risk (2010); The Clearing House Association, *Ending “Too-Big-to-Fail”: Title II of the Dodd-Frank Act and the Approach of “Single Point of Entry” Private Sector Recapitalization of a Failed Financial Company*, The Clearing House Banking Brief White Paper Series (2013).

⁶¹⁹ See, e.g., Boris Groendahl and John Glover, *EU Readies Plan for Clearing Crisis, the New Too-Big-to-Fail*, Bloomberg (October 5, 2016); Francois Lenoir, *EU sets out new rules for handling clearing house failures*, Reuters (October 4, 2016).

⁶²⁰ See, International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., pp. 9-10, 15 (arguing that “the legal responsibility for this decision must reside with the CCP management.” and “[i]n all default loss circumstances, we consider that authorities should not interfere with the CCP’s default management process before the end of the waterfall is reached, even once it becomes apparent that the waterfall will not be sufficient to cover all losses.”).

⁶²¹ *Ibidem.*

⁶²² *Ibidem.*

⁶²³ For further discussion on this point, see, Emma Murphy and Stephen Senior, *Changes to the Bank of England*, Bank of England Quarterly Bulletin, Vol. 53, No. 1, pp. 20–28 (2013).

⁶²⁴ See, Committee on Payment and Settlement Systems (CPSS) and Board of the International Organization of Securities Commissions (IOSCO), *Recovery and Resolution of Financial Market Infrastructures* (2012), cit.

an insolvency scenario (often referred to as 'no creditor worse off').⁶²⁵ Finally, when restructuring and recapitalization are an available option, bankruptcy courts or resolution authorities could also be given the legal authority to apply VMGH or tear-ups even if that option is not expressly contemplated in clearing agreements.⁶²⁶ For instance, under a U.S. Title II failure administration procedure, the FDIC has the legal right to reject contracts, provided that rejection is not applied selectively across contracts with the same counterparty.

⁶²⁵ See, Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., p. 35.

⁶²⁶ See, Darrell Duffie, *Resolution of Failing Central Counterparties*, cit., p. 11.

CHAPTER 5: BENEFITS OF OTC DERIVATIVES CENTRAL CLEARING

Chapter 5 will examine a number of advantages of central clearing of OTC derivatives, which have helped lend increasing credibility to OTC CCPs as effective means for reducing counterparty risk and mitigating systemic risk.

5.1. Transparency

In bilateral OTC derivatives markets, negotiation can be complex, costly, and time consuming due to the existence of asymmetry information problems, differences in the relative degree of access to the market by the parties, and alternative trading opportunities. Moreover, in bilateral OTC derivatives markets price transparency tends to be limited compared to exchange-based derivatives markets, which are characterized by transactions reporting and pre-trade disclosure that covers at least the best executable bid and offer. In addition, in bilateral OTC derivatives markets each participant has usually information on its own risk exposure, but it is very unlikely to have visibility on its counterparties' exposures to others institutions and market participants. This opacity, in turn, may generate information-related gridlock and may exacerbate systemic instability.⁶²⁷

OTC CCPs help improve the status of the OTC derivatives market described above, by increasing pre-trade and post-trade transparency.⁶²⁸ This is achieved in a number of ways. First, OTC CCPs can increase transparency of counterparty credit risk and allow market participants and regulatory supervisors to better monitor the application and enforcement of margin requirements and the strength of risk-management and default-management capabilities.⁶²⁹ Second, OTC CCPs can facilitate the monitoring of OTC derivatives market participants' individual and aggregate exposures with respect to industries, sectors, or parties in the market, as well as relative OTC derivatives interconnections and concentrations.⁶³⁰ Increased transparency of derivatives exposures allows OTC CCPs to promptly intervene should a CM acquire a particularly large or particularly concentrate position and mitigate the risks

⁶²⁷ See, Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit. (discussing the findings of studies on information and systemic risk in financial network). See, also, Ricardo J. Caballero, and Alp Simsek, *Fire Sales in a Model of Complexity*, Massachusetts Institute of Technology Department of Economics Working Paper No. 09-28 (2009).

⁶²⁸ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 200.

⁶²⁹ See, Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit. (noting that the centrally-cleared structure "is more transparent, and the central counterparty is well positioned to impose common margin requirements on all market participants"); Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 410-412; Darrell Duffie, *Replumbing Our Financial System: Uneven Progress*, *International Journal of Central Banking*, Vol. 9, No. S1, pp. 251-279 (2013), p. 267 (arguing that "[c]entral clearing further promotes financial stability through improved transparency into counterparty credit risk. With a well-regulated CCP, market participants and regulatory supervisors should be in a better position to judge counterparty risk and default-management capabilities. They can better monitor the uniform application of collateral requirements on all members"); Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act,"* cit., p. 17 (arguing that "CCP clearing facilitates the monitoring of market participants' aggregate activity within the CCP across products, thereby enabling the clearinghouse to evaluate more effectively the risks faced by individual market participants. In other words, the CCP can function in part as a "delegated risk manager" for its clearing member participants").

⁶³⁰ See, e.g., Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 411 and accompanying notes 106-108; International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., p. 7 (noting that "CCPs can increase market transparency, as they maintain transaction records, including notional amounts and counterparty identities.").

involved in the position (for instance by requiring the positing of larger margins).⁶³¹ Moreover, increased transparency of derivatives exposures helps market participants manage the risks associate with OTC derivatives trades, and thus allow them to react in a timely manner by, for instance, adjusting the pricing of the securities they trade.⁶³²

Furthermore, OTC CCPs can facilitate price transparency in a number of ways: first, OTC CCPs promote standardization of OTC derivatives that facilitate price comparison;⁶³³ second, centrally cleared OTC derivatives are subject to variation margin requirements based on MTM prices calculated by the OTC CCP,⁶³⁴ and third, OTC CCPs report OTC derivatives trades on a regularly basis. The resulting price transparency, in turn, can help narrow dealer spreads,⁶³⁵ promote a more efficiently pricing of OTC derivatives,⁶³⁶ reduce disputes about margin requirements,⁶³⁷ and disperse the panic that would otherwise be generated in opaque OTC derivatives bilateral markets upon the default (or the perceived insolvency) of large market participants.⁶³⁸

⁶³¹ See, Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 392 (arguing that “[a]s key infrastructure for the market, the clearinghouse obtains privileged insight into the market’s movements. In monitoring trades, the clearinghouse mandates that its members continually set aside sufficient capital to support the risks that those members run.”).

⁶³² Id., p. 411.

⁶³³ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., pp. 1657-1658.

⁶³⁴ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 240-241.

⁶³⁵ See, e.g., Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, *Georgetown Law Journal*, Vol. 101, pp. 445-466 (2013), p. 453 (arguing that “[b]ecause clearinghouses do only matched swaps, they typically charge a flat, per-transaction fee or a transaction-size-based fee. Clearinghouses adjust for risk based on collateral requirements rather than fees. This means that it is impossible for dealers to make an invisible spread on cleared transactions. Instead, they have to price their execution of the transaction upfront to their end-user clients. Clearinghouses make dealer spreads transparent, and this price transparency should result in a more efficiently priced swaps market.”); Yee Cheng Loon and Zhaodong Zhong, *Does Dodd-Frank Affect OTC Transaction Costs and Liquidity? Evidence from Real-Time CDS Trade Reports*, *Journal of Financial Economics*, Vol. 119, No. 3, pp. 645-672 (2016).

⁶³⁶ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1658-1660; Michael Greenberger, *Diversifying Clearinghouse Ownership In Order To Safeguard Free And Open Access To The Derivatives Clearing Market*, *Fordham Journal of Corporate & Financial Law*, Vol. 18, No. 2, pp. 245-268 (2012), p. 248.

⁶³⁷ See, Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the “Dodd-Frank Wall Street Reform and Consumer Protection Act,”* cit., p. 16 (noting that “OTC-cleared derivatives are subject to margin requirements and cash resettlements that are based on mark-to-market prices determined by the CCP. The prices used by the CCP for calculating clearing balances and payment obligations, moreover, are applied in a consistent manner across firms [...] CCPs establish standard procedures for marking contract prices to market and reduce operational risks by establishing efficient mechanisms for monitoring and ensuring compliance with margin requirements. The aggregation of pricing information in the clearing house also enhances financial safeguards by reducing disputes about collateral valuation.”).

⁶³⁸ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1660 (arguing that “[t]ransparency and collateral interact. Some clearinghouse proponents argue that the financial crisis was exacerbated because, as the president of the New York Fed said, “market participants [, . . .] unable to assess the true health of financial firms[, . . .] demand[ed] more collateral [than necessary] or . . . move[d] their trades at the first sign of trouble.” A well-functioning clearinghouse would have demanded good collateral before a crisis. The well-collateralized clearinghouse would then have made good on the trades that the failed firm missed.”); Darrell Duffie and Haoxiang Zhu, *Does a Central Clearing Counterparty Reduce Counterparty Risk?*, *Review of Asset Pricing Studies*, Vol. 1, pp. 74–95 (Revised 2011), pp. 74-75 (noting that clearing also reduces the degree to which the solvency problems of a market participant are suddenly compounded by a flight of its OTC derivative counterparties, such as when the solvency of Bear Stearns and Lehman Brothers was in question.).

5.2. Standardization and Fungibility

OTC CCPs can play an important role in facilitating standardization of OTC derivatives contracts.⁶³⁹ Increased standardization, in turn, may create significant benefits.⁶⁴⁰

- First, standardization facilitates price comparison,⁶⁴¹ which helps risk management and narrow dealers' spreads.
- Second, when terms and conditions are standardized, trading becomes less expensive.⁶⁴²
- Third, when market players assume more standardized obligations, they generally incur lower capital costs, as they do not have to make provisions for tailored risks that may be difficult to resell down the line.⁶⁴³
- Fourth, standardization leads to increased fungibility, meaning the interchangeability of derivatives contracts.⁶⁴⁴ Fungibility, in turn, facilitates trading and enhances market liquidity by allowing buyers and sellers to close-out open positions through transactions in an equal and opposite contracts.⁶⁴⁵

5.3. Multilateral Netting

In bilateral OTC derivatives market, market participants have often partially or fully offsetting positions with multiple counterparties. As a result, gains in the value of positions with one counterparty cannot be commonly netted against losses in the value of positions with other counterparties.

Central clearing can improve this market structure and can help achieve more extensive multilateral netting.⁶⁴⁶ This is because, OTC derivatives contracts transacted between different counterparties but cleared through an OTC CCP can be offset and gains and losses can be netted across multiple market participants.

More extensive netting, in turn, can produce significant benefits.⁶⁴⁷

⁶³⁹ See, Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., pp. 410-411 and accompanying note 104.

⁶⁴⁰ See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., p. 9 (noting that "standardization is a necessary condition to achieving the counterparty risk reduction benefits of central clearing.").

⁶⁴¹ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1658; Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act,"* cit., p. 16.

⁶⁴² Ibidem.

⁶⁴³ See, Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 411.

⁶⁴⁴ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 240.

⁶⁴⁵ See, Thorsten V. Koepl and Cyril Monnet, *The Emergence and Future of Central Counterparties*, cit., pp. 3-4; Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1657-1658 (noting that by enhancing price transparency and require standardization, CCP also help expand the size of the market for the product traded).

⁶⁴⁶ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 200.

⁶⁴⁷ Cf., e.g., Viral V. Acharya and Alberto Bisin, *Counterparty Risk Externalities: Centralized Versus Over-The-Counter Markets*, *Journal of Economic Theory*, Vol. 149, pp. 153-182 (2014); Darrell Duffie and Haoxiang Zhu, *Does a Central Clearing Counterparty Reduce Counterparty Risk?*, cit.; Rama Cont and Thomas Kokholm, *Central Clearing Of OTC Derivatives: Bilateral vs. Multilateral Netting*, *Statistics and Risk Modeling*, Vol. 31, No. 1, pp. 3-22 (2014).

- First, the opportunity of more extensive netting can reduce the costs of trading OTC derivatives (in particular the costs of portfolio margining) and, can provide the necessary flexibility for a party to enter into new transactions and terminate existing ones.⁶⁴⁸
- Second, the opportunity of more extensive netting helps balance the bargaining power of the parties to a OTC derivatives trade, by reducing the need for a party that wants to unwind a certain position to return to the original counterparty.⁶⁴⁹
- Third, if central clearing extends to cover a sufficient amount of derivatives trade and is performed through sufficiently few OTC CCPs, it can also lower average counterparty risk through the effect of netting.⁶⁵⁰
- Fourth, more extensive netting can also reduce the aggregate number of positions and notional amount that needs to be replaced in the event of a default of a CM; this, in turn, helps minimize price impact from the closing a large portfolio.⁶⁵¹

5.4. Risk Sharing and Loss Mutualization

Central to the structure and operation of an OTC CCP are the concepts of risk sharing and loss mutualization.⁶⁵² As discussed in Chapter 4, upon default of a CM, default losses that exceed the financial resources provided by the defaulted CM (its margin and default fund contribution) and the first tranche of the OTC CCP's equity contribution (collectively, the "defaulter's resources") are allocated among all remaining non-defaulting CMs via a mutualized pre-funded default fund and (if necessary) additional non-prefunded resources further contributed by non-defaulting CMs.

⁶⁴⁸ See, Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market*, cit., p. 8 (noting that "the underlying intuition is that the margin required to cover the exposure of the portfolio would be smaller under a CCP than in a bilateral OTC derivatives trading, because the prices of the portfolio's components could be correlated and could be offset in a CCP").

⁶⁴⁹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 240.

⁶⁵⁰ See, Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit. (noting that more extensive netting has the potential to significantly reduce each market participant's aggregate counterparty risk exposure); Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, Working Paper (2013), pp. 1-2, 5; Squam Lake Working Group on Financial Regulation, *Credit Default Swaps, Clearinghouse, and Exchange*, cit., p. 3; Darrell Duffie, *Replumbing Our Financial System: Uneven Progress*, cit., pp. 267-268; Darrell Duffie and Haoxiang Zhu, *Does a Central Clearing Counterparty Reduce Counterparty Risk?*, cit. (showing that the degree of efficiency of netting via CCPs (relative to bilateral netting) significantly depends on how CCP clearing is organized across different financial market segments and participants. In particular, netting efficiency can be severely restricted, whenever CCP clearing is sufficiently fragmented across borders and products. More fragmented clearing thus requires a high degree of interoperability between CCPs in order to increase netting efficiency and to achieve more collateral savings; Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., p. 13.

⁶⁵¹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 240.

⁶⁵² See, Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, *Brooklyn Journal of Corporate, Financial & Commercial Law*, Vol. 10, No. 1, pp. 129-154 (2015), pp. 147-148 (noting that "mutualization of risk, in general, is the policy preferred by the Dodd-Frank Act. Hence, another Dodd-Frank Act provision establishes an Orderly Liquidation Fund funded by assessments on systemically important financial institutions. The Orderly Liquidation Fund is to be used to finance the liquidation of systemically important financial institutions. Thus, systemically important financial institutions are required to finance what is essentially a mutual DIP loan fund (or perhaps more aptly described as a required subscription to a mutual burial society).").

The described risk-sharing mechanisms inherent in an OTC CCP's default waterfall structure can be viewed as the result of a process of evolution of risk sharing mechanisms in the bilateral OTC derivatives market. In particular, as noted by Prof. Pirrong, dealer firms may bear the losses from the default of another dealer both in a bilateral OTC derivatives market with no OTC CCPs and in a centrally cleared OTC derivatives market:⁶⁵³

- In a bilateral OTC derivatives market with no OTC CCPs, losses that arise from a dealer's default are allocated among its counterparties, who can include other dealers as well as non-dealers. As a result, dealers assume significant counterparty risk on both end users and one another, and take potential exposure on the derivatives themselves if they do not hedge the exposure through matched swaps.⁶⁵⁴
- In a centrally cleared OTC derivatives market, OTC CCPs formalize the inter-dealer default risk-sharing mechanism, sever the link between the number of transactions particular dealers execute with one another and structurally organize the allocation of default losses. As a result, dealers who are CMs share default losses in an amount determined by OTC CCP rules rather than by the identity of their counterparties and the volume of trading with these counterparties.⁶⁵⁵

The ability of an OTC CCP to insure default risks through pooling mechanisms and distribute losses across all CMs can generate significant benefits:⁶⁵⁶

- First, mutualization of risk can reduce the impact of losses on any one CM, and, thus, can help mitigate the possibility that the default of a CM generates a cascade of defaults of other CMs.⁶⁵⁷
- Second, the ability of an OTC CCP to disperse losses across all CMs also helps reduce information asymmetry that may exacerbate stress events.⁶⁵⁸
- Third, the process of mutualization of losses can foster CM-level self-restraint and can encourage CMs not to take on excessive risks as CMs ultimately insure risks for each other.⁶⁵⁹

⁶⁵³ Cf., e.g., Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, pp. 10-11; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 9.

⁶⁵⁴ See, Robert L. McDonald, *Derivatives Markets*, cit., p. 4 and accompanying note 3.

⁶⁵⁵ See, e.g., Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, pp. 10-11; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 9.

⁶⁵⁶ See, e.g., Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1660 (arguing that "mutualization of risk is ... a major articulated benefit of OTC CCP.").

⁶⁵⁷ See, e.g., International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., p. 7; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 200.

⁶⁵⁸ See, e.g., Jon Gregory, *Are We Building the Foundations for the Next Crisis Already? The Case of Central Clearing*, Working Paper (2010), p. 6.

⁶⁵⁹ See, Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 411 and accompanying notes 109-110 (noting that "mutualization instills shared norms that punish players for assuming too much risk. The clearinghouse's risk-mitigation measures are designed to stop trades with a misbehaving party by threatening expulsion of members if they fail to abide by the rules. In theory, continuous trade monitoring and reporting in real time should catch

- Fourth, mutualization of risks coordinated by the OTC CCP can help ensure that losses are allocated in a transparent and relatively predictable way across all CMs.⁶⁶⁰

5.5. Margins

OTC CCPs implement and enforce rigorous margining requirements for the derivatives transactions being cleared. This helps reduce counterparty risk associated with OTC derivatives trades.⁶⁶¹ Moreover, rigorous daily (or even intra-daily) margining can promote more accurate pricing and more transparent valuation of OTC derivatives products.⁶⁶² Furthermore, a centralized collateral management and holding via OTC CCPs can also make OTC derivatives trading sounder and less expensive.⁶⁶³

In addition to the benefits discussed above, OTC CCPs can also increase the efficiency of collateral / margin posting relative to bilateral markets. In particular, through novation, an OTC CCP interposes itself between two counterparties of an OTC derivatives transaction and takes on counterparty risk on both sides of the trade. As a result, CMs are exposed to the average default probability, but they are no longer exposed to the idiosyncratic risk that one's counterparty will default.⁶⁶⁴ Moreover, an OTC CCP can net overall exposures across all its CMs and, consequently, can reduce exposures even before default becomes an issue. The reduction of overall default exposures, in turn, can facilitate a decrease in collateral requirements.⁶⁶⁵

5.6. Centralized Default Management Process

In bilateral OTC derivatives markets, upon the default of a market participant, each counterparty to the defaulted market participant needs to replace its open positions. The urgent need to replace trades, in turn, may increase demand for liquidity, perhaps at a time when liquidity is already low due to the default of the market participant at issue. Moreover, uncertainty regarding the exposure of the defaulted market participant may cause its counterparties and other financial institutions (directly and indirectly) connected to them to panic; this fear, in turn, may intensify the rush to uncoordinated replacements of defaulted trades and exacerbate the related demand for liquidity. The combination of these factors can lead to a period of extremely elevated price volatility, asset price correlations, and large price moves, which may result into more losses (e.g., in form of

signs of risky behavior early and prevent risks from materializing for the clearinghouse. Because members have their own money on the line, soft pressures to discipline other reckless members should be particularly effective.”)

⁶⁶⁰ See, Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit.

⁶⁶¹ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 11; Michael Greenberger, *Diversifying Clearinghouse Ownership In Order To Safeguard Free And Open Access To The Derivatives Clearing Market*, cit., p. 248 and accompanying note 11.

⁶⁶² See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 241.

⁶⁶³ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1660-1661.

⁶⁶⁴ Cf., Thorsten V. Koepl and Cyril Monnet, *The Emergence and Future of Central Counterparties*, cit.; Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit.

⁶⁶⁵ *Ibidem*.

increased cash calls or significant market-to-market (MTM) losses), threatening the solvency of other market participants.

In contrast, as discussed in Chapter 4, upon the default of a CM, an OTC CCP can provide a centralized and coordinated default management process, through which outstanding OTC derivatives transactions with the defaulted CM are hedged, and closed or replaced.⁶⁶⁶ This centralized default management process can help mitigate the risk of price and market disruptions associated with the default of a large CM. Moreover, the OTC CCPs' multilateral netting can help reduce the positions that have to be replaced in the event of default of a CM. Furthermore, portability of clients' positions allows their transfer via market transactions, thus, ensuring continuance of trading.⁶⁶⁷ Finally, an OTC CCP also typically undertakes periodic fire drills to access the end-to-end coordination and test the procedures and processes in place to manage a CM's default.⁶⁶⁸

5.7. Liquidity

OTC CCPs may increase market liquidity by promoting standardization and fungibility of the OTC derivatives contracts and by allowing OTC derivatives market participants to benefit from more extensive multilateral netting.⁶⁶⁹

5.8. Reducing Market Entry Costs

OTC CCP can facilitate market entry by reducing counterparty risk through rigorous margin, netting and risk-sharing mechanisms. Moreover, the ability to bypass idiosyncratic risk throughout the interposition of the OTC CCP between the original parties to a trade may help reduce due diligence costs, which, in turn, may help more entities access the OTC derivatives market.⁶⁷⁰

5.9. Operational Efficiency and Legal Costs

OTC CCPs' margining, netting, and default management functions have the potential for increasing operational efficiency and reducing operational costs. Moreover, OTC CCPs can help minimize legal risks by establishing and enforcing a centralized set of rules and mechanisms.

5.10. Regulatory Benefits

The use of OTC CCPs can produce significant benefits for regulators and supervisory authorities. OTC CCPs can facilitate supervision and monitoring of OTC derivatives trades by regulators, can provide regulators with more complete

⁶⁶⁶ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 36.

⁶⁶⁷ Id., pp. 3, 11 and 32.

⁶⁶⁸ See, See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 241 (noting that OTC CCPs are in a "better position to 'war game' and resolve potential problems in OTC derivative markets").

⁶⁶⁹ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 200. For an empirical evidence of how increased post-trade transparency following central clearing is associated with an improvement in liquidity and trading activity in the swaps context, see Yee Cheng Loon and Zhaodong Ken Zhong, *The Impact of Central Clearing on Counterparty Risk, Liquidity, and Trading: Evidence From the Credit Default Swap Market*, *Journal of Financial Economics*, Vol. 112, No. 1, pp. 91-115 (2014).

⁶⁷⁰ Cf., e.g., Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit.; Darrell Duffie, *Replumbing Our Financial System: Uneven Progress*, cit.

information on individual and aggregate exposures, and can help regulators assess such exposures more accurately and in real time.⁶⁷¹

5.11. Mitigating Systemic Risk

Central to the financial reforms mandating central clearing for OTC derivatives is the belief that OTC CCPs can reduce systemic risk and can, thus, decrease the likelihood of future systemic crises.⁶⁷² Key features of OTC CCPs appear to support this belief.

First, because of their “centralized position,” OTC CCPs can better monitor individual and aggregate OTC derivatives exposures. This can help OTC CCPs efficiently manage counterparty risks associated with OTC derivatives trades, and accurately price the related risks (e.g., by requiring CMs to set aside adequate margin).⁶⁷³ This, in turn, can reduce the risk of occurrence of default or distress of a major CM and lower the likelihood that its insolvency (or illiquidity) would cause the insolvency (or illiquidity) of other major CMs or other financial institutions.⁶⁷⁴

⁶⁷¹ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., pp. 1659-1660 (discussing the benefits of centralization via OTC CCPs in promoting sound regulation). *But*, see, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 62-63 (noting that “it is important to recognize that these benefits can be obtained without the formation of a CCP ... Mandatory registration of all trades in a central “OTC data hub” using the methods and protocols that a clearing house would employ would reduce operational risk, and provide regulators with additional transparency, without requiring problematic changes in the mechanism for sharing default risks ... Only if the risk-allocation effects of CCPs reduce systemic risk is their mandatory creation justified; market participants have the incentive to take the private benefits into account, and the benefits arising from lower operational risks and better information can be obtained by other means.”).

⁶⁷² See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1651 (noting the widespread belief that “if a large financial institution’s risky obligations had gone through clearinghouses during the financial crisis, the institution might not have failed and, even if it did fail, the clearinghouse would have diffused the costs sufficiently to avoid both the massive bailouts and the economic downturn that ensued”).

⁶⁷³ See, International Monetary Fund, *Making Over-the-Counter Derivatives Safer: The Role of Central Counterparties*, cit., p. 3 (noting that “In very broad terms, a CCP can reduce systemic risk by interposing itself as a counterparty to every trade, performing multilateral netting, and providing various safeguards and risk management practices to ensure that the failure of a clearing member to the CCP does not affect other members.”); Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1659 and accompanying note (discussing the widespread belief that “[a] centralized clearing organization [...] is the best way to pay attention, by putting the task on the clearinghouse not the traders. A single centralized player evaluates whether more collateral is needed and what collateralization formula to use. The clearinghouse can use mechanical collateral rules, requiring collateral based on the trade, not the creditworthiness of the counterparty. Either way, total assessment costs decline.”); Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the “Dodd-Frank Wall Street Reform and Consumer Protection Act,”* cit., p. 15 and accompanying note (“[b]y interposing a single counterparty between all buyers and sellers, a CCP facilitates “counterparty anonymity” and reduces the need for credit evaluations of numerous different trading counterparties on an ongoing basis. That separation of price and credit risks has long been recognized as a significant benefit of organized futures exchanges and CCPs.”).

⁶⁷⁴ Cf., e.g., Michael Greenberger, *Diversifying Clearinghouse Ownership In Order To Safeguard Free And Open Access To The Derivatives Clearing Market*, cit.; Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit.; Darrell Duffie, *Replumbing Our Financial System: Uneven Progress*, cit., p. 267 (noting that “[e]ffective clearing mitigates systemic risk by lowering the risk that defaults propagate from counterparty to counterparty [...] Clearing also reduces the degree to which the solvency problems of a market participant are suddenly compounded by a flight of its OTC derivative counterparties, such as when the solvency of Bear Stearns and Lehman Brothers was in question.”); Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 392 (noting that for CCPs to reduce systemic risk is critical to have expanded risk-management tools); Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., p. 11 (noting that “[p]roperly designed CCPs maintain high collateral standards that mitigate the exposure risks to their participating members. Further, even in the face of heightened fears of counterparty defaults, a CCP’s contractual obligations to its clearing participants prevent it from novating or terminating positions in an attempt to “run” from a deteriorating counterparty. Thus, more extensive use of clearing will lower the systemic risk associated with runs by derivatives counterparties. Because, moreover, well regulated CCPs are held to high standards for margin and guarantee funds, their counterparties should have no need to run from them.”); Yee Cheng Loon and Zhaoqiong Ken Zhong, *The Impact of Central Clearing on Counterparty Risk, Liquidity, and Trading: Evidence From the Credit Default Swap Market*, cit.; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 11.

Second, OTC CCPs facilitate more extensive netting that can reduce the aggregate number of positions and notional amount that need to be replaced in the event of default of a CM. This, in turn, helps minimize the price impact associated with the closing of a large portfolio and, thus, contributes to reducing the risk of systemic instability.⁶⁷⁵ Moreover, more extensive netting can positively affect the way market participants react to perceived increasing risk of a particular counterparty.⁶⁷⁶ In absence of netting, all market participants trading with a troubled counterparty would have the incentives to close their positions. Contrary, with multilateral netting, parties that have no current exposure to the OTC CCP would be less worried, and the resulting reduced concern would help minimize the risk of systemic instability.⁶⁷⁷

Third, as previously discussed, in bilateral OTC derivatives markets, each individual player may not have the incentive to consider and properly internalize the systemic risk associated with its uncleared derivatives trades and may be encouraged to take on excessive risk. Contrary, OTC CCPs can help mitigate these externalities through risk pooling and loss mutualization mechanisms inherent in their structure: the mutualization of risk based on the scale of CM's transactional activity will force CMs to internalize their own systemic externalities, and will help reduce the incentive for them to engage in excessively risky transactions.⁶⁷⁸

Fourth, OTC CCPs can mitigate the risk of domino effect discussed in Chapter 3 by changing the structure of the network of derivatives counterparty exposures.⁶⁷⁹ Figure 35(a) below illustrates the network of bilateral counterparty exposures associated with a class of OTC derivatives. In absence of an OTC CCP, each party to a trade is exposed to the risk that the other party to the trade will fail to perform its obligations. Furthermore, the interconnection existing among OTC derivatives market participants creates the risk that the failure of a major market participant could trigger a cascade of failures of other entities and could, thus, transmit distress through the whole financial system.

⁶⁷⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 240-241; Michael Greenberger, *Diversifying Clearinghouse Ownership In Order To Safeguard Free And Open Access To The Derivatives Clearing Market*, cit., pp. 248-249.

⁶⁷⁶ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 56.

⁶⁷⁷ *Ibidem*.

⁶⁷⁸ See, Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., p. 147 and accompanying notes 78-80; Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 400; Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 451 (arguing that "[t]he loss spreading enabled by clearinghouses is perhaps their single most important feature in terms of reducing systemic risk"); Darrell Duffie, Ada Li and Theo Lubke, *Policy Perspectives on OTC Derivatives Market Infrastructure*, cit., p. 13 (noting that "[a]nalogous to air pollution, the systemic risk associated with uncleared derivatives represents a "negative externality" that may be appropriately treated with regulatory pressure or incentives. For example, for a given type and size of derivatives position, the regulatory minimum capital requirement of a financial institution should be materially lowered by clearing the position.").

⁶⁷⁹ See, Group of Twenty (G20) Meeting, *Leaders' Statement The Pittsburgh Summit*, cit.; Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit.

Figure 35(a). Fully bilateral network.

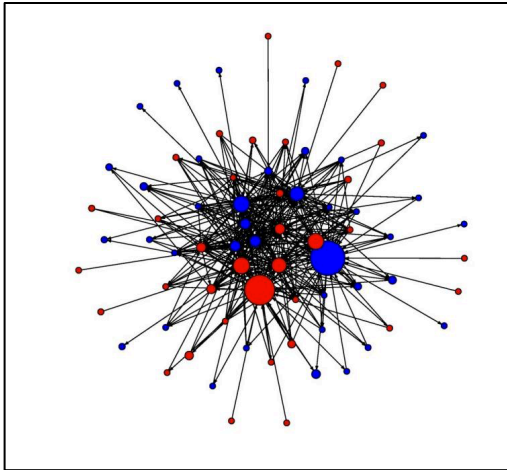


Figure 35(a) shows a bilateral network in the credit default swap (CDS) market for a single and highly traded CDS contract. In the figure, a red circle denotes a protection seller and a blue one denotes a protection buyer. The size of the circle represents the amount of protection bought or sold.

Source: Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, Speech at the American Economic Association/American Finance Association Joint Luncheon, San Diego, California (January 4, 2013), p. 26.

An OTC CCP changes the bilateral network structure shown in [Figure 35\(a\)](#) above into a “hub-and-spoke network” that simplifies and improves the transparency of the network of counterparty risk exposures. As illustrated in [Figure 35\(b\)](#) below, in presence of an OTC CCP, each party to a derivatives trade faces only the risk of the OTC CCP’s non-performance. By acting as a central hub of trades, an OTC CCP can lower the potential for contagion and domino effect in the event of default of a major market participant.⁶⁸⁰ In doing so, the OTC CCP essentially operates as a “systemic-risk circuit breaker” and a “centralized shock absorber.”⁶⁸¹

⁶⁸⁰ See, Stephen J. Lubben, *Failure of the Clearinghouse: Dodd-Frank’s Fatal Flaw?*, cit., p. 1; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 24 and accompanying notes 60-61; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 195.

⁶⁸¹ See, e.g., Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 453; Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., pp. 131-132. On the role of circuit breakers in the context of financial crisis, see, e.g., Bruce C. Greenwald and Jeremy C. Stein, *Transactional Risk, Market Crashes, and the Role of Circuit Breakers*, *The Journal of Business*, Vol. 64, No. 4, pp. 443–462 (1991).

Figure 35(b). Centrally cleared network.

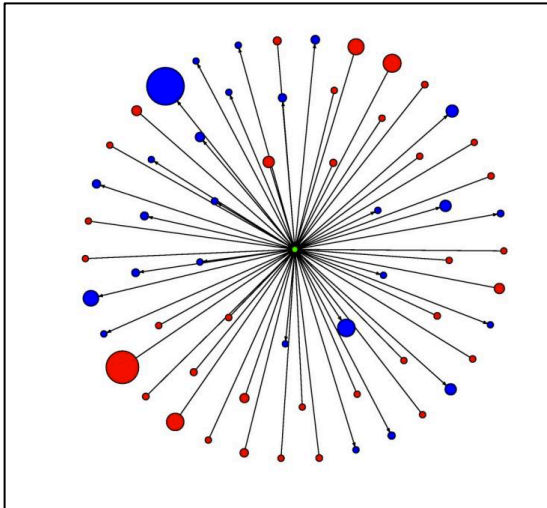


Figure 35(b) shows the hypothetical network that would exist if the contract in Figure 35(a) were cleared through a single central counterparty. In the figure, a red circle denotes a protection seller and a blue one denotes a protection buyer. The size of the circle represents the amount of protection bought or sold.

Source: Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, Speech at the American Economic Association/American Finance Association Joint Luncheon, San Diego, California (January 4, 2013), p. 26.

Crucial to the function of an OTC CCP as systemic-risk circuit breaker and centralized shock absorber is its ability to absorb losses and spread losses among its CMs.⁶⁸² As discussed in detail in Chapter 4, the multi-layer default waterfall structure of an OTC CCP makes it resilient to losses,⁶⁸³ while the mechanisms of loss mutualization inherent in its structure helps minimize the destabilizing effects generated by the default of one or more of its CMs, so that the risk of systemic disturbance is reduced.⁶⁸⁴

⁶⁸² See, e.g., Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 453; Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., pp. 131-133, 139-140.

⁶⁸³ See, e.g., Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., p. 139 (comparing the capital structure of an OTC CCP to “a levy designed to withstand floodwaters” and arguing that CCPs “aggregate the capital of their members making a firm that is (in theory) far stronger and more capable of absorbing losses than any individual member.”); Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., pp. 461-463 (arguing that the “significant potential advantage clearinghouses have over dealer banks is in their ability to absorb risk, rather than manage it. Clearinghouses are essentially highly layered capital structures [...] ultimately, ex post loss resilience, rather than ex ante risk management, is more important from a systemic-risk standpoint. If clearinghouses can accomplish that, they will serve as systemic risk circuit breakers in the swap space.”).

⁶⁸⁴ See, Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., pp. 147-148 (noting that “because of the interconnected nature of systemic risk, it is impossible to articulate the precise modicum of risk is created by a particular financial institution’s activities. Therefore, mutualizing the costs of systemic risk to the entire financial services industry is an entirely appropriate response ... [and] a reasonable one for addressing the systemic risk that arises from interconnectedness of the financial services industry.”); Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 451 (arguing that “[t]he details of the design in terms of capital structure and risk-management techniques are what will determine clearinghouses’ success in mitigating systemic risk”).

CHAPTER 6: DRAWBACKS OF OTC DERIVATIVES CENTRAL CLEARING

Chapter 5 has focused on the impact of central clearing on the OTC derivatives market and has discussed significant benefits associated with the use of OTC CCPs. This Chapter will extend the above analysis by discussing a number of disadvantages of central clearing of OTC derivatives.

In particular, at the time of writing, the question of how OTC CCPs may generate and/or exacerbate systemic risk within the financial system remains thinly explored. Chapter 6 will contribute to a dawning debate on this point by identifying and analyzing key features and mechanisms of OTC CCPs that may contribute systemic instability into the financial system and that may allow systemic risk to build up over time.

Significantly, prior researches on central clearing of OTC derivatives have usually focused on the analysis of a single benefit or risk associated with the use of OTC CCPs. The analysis provided in Chapter 5 and Chapter 6 differs from prior researches in that it examines multiple benefits and risks created by OTC CCPs and, then, identifies and investigates relationships and dynamic interactions among them. The result is, thus, a comparative and more comprehensive analysis of the benefits and risks created by OTC CCPs, which helps gain a more realistic appreciation of their systemic-risk implications.

As explained in detail below, the benefits of OTC CCPs discussed in Chapter 5 need to be reconsidered and somehow qualified based on the understanding of the following three key points:

- First, as discussed in Chapter 2, counterparty risk can be thought of as an intersection of different types of financial risks and the process of mitigation of counterparty risk may itself generate financial risks. This means that financial risks cannot and should not be analyzed and assessed in isolation. Based on this understanding, the following sections will explain how mechanisms of OTC CCPs that aim at reducing/eliminating counterparty risk and systemic risk (e.g., multilateral netting and increased and rigorous margining) can actually transform counterparty risk into other types of financial risks (including liquidity risks, legal risk, and operational risk) and eventually increase systemic instability.
- Second, the OTC derivatives market is a part of a broader financial system. This means that mitigating systemic risk requires taking a systemic perspective and thinking at the financial system as a whole. This also means that, in order to assess the systemic effects of central clearing mandates, it is necessary to look beyond the OTC derivatives market and consider the interaction between OTC CCPs and the broader financial system. Based on this understanding, the following sections will explain how mechanisms of OTC CCPs that aim at reducing/eliminating counterparty risk and systemic risk (e.g., multilateral netting and increased and rigorous margining) redistribute this risk across the financial system in a way that may foster systemic instability, particularly during periods of market turbulence.

- Third, financial products and markets have a tendency to adjust rapidly, especially in response to external stimuli. This is certainly true for central clearing mandates: requiring OTC derivatives to be centrally cleared and enforcing related measures to improve the safety of the OTC derivatives market will induce reactions and adjustments by the financial system, and these reactions and adjustments will have profound consequences. Based on this understanding, the following sections will explain how clearing mandates of OTC derivatives can affect the behavior of OTC derivative market participants and can induce them to adjust their leverage, funding, and capital structure decisions; how the resulting adjustments, in turn, can have spillover effects onto other parts of the financial system, which will themselves react to these changes; and how the adjustments and changes (directly and indirectly) induced by central clearing of OTC derivatives can ultimately affect the stability of the financial system.

6.1. Member Base Composition

As discussed in Chapters 1 and 2, the bilateral OTC derivatives market has long functioned among a small number of specialized players. This specialization was necessary, not least because parties to OTC derivatives trades had to trust each other to take risks without the risk centralization and risk mutualization advantages offered by OTC CCPs. As indicated in previous Chapters, unlike bilateral OTC derivatives markets, OTC CCPs may help create a more homogeneous market. In particular, risk sharing mechanisms and initial margins calculated primarily on the portfolio being cleared can facilitate homogeneity. Increased homogeneity, in turn, can have the effect of broad direct access to OTC derivatives trading. However, while broad direct access has the advantages of expanding the operations of OTC CCPs and increasing the scope for multilateral netting, it has also obvious disadvantages:

- First, a larger number of players in the OTC derivatives market may increase the inter-linkages in the financial system.⁶⁸⁵
- Second, a larger number of players in the OTC derivatives market may also increase OTC CCPs' exposure to sudden credit quality deteriorations in particular segments of the financial system.
- Third, broad direct access may lead to pricing dependencies.
- Fourth, broad direct access may allow CMs with weaker credit quality and/or weaker risk management to benefit at the expense of those CMs with better credit quality and/or better risk management.

Interesting, in a recent study by Armakolaa and Laurent,⁶⁸⁶ the authors examine the payment capacity of a member base under normal and stressed scenarios, as a measure of an OTC CCP's resilience. Their findings show that under a

⁶⁸⁵ See, e.g., Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., pp. 62-63; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 242-243.

⁶⁸⁶ See, Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, cit.

“Cover 2” stressed scenario, member base quality may drop dramatically, thus reducing the ability of CMs to provide contingent liquidity and to sustain the OTC CCP’s clearing activities. Armakolaa and Laurent further identify four different types of OTC CCP member base composition, as illustrated in Tables 13(a) and (b) below. Each table contains a matrix consisting of four cells, where each cell corresponds to a member base with different proportions of good and lower quality members. The authors, then, assign major existing OTC CCPs to the corresponding cell.

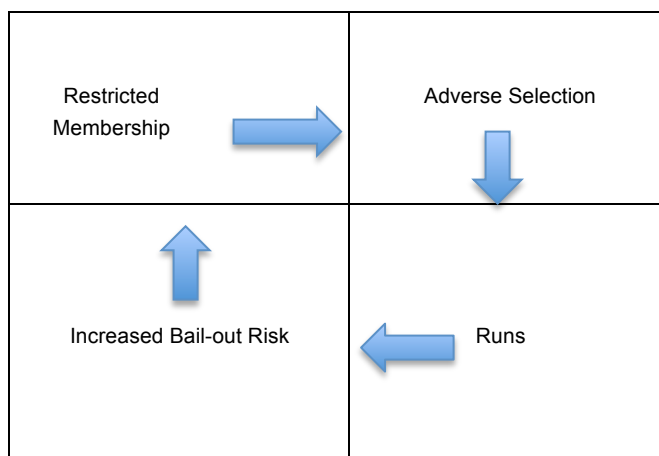
Table 13. Member base typology.

Table 13(a)		Table 13(b)	
Member base consists only of good quality CMs	Member base majority if of good quality, small proportion of low quality CMs	<ul style="list-style-type: none"> • LCH.CLEARNET LLC • ICE CLEAR CREDIT 	<ul style="list-style-type: none"> • ECC • CME CLEARING EU • LCH.CLEARNET LTD • TCC • EUREX
Member base majority if of low quality, only a small proportion of good quality CMs	Member base majority if of good quality, but significant proportion of low quality CMs	<ul style="list-style-type: none"> • CC&G 	<ul style="list-style-type: none"> • ICE CLEAR US • CME CLEARING US • EUROCCP • LCH.CLEARNET SA • ICE CLEAR EU

Source: Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, Working Paper (2015), p. 24.

Armakolaa and Laurent, then, examine possible conflicts of interest associated to each of the four types of OTC CCP member base indicated above and discuss how such conflicts of interests may affect stability within the financial system.

Figure 36. Financial stability dilemma.



Source: Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, cit., p. 25.

As illustrated in [Figure 36](#) above:

- Top left cell - An OTC CCP with only good quality CMs may have the negative effect of excessively restrict membership. In light of the number of OTC CCPs and the possibly “races to the bottom,” Armakolaa and Laurent conclude that OTC CCPs that fall in this category may not be sustainable in the long term (unless regulation and supervision of OTC CCPs is stringent.)
- Top right cell - An OTC CCP with a member base composed by a majority of good quality CMs and only a small proportion of low quality CMs may face adverse selection problems. In particular, in this scenario the aggregate stronger payment capacity may lead to lower pre-funded contributions. Because of this, Armakolaa and Laurent conclude that this type of OTC CCPs will most likely attract low quality CMs.⁶⁸⁷
- Bottom right cell - An OTC CCP with a member base consisting primarily of good quality CMs, but with a significant proportion of low quality CMs, is prone to runs. In particular, Armakolaa and Laurent argue that the major risk for this type of OTC CCPs is that good quality CMs faced with a costly bail-in in case of failure may choose to run from the OTC CCP.
- Bottom left cell - When an OTC CCP has a member base composed by a majority of low quality CMs and only a small proportion of good quality CMs, the OTC CCP may incur the risk that market instability will cause further erosion of the CMs’ credit quality and, thus, lead to increases in default probabilities. As noted by Armakolaa and Laurent, in the event such an OTC CCP is not-systemically important, then the OTC CCP will most likely be liquidated. In contrast, if such an OTC CCP is systemically importance, then alternative means of resolution should be considered, including a government bailout.

6.2. Risk Concentration

Chapter 5 above has explained how the introduction of OTC CCPs may result into a hub-and-spoke type system, which could help avoid “domino effects” in the event of default of one or more CMs, and ultimately mitigate systemic risk.

This argument needs to be qualified. In particular, the concern is that funneling OTC derivatives trading through OTC CCPs may create excessive concentration of multiple risks into one single focal point. This, in turn, may reduce the possibility for diversification and increase the probability that the failure of an OTC CCP could have system-wide destabilizing effects.⁶⁸⁸

⁶⁸⁷ In this sense see, also, David Murphy, *The next generation: CCP waterfalls and mutuality*, RegTechFS (August 12, 2013) (noting that “[i]f a CCP has a low membership bar and full mutuality, then better quality firms may be discouraged from becoming clearing members, as they will in effect have to underwrite their competitors’ poor credit quality. Relaxing mutuality in the default fund would make such a CCP more attractive to high quality clearing members.”).

⁶⁸⁸ See, e.g., Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., pp. 10-11 (arguing that “[the] transfer of counterparty risk in OTC derivatives market makes CCPs operating in this market segment the most important risk nodes of the entire financial system. ... once risk has been concentrated within a CCP, it becomes systemic risk: When the failure of a single large participant in the OTC

Proponents of clearing mandates do not seem to have fully appreciated the problem of risk concentration and the system wide effects associated with the failure of OTC CCPs. Contrary, they have long justified their confidence in the resilience of OTC CCPs on the fact that no modern U.S. financial CCPs have failed. Experience, however, seems to point in the opposite direction and shows that the failure of a CCP is far from being a mere theoretical possibility. Financial CCPs around the world have failed, and in the United States nonfinancial CCPs have been mismanaged and failed, as well.⁶⁸⁹ As noted by Prof. Pirrong, “[t]he Kuala Lumpur CCP failed in 1983. The French Caisse de Liquidation clearinghouse failed in 1974. The Hong Kong Futures Exchange failed in 1987, and was bailed out by the government. But the most modern, well-documented, and sobering example is the near failure of major derivatives CCPs in the immediate aftermath of the 1987 crash. On October 19–20, 1987, the clearinghouses of the Options Clearing Corporation, Chicago Mercantile Exchange, and the Chicago Board of Trade were on the verge of failure. Arguably, only prompt action by the Federal Reserve prevented such a catastrophe.”⁶⁹⁰ Crucially, when these failures occurred, CCPs were not systemically important entities and losses resulting from their failures mostly hit single market segments. Failures of OTC CCPs will be different. As previously discussed, OTC CCPs concentrate within their structures the risks associated with multiple OTC derivatives trades cleared, thus their failures are more likely to have system-wide effects and to result into greater systemic instability.

A number of scholars and market participants are now warning against the danger of risk concentration.⁶⁹¹ Similarly, regulators and policy-makers throughout the world are now becoming increasingly aware of the danger of risk concentration posed by OTC CCPs.⁶⁹² The shared concern that OTC CCPs may

derivatives market was enough to endanger the entire financial system prior to introducing CCP clearing, so will be the failure of a CCP that clears derivatives. ... By concentrating aggregate risk on their books, CCPs operating in the OTC derivatives market will be too-big-too-fail.”); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 39; Dan Nixon and Amandeep Rehlon, *Central Counterparties: What are They, Why Do They Matter, and How Does the Bank Supervise Them?*, Bank of England Quarterly Bulletin (2013), p. 2; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 34-35.

⁶⁸⁹ See, Mark J. Roe, *Clearinghouse Overconfidence*, California Law Review, cit., p. 1692-1693 and accompanying notes 125-128.

⁶⁹⁰ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 26 notes 66-67. For a thoughtful analysis of the operation of CCPs in the context of financial crises, cf., e.g., Gregory, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 267-271; Ben S. Bernanke, *Clearing and Settlement during the Crash*, cit., pp. 133–151; Ben S. Bernanke (then Chairman of the Board of Governors of the Federal Reserve System), *Clearinghouses, Financial Stability, and Financial Reform*, Speech at the 2011 Financial Markets Conference, Stone Mountain, Georgia (April 4, 2011); Presidential Task Force on Market Mechanisms, *Report of the Presidential Task Force on Market Mechanisms*, U.S. Department of Treasury (1988); Peter Norman, *The Risk Controllers: Central Counterparty Clearing in Globalised Financial Markets*, cit.; Vincent Bignon and Guillaume Vuillemeay, *The Failure of a Clearinghouse: Empirical Evidence*, Working Paper (2016).

⁶⁹¹ Cf., e.g., Manmohan Singh, *Making OTC Derivatives Safe—A Fresh Look*, International Monetary Fund Working Paper No. 11-66 (2011), pp. 5-9; Stephen J. Lubben, *Failure of the Clearinghouse: Dodd-Frank’s Fatal Flaw?*, cit., pp. 1-2; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 26; Darrell Duffie, *How Big Banks Fail and What to Do about It*, cit., p. 66; Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, cit.; Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit.; PIMCO, *Setting Global Standards for Central Clearinghouses*, cit.; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit.; BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit.; Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds, and the Perils of Financial Innovation*, cit.; Alexandra Heath, et al., *CCPs and Network Stability in OTC Derivatives Markets*, Journal of Financial Stability, Forthcoming (2016).

⁶⁹² See, e.g., Jerome H. Powell (Member of the Board of Governors of the U.S. Federal Reserve System), *A Financial System Perspective on Central Clearing of Derivatives*, cit.; Jerome H. Powell (Member of the Board of Governors of the U.S. Federal Reserve System), *Central Clearing in an Interdependent World*, Speech at the Clearing House Annual

become concentrated risk nodes, and that these nodes (although in remote cases) may fail. In particular, by concentrating risk associated with the trades being cleared, OTC CCPs may themselves become systemically significant entities and their failure may suddenly expose many major market participants to severe losses. Furthermore, as discussed in detail below, there is the risk that during period of extreme market turbulence OTC CCPs may become particularly vulnerable to default and that key features of OTC CCPs (e.g., margin and assessment rights) may funnel (rather than mitigate) systemic risk. This is a key point because periods of extreme market turbulence are exactly the times when market participants will rely most on OTC CCPs to protect the stability of the financial system and act as “systemic bulwarks.”⁶⁹³

6.3. Too-Big-To-Fail

Related to the point discussed above is the concern that with the introduction of clearing mandate the “too-big-to-fail” problem might have been elevated to a new higher level: given the increasingly vital role played by OTC CCPs, OTC CCPs might have become “too-big-to-fail.”

Different views have been expressed on this point.

On one hand, certain scholars have argued that the danger might have been overstated, because the “too-big-to-fail” problem is far less concerning for OTC CCPs than it is for other financial institutions. Prominent among these scholars is Prof. Levitin, who has advanced a number of arguments to support this position, including the following:⁶⁹⁴

- First, OTC CCPs have deep pockets of capital resources to absorb default losses that make them much less likely to fail compared to any individual institution.
- Second, access to central banks’ liquidity resources may further reduce the risk of an OTC CCP’s failure causing a systemic crisis.

Conference, New York, New York (November 17, 2015); Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit.; Benoît Cœuré (Member of the Executive Board of the European Central Bank), *Ensuring an Adequate Loss-Absorbing Capacity of Central Counterparties*, Lecture at the at the Federal Reserve Bank of Chicago 2015 Symposium on Central Clearing, Chicago, Illinois (April 10, 2015); Ben S. Bernake (then Chairman of the Board of Governors of the Federal Reserve System), *Clearinghouses, Financial Stability, and Financial Reform*, cit; Daniel K. Tarullo (Member of the Board of Governors of the U.S. Federal Reserve System), *Advancing Macroprudential Policy Objectives*, cit.

⁶⁹³ Ibidem. See, also, Craig Pirrong, *The Risks of Clearing Finally Dawn on Tarullo: Better Late Than Never, I Guess*, Streetwise Professor Blog (April 11, 2015) (quoting an article by Michael Beaton, managing partner at Derivatives Risk Solutions (DRS), discussing the potential of OTC CCP for creating systemic risk: “In general, I think what we need to take away from all of this is that systemic risk can be transferred – it’s arguable whether or not it can be reduced – but it certainly can’t be eliminated, and the clearing model that we are working towards is a hub and spoke which concentrates risk on a very, very small number of names. A decentralised network is arguably stronger than a hub and spoke model, mainly because open systems are generally regarded as more robust than closed ones. The latter is what the clearing model operates on and you have that single, glaring point of failure, and there’s really no escape from that”); Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 195.

⁶⁹⁴ See, Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., pp. 152-153.

- Third, unlike large banks or other financial institutions, OTC CCPs are generally not leveraged entities and have matched books of highly liquid contracts.
- Fourth, because of their corporate governance and ownership structures, OTC CCPs also lack the distorted incentives that may lead to excessive risk-taking and they price solely to cover risk (not to generate a profit).
- Fifth, because the risk of OTC CCPs increase with the size of the positions of their CMs, OTC CCPs have a strong incentive to proper count for the size of their CMs' positions when pricing: through their pricing mechanism they apply a sort of market-based too-big-to-fail penalty on larger financial institutions, which, in turn, helps reduce CMs' incentives to be large in order to capture too-big-to-fail benefits.
- Sixth, it could be technically easier to bail out an OTC CCP compared to a large bank or other financial institutions, because OTC CCPs' corporate and financial structures are relatively simpler and there are relatively few operational issues to address in case of their failure. Moreover, unlike bailouts of large banks or other financial institutions that are typically disfavored, bailouts of OTC CCPs could be less politically problematic.⁶⁹⁵

Prof. Lubben goes even further to suggest that the government should nationalize OTC CCPs upon their failure.⁶⁹⁶ The author argues that the intention to exercise this authority by the government should be made clear *ex-ante* and that any applicable procedure and mechanism should be planned in advance. Leaving things to be handled in an *ad hoc* way at the time of failure – Prof. Lubben argues – would be a recipe for a disaster, not least because of the response by market participants to the uncertainty created by the failure of an OTC CCP. As explained by Prof. Lubben, upon nationalization, both OTC CCP's shareholders and CMs will incur real costs: both types of interest in the OTC CCP (membership and formal equity) will be forfeited and cancelled in exchange for the bailout.⁶⁹⁷ Nationalizations of failing OTC CCPs would have numerous advantages. First, a nationalization would provide all stakeholders in the OTC CCPs with the strong incentives to oversee its management.⁶⁹⁸ Second, a structured and well planned nationalization would help avoid the destabilizing

⁶⁹⁵ Id., p. 153 (arguing that it is much easier politically to bail out a failed CCP because "it is essentially a utility that benefits an entire sector of the economy, rather than a privately owned firm. A clearinghouse will only fail after its members have already kicked in additional capital, and at that point a government bailout is appropriate, as it is about ensuring continued economic stability, rather than benefitting private parties. ...Moreover, industry-wide bailouts let the government avoid the political problem of picking winners and losers in the market.").

⁶⁹⁶ Cf., Stephen J. Lubben, *Nationalize the Clearinghouses!*, Seton Hall Public Law Research Paper No. 2458506 (2014); Stephen J. Lubben, *Failure of the Clearinghouse: Dodd-Frank's Fatal Flaw?*, cit.

⁶⁹⁷ See, Stephen J. Lubben, *Nationalize the Clearinghouses!*, cit., p. 5. *But*, see, Craig Pirrong, *Nationalize the Clearinghouses?*, Streetwise Professor Blog (August 17, 2014) (arguing that "[t]his is superfluous, given the setup of CCPs. Many CCPs require members to meet an assessment call up to the amount of the original contribution to the default fund. Once they have met that call, they can resign from the CCP: that's when the CCP gives up the ghost. Thus, a CCP fails when members exercise their option to check out. There are no memberships to cancel in a failed CCP.").

⁶⁹⁸ See, Stephen J. Lubben, *Nationalize the Clearinghouses!*, cit., p. 5. *But*, see, Craig Pirrong, *Nationalize the Clearinghouses?*, cit. (arguing that "the ex ante efficiency effects of nationalization will be that large. After all, nationalization would occur only after the equity of the CCP (which is pretty small to begin with) is wiped out, and the default fund plus additional assessments have been blown through. Shooting/nationalizing a corpse doesn't have much of an incentive effect on the living ex ante.")

effect and chaotic consequences that would otherwise result from attempting to solve problems on an ad hoc basis.⁶⁹⁹ Third, nationalization would ensure continuity of the operations and clearing services of the OTC CCP.⁷⁰⁰

In contrast to the approach of Prof. Levitin and Prof. Lubben discussed above, a number of scholars and market participants have warned against the risk of OTC CCPs becoming the new too-big-to-fail entities and have opposed the possibility of a government bailout.⁷⁰¹ In particular, the concern is that bailouts of OTC CCPs would be complex, extremely costly, and would create severe moral hazard problems:⁷⁰² knowing they will be able to rely on government bailout, CMs (and their clients) would have less incentive to monitor the activities of the OTC CCP, they would be discouraged from performing careful due diligence on their original counterparties, and they would not have the incentive to deploy appropriate and efficient risk management tools.

6.4. Interconnectedness

As discussed in Chapter 5, the use of OTC CCPs has long been advocated as a means for reducing counterparty risk and mitigating systemic risk. The belief is that OTC CCPs can eliminate dangerous interconnectedness within the financial system and, thus, reduce the risk of systemic instability by replacing an interlocked labyrinth of bilateral connections between OTC derivatives market players with fewer centralized connections between market players and OTC CCPs.

This analysis is too simplistic in that it looks at the OTC derivatives markets in isolation and ignores the fact that OTC CCPs are a part of a broader financial

⁶⁹⁹ See, Stephen J. Lubben, *Nationalize the Clearinghouses!*, cit., p. 32. *But*, see, Craig Pirrong, *Clearing Angst: Here Be Dragons Too*, Streetwise Professor Blog (March 9, 2016) (quoting Ben Bernanke's work on central clearing (see, Ben Bernanke, *Clearing and Settlement during the Crash*, Princeton University) and observing that Ben Bernanke "forthrightly declared that it was appropriate for the Fed to socialize clearinghouse risks on Black Monday and the following Tuesday," thus "[i]n Bernanke's view, socializing the risk prevented a more serious crisis." However, Prof. Pirrong notes, "[w]hen you compare the sizes of the CCPs at issue then (CME Clearing, BOTCC, and OCC) to the behemoths of a post-mandate world, you should be sobered. The amount of risk that must be socialized to protect the handful of huge CCPs that currently exist dwarfs the amount that Greenspan (implicitly) took onto the Fed balance sheet in October, 1987. Put differently, CCPs have become single points of socialization.").

⁷⁰⁰ See, Stephen J. Lubben, *Nationalize the Clearinghouses!*, cit., p. 31.

⁷⁰¹ Cf., e.g., Mark J. Roe, *The Derivatives Market's Payment Priorities as Financial Crisis Accelerator*, *Stanford Law Review*, Vol. 63, Issue3, p. 539-590 (2011), p. 587; Mark J. Roe, *Derivatives Clearinghouses Are No Magic Bullet: Will the Dodd bill create another kind of institution that's too big to fail?*, *The Wall Street Journal* (May 6, 2010); Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, cit.; Froukelien Wendt, *Central Counterparties: Addressing their Too Important to Fail Nature*, cit.; PIMCO, *Setting Global Standards for Central Clearinghouses*, cit.; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit.; BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit.; Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, p. 2; Craig Pirrong, *Lloyd Blankfein Channels SWP*, Streetwise Professor Blog (September 29, 2010) (quoting Lloyd Blankfein, Goldman Sachs Group Inc.'s chairman and chief executive officer, arguing at a finance and regulation conference in Brussels that "clearinghouses make things less risky for the regular crisis, but in an extreme crisis that could affect the clearinghouse itself ... We have to make sure that something that we do to reduce the risk in a once-in-a-20-year storm doesn't increase the risk in a once-in-a-50-year storm...Otherwise, the clearinghouse becomes the biggest systemic risk in the world."); David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 132; Paul Tucker (Deputy Governor Financial Stability at the Bank of England), *Clearing Houses as System Risk Managers*, Speech at The Launch of The DTCC-CSFI Post Trade Fellowship Launch, London (June 1, 2011).

⁷⁰² See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 36, 280-285.

system.⁷⁰³ Hence, although OTC CCPs do change the topology of the network of connections in the OTC derivative markets, they do not eliminate interconnections, rather they replace one set of interconnections with another.⁷⁰⁴ This occurs in a number of ways, including the following.

First, central clearing creates connections among derivatives market participants.⁷⁰⁵ CMs are connected, and thus exposed, to each other through the mutualized default fund. Furthermore, clients of CMs may be clients of multiple CMs and, thus, may indirectly connect CMs to each other. OTC CCPs themselves may be connected to each other. The linkages among OTC CCPs can be direct (through interoperability mechanisms),⁷⁰⁶ or indirect (through overlapping membership or collateral and liquidity channels).⁷⁰⁷ Prof. Murphy makes essentially this point, noting that “[i]n a naive sense, CCPs reduce interconnectedness ... CCPs transform direct interconnectedness between bilateral OTC markets participant into infrastructural interconnectedness: market participants are connected via CCPs.”⁷⁰⁸

Second, market participants will likely react to increased use of central clearing of OTC derivatives by adjusting the terms and conditions of their contractual agreements. For instance, market participants may enter into new collateral transformation trades or establish new ways of borrowing to fund margin requirements. These adjustments, in turn, will create further linkages between CMs already connected to each other, and/or new connections within the financial system. Prof. Pirrong discusses this point noting that “given the nature of cleared systems (and the imposition of rigorous daily variation margins based on mark-to-market for cleared derivatives), market users will make arrangements

⁷⁰³ See, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 447 and accompanying note 6; David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 321.

⁷⁰⁴ See, Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, cit., p. 20 (observing that “whereas prior to Dodd-Frank a complex web linked numerous derivatives counterparties, now all roads lead to the DCO.”); Craig Pirrong, *The SWP Worldwide Personified Clearing Tour: Greatest Hits*, Streetwise Professor Blog (July 8, 2013) (arguing that “[c]learing does not eliminate interconnections between big financial firms: it reconfigures the network of connections. Moreover, it does so in a way that is rife with wrong-way risk. As noted before, CCP members—mainly big banks—are connected via CCP default funds, and are most likely to incur losses during periods of market stress, when they are least able to afford it.”); Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 24-25; Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., pp. 62-63; Janet L. Yellen (then Vice Chair of the Board of Governors of the Federal Reserve System), *Interconnectedness and Systemic Risk: Lessons from the Financial Crisis and Policy Implications*, cit.; Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 4, 3—33; Craig Pirrong, *Cleaning Up After the Dodd, Frank & Gensler Circus*, Streetwise Professor Blog (September 8, 2014); David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 132.

⁷⁰⁵ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, p. 25, 27-29; Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 4, 30-33; Craig Pirrong, *That’s His Story, and He’s Sticking To It*, Streetwise Professor Blog (June 24, 2010); Craig Pirrong, *The SWP Worldwide Personified Clearing Tour: Greatest Hits*, Streetwise Professor Blog (July 8, 2013).

⁷⁰⁶ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 35, 143-148 (noting that: “interoperability will increase interconnectedness in financial markets, potentially increasing systemic risk.”).

⁷⁰⁷ See section 6.12 below for further discussion on this point.

⁷⁰⁸ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 132.

to secure contingent liquidity. As a result, the entire financial network topology will change.”⁷⁰⁹

Third, central clearing may also increase infrastructural interconnectedness.⁷¹⁰ In particular, there exists an intimate interconnection between the banking system and the clearing system. First, large banks are CM at most major OTC CCPs. Second, large banks are an important source of liquidity to OTC CCP, their CMs and CMs’ clients. Third, margin payments at OTC CCPs also significantly rely on deposit transfer and settlement systems at large banks.⁷¹¹ Ben Bernanke correctly emphasizes this point, noting that: “[a] prominent part of the institutional structure is the interconnection of the clearing and settlement systems with the banking system. This interconnection exists at several points. First, banks are operationally a part of the clearing process. Clearinghouses typically maintain accounts at a number of clearing banks. [Clearing members] are required to maintain an account at a minimum of one of these banks and to authorize the bank to make debits or credits to the account in accord with the clearinghouse’s instructions. This facilitates the settling of accounts and the making of margin calls. Note that the bank’s role may exceed simple accounting if, for example, it must decide whether to permit an overdraft on a [clearing member]’s account. Second, banks are a major source of credit, especially very short-term credit, to all of the parties, including the customers, the [clearing members], and the clearinghouse itself ... bank letters of credit can in some cases be used as initial margin. Customers and [clearing members] often rely on bank credit to facilitate the speedy posting of variation margin, and [clearing members] would typically have to turn to banks to finance payments made necessary by customers’ defaults or slow payment. In equity markets, banks are often the ultimate source of credit for the purchase of securities on credit. Finally, it should be noted that while, in the conventional language, most margin postings and settlement payments are made in cash, these transactions are, of course, not really made in cash but by the transfer of bank deposits. Thus, the smooth operation of the financial market clearing and settlement system is based at all times on the presumption that the banking system is sound and can satisfy demands for withdrawals of funds.”⁷¹²

Fourth, jurisdictional issues will likely lead to the establishment of a relatively large number of OTC CCPs. As discussed in Chapter 1, many jurisdictions already require that OTC derivatives traded in their country or referencing their currency be cleared locally. As a result, financial institutions may be forced to utilize multiple OTC CCPs across a number of jurisdictions.⁷¹³ This, in turn,

⁷⁰⁹ See, e.g., Craig Pirrong, *It’s contagion, stupid-not interconnectedness*, Streetwise Professor Blog (November 21, 2012); Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 24-28; Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 30-33.

⁷¹⁰ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 106 (describing infrastructural interconnectedness as the interconnectedness that “occurs because many financial institutions use the same pieces of financial markets infrastructure.”).

⁷¹¹ See, e.g., Cecile Sourbes, *LCH payments system raises concentration concerns: Most cash payments to the CCP routed via just two banks, sources claim*, Risk.net (September 8, 2014); Christopher L. Culp, *OTC-Cleared Derivatives: Benefits, Costs, and Implications of the “Dodd-Frank Wall Street Reform and Consumer Protection Act,”* cit., pp. 62-63; Craig Pirrong, *Cleaning Up After the Dodd, Frank & Gensler Circus*, Streetwise Professor (September 08, 2014).

⁷¹² Cf., Ben S. Bernanke, *Clearing and Settlement during the Crash*, cit.

⁷¹³ See, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 231.

creates the need to establish connections among OTC CCPs domiciled in different jurisdictions through a variety of mechanisms, including cross-margining, cross-memberships, mutual offset, and interoperability. The creation of these linkages may contribute further instability to the financial system. As noted in a recent BIS report, “from an international perspective, risks can be correlated across CCPs in several jurisdictions.”⁷¹⁴ In particular, “[g]iven the overlapping memberships of many CCPs, liquidity problems at one CCP may well coincide with similar issues at others. A participant bank unable to meet obligations ... could be a global player active in many centrally cleared financial markets and could therefore be a participant in several CCPs. In the extreme case, the default of common clearing members could threaten the resilience of several CCPs at the same time. This, in turn, would impose strains on the surviving clearing members, propagating systemic risk.”⁷¹⁵

Fifth, a number of different OTC CCPs have been established and have become important in different asset classes.⁷¹⁶ These OTC CCPs may be directly (e.g., via interoperability agreements) or indirectly (e.g., through member sharing) linked to each other. This additional links may create new challenges for risk propagation.

Finally, in addition to the points discussed above, it is important to understand that, although clearing has been extended to cover new products, OTC CCPs cannot, and will not, clear all OTC derivatives.⁷¹⁷ Hence, to be centrally cleared an OTC derivatives instrument must possess a number of relevant features, including the following;

- Standardization – the OTC derivatives instrument must have achieved a sufficient degree of standardization. Standardization of legal and economic terms is necessary as it facilitates risk management, reduces operational complexities through the clearing process, increases the opportunities for multilateral netting, and simplifies contract replacement in the event of default of a CM.
- Liquidity - the OTC derivatives instrument must also have achieved a sufficient level of liquidity. Liquidity is necessary to accurately price the risks associated with the relevant derivatives product and calculate

⁷¹⁴ Cf., Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., pp. 68-69

⁷¹⁵ Ibidem.

⁷¹⁶ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 155 (noting that, for instance ICE has become a leading credit derivatives clearer, while LCH has established a dominant position in interest rate derivatives).

⁷¹⁷ See, John C. Hull, *OTC Derivatives and Central Clearing: Can All Transactions Be Cleared?*, Financial Stability Review, No. 14, pp. 71-89 (2010) (dividing OTC derivatives into the following four classes and suggesting how each class should be centrally cleared: (i) plain vanilla with standard maturities; (ii) plain vanilla with non-standard maturities; (iii) non-standard but with well-established models; and (iv) highly exotic); Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., p. 150 (explaining that central clearing should extend to cover all systemically important OTC derivatives instruments and arguing that “[t]here is a fairly easy test of determining which contracts are systemically important and should be cleared via clearinghouses and which are not. Central clearing is only practical on relatively common and homogeneous financial instruments ... because it is too difficult and costly for a clearinghouse to accurately price and margin bespoke contracts. To the extent that financial contracts are not sufficiently homogeneous and common for central clearing to be practical, these contracts are unlikely to present a systemic risk.”); David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 151-153.

adequate margin and default fund contributions. In addition, liquidity of the market is necessary to facilitate close out in case of default of a CM: illiquid products may be more difficult to replace in an auction because they tend to have higher bid offer spreads and are more likely to be subjected to large risk premiums and negative price moves in turbulent markets.

- Complexity – The terms of the OTC derivatives instrument should not be too exotic or complex. This is relevant because OTC derivatives instrument that are particularly complex or exotic pose significant challenges for pricing, risk management and margin calculations, and may create information asymmetry and adverse selection problems.

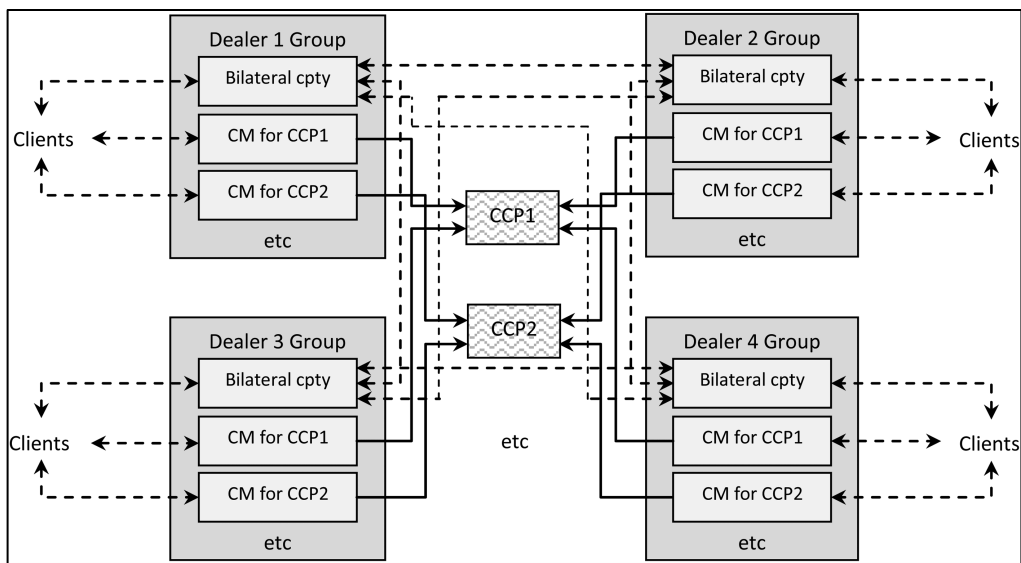
For these reasons, a significant number of OTC derivatives that are not standardized, not liquid and too complex will continue to be traded bilaterally.⁷¹⁸ This may lead to bifurcations between cleared and non-cleared derivatives trades, which, in turn, may result into highly volatile cashflows for customers and divergences of margin requirements for seemingly hedged positions.⁷¹⁹

The combination of the linkages discussed in this section makes the OTC derivatives market structure more articulated and complex than the one depicted in [Figure 28\(b\)](#) in Chapter 4 and [Figure 35\(b\)](#) in Chapter 5. Thus, a more accurate representation of the OTC derivatives market is shown in [Figure 37](#) below.

⁷¹⁸ See, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 321. See, also, Thorsten V. Koepl and Cyril Monnet, *The Emergence and Future of Central Counterparties*, cit., pp. 3-4; Mark J. Roe, *The Derivatives Market's Payment Priorities as Financial Crisis Accelerator*, cit., p. 587. For interesting studies of non-cleared segments of the OTC derivatives market, see, e.g., International Swaps and Derivatives Association (ISDA), *Size and Uses of the Non-Cleared Derivatives Market*, International Swaps and Derivatives Association Study (2014); International Swaps and Derivatives Association (ISDA), *Non-Cleared OTC Derivatives: Their Importance to the Global Economy*, International Swaps and Derivatives Association (2013).

⁷¹⁹ See, e.g., Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 38; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 195-196.

Figure 37. Central cleared market.



Bilateral cpty = bilateral counterparty; CM = central clearing house's member; CCP1 = central clearing house 1; CCP2 = central clearing house 2.

Source: David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 322.

The raise of “alternative forms” of clearing of OTC derivatives complicates the scenario depicted in [Figure 37](#) above even further.

Significantly, at the date of writing a number of financial technology companies are applying new technology to OTC derivatives trading. Of particular interest among them is SynSwap, a UK-based post-trade start-up that applies blockchain and hyperledger technology to the process of derivatives clearing.⁷²⁰ The company focuses its activities on interest rate swaps and CDSs. Once a trade is captured,⁷²¹ SynSwap automatically processes the whole post-trade workflow on its blockchain platform. Through smart contracts run by trading members on a peer-to-peer network,⁷²² it performs key post-trade functions such as automatic matching, confirmation, decentralized clearing, collateral management,⁷²³ default management,⁷²⁴ settlement, compression,⁷²⁵ reconciliation, reporting and

⁷²⁰ For more information on SynSwap, visit SynSwap's website at <http://synswap.com>. See also, Joe Parsons, *Blockchain startup aims to replace clearing houses. The start-up aims to use blockchain technology to replace clearing houses and remove intermediaries between trades*, *The Trade* (October 11, 2016).

⁷²¹ See, Altoros, *Hyperledger Project - Distributed Clearing Platform for Derivatives*, Altoros Hyperledger Demo (2016), slides 15-17 (explaining that “[c]ounterparties enroll in a network as equal members, supporting and executing workflows. Financial agreements between counterparties are represented by smart contracts. They are isolated ledgers and executable code. They can be decrypted and executed only by its counterparties. Other members support order and persistence but cannot see confidential data.”).

⁷²² *Id.*, slides 18-19 (explaining “[s]mart contracts orchestrate payments by issuing instructions to the payment system outside of the platform. The payment system, then, notifies the platform of successful transfers. Smart contracts react to these events by steps in their workflows.”).

⁷²³ *Id.*, slides 21-24 (explaining “[p]rices for collateral management are calculated by a smart contract run by each member. Members reach consensus on the relevant derivative price. Based on results of pricing margin accounts are adjusted daily. Payment instructions are issued and confirmed. When a payment confirmation is not received the payer is in default.”).

⁷²⁴ *Id.*, slides 25-30 (explaining “[w]hen a member defaults, a smart contract calls to auction out the defaulted member's portfolio among remaining members. A smart contract determines the winner(s) of the auction process. Member(s) who win the trades of the defaulted member become new counterparties of the trades: a smart contract unwinds trades of the defaulted member and redistributes them among the winners of the auction. Thus, new trades are created automatically. Members collectively cover for the defaulted member.”).

recordkeeping. The access to trade details is restricted to the trade's counterparts, regulators, and auditors, so that trade confidentiality and data privacy are preserved. In addition, to ensure full market transparency, Synwap enables regulators to be members of the platform.

Thus, by leveraging blockchain and hyperledger technology, Synwap platform aims at “disintermediating” CCPs from the clearing process and ultimately transforming central clearing into “distributed clearing.” The resulting distributed clearing is expected to remove both concentration and counterparty risk from OTC CCPs and reduce the costs of clearing (e.g., fees, operational costs and capital requirements).⁷²⁶

Another interesting financial technology companies is Clearmatics, a London-based company that leverages the power of distributed ledger systems based upon Ethereum with the goal to bring efficiency and transparency to OTC securities markets.⁷²⁷ As explained by Clearmatics' Founder and CEO, Robert Sams, “[t]he vision that [Clearmatics] is working on is to turn the post-trade life cycle into a bunch of different member-run utilities. So instead of having post-trade intermediation, you have got a membership-run network that automates the post-trade lifecycle without third-party intermediation.”⁷²⁸

Notwithstanding the described advantages, it is important to understand that the application of blockchain and hyperledger technologies to the process of central clearing may also contribute complexity into the OTC derivatives markets and may generate new sources of vulnerability and fragility in the financial system. Moreover, it is worth noting that there are certain core functions performed by OTC CCPs that distributed clearing does not offer.⁷²⁹ As discussed in Chapter 4, OTC CCPs mutualize default risk, manage liquidity risk, hedge and manage defaulted positions and port customer positions from a defaulted intermediary to a solvent one. The proposed decentralized clearing does not perform all these functions and, rather, provides different services. As Prof. Pirrong observes “[distributed clearing] is not a perfect substitute for central clearing, and will not disintermediate central clearing in cases where the services it does not offer and the functions it does not perform are demanded by market participants, or by regulators.”⁷³⁰ Because of this, the resulting co-existence of central clearing and new distributed clearing mechanisms will likely lead to new linkages and interconnections among OTC derivatives markets participants, which will further increase the complexity of the OTC derivatives market structure illustrated in Figure 37 above.

⁷²⁵ Id., slides 31-35 (“[e]ach member submits his portfolio anonymously to a smart contract. No member nor the smart contract can see trade details or deduce parties to trade. The smart contract runs a compression algorithm on anonymized inputs. Number of trades is reduced and so are the risk and capital requirements.”).

⁷²⁶ See, Joe Parsons, *Blockchain startup aims to replace clearing houses. The start-up aims to use blockchain technology to replace clearing houses and remove intermediaries between trades*, cit.

⁷²⁷ For more information on Clearmatics, visit Clearmatics' website at <http://www.clearmatics.com>.

⁷²⁸ See, Ian Allison, *Ethereum-inspired Clearmatics to save OTC markets from eternal darkness*, International Business Times (February 22, 2016).

⁷²⁹ See, Craig Pirrong, *A Pitch Perfect Illustration of Blockchain Hype*, Streetwise Professor Blog (October 12, 2016).

⁷³⁰ Ibidem.

6.5. Tightly Coupled System

The previous section has explained how the introduction of OTC CCPs may reshape but not necessarily simplify the structure of the OTC derivatives market.⁷³¹ Related to this point, it is the observation that central clearing of OTC derivatives, and in particular the rigorous margin requirements enforced by OTC CCPs, may have the effect of increasing operational complexity and rigidity within the OTC derivatives market, which, in turn, may lead to the creation of a more tightly coupled financial system.⁷³² This is important from a systemic-risk perspective. As Prof. Pirrong observes discussing the findings of a report published by the Depository Trust & Clearing Corporation (DTCC) “[s]ystemic risk in financial systems is largely due to the fact that these systems are tightly coupled. Clearing increases tight coupling. This almost certainly increases systemic risk. More players have to move more money in more jurisdictions as a result of clearing mandates. As DTCC report makes plain, this is a new responsibility for many of these players, and they do not have the capability or experience or systems. Greater operational complexity involving more parties, many of whom are relatively inexperienced, creates grave risks in a tightly coupled financial system.”⁷³³

As Prof. Pirrong further observes, clearing mandates of OTC derivatives will lead to a whole series of changes to the demand for liquidity and the mechanism to supplying it, which will likely result into a more tightly coupled system.⁷³⁴ The tightly coupled nature of the system, in turn, would make the system more vulnerable and more prone to failure upon the breakdown of a few links: in a tightly coupled system, when actions are taken with the goal to protect the safety and soundness of a single market participants or a group of market participants, the same actions may end up having (highly) destabilizing effects onto other parts of the system. For instance, as Prof. Pirrong observes, although variation margining and marking-to-market are aimed at protecting OTC CCPs and their CMs, the rigidities (in terms of time and scale) of these mechanisms create tight couplings that can be extremely destabilizing during period of stress.⁷³⁵ Thus, variation margining and marking-to-market can cause sharp increases in the demand for liquidity during periods of large price movements, which also tend to be characterized by severe contractions in liquidity supply. The unintended

⁷³¹ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 34 (referring to the post-crisis clearing mandates as “radical experiment to completely reshape the derivatives market structure.”).

⁷³² See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1678-1680; Craig Pirrong, *Were the Biggest Banks Playing Brer Rabbit on the Clearing Mandate, and Was Gensler Brer Fox?*, Streetwise Professor Blog (January 28, 2014); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 242.

⁷³³ See, Craig Pirrong, *Disconnected About Interconnections: Regulators Still Don’t Get the Systemic Risks in Central Clearing*, Streetwise Professor Blog (January 26, 2014); The Depository Trust & Clearing Corporation, *Trends, Risks and Opportunities in Collateral Management*, A Collateral Management White Paper (2014).

⁷³⁴ See, e.g., Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 5-6; Pirrong, Craig, *Clearing and Collateral Mandates: A New Liquidity Trap?*, *Journal of Applied Corporate Finance*, Vol. 24, No. 1, pp. 67-73 (2012). See, also, Darrell Duffie, Martin Scheicher, Guillaume Vuilleme, *Central Clearing and Collateral Demand*, *Journal of Financial Economics*, Vol. 116, No. 2, pp. 237-256 (2015).

⁷³⁵ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 3-4; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 36.

results could be involuntary liquidations of losing positions and chaotic fire sales in illiquid markets, which further exacerbate systemic stress.⁷³⁶

6.6. Undercapitalization

One of the discussed advantages of OTC CCPs is that they can aggregate more layers of capital to absorb losses than individual market participants could otherwise do. For this reason, OTC CCPs are expected to be more resilient to shocks with potential system-wide effects.

This argument is not persuasive. As correctly observed by Prof. Murphy, most OTC CCPs have not raised substantial equity capital in the public markets, and rather they largely rely on resources contributed by CMs.⁷³⁷ As a result, a significant large component of OTC CCPs' pre-funded resources still comes from OTC derivatives market participants and should not be regarded as "new money." Consistent with the observation made by Prof. Murphy, Prof. Pirrong notes that "[t]he financial capacity of CCPs to absorb default losses is still limited, and somebody — namely, financial institutions — has to capitalize them, and absorb default losses not covered by collateral."⁷³⁸ Similarly, a number of market participants have also expressed their concerns that, notwithstanding the growth of their clearing activities, major OTC CCPs are still considerably undercapitalized.⁷³⁹

Significantly, a recent report by BIS shows that capital of OTC CCPs tends to be "quite modest compared with their other prefunded resources, their gross exposures and the scale of their potential losses."⁷⁴⁰ In particular, the report indicates that the average size of an OTC CCP's contribution to the default waterfall is still a very small percentage of the aggregate default resources, and often it is uncorrelated with the risks incurred by the OTC CCP should one or more CMs fail to meet their trading obligations.⁷⁴¹

A number of factors may work against a strengthening of OTC CCPs' capital resources, including changes in ownership structures of OTC CCPs and

⁷³⁶ Ibidem.

⁷³⁷ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 11 note 10. See, also, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 226 (arguing that "[i]t is important to note that the financial resources that CCPs use to support [counterparty credit risk] come almost entirely from within the existing system of OTC derivatives market participants. That is, they have not been required to raise substantial amounts of new capital to support counterparty credit risk. This is interesting, in that two policy choices are available to reduce the danger that a risk poses to the financial system without causing problems elsewhere: 1. Pool or diversify it to reduce the total amount of risk; or 2. Require that the financial system raises new capital to support it. Central clearing attempts to use the first but not the second of these mechanisms.").

⁷³⁸ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 24. See, also, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 448 (noting that "[w]ell-capitalized clearinghouses can absorb and diffuse losses, serving as systemic lightning rods. But without sufficient capital (protected by regulation), clearinghouses present vulnerable points of financial interconnectivity that may incur excessive risk in a race for market share."); Ellen Davis, *CCPs 'thinly capitalised' warns UniCredit's Mustier*, Risk.net (April 14, 2011); Vijay Albuquerque, Chris Perkins and Mariam Rafi, *CCPs need thicker skins – Citi analysis*, Risk.net (August 3, 2015).

⁷³⁹ Cf., e.g., BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit.; PIMCO, *Setting Global Standards for Central Clearinghouses*, cit.; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit.

⁷⁴⁰ See, Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., p. 70.

⁷⁴¹ Ibidem. See, also, Vijay Albuquerque, Chris Perkins and Mariam Rafi, *CCPs need thicker skins – Citi analysis*, cit. (arguing that "[i]n the absence of regulatory requirements, CCPs are putting a tiny amount of their own capital into default waterfalls – equivalent to just 2.6% of the combined guarantee funds of the five biggest swaps clearers.").

increasing competition in the OTC derivatives central clearing industry. In particular, during the last few years many OTC CCPs have migrated from being utilities owned by CMs, to privately owned for-profit institutions, often vertically integrated with other financial market infrastructures such as exchanges. This shift in the ownership structure of OTC CCPs has introduced an inherent (and dangerous) tension between the role of OTC CCPs in reducing counterparty risk and mitigating systemic risk and their commercial objectives to increase revenues by expanding their product offering and capturing market share.⁷⁴² The resulting tension, in turn, may generate system-wide instability and may increase the risks in the financial system, which clearing CMs (directly) and other market participants (indirectly) will need to bear if OTC CCPs do not increase their capital contributions commensurately.⁷⁴³

6.7. Risk Management, Risk Pricing, and Information Analysis

There is a growing concern about the efficiency of the risk management tools deployed by OTC CCPs.⁷⁴⁴ In this respect, Prof. Levitin notes that “[t]he ability of clearinghouses to manage risk is critical to their success in mitigating systemic risk.”⁷⁴⁵ In particular, the author observes that if OTC CCPs underprice risk, they

⁷⁴² See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 156, 237-242, 253, 262 (arguing that “there is a trade-off between rather high standards, which make CCPs safer but which discourage CCP competition; and somewhat lower ones, which give CCPs less ability to withstand losses before falling but which may make a challenge to incumbent CCPs more likely.”); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 36, 123-126, 272-273; Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., p. 72; Angela Armakolaa and Jean-Paul Laurent, *CCP Resilience and Clearing Membership*, cit., pp. 2, 25; Oliver Wyman, *The Future of Capital Markets Infrastructure*, Morgan Stanley & Co. (2011); Craig Pirrong, *Clear the Way: LSE (and LCH!) on the Block*, Streetwise Professor Blog (March 7, 2016); Craig Pirrong, *Hit the Road, State Street*, Streetwise Professor Blog (December 6, 2014); Craig Pirrong, *The Vertical (Silo) Bop: A Reprise*, Streetwise Professor Blog (March 24, 2014); Craig Pirrong, *An Unintended Consequence?*, Streetwise Professor Blog (September 26, 2011); Craig Pirrong, *After Having Jumped the Fence, the Grass Doesn't Look So Green All of a Sudden*, Streetwise Professor Blog (September 21, 2011); Craig Pirrong, *Network Industries and Antitrust*, Streetwise Professor Blog (September 6, 2011); Craig Pirrong, *Splitting the Baby*, Streetwise Professor Blog (September 6, 2011); Craig Pirrong, *Son of Frank-n-Dodd?*, Streetwise Professor Blog (September 6, 2011); Craig Pirrong, *Monopoly Leveraging in Clearing and Execution: Realistic Fear or Bugbear?*, Streetwise Professor Blog (July 18, 2011); Craig Pirrong, *LCH.Cleernet and the Exchanges: It's the Transactions Costs, *Not* the Scope Economies*, Streetwise Professor Blog (May 31, 2011); Craig Pirrong, *Another Quickie: The Regulatory Dialectic*, Streetwise Professor Blog (May 4, 2011); Craig Pirrong, *The Shape of Things to Come*, Streetwise Professor Blog (May 1, 2011); Craig Pirrong, *Armageddon Time*, cit.; Craig Pirrong, *The Battle of Silo Continues*, Streetwise Professor Blog (April 6, 2011); Craig Pirrong, *To Merge Their Farms, Will Deutsche Borse and NYSE Have to Sell the Silo?*, Streetwise Professor Blog (March 16, 2011); Craig Pirrong, *A New Round of Exchange Speed Dating*, Streetwise Professor Blog (February 10, 2011); Craig Pirrong, *The Antitrust Division Lays and Egg, Again*, Streetwise Professor Blog (January 12, 2011); Craig Pirrong, *Yogi Berra and the OTC Derivatives Markets*, Streetwise Professor Blog (December 12, 2010); Craig Pirrong, *Fragged*, Streetwise Professor Blog (November 16, 2010); Craig Pirrong, *One Member, One Vote?*, Streetwise Professor Blog (November 11, 2010).

⁷⁴³ See, e.g., BlackRock, *Central Clearing Counterparties and Too Big To Fail*, cit., p. 3; J.P. Morgan Chase & Co., *What is the Resolution Plan for CCPs?*, cit., p. 1, 4. But, see Zhenyu Cui, Qi Feng, Ruimeng Hu and Bin Zou, *Systemic Risk and Optimal Fee Structure for Central Clearing Counterparty Under Partial Netting*, Working Paper (2016) (The authors develop a novel CCP design in a financial network in which banks can choose the proportion of their liabilities to be cleared through the CCP and the CCP charges clearing fee for providing the clearing service and putting its own capital in risk. The participation percentage of banks in the CCP solely depends on the proportional clearing fee charged by the CCP. The authors show that the optimal clearing fee exists for the CCP's optimization problem under some technical (but reasonable) assumptions. They theoretically prove that the CCP's interest of profit seeking is aligned with the overall goal of reducing the aggregate systemic risk. Their theoretical results support the economic desirability of a profit-seeking CCP).

⁷⁴⁴ See, Ben S. Bernanke (then Chairman of the Board of Governors of the Federal Reserve System), *Clearinghouses, Financial Stability, and Financial Reform*, Speech at the 2011 Financial Markets Conference, Stone Mountain, Georgia (April 4, 2011).

⁷⁴⁵ See, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., 453.

may fuel moral hazard that can, then, encourage greater and riskier use of OTC derivatives.⁷⁴⁶

From a risk management perspective, whether a centralized clearing model is superior to a bilateral dealer-based model remains a very open question. Scholars have expressed different views on this point.

For instance, Prof. Levitin analyzes the risk management mechanisms of OTC CCPs and dealers and he concludes that OTC CCPs and dealers operate with a same basic set of risk management tools, which are functionally the same:

- First, both OTC CCPs and dealers can select whether or not to deal with certain counterparties and they both have counterparty screening mechanisms.
- Second, both OTC CCPs and dealers can price risk. As he explains “pricing risk can come in a number of forms. For CCPs, there are clearing fees; for dealer banks, pricing is in the form of the spread required on the swap. For both CCPs and dealers, pricing can also come in the form of collateral.”⁷⁴⁷ With respect to the collateral, both OTC CCPs and dealers can require the posting of different types of collateral (e.g., initial collateral and maintenance collateral) and both can also select eligible types of collateral. However, while in the bilateral derivatives markets the specific terms for the collateral are typically customized by the counterparties to a trade and the collateral is marked-to-market on whatever frequency agreed upon by the parties,⁷⁴⁸ in a centrally cleared derivatives market margins tend to be evaluated daily (or even twice a day) and margin calls are more incremental.⁷⁴⁹
- Third, as Prof. Levitin notes, OTC CCPs and dealers can also require general collateral.⁷⁵⁰ For instance, for OTC CCPs general collateral can come in the form of “a lien on the clearinghouse membership or account itself, a mandatory contribution to a guaranty fund, or liability for assessments;” for dealers, general collateral can take the form of “required maintenance of a brokerage or deposit account or other assets with the dealer;” and for both OTC CCPs and dealers general collateral can also come in form of third-party guarantees.
- Fourth, both OTC CCPs and dealers have setoff and netting mechanisms, which together with the transaction-specific collateral and the general forms of collateral discussed above, operate like “deductibles,” which can

⁷⁴⁶ *Ibidem*.

⁷⁴⁷ *Id.*, p. 454.

⁷⁴⁸ *Id.*, p. 455 and accompanying notes 34-37 (noting that “often CDSs provide for margin calls only upon the ratings downgrade of a counterparty or a significant increase in the credit exposure of the in-the-money party. The result is that margin calls are infrequent, but when they occur, they are often large—a phenomenon similar to the “jump-to-default” problem in CDS. Moreover, because these margin calls are linked to a counterparty’s credit rating, they are likely to occur simultaneously for numerous swaps. The result can be an acute liquidity crisis for the party faced with the margin call.”).

⁷⁴⁹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, *cit.*, pp. 77-78 (noting that if margin calls are frequent, “they maximizes the risk reduction benefit but may cause operational and liquidity problems.”).

⁷⁵⁰ See, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, *cit.*, p. 455.

help reduce moral hazard in OTC derivatives clearing by forcing a defaulting CM to internalize its losses.”⁷⁵¹

- Fifth, both OTC CCPs and dealer can limit the size of their counterparties’ positions: for CCPs, position limits are formal and pre-determined; while for dealers they tend to be customized on a case by case.

Thus, according to Prof. Levitin, because OTC CCPs and dealers have the same risk management tools, to assess the relative efficiency of the two structures (cleared market vs. bilateral market) one should also consider the ability of OTC CCPs and dealers to utilize such risk management tools. This ability, in turn, depends on the relative ability by OTC CCPs and dealers to identify and evaluate default risk.⁷⁵²

In this respect, building on prior research on central clearing and systemic risk conducted by Prof. Pirrong,⁷⁵³ Prof. Levitin identifies two sources of default risk that both OTC CCPs and dealers assume in their intermediation: first is “position risk”, meaning the risk that a counterparty to a trade defaults on its derivative obligations based on losses on the derivatives instrument; second is “balance sheet risk,” meaning the risk that a counterparty to a derivatives trade defaults on its derivative obligations because insolvent due to losses arising from other transactions.⁷⁵⁴ The author then explains that identification and evaluation of these risks depend on the relative amount and quality of information available to dealers and OTC CCPs, as well as their relative ability to process such information.⁷⁵⁵

Scholars have further investigate this point and have argued that OTC CCPs have informational advantages over any individual firm because of their “centralized position,” which allow OTC CCPs to see much more of the market than any individual firm. This information advantage, in turn, enables OTC CCPs to price the risk associated with OTC derivatives more efficiently.⁷⁵⁶ For instance, in a recent study, Acharya et al.⁷⁵⁷ observe that in OTC derivatives bilateral markets credit enhancement and collateral terms are negotiated on a bilateral basis and parties to a transaction “often cannot take account of the counterparty risk externality in an OTC setting [meaning, the fact that counterparty risk that the parties undertake in a contract can also affects other players] due to

⁷⁵¹ Id., p. 456.

⁷⁵² Ibidem.

⁷⁵³ See, Craig Pirrong, *The Clearinghouse Cure*, Regulation, Vol. 31, No. 4, pp. 44-51 (2008-2009), pp. 44-45; See, also, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 11-12.

⁷⁵⁴ Id., p. 454.

⁷⁵⁵ Ibidem. See, also, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 14 (“[i]nformation about risk is crucial to pricing it efficiently. The amount of information, the distribution of information, and the ability to use it, can differ across alternative institutional structures. Therefore, the comparative advantages relating to the amount of information available for pricing the relevant risks, and the ability to use it in cleared and bilateral settings, is essential to understand the relative efficiency of these alternatives.”).

⁷⁵⁶ See, Adam J. Levitin, *Prioritization and Mutualization: Clearinghouses and the Redundancy of the Bankruptcy Safe Harbors*, cit., pp. 9-10; Yaron Leitner, *Inducing Agents to Report Hidden Trades: A Theory of an Intermediary*, Federal Reserve Bank of Philadelphia Working Paper Series No. 10-28R (2011).

⁷⁵⁷ See, Viral V. Acharya, Robert F. Engle, Stephen Figlewski, Anthony W. Lynch and Marti Subrahmanyam, *Centralized Clearing for Credit Derivatives*, in Viral V. Acharya, Matthew Richardson (eds.), *Restoring Financial Stability: How to Repair a Failed System*, John Wiley & Sons, Apr 20, 2009, pp. 251-268.

inadequate transparency about the counterparty's other positions and its interconnectedness with the rest of the market."⁷⁵⁸ Because of this, the authors argue, OTC derivatives markets should trade through a clearing facility, which would help aggregate information on outstanding transactions and risk exposures for the benefit of market participants and regulators. Acharya et al., then, explain that such a clearing facility could take three alternative forms, each characterized by a particular level of market integration and transparency: registry, CCP, and exchange.⁷⁵⁹ In particular, the authors suggest that an OTC derivatives market, which has grown sufficiently large to become systemically significant, should establish a CCP that will assume the role of counterparty and guarantees every trade. This way - the authors argue - counterparty risk associated with the trades will be reduced, market transparency will increase, and the parties will be able to properly account for the counterparty risk externalities associated with their trading.⁷⁶⁰

Contrary, other scholars have taken the position that dealers are better equipped than OTC CCPs to access and manage risks associated with the trading of OTC derivatives and that transparency could be achieved through the use of trade repositories without the need to establish any OTC CCPs.⁷⁶¹ For instance, Prof. Pirrong argues that "market participants have developed mechanisms for addressing the asset substitution problem [described by Acharya et al.] that do not involve clearing. Many of these mechanisms are employed in bilateral markets. Most notably, repeat dealing and capital structure impose costs on financial institutions that engage in the risk increasing asset substitution strategy that they decry. ... Changes in riskiness, as measured by counterparties, will affect the terms on which a dealer can trade, including prices, quantities, and collateral. Moreover, the liability structures of dealer firms limit their ability to engage in these asset substitution strategies. Dealers typically rely on very-short-term financing, including repurchase agreements and short maturity debt. Changes in perceived riskiness will affect the financing terms that creditors offer such dealers. ... Put differently, as noted by Diamond and Rajan,⁷⁶²

⁷⁵⁸ See, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 258.

⁷⁵⁹ Id., pp. 260-266.

⁷⁶⁰ Ibidem.

⁷⁶¹ See, e.g., David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, Journal of Risk Management in Financial Institutions, cit., p. 321 (arguing that "transparency can be addressed via the use of trade repositories, while timely trade confirmation and ongoing reconciliation can be performed without the intercession of a CCP. Moreover, if supervisors desire a change in margin practices, such as the abandonment of trigger CSAs, then this could either be imposed by fiat, or encouraged via the regulatory capital framework."); David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 11 and accompanying note 11; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 37, 248-249; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 194; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 29; Craig Pirrong, *A Potential Clearing Structure*, cit. (arguing that OTC CCP unnecessarily bundle a number of functions (including, counterparty risk pricing, counterparty risk management, mutualization, position information collection, and default resolution). Among them, information collection could be achieved in bilateral markets through the use of one (or more) information repositories, without the need for central clearing. In particular, the author notes that "[r]epositories can collect and aggregate information, perhaps more effectively than CCPs (because they can incorporate information on non-cleared positions, and information on positions held across CCPs).").

⁷⁶² See, also, Douglas W. Diamond and Raghuram G. Rajan, *Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking*, Journal of Political Economy, Vol. 109, No. 2, pp. 287-327 (2001).

intermediaries typically have very fragile financial structures; these structures serve as a disciplining device that punishes opportunistic behavior.”⁷⁶³

In addition, Prof. Pirrong observes that dealers have a significant information advantage on position risk relative to OTC CCPs, particularly when it comes to more complex and less liquid derivatives instruments.⁷⁶⁴ This is due to a number of reasons:

- First, the fact that these OTC derivatives instruments are traded less frequently, and, as a result, current market price information is very scarce. Lack of market price information and historical benchmarking, in turn, create the risk of inaccuracies in valuation by OTC CCPs.
- Second, when trading of complex OTC derivatives is limited, OTC derivatives instruments need to be marked-to-model (rather than marked-to-market) and sophisticated modeling becomes necessary to properly understand and assess their risks. This scenario can pose additional challenges for OTC CCPs compared to dealers.⁷⁶⁵ Hence, unlike OTC CCPs, large dealer firms can invest considerable resources to develop models designed to quantify and characterize these risks.⁷⁶⁶ Moreover, unlike OTC CCPs, large dealers firms have very stronger incentives to develop good models, not least because better models would help them earn higher trading profits.

In addition to the above, Prof. Pirrong notes that dealers are likely to have better and more complete information on balance sheet risk and stronger incentives to collect such information relative to OTC CCPs.⁷⁶⁷ Because of this, Prof. Pirrong concludes, information on balance sheet risk is more complete, accurate, and

⁷⁶³ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 18-19. See, also, Craig Pirrong, *CCPs & RTGS: Devil Take the Hindmost?*, Streetwise Professor Blog (January 31, 2016).

⁷⁶⁴ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 14-15, 24 (arguing that “AIG is constantly invoked to show what can happen in the absence of clearing. This example is deeply misleading because the instruments that brought down AIG would never have been clearable. It is also misleading because of hindsight bias. ... firms did not require AIG to post initial margin because they perceived, given the information and beliefs prevailing at the time, that the default risks posed by the trades and by AIG itself were small ... Furthermore, even if the AIG positions had been cleared, the firm’s financial implosion would have imposed default losses on the CCP—which would have imposed costs on its members—which would have almost certainly have included the same firms at risk of default on its OTC positions.”); Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 34-38; Craig Pirrong, *It’s a Wonderful Life: AIG Edition*, Streetwise Professor Blog (March 28, 2009); Darrell Duffie, *Replumbing Our Financial System: Uneven Progress*, cit., p. 267 (noting that “[i]n any case, the AIG derivatives were too customized to be handled safely by a CCP.”).

⁷⁶⁵ See, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., p. 37. This observation doesn’t mean that dealers’ risk modeling is superior to that of CCPs. Hence, as observed by Prof. Pirrong “[t]he key issue in risk sharing is asymmetry, which depends on the relative quality of information ... [t]he point is that the one eyed man is king in the land of the blind; if the dealer has a more precise model than the CCP, he is the one-eyed man and has an advantage over the blind CCP.” This means that if a dealer has a better model than the OTC CCP, than it has an advantage over OTC CCP and information asymmetry problem arise, even if the dealer’s model is not completely accurate.

⁷⁶⁶ See, Craig Pirrong, *Rocket Science, Default Risk and The Organization of Derivatives Markets*, cit., p. 5 (arguing that “OTC dealers use “rocket scientists”—quantitative financial economists, physicists, and mathematicians—to develop proprietary models for valuing non-standard OTC derivatives. These models provide them with superior information about their default risk. This information asymmetry impedes the sharing of default risk.”).

⁷⁶⁷ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 16-18; Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 38-42.

more symmetrically distributed, in a bilateral market than it is in a centrally cleared market.⁷⁶⁸

In line with the view expressed by Prof. Pirrong, Thorsten V. Koepl and Cyril Monnet argue that there exists very little evidence that an OTC CCP can gather more information about the quality of a counterparty relative to what is available under bilateral clearing.⁷⁶⁹

Moreover, Prof. Levitin further observes that whether an OTC CCP has more visibility on risks and exposures (compared to individual dealers) depends on the number of existing OTC CCPs, and the relative market share of OTC CCP(s) and individual dealers.⁷⁷⁰ As the author explains, if there is a single OTC CCP, then such OTC CCP will likely know the full extent of all of its CMs' OTC derivatives exposures. Contrary, if there are multiple OTC CCPs, information will be as fragmented as it is for dealer banks, unless OTC CCPs share information. In this respect, Prof. Levitin notes that OTC CCPs might be more willing to share data than dealer banks, because they typically make money on per-transaction fees, rather than on spreads between matched transactions.⁷⁷¹ This, in turn, means that OTC CCPs might be less likely to view exposure data as proprietary in the same way a dealer would view bids and asks. Moreover, mandatory clearing gives OTC CCPs a great deal of leverage to force information from counterparties, which may help them address balance-sheet risk. However, Prof. Levitin also acknowledges that competition among OTC CCPs may erode this leverage.⁷⁷²

In addition, Domanski, Gambacorta and Picillo note that the global nature of the OTC derivatives markets and increasing competitive pressure among OTC CCPs may contribute further complexities and reduce the ability of OTC CCPs to properly access the risks associated with the trades that they clear. In particular, the authors observe that, due to limited available information on CMs' aggregate exposures, OTC CCPs may underestimate the initial margins for CMs that are clearing members in multiple OTC CCPs for the same product.⁷⁷³

⁷⁶⁸ Ibidem.

⁷⁶⁹ See, Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., pp. 6-7. See, also, Thorsten Koepl, *The Limits of Central Counterparty Clearing: Moral Hazard and Market Liquidity*, Queen's Economics Department Working Paper No. 1312 (2012).

⁷⁷⁰ See, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., pp. 457-458.

⁷⁷¹ Ibidem.

⁷⁷² Ibidem.

⁷⁷³ See, e.g., Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., p. 73 (arguing that "large internationally active banks may split their positions across several CCPs. Limited information on the total centrally cleared positions of its members in a specific product could induce the CCP to underestimate initial margins needed to appropriately cover liquidity costs in the liquidation process. Since liquidity costs tend to increase in a non-linear way with the size of the portfolio, the simultaneous liquidation of the larger aggregated position will have a market liquidity cost that is higher than one which the individual CCPs may have factored into initial margins."). See, also, Paul Glasserman, Ciamac C. Moallemi and Kai Yuan, *Hidden Illiquidity with Multiple Central Counterparties*, Office of Financial Research, Working Papers, No. 15-07 (2015); Nicole Abruzzo and Yang-Ho Park, *An Empirical Analysis of Futures Margin Changes: Determinants and Policy Implications*, Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series, No. 86 (2014) (discussing how competition among CCPs can result in lower margin levels in order to attract more trading volume, a phenomenon referred to as "race to the bottom." Findings of their analysis show that the margin difference between CME Group and Intercontinental Exchange (ICE) is an important driver of margin changes after changes in other margin determinants are controlled for, thus suggesting that competition may be factored into margin setting.)

6.8. Loss Mutualization

As discussed in Chapter 5, loss mutualization and risk-sharing mechanisms of OTC CCPs (e.g., pre-funded mutualized default fund and the non-prefunded additional resources) are generally considered efficient means for reducing counterparty risk and mitigating systemic risk. The use of loss mutualization and risk sharing mechanisms, however, raises a number of issues.

First, loss mutualization may increase opacity of OTC derivatives trading, which, in turn, may create the risk of runs on OTC CCPs in the event of default of one or more of their CMs. Prof. Roe explains this point in detail, noting that “uncertainty about a prime member can induce panic elsewhere: [i]f traders fear that the prime member will not be able to meet a capital call (because it is tottering), then that will call into question both the clearinghouse and the solvency of the other clearinghouse members upon which the clearinghouse will make capital calls.”⁷⁷⁴ Moreover, Prof. Roe observes, “[i]f one or two [CMs] appear to be insolvent and unable to meet capital or collateral calls, then mutualizing risk via the clearinghouse will degrade the entire clearinghouse, cast an ominous shadow over the financial market it’s meant to steady, and risk calling into question the solvency of the other clearinghouse members.”⁷⁷⁵

Second, OTC CCPs’ risk-sharing mechanisms may expose OTC CCPs to problems of adverse selection.⁷⁷⁶ In particular, OTC CCPs may face asymmetric information problems when CMs have better information about the valuation (price) and risk of the OTC derivatives being cleared.⁷⁷⁷ This asymmetry becomes particularly acute when OTC CCPs provide clearing services for complex and/or illiquid OTC derivatives.⁷⁷⁸ Asymmetry information, in turn, generates adverse selection problems by creating the incentives for CMs to

⁷⁷⁴ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., pp. 1678-1679.

⁷⁷⁵ *Ibidem*.

⁷⁷⁶ See, e.g., Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., pp. 417 ss; Craig Pirrong, *Rocket Science, Default Risk and The Organization of Derivatives Markets*, cit., 12; Bruno Biais, Florian Heider and Marie Hoerova, *Clearing, Counterparty Risk and Aggregate Risk*, International Monetary Fund (IMF) Economic Review, Vol. 60, No. 2, pp. 193–222 (2012).

⁷⁷⁷ See, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 33 (noting that “all risk sharing mechanisms are potentially vulnerable to asymmetric information. When evaluating the costs and benefits of alternative methods for allocating default losses, it is important to consider their susceptibility to information asymmetries because they give rise to real costs. If large enough, the costs arising from asymmetric information can make it inefficient to allocate default losses through a clearinghouse.”); Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 10 seq.; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 2-3, 13 seq. (arguing that “[c]learing via CCPs is in essence a protection mechanism whereby risks are redistributed. Although this redistribution of risk can generate benefits, risk sharing mechanisms can also create costs, in the form of distorted incentives, in the presence of information imperfections.”).

⁷⁷⁸ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 243; Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., p. 38 (noting that “[t]he severity of adverse selection also depends on CCP policies regarding the derivatives it clears. Futures exchanges typically require all of the products they trade to be cleared. In contrast, at least one OTC CCP, SwapClear, gives dealers the option to choose the trades to submit for clearing. This gives dealers the ability to clear trades when the CCP underprices the default risk, and to hold onto trades when the CCP overprices it.”); Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., pp. 417-419; Craig Pirrong, *Rocket Science, Default Risk and The Organization of Derivatives Markets*, cit., p.1 (noting that “[t]he lack of default risk mutualization in OTC derivatives markets and its presence for exchange derivatives is consistent with the greater importance of private information on OTC markets.”).

under-trade OTC derivatives for which OTC CCPs overestimate risk, and over-trade OTC derivatives for which OTC CCPs underestimate (underprice) risk.⁷⁷⁹

Third, loss mutualization mechanisms may also generate distorted incentives on the part of CMs (and their clients) and may expose OTC CCPs to severe moral hazard problems. In particular, knowing that part of the losses will be shared among all CMs, each CM (acting on behalf of itself and/or its clients) may have the strong incentive to take on excessive risk and/or increase the volume/scale of its OTC derivatives trades cleared through the OTC CCP.⁷⁸⁰ In addition, knowing that part of the losses will be allocated across all CMs, each CM may have the further incentive to adjust the risk of other assets on its balance sheets, and/or change its leverage, thus, affecting the distribution of the default losses shared among CMs through the pre-funded mutualized default fund. Furthermore, relying on the loss mutualization mechanisms inherent in the OTC CCP's structure, each CM may be discouraged to closely monitor risk exposures.⁷⁸¹ All these distorted incentives, in turn, may increase the change of failure of OTC CCPs and, thus, the risk of instability for the system. OTC CCPs can seek to correct these incentives and reduce moral hazard problems by requiring their CMs to post higher and more liquid margins and/or enforcing stricter membership requirements. The benefits associated with any of these

⁷⁷⁹ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 9; Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 37-38 (noting that "[d]ealers with better information on the value and risks of a particular instrument, or portfolio of instruments, can identify risks that the CCP misprices. It can trade the underpriced risks more intensively, and the overpriced ones less intensively. As a result, the CCP will suffer greater default losses than it anticipates. The CCP has to adjust prices (collateral) as a result. Due to the information asymmetry, the equilibrium prices that the CCP charges (its equilibrium collateral levels) diverge from the first-best prices, leaving the better informed dealers with an information rent, and distorting the level of trade."). Competitive pressure to expand the set of eligible securities for margin purposes may expose OTC CCPs to greater adverse selection by creating the incentive for CMs to post more risky assets as margins. In this sense, see, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 274-275 (noting that pressure to expand the set of eligible securities for margin purposes may also expose OTC CCPs to greater wrong-way risk).

⁷⁸⁰ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 243; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 25 (noting that "clearing can affect the magnitudes of positions taken and the amount of risk exposure taken. Specifically, by widening the allocation of default risk, clearing tends to induce hedgers and speculators to take larger positions. This effect tends to increase the total amount of risk exposure, including counterparty risk exposure and, hence, systemic risk. Moreover, ... position netting tends to free up capital and collateral, which allows firms to take on bigger positions. This can be beneficial, but it also increases the total counterparty risk exposure, which affects the level of systemic risk. Furthermore, to the extent that CCPs do not price counterparty risk as effectively as is done in OTC markets, moral hazard and adverse-selection problems tend to induce an increase in risk exposure."); Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., p. 3, 6-7, 11 (arguing that "the risk transfer that characterizes CCP clearing leads to incentives for individual risk-taking and, thus, necessitates additional collateral increases."); Philipp Haene and Andy Sturm, *Optimal Central Counterparty Risk Management*, Swiss National Bank Working Papers No. 2009-7 (2009); Paul Nahai-Williamson, Tomohiro Ota, Mathieu Vital and Anne Wetherilt, *Central Counterparties and their Financial Resources - A Numerical Approach*, Bank of England Financial Stability Paper No. 19 (2013).

⁷⁸¹ See, Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., p.7; Thorsten V. Koepl and Cyril Monnet, *The Emergence and Future of Central Counterparties*, cit.; Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 47-48. For a thoughtful analysis on delegated monitoring, see, e.g., Jean Tirole, *The Theory of Corporate Finance*, Princeton University Press (2006); Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1695 and accompanying note 133-134; Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 12 and accompanying note 25; Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., p. 416.

measures, however, would need to be weighted against their relative costs (e.g., funding and liquidity costs, and increased entry barriers).⁷⁸²

Fourth, associated with the use of OTC CCPs' loss mutualization and risk sharing mechanisms is the problem of externalities. As discussed in Chapter 3, the adoption of clearing mandates for OTC derivatives was motivated, among others, by the need to eliminate "negative externalities" associated with the trading of OTC derivatives. The risk-sharing mechanisms inherent in OTC CCPs' structures were, thus, regarded as an effective means to help derivatives market participants internalize the systemic risk effects associated with their derivatives trading. This view is flawed as it doesn't account for the fact that risk sharing mechanisms inherent in OTC CCPs' structures may themselves create systemic risk externalities. Because CMs know that they will not bear the full risk of their trades, CMs may have the incentive to individually and collectively channel risk into the derivatives markets that are cleared through OTC CCPs. These distorted incentives, in turn, may generate dangerous externalities: CMs may be induced to take on excessive risks, increase the size/volume of their trades, and/or reduce risk management and monitoring efforts.

Fifth, the idea that OTC CCPs' loss mutualization and risk sharing mechanisms can insure against systemic risk is fundamentally wrong. As Gregory correctly points out "systemic risk insurance is a misnomer, since insurance relies on some level of diversification."⁷⁸³ As further explained by McDonald, "risk is diversifiable risk if it is unrelated to other risks ... If many investors share a small piece of this risk, this risk has no significant effect on anyone. Risk that is not eliminated when spread across many investors is non-diversifiable risk. The risk of a stock market crash, for example, is non-diversifiable."⁷⁸⁴ When translated into the central clearing context, the above means that mutualization of losses through the default fund and other non-prefunded resources to be contributed by surviving CMs works well when risks are relatively idiosyncratic and independent, but it works less well when risks become more correlated and systemic in nature.⁷⁸⁵ Thus, if the risks of default of CMs are diversifiable and exhibit relatively little correlation, then the loss mutualization of the OTC CCP can improve the allocation of risks and can help enhance stability; contrary,

⁷⁸² See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 243.

⁷⁸³ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 192.

⁷⁸⁴ See, Robert L. McDonald, *Derivatives Markets*, cit., p. 11.

⁷⁸⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 273. See, also, Robert S. Steingerwald, *Central Counterparty Clearing and Systemic Risk Regulation*, in Anastasios G. Malliaris and William T. Ziemba (eds.), *The World Scientific Handbook of Futures Markets*, World Scientific (2015), pp. 181-246, at p. 225 (noting that "it is one thing, however, to mitigate the magnitude of counterparty credit risk by netting offsetting risk positions; it is an entirely different matter to effectively diversify among a small number of clearing members. To diversify the likelihood of a clearing member default, counterparty credit risk must not be highly correlated among clearing members. Whether or not such correlation exists, however, is independent of the extent to which a CM's can be netted. Netting only affects the loss given default, not the probability of default"); Craig Pirrong, *You Can't Mutualize, Insure, or Diversify Systematic Risk*, cit. (explaining that "[i]nsurance works when risks are diversifiable. So, to the extent that the risks of default exhibit relatively little correlation across clearing members (CMs), mutualization through a CCP can improve the allocation of risk: through diversification, the variability of the average default loss across all CCP members is smaller than the variability of any CM's default loss profile."); Ben S. Bernanke, *Clearing and Settlement during the Crash*, cit., pp. 144-145.

when default risks are highly correlated across CMs, the loss mutualization mechanisms of OTC CCPs will be less helpful.⁷⁸⁶

This point, in turn, raises the question of what kind of risks OTC CCPs seek to reduce through risk-sharing mechanisms. As discussed in Chapter 4, the “OTC CCP-insurer” has some protection in the form of a “deductible,” given by the sum of the defaulting CM’s margin, its default fund contribution, and the first tranche of the OTC CCP’s equity (collectively, the “defaulter’s resources”). Because of the existence of this deductible, only losses that are large enough to exhaust the defaulter’s resources (the “deductible”) will hit the default funds and will be shared among all surviving CMs. Prof. Pirrong explains this point: “[c]learinghouses use margins to limit the amount of risk that is mutualized. Only losses on defaulted positions in excess of margin posted by the defaulter are mutualized. The higher the margin cover, the lower the level of risk sharing. In practice, CCPs utilize a “defaulter pays” model in which margin covers losses on defaulted positions with extremely high probability, e.g., 99.7 percent of the time. In a defaulter pays model, the amount of risk mutualization is very low.”⁷⁸⁷

The above essentially means that the risk-sharing mechanisms embedded in an OTC CCP do not insure against idiosyncratic (diversifiable) risks; rather they seek to cover tail highly correlated systemic risks. But, these risks cannot be mutualized, nor they can be diversified. Thus, the risk-sharing mechanisms embedded in an OTC CCP may not be as efficient as they were thought to be, and they may even make things worse by creating dangerous exposures for CMs and OTC CCPs to systematically bad economic and financial states.⁷⁸⁸

6.9. Structured Entities: OTC CCPs as CDOs

A number of authors have observed that a typical OTC CCP’s default waterfall may resemble the loss allocation structure of a CDO and that the risk characteristics of the two structures may, therefore, be very similar.

For instance, Prof. Pirrong notes that “[t]here is an analogy between CCPs and ... senior (and super-senior) tranches of collateralized debt obligations (CDOs) and monoline insurers. AAA CDO tranches were deemed to be very secure because junior tranches absorbed default losses first, in the same way that margins are intended to absorb losses on defaulted derivatives positions. Credit rating agencies estimated that the probability that AAA tranches would incur losses were very small: that is what justified the ratings, and resulted in these instruments trading at very low yields. Monoline insurers that wrote insurance on these tranches were highly rated for similar reasons: it was estimated that the likelihood of monolines having to pay out on this protection was very small.”⁷⁸⁹

⁷⁸⁶ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 273.

⁷⁸⁷ See, Craig Pirrong, *Moral Hazard, Defaulter Pays, and the Relative Costs of Cleared and Uncleared Derivatives Trades*, Streetwise Professor Blog (October 28, 2013); Stephen J. Lubben, *Failure of the Clearinghouse: Dodd-Frank’s Fatal Flaw?*, cit., pp. 10-11 and accompanying 50.

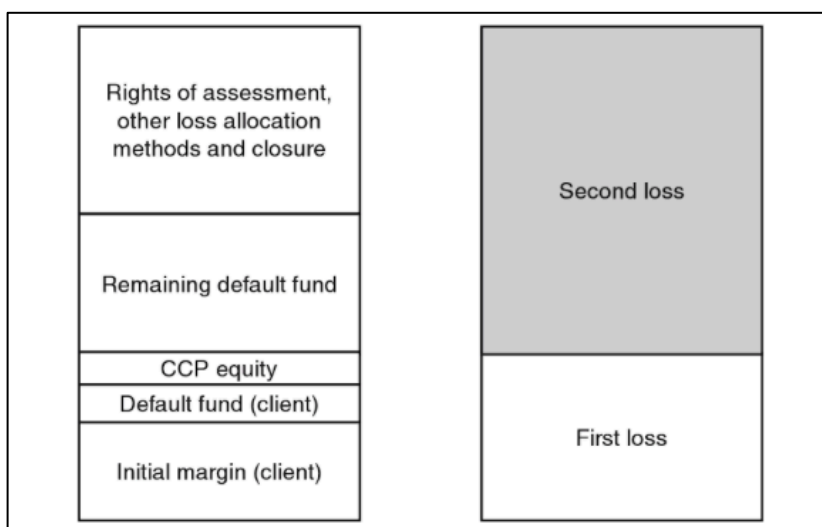
⁷⁸⁸ See, Craig Pirrong, *Moral Hazard, Defaulter Pays, and the Relative Costs of Cleared and Uncleared Derivatives Trades*, Streetwise Professor Blog (October 28, 2013); Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 35.

⁷⁸⁹ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 28-29.

Similarly, Prof. Murphy points out that “[t]he different levels in the default waterfall – margin, CCP equity, default fund, default fund assessment rights, and so on – are accessed in sequence, much like the tranches of a CDO. Typically the defaulter’s margin and default fund are used first, then an amount of CCP equity is at risk, then the mutual default is used, and typically more default fund can then be called from surviving members. That is, the default waterfall starts off individual, with the defaulter (or rather their estate) paying, and then becomes mutual.”⁷⁹⁰ This, in turn, means that assessing the safety of an OTC CCP corresponds to asking what the probability that the tranches corresponding to the OTC CCP’s financial resources are exhausted would be.⁷⁹¹

The comparison between the two structures is illustrated in [Figure 38](#) below.

Figure 38. Comparison between an OTC CCP’s default waterfall (inverted) and a CDO’s structure.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 274.

The defaulted CM’s margins and mutualized default fund contribution together with the first piece of the OTC CCP’s equity contribution correspond to the CDO’s equity and junior tranches. This means that the defaulted CMs and the OTC CCP (to the extent of its first tranche of equity) have a “first loss position” in the hypothetical CDO.

The contributions to the mutualized default fund made by non-defaulting CMs together with their other loss allocation exposures (e.g., rights of assessment,

⁷⁹⁰ See, David Murphy, *The next generation: CCP waterfalls and mutuality*, cit. See, also, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., pp. 323-324 (observing that similar to a CDO, “[an OTC CCP] has a variety of assets, namely derivatives receivables from its counterparties; It can suffer losses due to default; It has a number of tranches of protection against the risk of default, namely the CCP’s default waterfall. (In this analogy, margin is the junior tranche of the CDO, default fund is a mezzanine tranche, and so on.”); David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 10; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 149, 174 note 323.

⁷⁹¹ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 227 note 409.

variation margin gains haircutting and other loss allocation methods) are analogous to CDO's senior and super-senior tranches. This means that non-defaulting CMs have a "second loss position" in the hypothetical CDO.

As discussed in Chapter 1, because of the tranching and prioritization mechanics, the senior and super-senior tranches of a CDO suffer losses only at the occurrence of a very extreme shock that adversely impacts near simultaneously a large number of assets underlying the structure.⁷⁹² This means that, although the probability of losses hitting the senior and super-senior tranches in a CDO is very low, any of such losses are likely to occur precisely during periods of systemic instability. As noted by Gregory, "senior tranches are well known to be heavily concentrated in terms of their systemic risk exposure and perform very badly during large, market-wide shocks."⁷⁹³ As further observed by Prof. Pirrong, "these structures insured some kinds of risk via diversification, but concentrated non-diversifiable risks: most notably, they concentrated the risk of a systemic shock that by definition cannot be diversified away."⁷⁹⁴ When applied to an OTC CCP's default waterfall structure, the above means that the exposure borne by non-defaulting CMs is very systemic in nature.

Modeling the risks exposure of an OTC CCP's default waterfall as a CDO's waterfall helps understand the cost of capital and the cost of clearing. As noted by Gregory, because of the exposure of the default funds and other mutualized resources to systemic risk, the "[d]efault funds and associated capital charges should ... be very large and expensive."⁷⁹⁵ Consistent with this view, Prof. Pirrong argues that the high systemic risk of the default fund "means that default fund capital is extremely expensive." As the author notes "[t]he default fund is like a deep out of the money short put on the market. Such puts are essentially bets on systematic risk, and hence are very expensive. The expense of such capital means that CMs are likely to want to minimize the amount they post. They have every incentive to try to construct risk measures that make CCPs look

⁷⁹² See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 29.

⁷⁹³ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 273. See, also, Michael S. Gibson, *Understanding the Risk of Synthetic CDOs*, cit.; Joshua D. Coval and Jakub W. Jurek and Erik Stafford, *Economic Catastrophe Bonds*, HBS Finance Working Paper No. 07-102 (2008) (showing that the tranching and prioritization mechanics that allow senior tranches of structured products to have low default probabilities (and thus high credit ratings) also give such tranches considerable exposure to systematically bad economic states, thus, effectively creating economic catastrophe bonds. Based on the asset pricing theory, securities resembling economic catastrophe bonds should offer a large risk premium to compensate for their systematic risk. Interesting, however, Coval et al. show that the market price of senior tranches of structured product is substantially lower than their expected value would suggest, and rather similar to single name securities with identical credit ratings); Michael J. Brennan, Julia Hein and Ser-Huang Poon, *Tranching and Rating*, UCLA Working Paper (2008); Viral V. Acharya and Philipp Schnabl, *How Banks Played the Leverage Game*, in Viral V. Acharya and Matthew Richardson (eds.), *Restoring Financial Stability: How to Repair a Failed System*, cit., p. 98 (noting that "[t]he AAA-rated risk transfer assets and vehicles were a way of betting on aggregate risk. In academic parlance, these are now referred to as "economic catastrophe bonds." They are low in risk overall, but their risk is aggregate in nature; in fact it arises only in aggregate crashes.").

⁷⁹⁴ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 29; See, also, Craig Pirrong, *You Can't Mutualize, Insure, or Diversify Systematic Risk*, cit.

⁷⁹⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 274.

safe, with very low risk of default, in order to reduce their exposure to the default fund.”⁷⁹⁶

Moreover, modeling the risks exposure of an OTC CCP’s default waterfall as a CDO’s waterfall also helps understand the relevance of correlations and dependencies inherent in the structure of OTC CCPs. At the time of writing, these correlations and dependencies do not seem to be fully appreciated, very much like they weren’t appreciated with respect to CDOs and other complex structured products before the GFC.⁷⁹⁷

In particular, a key consideration when assessing the risk associated with a CDO is the effect of default correlation:

- If default correlation is low, multiple defaults will happen rarely. As a result, the equity piece and the junior tranches will be very risky, while the senior tranches will be relatively safe;
- If default correlation increases, the likelihood of multiple defaults will increase and there will be a substantial risk of losses large enough to deplete the senior tranches. As a result, the junior tranches will become relatively less risky, whilst the senior tranches will become relatively more risky.
- If the correlation is perfect and the recovery rate is zero, the tranches are equally risky.

Estimating the relationship between defaults of different assets poses significant challenges. First, in time of market stress default correlation tends to increase significantly compared to ordinary times. Second, market measures of default correlation are observable for a very limited number of portfolios.⁷⁹⁸ As a result, there is no widely agreed model and often very limited data are available to calibrate the selected model.⁷⁹⁹

When translated into the context of central clearing, the above means that, in order to assess the safety of an OTC CCP, one needs to understand what the default correlation of its CMs is likely to be in markets stressed enough to cause their default.⁸⁰⁰ A scenario of volatile and illiquid markets may lead to a significant increase in correlation among CMs’s defaults, as all CMs will be likely to suffer losses in this scenario.⁸⁰¹ As a result, Prof. Murphy argues, “unless a CCP is safe against the default of a significant number of clearing members in volatile markets, it could itself become distressed, possibly causing stress to

⁷⁹⁶ See, Craig Pirrong, *You Can’t Mutualize, Insure, or Diversify Systematic Risk*, cit.

⁷⁹⁷ See, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 234; Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, Streetwise Professor Blog (January 10, 2011); Craig Pirrong, *Gary Dunn of HSBC Meets Wrongway Peachfuzz*, Streetwise Professor Blog (April 30, 2013); Aaron Woolner, *Isda AGM: CCP ‘Armageddon’ could lead to sovereign default, warns HSBC executive*, Risk.net (April 25, 2013) (quoting Gary Dunn, senior manager for regulatory and risk analytics at HSBC, at Isda’s AGM in April 2013).

⁷⁹⁸ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 70-71.

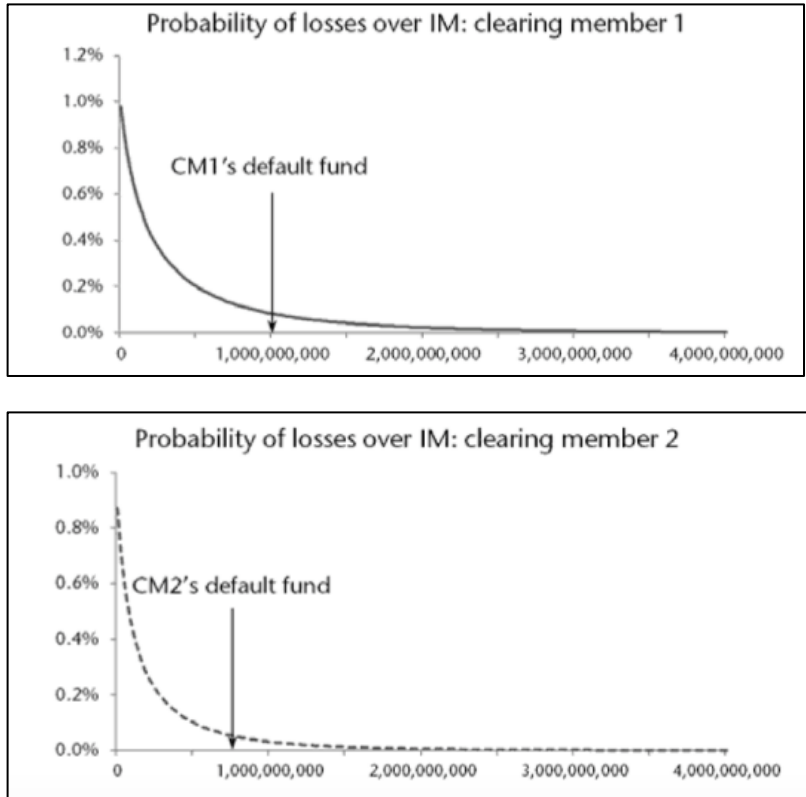
⁷⁹⁹ *Ibidem*.

⁸⁰⁰ See, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 234.

⁸⁰¹ *Ibidem*.

other institutions.”⁸⁰² Figures 39(a)-(d) below provide a graphical illustration of this point.

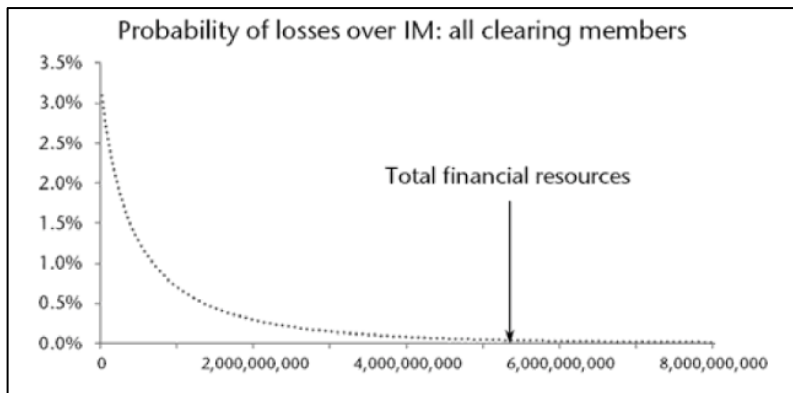
Figures 39(a) and (b). Illustration of the distribution of losses above initial margin for two different CMs (CM1 and CM2). CM1 has a riskier portfolio than CM2, therefore its default contributions are larger.



Source: David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, Palgrave Macmillan (2013), p. 211.

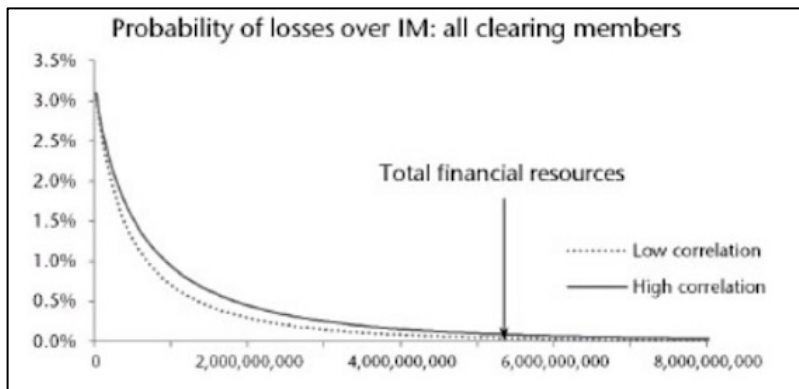
⁸⁰² Ibidem. See, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 274 (noting that “the implication of the systemic and wrong-way risk concentration via the senior tranche exposure created by a CCP, by analogy to a CDO, would be [that] ... correlation between losses from different clearing member defaults is likely to be high.”); David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 174 note 319 (noting that “[m]argin reduces the risk of the poster’s portfolio: it should therefore be based on the loss distribution of that CM’s portfolio. [Default fund] reduces the risk of the total cleared portfolio: it therefore applies to multivariate loss distribution of all cleared trades. The adequacy of the [default fund] therefore critically depends on the default comovement assumptions used to determine the multivariate loss distribution.”).

Figure 39(c). Illustration of the combined loss distribution.



Source: David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 212.

Figure 39(d). Illustration of the combined loss distribution under different assumptions of CM's default co-movements.



Source: David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 213.

In [Figure 39\(c\)](#), the area to the right of the financial resources line represents the probability of failure of the OTC CCP due to counterparty credit risk. In [Figure 39\(d\)](#) the likelihood of multiple CMs' defaults is higher. The area to the right of the financial resources line is twice as large, representing a greater probability that the financial resources of the OTC CCP will be exhausted.

Related to the points discussed above is the observation made by Prof. Pirrong that an OTC CCP's overall exposure depends on the distribution of the sum of the net exposures, which, in turn, depends on the dependencies between instruments in each CM's portfolio.⁸⁰³ One relevant form of dependency between exposures is correlation. For instance, low correlation of price movements of different products means that, being all else equal, broader portfolios are less risky than portfolios concentrated in a single instrument or a small number thereof. Negative correlations allow even greater reductions in risk exposures for broader portfolios.⁸⁰⁴ Another form of dependency exists between the exposure

⁸⁰³ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 19.

⁸⁰⁴ *Ibidem*.

on a CM's portfolio and its likelihood of default. As discussed in detail in the following sections, this form of dependency (typically referred to as "wrong-way risk") can create acute challenges to OTC CCPs' clearing services.⁸⁰⁵

The described dependencies are very difficult to model due to a number of reasons, including the following:⁸⁰⁶

- First, dependencies tend to change significantly during periods of market stress and crisis.⁸⁰⁷ This is relevant for OTC CCPs. As correctly pointed out by Prof. Pirrong, the risk is that the OTC CCP will establish levels of margin that although prudent in normal times may become severely insufficient during periods of market turbulence.⁸⁰⁸ Moreover, the same problems that can cause an OTC CCP to substantially underestimate the amount of margins can also lead the OTC CCP to underestimate the size of its default fund.⁸⁰⁹
- Second, dependencies are inherently unstable and can change significantly over time. This is a key point, as counterparty risk assessment by OTC CCPs must be made over long periods of time, sometimes many years.⁸¹⁰
- Third, the contribution of any derivatives products to an OTC CCP's default risk exposure depends on its dependence between the derivatives products that the OTC CCP already clears, and between the derivatives products and the creditworthiness of CMs.⁸¹¹ As a result, Prof. Pirrong argues, one cannot estimate the riskiness of clearing a particular product at a specific OTC CCP without knowing the dependence between that product and the OTC CCP's existing portfolio of risks (including the default risks of its CMs).⁸¹²
- Fourth, modeling market liquidity and its impact on OTC CCP risks is also very difficult, particularly because of the complexities in characterizing the

⁸⁰⁵ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 19-20; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 23-24 (arguing that "the very notion of correlation (as used in financial market) may be heavily restrictive in terms of its specification of co-dependency ... correlation (as it is generally defined in financial application) is not the only way to represent dependency, and other statistical measures are possible. Particularly in the case of wrong-way risk, the treatment of co-dependencies via measures other than correlation is important. In general, xVA calculations require a careful assessment of the co-dependencies between credit risk, market risk, funding and collateral aspects."); David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 70-71 (using the broader term "default comovements" rather than "default correlation" and explaining that correlation implies a certain mathematical relationship that does not necessarily hold. See below for further discussion on this point).

⁸⁰⁶ See, See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 20; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 278; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 23 (arguing that "[p]robably the most difficult aspect in quantifying financial risk is that of co-dependency between different financial variables.").

⁸⁰⁷ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 20; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 23-24 (noting that "[i]t is well known that historically estimated correlations may not be a good representation of future behavior. This is especially true in a more volatile market environment, or crisis, where correlations have a tendency to become very large.").

⁸⁰⁸ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 20.

⁸⁰⁹ *Id.*, p. 20, note 24.

⁸¹⁰ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 23-24.

⁸¹¹ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 20.

⁸¹² *Ibidem*.

dependence between market liquidity and the event(s) that cause a large default or defaults.⁸¹³

6.10. Wrong-Way Risk

Prominent scholars have warned against the risk of relying on OTC CCPs as a means of mitigating systemic risk, because of certain features and mechanisms of OTC CCPs that make them particularly vulnerable to wrong-way risk (WWR).⁸¹⁴

WWR refers to the risk that occurs when the exposure to a counterparty is adversely correlated with the credit quality of that counterparty.⁸¹⁵ In particular, WWR exists when “the exposure increases as the credit quality of the counterparty deteriorates.”⁸¹⁶

There are two types of WWR:

- Specific WWR – Specific WWR arises through poorly structured transactions generating wrong-way exposures for a party to the transaction that is specific to the counterparty.⁸¹⁷ Examples of specific WWR include the cases of a company writing put options on its own stock, and a company collateralizing its obligations using its own (or a related party’s) shares or assets.⁸¹⁸
- General WWR – General WWR arises when the credit quality of the counterparty is correlated with macroeconomic factors.⁸¹⁹ Examples of general WWR include the case of interest rates being correlated to credit spreads; and the case where a trade position is affected by inflation or political risk in a particular geographic area.

⁸¹³ Id., p. 23.

⁸¹⁴ See, e.g., Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 27-30 (arguing that “[t]he structures of CCPs have features that are particularly vulnerable to [dependencies that give rise to wrong-way risk]. In this respect, they are similar to monoline insurers, which were similarly exposed to loss only under extreme market conditions, and which were effectively destroyed when these conditions occurred in 2007-2008.” Therefore, “[t]he experiences with AAA CDO tranches, and monoline insurers, provide a warning of risks that CCPs incur, and of their limited utility as a way of mitigating systemic risk”); See, also, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 378-395; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 117-118; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 78-84.

⁸¹⁵ See, International Swaps and Derivatives Association (ISDA), Letter to Daniele Nouy, dated August 7, 2001; International Swaps and Derivatives Association (ISDA), Letter to Richard Gresser, dated September 7, 2001. See, also, Eduardo Canabarro and Darrell Duffie, *Measuring and Marking Counterparty Risk*, Asset/Liability Management for Financial Institutions, Euromoney Books, pp. 122-134 (2003), p.123 (defining wrong-way exposures as “exposures that are ... negatively correlated with the credit quality of the counterparty.”).

⁸¹⁶ See, Basel Committee on Banking Supervision, *Basel III: A Global Regulatory Framework for more Resilient Banks and Banking Systems*, Bank for International Settlements (Revised June 2011), p. 4; Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit. (noting that “[w]rong way exists when the exposure is large when the probability of a counterparty default is large. This is often characterized as a “correlation” between default risk and exposure (although “correlation” is too limiting a concept because correlation implies dependency, but dependency does not imply correlation)); Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., Chapter 17; Jon Gregory, *Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets*, cit., Chapter 15; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit. pp. 79-82.

⁸¹⁷ See, Basel Committee on Banking Supervision, *Basel III: A Global Regulatory Framework for more Resilient Banks and Banking Systems*, cit., p. 38.

⁸¹⁸ Id., pp. 38-39.

⁸¹⁹ Ibidem. See, also, International Swaps and Derivatives Association (ISDA), Letter to Richard Gresser, dated September 7, 2001.

With respect to derivatives, examples of transactions involving WWR include put options, senior tranches of structured products (e.g., CDO, CDO²), CDSs, and certain FX forward or cross-currency products:⁸²⁰

- Put options – As noted by Prof. Pirrong, a deep out of the money option generates an exposure only if the underlying price moves significantly.⁸²¹ But, if the underlying price and the creditworthiness of the option writer move in the same direction, then a large movement in the underlying that puts the option in the money will also be associated with a dramatic erosion in the creditworthiness of the option writer. This, in turn, means that “exposure and default risk peak simultaneously.”⁸²²
- Senior tranches of structured products (e.g., CDO, CDO²) – As further observed by Prof. Pirrong, losses on a senior (or supersenior) tranche will occur only in the event of an extreme adverse shock hitting near simultaneously many of the credits underlying the CDO structure. If this extreme adverse shock puts the writer of protection on the CDO’s senior (or super senior) tranche into financial difficulties, the writer will be most likely to default right at the same time that it is supposed to pay for the protection it sold.⁸²³
- CDSs - Significant WWR may arise when a strong relationship exists between the credit quality of the reference entity and counterparty.⁸²⁴ As correctly explained by Prof. Pirrong, the credit quality of the counterparty is important because a high quality counterparty is likely to default on a contract only if it suffers a severe adverse shock to its balance sheet.⁸²⁵ This, in turn, means that exposure will be large precisely when the counterparty is highly likely to default.⁸²⁶
- FX forward or cross-currency transactions - Significant WWR exists in case of FX forward or cross-currency transactions entered into with a sovereign where payments are made in their local currency (or when these transactions are hedge with a bank in that same region).⁸²⁷

When applied to central clearing of OTC derivatives, the above analysis suggests the existence of (at least) three scenarios where WWR may arise.⁸²⁸

⁸²⁰ See, Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit. (noting that “[o]ut-of-the-money options exposures, very senior tranches of structures, and highly rated counterparties are most vulnerable to wrong-way risk.”).

⁸²¹ *Ibidem*. See, also, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 378.

⁸²² See, Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.

⁸²³ *Ibidem*.

⁸²⁴ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 379.

⁸²⁵ See, Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 37 (arguing that “[w]rong-way risk tends to be largest for the most senior component of payment waterfalls, and highly rated counterparties. These features are characteristic of CCPs. Entities with these characteristics seldom fail, but their failure tends to occur concurrently with large asset price movements, thereby exacerbating market crises. Given that CCPs have attributes that make them vulnerable to wrong-way risk, this is a major concern.”).

⁸²⁶ *Ibidem*.

⁸²⁷ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 378.

⁸²⁸ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 117-118; Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.; Craig Pirrong, Gary Dunn *of HSBC Meets Wrongway Peachfuzz*, cit.

- Exposure WWR - Exposure WWR refers to the case where an OTC CCP clears derivatives transactions whereby the exposure of a party to the transaction is adversely related to the credit quality of the counterparty.⁸²⁹ Examples include the case where a counterparty pays a floating rate of interest in a swap that is more likely to default in a high interest rate regime; and the case where a financial institution sells credit default swap protection on another financial institution domiciled in the same country. In such cases the danger is that the process of central clearing could disguise exposure WWR. Hence, via novation the OTC CCP steps in between the original parties to the transaction and becomes the buyer to the original seller and the seller to the original buyer. Because of this, as noted by Gregory, the exposure WWR “is essentially absorbed by [and concentrated into] the CCP and may not be quantified properly, leading to insufficient margins and default funds being held against the risk.”⁸³⁰

Quantifying WWR will require modeling the relationship between credit, collateral, funding, and exposure.⁸³¹ This can be very difficult, not least because of the absence of informative empirical data (e.g., historical time series analysis of correlations), misspecification of relationship, and direction uncertainty.⁸³² These complexities, in turn, mean that OTC CCPs, clearing derivatives transactions that involve significant WWR (e.g., CDSs), may face considerable challenges in calculating adequate margins and default fund contributions.⁸³³ Furthermore, as observed by Gregory, empirical evidence indicates that WWR tends to increase with increasing credit quality,⁸³⁴ which, in turn, suggests that OTC CCPs should require CMs with a better credit quality to post greater initial margin and make greater default fund contributions.⁸³⁵

- Margin WWR – Margin WWR arises in case where there is a strong dependency between the value of the margin and the credit quality of the CM posting the margin.⁸³⁶ For instance, this could be the case of a firm sensitive to a high interest rate regime that posts treasury bonds as collateral, or a

⁸²⁹ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., pp. 37-38, Guidance No. 5.2.45-5.2.46.

⁸³⁰ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 117-118.

⁸³¹ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 381.

⁸³² Ibidem.

⁸³³ Cf., e.g., Matthias Arnsdorf, *Quantification of Central Counterparty Risk*, *Journal of Risk Management in Financial Institutions*, Vol. 5, No. 3, pp. 273-287 (2012); John C. Hull and Alan White, *CVA and Wrong Way Risk*, *Financial Analysts Journal*, Vol. 68, No. 5, pp. 58-69 (2012); Paul Glasserman, Linan Yangy, *Bounding Wrong-Way Risk in CVA Calculation*, *Columbia Business School Research Paper No. 15-59* (2015); Samim Ghamami and Lisa R. Goldberg, *Stochastic Intensity Models of Wrong Way Risk: Wrong Way CVA Need Not Exceed Independent CVA*, *The Journal of Derivatives*, Vol. 21, No. 3, pp. 24-35 (2014).

⁸³⁴ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 380-390

⁸³⁵ Id., p. 393 and accompanying note 16 (noting that “[o]f course, better credit quality members are less likely to default, but the impact in the event that they do is likely to be more severe.”). See, also, Michael Pykhtin and Alexander Sokol, *Exposure Under Systemic Impact*, *Risk.net* (August 20, 2013).

⁸³⁶ See, Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 382-393.

sovereign that posts its own bonds as margin.⁸³⁷ As noted by Gregory, OTC CCPs might implicitly ignore WWR, because they charge initial margins and default fund contributions driven primarily by the market value of the portfolios that they clear.⁸³⁸ Moreover, as the author further observes, OTC CCPs will likely be under pressure to accept a wide range of eligible assets for initial margin purpose.⁸³⁹ This pressures, in turn, may exacerbate the described problem: as noted by Gregory “[a]ccepting more risky and illiquid assets creates additional risks and puts more emphasis on the calculation of haircuts that can also increase risk if underestimated. CCPs admitting a wide range of securities can become exposed to greater adverse selection as clearing members (and clients) will naturally choose to post collateral that has the greatest risk (relative to its haircut) and may also present the greatest WWR to a CCP.”⁸⁴⁰

- Default Fund WWR⁸⁴¹ - WWR may arise with respect to the mutualized default fund of the OTC CCP.⁸⁴² As previously explained, in the event of default of a CM, surviving CMs will cover losses through the mutualized default fund only to the extent that such losses exceed the defaulter’s resources. This means that surviving CMs essentially mutualize only tail risks. As observed by Prof. Pirrong, this oft-touted feature of OTC CCPs’ default waterfall creates “a seniority/out-of-the-moneyness that gives rise to “wrong-way risk” if the pre-requisite dependencies also exist.”⁸⁴³

Considering that we are talking about tail events, it might be difficult to assess the above question analytically and empirically.⁸⁴⁴ Nevertheless, as Prof. Pirrong acknowledges “there are reasons to believe that these dependencies are in fact lurking.”⁸⁴⁵ Significantly, because of the described loss allocation structure, losses large enough to hit an OTC CCP’s default fund are expected to be remote, but at the same time they are also likely to occur during period of extreme market turbulence. This, in turn, means that CMs are most likely to incur losses via their contributions onto the mutualized default fund during periods when they are more vulnerable and can least afford such losses. As explained by Prof. Pirrong, the wrong-way risk problem can operate as a “systemic crisis accelerant, rather than a firebreak: CCP default funds channel losses to large financial institutions

⁸³⁷ See, Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., p. 38, Guidance No. 5.2.47.

⁸³⁸ Id., p. 393.

⁸³⁹ Id., p. 394.

⁸⁴⁰ Ibidem.

⁸⁴¹ Related to the default fund WWR discussed above, is the WWR associated with the activation by an OTC CCP of unfunded liquidity arrangements or other recovery instruments. Hence, calls by OTC CCPs for additional resources may impose significant liquidity and financial strains on CMs right at the time when they can bear them less. The pressure to raise additional resources may, thus, result into a cascade of defaults of CMs. In this sense, see Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit.; Alexandra Heath, Gerard Kelly and Mark Manning, *Central Counterparty Loss Allocation and Transmission of Financial Stress*, Economic Group Payments Policy Department Reserve Bank of Australia, Research Discussion Paper No. 2015-02 (2015).

⁸⁴² See, Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 263.

⁸⁴³ See, Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.

⁸⁴⁴ Ibidem.

⁸⁴⁵ Ibidem.

precisely when they are under financial stress.”⁸⁴⁶ Therefore, “[t]he major risk that CCPs face might arise right from system-wide, common shocks where if one firm defaults, others are at elevated risk of default too. In such a scenario, even if a CCP doesn’t fail, the CCP members will be required to absorb default losses (through the mutualized default fund) precisely at the time when they are in very bad financial straits. At that point mutualization isn’t of much help and it might even actually make things worst.”⁸⁴⁷ This is a key point since OTC CCPs have been mostly sold as “breakers” that can reduce systemic risk and protect the system by containing financial firestorms.⁸⁴⁸ Contrary, the above analysis suggests that OTC CCPs may be most vulnerable to failure precisely during stressed financial conditions.⁸⁴⁹

Finally, a number of effects associated with stressed financial conditions can also create dependencies that give rise to WWR. First, big financial shocks are often associated with large price movements, which can cause exposures on derivatives trades to raise significantly,⁸⁵⁰ and large increases in volatility, which can exaggerate movements in exposures and creditworthiness.⁸⁵¹ Second, big financial shocks are often associated with price correlations nearly equal to one and minus one, which can have two effects: a direct effect represented by a large change in the mark-to-market values on correlation-sensitive positions (e.g., CDOs, multiproduct options), and an indirect effect represented by a significant increase in WWR.⁸⁵² Third, period of financial and economic crises are also associated with sharp declines in liquidity, which, in turn, can cause sharp increases in volatilities and can make it extremely difficult to manage and reduce risk exposures.⁸⁵³

6.11. Multilateral Netting

A major point made by policymakers and regulators when promoting the use of central clearing for OTC derivatives is that OTC CCPs can facilitate multilateral netting, which, in turn, can help mitigate systemic risk by reducing the aggregate exposure in the OTC derivatives market. This section will challenge this approach. The analysis is two-fold: the first part of this section investigates the

⁸⁴⁶ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 29-30.

⁸⁴⁷ See, e.g., Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.; Craig Pirrong, *You Can’t Mutualize, Insure, or Diversify Systematic Risk*, cit.

⁸⁴⁸ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 28.

⁸⁴⁹ Id., p. 27 (noting that “in crisis periods, dependencies between the value of the backers of CCPs—the member firms (often banks)—and the exposures that CCPs are effectively writing protection against are highly likely to be of the wrong-way variety.”).

⁸⁵⁰ See, e.g., Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.; Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 26.

⁸⁵¹ Ibidem. See, also, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 13 (noting that “[t]he nonlinearity (in counterparty risk) means that expected default losses depend on the volatilities of the underlying risk factors, the correlations among these volatilities, jump risks in any of the underlying factors, and other factors that affect the joint probability distribution of the various risk factors. The market value of the default losses depends on all these factors; it also depends on the covariance between the default losses and the marginal value of consumption. This covariance can have a material effect on the market value of these losses. If defaults tend to occur when the marginal value of consumption is high (e.g., dealers tend to fail during a market crash), the covariance effect can magnify the market value of the default losses. The optionality of default exposures can exaggerate this effect further.”); Izabella Kaminska, *Wall Street’s next top model*, FT Alphaville (August 2, 2011).

⁸⁵² See, Craig Pirrong, *Wrongway Peachfuzz Returns to Wall Street?*, cit.

⁸⁵³ Ibidem (noting that “[t]hese dependencies can be especially exaggerated for certain kinds of products and CCPs.”); Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 27.

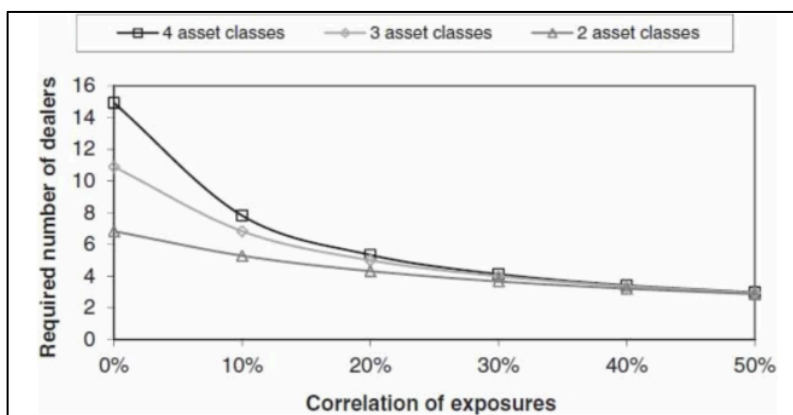
question of how central clearing of OTC derivatives affects netting benefits, with focus on the reduction of counterparty risk exposures; the section part of this section will consider the interaction between OTC CCPs and the broader financial system and will discuss redistributive effects of multilateral netting.

6.11.1. Multilateral Netting and Counterparty Credit Risk Exposure

Duffie and Zhu were among the first to empirically address the question of whether central clearing for a particular class of OTC derivatives can reduce counterparty exposures.⁸⁵⁴ In their study, the authors show that the degree of netting efficiency produced by CCP (relative to bilateral markets) depends on how central clearing is organized across different financial market segments and participants.⁸⁵⁵ In particular, Duffie and Zhu’s simulations show that introducing a CCP for a particular derivatives class is effective only to the extent that the opportunity for multilateral netting in that class dominates the resulting loss in bilateral netting opportunities across uncleared derivatives from other asset classes. These findings evidence that average counterparty exposures is reduced if, and only if, the number of clearing participants is sufficiently large relative to the exposure on derivatives that continue to be bilaterally netted. Moreover, the authors also show that, when multiple derivatives classes are cleared, it is more efficient to have a single CCP that jointly clears them rather than having multiple separate CCPs that clear their respective classes.

Figure 40 below illustrates the findings from Duffie and Zhu’s analysis. Results are plotted as a function of correlation and number of asset classes. The figure shows that, for example, for four uncorrelated asset classes, there must be at least 15 members to make clearing a single asset class through the CCP valid (in terms of exposure reduction).

Figure 40. Required number of members for a single asset class CCP to improve netting efficiency calculated using the formula of Duffie and Zhu.



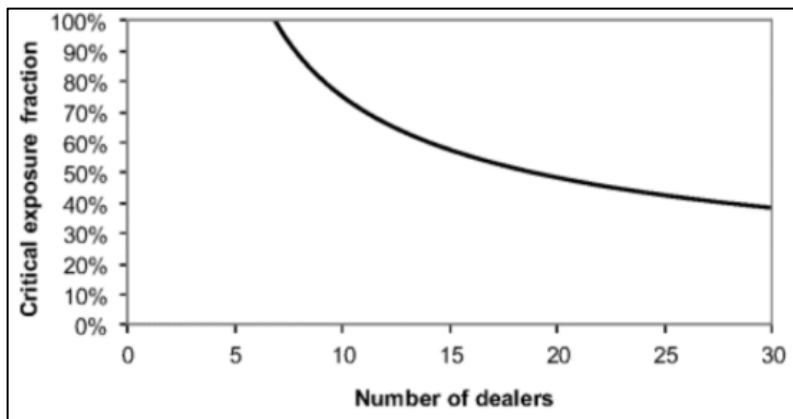
Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 72.

⁸⁵⁴ See, Darrell Duffie and Haoxiang Zhu, *Does a Central Clearing Counterparty Reduce Counterparty Risk?*, cit.

⁸⁵⁵ The findings from Darrell Duffie and Haoxiang Zhu’s study are based on a simplified model, which utilizes simplifying assumption of asymmetry and equal variance of exposure.

The above example assumes equal distribution of exposure across asset classes. Figure 41, further, considers the findings of Duffie and Zhu’s analysis in a non-homogenous scenario. The figure shows the required fraction of dealer’s exposure that must be concentrated in a particular asset class to make a CCP for that asset class viable. For example, with 10 dealers, using a CCP for a given class of derivatives will be effective only if three quarters of the dealers’ bilaterally netted exposure resides in that class of products.

Figure 41. Required fraction of exposure attributed to a single asset class (“critical exposure fraction”) to make a CCP for that asset class effective. The results as a function of the number of members are calculated using the formula of Duffie and Zhu.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 73.

Thus, the study by Duffie and Zhu illustrates that increased netting benefits in a centrally cleared system (compared to a bilateral system) can only be achieved if there is a relatively small number of CCPs clearing a relatively large volume of transactions. In reality, however, fragmentation could be a major problem. As Gregory observes, there are two main sources of fragmentation: first, the existence of multiple CCPs; and second, the existence of non-clearable trades that remain bilateral.⁸⁵⁶ In this respect, Prof. Pirrong notes that jurisdictional issues may also be relevant, at least for two reasons. First, certain jurisdictions may view it as important to have their own “local” OTC CCPs. Hence, for instance, regulators and policy makers in certain jurisdictions require that derivatives denominated in their own currencies, or traded by entities subject to their authority, be cleared via OTC CCPs domiciled in their respective jurisdictions.⁸⁵⁷ Second, market participants may also show a preference to clear a particular derivatives product in a certain jurisdiction, due to the more favorable bankruptcy regime of that country.⁸⁵⁸ Consistent with the observations made by Gregory and Prof. Pirrong, Prof. Murphy notes that OTC CCPs also tend to act

⁸⁵⁶ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 72-73.

⁸⁵⁷ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 41.

⁸⁵⁸ *Ibidem*.

as vertical structures and to specialize in certain product types (e.g. IRS or CDS).⁸⁵⁹

As a result, the described factors, among others, lead to a market characterized by the existence of multiple OTC CCPs domiciled in various jurisdictions, multiple OTC CCPs utilized to clear different asset classes, and certain OTC derivatives whose trading remain bilateral. This is illustrated in Figure 37 in section 6.4 above.

The scenario illustrated in Figure 37 can generate severe destabilizing effects:

- First, the maximum level of netting benefits theoretically available is reduced,⁸⁶⁰ and this, in turn, decreases the efficiency of capital utilization and increases the costs and risks of position replacement in the event of default.⁸⁶¹
- Second, close-out netting possibilities and efficiencies from portfolio margining are also diminished.⁸⁶²
- Third, regionalization of global liquidity pools is also created, which can reduce liquidity, increase the costs of trading, and preclude the realization of scale and scope economies.⁸⁶³

Significant, in a recent study, Singh shows that in presence of multiple CCPs that are not linked to each other, the benefits of netting are reduced because cross-product netting cannot take place.⁸⁶⁴ To maximize netting benefits across multiple CCPs, Singh suggests considering three mechanisms: interoperability,⁸⁶⁵ multilateral cross-guarantee agreements, and unlimited calls.⁸⁶⁶ In particular, Singh notes that interoperability could allow two parties to a

⁸⁵⁹ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 2; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 41.

⁸⁶⁰ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 2.

⁸⁶¹ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 42.

⁸⁶² *Ibidem*.

⁸⁶³ For a thoughtful analysis of fragmentation of liquidity pools, see International Swaps and Derivatives Association (ISDA), *Cross-Border Fragmentation of Global Interest Rate Derivatives: Second Half 2015 Update*, International Swaps and Derivatives Association Research Note (2016); International Swaps and Derivatives Association (ISDA), *Cross-Border Fragmentation of the Global Interest Rate Derivatives: The New Normal?*, International Swaps and Derivatives Association Research Note (2015); International Swaps and Derivatives Association (ISDA), *Cross-Border Fragmentation of Global Derivatives: End-Year 2014*, International Swaps and Derivatives Association Research Note (2015); International Swaps and Derivatives Association (ISDA), *Cross-Border Fragmentation of Global OTC Derivatives: An Empirical Analysis*, International Swaps and Derivatives Association Research Note (2014); International Swaps and Derivatives Association (ISDA), *Made-Available-to-Trade (MAT): Evidence of Further Market Fragmentation*, International Swaps and Derivatives Association Research Note (2014); International Swaps and Derivatives Association (ISDA), *Revisiting Cross-Border Fragmentation of Global OTC Derivatives: Mid-year 2014 Update*, International Swaps and Derivatives Association Research Note (2014); International Swaps and Derivatives Association (ISDA), *Dispelling Myths: End-User Activity in OTC Derivatives*, International Swaps and Derivatives Association Research Study (2014).

⁸⁶⁴ See, Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market*, cit.. See, also, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p. 2.

⁸⁶⁵ From a legal point of view, Interoperability would require novating the original contract into three agreements: two agreements, each between one original counterparties and the CCP of its choice, and one agreement between the two CCPs. In theory, this would give, at the level of each CCP, a CCP access to collateral from another CCP to which the former is linked. Moreover, if a CCP fails then the surviving CCPs linked to it would be responsible to fulfill the contractual obligations resulting from the linkage.

⁸⁶⁶ See, Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market*, cit., pp. 8-9. See, also, Nicholas Garvin, *Central Counterparty Interoperability*, Reserve Bank of Australia, Bulletin, pp. 59-68 (2012); Nathanael

derivatives transaction (CM_1 and CM_2) to clear through their own CCP (CCP_1 and CCP_2 , respectively), without the need to establish any contractual relationship between CM_1 and CCP_2 and CM_2 and CCP_1 . As a result, parties to derivatives transactions would be allowed to concentrate their portfolio at their CCP of choice, regardless of the CCP chosen by its trading counterparty.⁸⁶⁷ Notwithstanding these benefits, in practice, interoperability does create a number of challenges:⁸⁶⁸

- First, given the global nature of the OTC derivatives market, interoperability requires great cross-border alignment among regulatory regiments and bankruptcy rules to avoid regulatory arbitrage.⁸⁶⁹
- Second, as Singh acknowledges, it is unlikely that a CCP domiciled in a country would be allowed access to collateral posted to a CCP located in another country.⁸⁷⁰
- Third, when implemented, interoperability creates the need to manage the exposures and risks that connected CCPs would have to each other.⁸⁷¹ In particular, the concern is that interoperability arrangements may channel and transmit default losses arising at one CCP onto other CCPs, thus, increasing systemic instability.⁸⁷²

Consistent with the view expressed by Singh is a more recent study by Rodney Garrett and Peter Zimmerman.⁸⁷³ Garrett and Zimmerman consider network structures with particular focus on scale-free and core-periphery structures, which are a more accurate representation of real-world financial networks than the model considered by Duffie and Zhu discussed above. In their study the authors show that when the link structure of the network relies on relatively few key nodes, then a CCP is unlikely to be beneficial. In particular, Garrett and Zimmerman demonstrate that in large scale-free networks expected net exposures always increase when a single asset is novated to a CCP. In such a

Cox, Nicholas Garvin and Gerard Kelly, *Central Counterparty Links and Clearing System Exposures*, Reserve Bank of Australia, Research Discussion Paper No. 2013-212 (2013); Stacey Anderson, Jean Philippe Dion and Hector Perez Saiz, *To Link or Not to Link? Netting and Exposures Between Central Counterparties*, Journal of Financial Market Infrastructures, Vol. 1, No. 4, pp. 3–29 (2013); Jurg Magerle and Thomas Nellen, *Interoperability between Central Counterparties*, Swiss National Bank, Working Paper No. 2011-12 (2011); George Kalogeropoulos, Daniel Russo and Andreas Schonenberger, *Link Arrangements of CCPs in the EU - Results of an ESCB Survey*, in European Central Bank (ECB) and Federal Reserve Bank of Chicago (FED Chicago), *The Role of Central Counterparties*, Issues Related to Central Counterparty Clearing, ECB and FED Chicago Conference (2007), pp. 50-60.

⁸⁶⁷ See, Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market*, cit., p. 8. See, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 143-144 (discussing benefits associated with interoperability arrangements (e.g., lower operation costs, lower margin costs, and higher netting benefits) and noting that “[o]ne example of the need for interoperability is the need for a linkage between a global and local CCP so as to support trading between a global bank with a local bank. Another example would be a linkage between two CCPs clearing different products to provide margin benefits via cross-margining”).

⁸⁶⁸ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 42.

⁸⁶⁹ See, Scott O’Malia (Chief Executive Officer International Swaps and Derivatives Association), Testimony before the US House of Representatives Committee on Agriculture (July 29, 2015) (arguing that limited cross-border regulatory coordination and the lack of consistency in the timing and substance of national-level rules for OTC derivatives may create additional complexities and further affect market participants’ trading behavior).

⁸⁷⁰ See, Manmohan Singh, *Collateral, Netting and Systemic Risk in the OTC Derivatives Market*, cit., p. 8.

⁸⁷¹ Id., pp. 12 seq; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 144.

⁸⁷² Ibidem.

⁸⁷³ See, Rodney Garrett and Peter Zimmerman, *Does Central Clearing Reduce Counterparty Risk in Realistic Financial Networks?*, Federal Reserve Bank of New York, Staff Reports No. 717 (2015).

case, CCPs can improve netting efficiency only if agents have some degree of risk aversion that allows them to trade off the reduced variance against the higher expected netted exposures. This, as the authors suggest, may explain why derivatives market participants have long resisted the use of central clearing.

Thus, the findings of the studies discussed above suggest that it is extremely difficult to determine a priori whether central clearing mandates increase or reduce netting economies: OTC CCPs can increase netting benefits by facilitating multilateral netting, but, at the same time, they can also reduce netting benefits due to splitting of netting sets.⁸⁷⁴ As acknowledged by Prof. Murphy, “[t]he impact of OTC derivatives central clearing on the amount of counterparty credit risk in the financial system is unclear.”⁸⁷⁵ This, in turn, means that an examination of the impact of clearing mandates on netting benefits in terms of increase/reduction in counterparty credit risk exposures in the OTC derivatives market can provide little insights on the system-wide effects of multilateral netting through OTC CCPs. Because of this, the following subsection will extend the analysis by examining the distributive effects of changes in netting efficiency caused by clearing mandates across the entire financial system.

6.11.2. Multilateral Netting and Redistributive Effects

In a recent study, Prof. Roe notes that multilateral netting and setoff through OTC CCPs reduce risk for cleared derivatives transactions at the expense of creditors in transactions that are not handled by OTC CCPs.⁸⁷⁶ In particular, netting and setoff through OTC CCPs alter creditor priority by increasing the priority of the OTC CCP and the derivatives counterparties over other claimants on a defaulted CM, thus limiting the assets available to the latter in the event of the CM’s bankruptcy. In so doing, multilateral netting and setoff through OTC CCPs redistribute value from one group of creditors to other creditors and re-allocate risks of losses from one set of claimants to another.⁸⁷⁷ This means that multilateral netting and setoff through OTC CCPs protect one group of creditors (the defaulted CM’s derivatives counterparties) at the expense of others (the defaulted CM’s non-derivatives creditors).⁸⁷⁸

The distributive effect discussed by Prof. Roe has important systemic risk-related implications. Because of the redistributive effect, multilateral netting and setoff

⁸⁷⁴ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 8.

⁸⁷⁵ See, David Murphy, *The Possible Impact of OTC Derivatives Central Clearing on Counterparty Credit Risk. Illustrative Examples and their Implications for Policy*, cit., p.2.

⁸⁷⁶ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit. pp. 1663-1665. In this sense, see, also, Rama Cont and Thomas Kokholm, *Central Clearing Of OTC Derivatives: Bilateral vs. Multilateral Netting*, cit.; Svetlana Borovkova and Hicham Lalaoui El Mouttalibi, *Systemic Risk and Centralized Clearing of OTC derivatives: A Network Approach*, Working Paper (2013).

⁸⁷⁷ See, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 54-55; Mark J. Roe, *The Derivatives Market's Payment Priorities as Financial Crisis Accelerator*, cit., p. 587.

⁸⁷⁸ See, e.g., Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 25-33; Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 10; Craig Pirrong, *An Elegant Answer to the Wrong Question (or an Incomplete One)*, Streetwise Professor Blog (March 30, 2015); Craig Pirrong, *Where Have You Read This Before?*, Streetwise Professor Blog (July 11, 2015); Mark J. Roe, *Clearinghouse Overconfidence*, cit. pp. 1663-1665; 1672-1675.

through OTC CCPs affect the distribution of losses among the creditors of the defaulting CM, but they do not affect the aggregate magnitude of the losses.⁸⁷⁹ As a result, multilateral netting and offset through OTC CCPs do not necessarily reduce systemic risk, nor they necessarily make the whole system safer. Hence, the transfer of risk of losses from inside to outside the cleared system could be systemically damaging if the risk is transferred to parties that are as systemically important and as vulnerable as (or more systemically important and more vulnerable than) OTC derivatives market participants. In such a case, multilateral netting and offset through OTC CCPs may even exacerbate systemic risk.⁸⁸⁰

The Modigliani and Miller Theory can help understand the described systemic risk-related implications.⁸⁸¹ As noted by Prof. Roe, the Modigliani-Miller capital structure irrelevance theorem⁸⁸² and the clearinghouse-setoff analysis are conceptually parallel: an OTC CCP does not in itself reduce systemic risk, rather it transfers the loss arising from the default of one of its CMs to other creditors of the defaulting CM, without changing the financial system's overall exposure. If the other creditors to which the risk has been transferred are systemically unimportant, or financially more resilient, or better able to bear the risks, then, systemic risk is reduced. Contrary, if the other creditors are systemically important market participants, or financially less stable, or incapable of bearing the risks, then systemic risk is not mitigated and is perhaps even increased.⁸⁸³

As a result, it is a very much open to question whether the described reallocation is systemically stabilizing, or is instead a means whereby one relatively concentrated group of market participants (the OTC derivatives market players) can advantage themselves at the expense of others.⁸⁸⁴

⁸⁷⁹ See, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., p. 55 (noting that although multilateral netting through a CCP can reduce counterparty losses on derivative trades, it does not reduce counterparty losses overall).

⁸⁸⁰ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 25-26; See, Craig Pirrong, *The Economics of Clearing in Derivatives Markets: Netting, Asymmetric Information, and the Sharing of Default Risks Through a Central Counterparty*, cit., pp. 4, 5, 53 seq. (noting that "[d]ue to the distributive effects of clearing, and its effect on the pricing of default risk, it is not necessarily true that formation of a CCP reduces systemic risk. Indeed, it can increase systemic risk under some circumstances." Hence, he observes that "[t]o the extent that other creditors are financial institutions whose failure could pose systemic risks, it is not necessarily true that it is better to shift the burden of default from dealers to other creditors. A CCP might save dealers, but bankrupt others. These bankruptcies could have a larger external effect than the bankruptcies of dealers avoided by netting."); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 63; Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, cit., p. 447 (arguing that CCPs "merely effectuate a risk transfer from creditors inside the clearinghouse to creditors outside the clearinghouse."); Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., p. 2 (noting that "from an economic perspective, it is the risk transfer that matters for CCP clearing: it leads to a change in exposures against counterparty risk for market participants, but need not necessarily amount to a full guarantee of the trades."); Kent Cherny and Ben R. Craig, *Reforming the Over-the-Counter Derivatives Market: What's To Be Gained?*, Federal Bank of Cleveland, Economic Commentary, No. 2010-6 (2010), pp. 1, 4-5; Hal S. Scott, *The Reduction of Systemic Risk in the United States Financial System*, Harvard Journal of Law and Public Policy, Vol. 33, No. 2, pp. 671, 686-688 (2010) (noting that "[c]learinghouses can reduce but not eliminate systemic risk.").

⁸⁸¹ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., pp. 1672-1674.

⁸⁸² In their famous proposition 1, Modigliani and Miller show that (assuming there are no taxes, information asymmetries, transactional costs or costs of financial distress) the market value of any firm is independent of its capital structure. See, Franco Modigliani and Merton Miller, *The Cost of Capital, Corporation Finance and the Theory of Finance*, American Economic Review, Vol. 48, No. 3, pp. 261-297 (1958). See, also, Richard A. Bradley, Steward C. Myers and Franklin Allen, *Principles of Corporate Finance*, McGraw-Hill Irwin, 10th ed. (2011), pp. 418-439; William J. Carney, *Corporate Finance: Principles and Practice*, Foundation Press, 2nd ed. (2010), pp. 226 seq.

⁸⁸³ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., pp. 1672-1674.

⁸⁸⁴ See, Craig Pirrong, *CCPs & RTGS: Devil Take the Hindmost?*, Streetwise Professor Blog (January 31, 2016).

The uncertainty about the net effects of changing priorities among creditors caused by OTC CCPs is further increased by the fact that the changes in priority will also likely trigger changes in capital structures, and the pricing of debt and equity.⁸⁸⁵ It is very difficult to make any predictions on how post-central clearing mandate capital structures will look like and how fragile these structures will be.⁸⁸⁶ However, as Prof. Pirrong acknowledges, it is reasonable to argue that clearing mandates will induce adjustments in the capital structures throughout the financial system, and that these adjustments will affect the stability of the system as a whole.⁸⁸⁷ Thus, as Prof. Pirrong concludes, “analyses of netting that make assertions about the effects of netting on systemic risk that are based solely on its effects on derivatives counterparties, and which do not take into account the redistributive effects of netting for a given capital structure, and fail to consider how mandated derivatives netting will affect capital structures throughout the financial system, are flawed. They are flawed because they ignore the full systemic effects of netting driven by CCP mandates.”⁸⁸⁸

6.12. Margins

Chapter 5 has examined the benefits of margining through central clearing of OTC derivatives: increased and more rigorous margining reduces the risk that a party to a derivatives transaction will suffer losses due to its counterparty’s default and this, in turn, helps reduce the risk that the insolvency or illiquidity of a major derivatives market participant would trigger the insolvency or illiquidity of other derivatives market participants.

However, there are strong arguments to believe that the above analysis is flawed. First, the analysis seems to lose sight of counterparty risk as an intersection of other types of financial risks, and, in so doing, it does not properly account for the fact that mitigating counterparty risk through strict margins can create other types of risks, including liquidity risk and operational risk. In addition, the analysis seems to ignore (or at least underestimate) the incentives for market participants to adjust their capital structure in response to increased margin requirements, and the impact that the induced changes on capital structures may have on the stability of the financial system as whole. The remaining of this section will address these points in detail.

6.12.1. Margins and Redistributive Effects

Similar to what previously discussed with respect to multilateral netting, the provisions that regulate the posting and seizure of margins at OTC CCPs effectively benefit one set of creditors (the defaulting CM’s derivatives counterparties) at the expenses of others claimants. This is because, these provisions increase the priority of derivatives contracts in the context of

⁸⁸⁵ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 11.

⁸⁸⁶ Id., pp. 11-12.

⁸⁸⁷ Ibidem.

⁸⁸⁸ Ibidem.

bankruptcy of a CM, relative to other claims on such CM.⁸⁸⁹ As noted by Prof. Roe, the margin that the OTC CCPs obtain is essentially value denied to other creditors of the CMs posting the margin.⁸⁹⁰ These changes in priorities and the associated redistribution of value are not obviously systemically risk reducing. In particular, they have the positive effect of reducing the risk of default losses on derivatives transactions, which, in turn, helps limit the risk of failure of systemically important CMs; but, they have also the negative effect of increasing the counterparty credit losses incurred by other non-derivatives creditors, who might themselves be systemically important institutions.

The above observation is important for two reasons:

- First, it suggests that increased and more rigorous margining does not eliminate risks, rather it transfers risks from the cleared OTC derivatives market to other parts of the financial system.
- Second, it suggests that increased and more rigorous margining may help restrict one channel of contagion, but at the same time it may open up other (perhaps more dangerous) channels of contagion. This could occur in a number of ways. For instance, margins increase the likelihood that non-derivatives claimants may default or may incur significant liquidity strains, which, in turn, may negatively affect their counterparties. Moreover, although margins reduce the incentives of derivatives counterparties to run on the defaulting CM, they also increase the incentive of non-derivatives claimants to run on such CM.⁸⁹¹

As a result, a priori it is not evident whether increased and more rigorous margining will lead to a more or less risky financial system.⁸⁹² To explain this point Prof. Pirrong uses the metaphor of flood control.⁸⁹³ He observes that, “[b]uilding up a levee around a particular city protects that city ... but the rising water has to go somewhere. So raising the levees in one place makes the flooding problem worse somewhere else. Legislators and regulators seem obsessed with raising the levees around Derivatives City, without regard as to how this will affect where the water goes and who gets flooded ... It could well be the case that keeping Derivatives City high and dry results in even more devastating flooding in other, less privileged precincts ... There are of course

⁸⁸⁹ See, e.g., Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 25; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 93-100; Jon Gregory, *The Impact of Initial Margin*, Working Paper (2016).

⁸⁹⁰ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1664.

⁸⁹¹ See, Jon Gregory, *The Impact of Initial Margin*, cit. (using a structural model to illustrate the wealth transfer effect of OTC CCPs' margining).

⁸⁹² See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 15; Craig Pirrong, *CCPs & RTGS: Devil Take the Hindmost?*, cit.; Craig Pirrong, *Is There an Echo in Here?*, Streetwise Professor Blog (June 4, 2011); Craig Pirrong, *When the Levee Breaks*, Streetwise Professor Blog (June 8, 2011); Craig Pirrong, *There *Is* an Echo in Here*, Streetwise Professor Blog (June 8, 2011).

⁸⁹³ See, e.g., Craig Pirrong, *When the Levee Breaks*, cit.; Craig Pirrong, *There *Is* an Echo in Here*, cit.; Craig Pirrong, *The Fifth Year of the Frankendodd Life Sentence*, Streetwise Professor Blog (July 21, 2015); Craig Pirrong, *When the Levee Breaks, Redux*, Streetwise Professor Blog (April 5, 2012); Craig Pirrong, *Cleaning Up After the Dodd, Frank & Gensler Circus*, Streetwise Professor Blog (September 8, 2014). See, also, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 320 (arguing that “[a] CCP can be thought of as the financial analogue of a dam which prevents rising water upstream from causing flooding downstream. One problem with dams is that if they fail, those they are meant to protect can suffer significant distress. Similarly CCPs can both mitigate systemic risk and — if they become stressed — spread it. They may also cause systemic risk through their policies, as will be demonstrated.”).

differences. A river system is more mechanical than a financial system. But that actually makes the situation more fraught in financial markets. Market participants will respond to the privileging of one class of claim—such as derivatives—by adjusting their behavior, by adjusting what they trade, their capital structures, etc.”⁸⁹⁴

6.12.2. Margins, Liquidity Demand, and Changes to Capital Structures

Increased and more rigorous margin requirements create significant liquidity funding needs, particularly when margins cannot be reutilized (re-hypothecated) and/or must be segregated.⁸⁹⁵ This, in turn, can cause significant changes to the demand for liquidity and the mechanisms for supplying such liquidity.⁸⁹⁶

Moreover, to mitigate the impact of increased and more rigorous margining on OTC derivatives transactions, market participants may be induced to adjust their capital structures.⁸⁹⁷ This is an important point from a systemic-risk perspective. As noted by Prof. Pirrong, increased and more rigorous margin requirements can reduce the credit exposure in one set of financial contracts of a CM, but they do not necessarily decrease the CM’s total credit exposure because the CM can adjust its remaining set of financial contracts to offset, in whole or in part, the effect of increased and more rigorous margining of the one set.⁸⁹⁸ Similarly - as Prof. Pirrong further notes - although increased and more rigorous margin requirements help reduce credit exposures in derivatives transactions, they do not necessarily lead to a decline in the total credit exposures in the whole system because market participants can add leverage elsewhere.⁸⁹⁹

A study by Mello and Parsons helps understand the observations made by Prof. Pirrong.⁹⁰⁰ The authors show that a non-margined derivative transaction is equivalent to a margined derivative transaction and a line of contingent credit to fund the margin granted by the counterparty. The total credit exposure in the two scenarios is unchanged. More recent studies have further investigated this point. For instance, Albanese et al. show that more rigorous margin requirements can incentivize margin lending, whereby a third-party finance the required margin

⁸⁹⁴ See, Craig Pirrong, *When the Levee Breaks*, cit.

⁸⁹⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 94.

⁸⁹⁶ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 3, 6, 35; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 98-100, 107-108, 261-264 (discussing how collateral converts counterparty risk into create funding liquidity risk and explaining why this conversion, although beneficial in normal times, can be extremely dangerous in abnormal markets where liquidity is poor.).

⁸⁹⁷ See, Craig Pirrong, *It’s Contagion, Stupid-Not Interconnectedness*, Streetwise Professor Blog (November 21, 2012); Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 25 seq.

⁸⁹⁸ Cf., Pirrong Craig, *The Inefficiency of Clearing Mandates*, cit., pp. 25-26; Pirrong Craig, *Clearing and Collateral Mandates: The New Liquidity Trap?* cit., pp. 68-69; Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 15-16; Craig Pirrong, *The Clearinghouse Cure*, cit., pp. 49-50; Pirrong Craig, *The Economics of Clearing: Theory and Practice*, cit., p. 35-36; Craig Pirrong, *Clearing Angst: Here Be Dragons Too*, cit.; Craig Pirrong, *The Corps of Financial Engineers*, Streetwise Professor Blog (March 17, 2012).

⁸⁹⁹ Ibidem.

⁹⁰⁰ See, Antonio Mello and John Parsons, *Margins, Liquidity, and the Cost of Hedging*, Working Paper, MIT Center for Energy and Policy Research No. 005 (2012).

posting.⁹⁰¹ Similarly, a recent study by Prof. Murphy shows that more rigorous margin requirements can incentivize “collateral transformation,” thereby a party to a derivatives trade borrows cash (or other eligible assets) from a margin lender (a CM of a third-party) for margin posting purposes in exchange for assets that cannot be posted as margin at the OTC CCP.⁹⁰² Thus, these studies suggest that the decrease in credit exposure caused by increased and more rigorous margin at OTC CCPs may be smaller than the proponents of central clearing for OTC derivatives have long suggested.

Related to the point discussed above is the observation that margin lending and collateral transformation can contribute systemic instability to the financial system. This could occur in a number of ways:

- First, margin lending and collateral transformation increase interconnectedness within the financial system.⁹⁰³ Prominent scholars have investigated this point. For instance, Prof. Murphy observes that “collateral transformation ... increase[s] interconnectedness thanks to the transformation trade.”⁹⁰⁴ Similarly, Prof. Pirrong observes that the introduction of clearing mandates and the enforcement of strict margins requirements will create the incentive for market participants to enter into arrangements to secure the necessary liquidity.⁹⁰⁵ These arrangements, in turn, may affect the topology of the system and increase its interconnectedness. As the author suggests, the resulting changes may be significant and may lead to a financial market structure as fragile and as vulnerable to large shocks as (if not even more fragile and more vulnerable to large shocks than) the one existing before the introduction of central clearing mandates.⁹⁰⁶
- Second, margin lending and collateral transformation can create serious operational issues. This is because margin funded by credit payments are not frictionlessly and instantaneously recycled.⁹⁰⁷ The resulting timing

⁹⁰¹ See, Claudio Albanese, Fernanda D’Ippoliti and Giacomo Pietronero, *Margin Lending and Securitization: Regulators, Modeling and Technology*, Working Paper (2011). See, also, Claudio Albanese, Damiano Brigo and Frank Oertel, *Restructuring Counterparty Credit Risk*, Deutsche Bundesbank Discussion Paper No. 14/2013 (2013).

⁹⁰² See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 162-163 (noting that, to mitigate its risk, the margin lender usually requires the borrower to overcollateralize its exposure).

⁹⁰³ Recently, major regulators and supervisory authorities have warned about the dangers of margin lending and collateral transformation. See, e.g., Jeremy C. Stein (former Member of the Board of Governors of the Federal Reserve System), *Overheating in Credit Markets: Origins, Measurement, and Policy Responses*, Speech at the “Restoring Household Financial Stability after the Great Recession: Why Household Balance Sheets Matter” research symposium sponsored by the Federal Reserve Bank of St. Louis, St. Louis, Missouri (February 7, 2013); Committee on Payments and Market Infrastructures (CPMI), *Developments in Collateral Management Services*, Bank for International Settlements (2014). For recent articles discussing margin lending and collateral transformation, see, e.g., Bradley Keoun, *Big Banks Hide Risk Transforming Collateral for Traders*, Bloomberg (September 11, 2012); Tracy Alloway, *Wall Street’s latest idea. Banks have high hopes for the collateral transformation business – but regulators are raising concerns*, Financial Times (March 4, 2013); Nick Sawyer, *Collateral transformation needs to be carefully planned by clearing members*, says Isda’s O’Connor, Risk.net (July 12, 2011).

⁹⁰⁴ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 163.

⁹⁰⁵ See, Craig Pirrong, *It’s Contagion, Stupid-Not Interconnectedness*, cit.

⁹⁰⁶ Ibidem. See, also, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., p. 33.

⁹⁰⁷ See, Craig Pirrong, *Clearing Mandates: Would That Regulators Had Remembered Takeoffs are Optional, But Landings Are Not*, Streetwise Professor Blog (December 7, 2015).

mismatches can, thus, add significant complexity to the system and further exacerbate the need for liquidity and credit.

- Third, margin lending, collateral transformation and related structures pose significant risks of liquidity contagion. As noted by Gregory, as the credit quality of the borrower decreases, the cost of margin lending will increase with the effect that the borrower will no longer be able to bear such costs right at the time when it is under most severe financial or economic constraints.⁹⁰⁸ Moreover, the assets pledged by the borrower in exchange for cash (or other assets eligible for margin purposes) will become extremely risky and illiquid during periods of severe market crises and, although subject to increasing “haircuts”, they will likely be severely impacted by the crises.⁹⁰⁹ As warned by Prof. Pirrong, these mechanisms can generate dangerous instability into the system: while market volatility jumps, funding capacity drops and market participants that have borrowed money (or other margin eligible assets) are forced to sale assets at depressed prices, which further exacerbate the funding cycle.⁹¹⁰

6.12.3. Margins, Transformative Effects, and Feedbacks

As discussed in Chapter 2, collateral and margining mechanisms can transform credit risk into liquidity risk. This risk transformation, in turn, can generate liquidity pressures on CMs and ultimately trigger negative feedbacks, including deleveraging, fire sales, and runs.⁹¹¹ As observed by Prof. Pirrong, negative feedbacks may arise “during periods of market stress, particularly when the collateralization mechanism is rigid and it operates on a precise time schedule as is the case of OTC CCPs.”⁹¹²

Both initial margin and variation margin can generate destabilizing feedback mechanisms.⁹¹³

⁹⁰⁸ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 258-259, 262 (analyzing this issue from the perspective of valuation adjustments components faced by banks and concluding that “[t]he bottom line is that margin redistributes counterparty risk and converts it into other financial risks. It is not completely clear that this redistribution and conversion is beneficial to financial markets generally.”). See, also, Jon Gregory, *Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets*, cit. (comparing CVA and FVA as a function of the margining and showing that a bilateral margin agreement (no initial margin) is most optimal from a price perspective).

⁹⁰⁹ Greater haircuts essentially mean that borrowers need to provide more (and more liquid) collateral than before in order to fund themselves. See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 258-259.

⁹¹⁰ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 16-17. See, also, Craig Pirrong, *The Red Queen’s Race: Financial Regulation Edition*, Streetwise Professor Blog (December 1, 2015); Craig Pirrong, *Creeping Recognition that Regulation Has Created a Liquidity Death Star*, Streetwise Professor Blog (October 24, 2015).

⁹¹¹ See, Craig Pirrong, *The Inefficiency of Clearing Mandates*, cit., pp. 28 seq.; Craig Pirrong, *Creeping Recognition that Regulation Has Created a Liquidity Death Star*, cit.; Craig Pirrong, *Disconnected About Interconnections: Regulators Still Don’t Get the Systemic Risks in Central Clearing*, Streetwise Professor Blog (January 26, 2014) (quoting an article by Andrew Brimmer and arguing that it is liquidity/credit/funding of margin calls for CCPs that can create stresses in the financial system and where the systemic risk of clearing arises). See, also, Andrew F. Brimmer, *Distinguished Lecture on Economics in Government: Central Banking and Systemic Risks in Capital Markets*, *Journal of Economic Perspectives*, Vol. 3, No. 2, pp. 3-16 (1989); Stephen Morris and Hyun Song Shin, *Financial Regulation in a System Context*, *Brookings Papers on Economic Activity* (2008), pp. 229-274.

⁹¹² See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 24. See, also, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 12, 36-37.

⁹¹³ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 17.

- With respect to initial margin, a major danger is represented by procyclicality.⁹¹⁴ The risk is that OTC CCPs may raise margin requirements right at times of market stress (e.g., when volatility or correlations increase). In such a case, CMs that are out of the money and know they can't afford the higher margins will have the incentive to liquidate their assets in anticipation of the margin increases. Their liquidations will, then, exacerbate the selloff and the resulting bigger price move will induce the OTC CCPs to raise margins even more than they would have done otherwise. Moreover, increases in margins by OTC CCPs will create the incentives for market participants to adjust their positions both in the instruments experiencing margin increases and other transactions.⁹¹⁵ These adjustments, in turn, will likely trigger spillover effects on prices in other markets, which will impact collateral requirements in those markets as well. Low market and funding liquidity typically experienced during periods of crisis will then exacerbate this scenario. As noted by Prof. Pirrong, poor market liquidity can worsen the price impact of position changes induced by margin changes, while reduced funding liquidity can increase the position adjustments that result from an increase in margins because under such circumstances it is more expensive to fund the higher initial margin.⁹¹⁶

⁹¹⁴ In particular, margin models based on VAR methodologies could understate the risk in ordinary conditions and amplify it during periods of market turbulence. Cf., e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 75-77; David Murphy, Michalis Vasios and Nicholas Vause, *A Comparative Analysis of Tools to Limit the Procyclicality of Initial Margin Requirements*, Bank of England Staff Working Paper No. 597 (2016); Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., p. 201 (noting that "CCP may create procyclicality effects by, for example, increasing collateral requirements (or haircut) in volatile markets or crisis periods. The greater frequency and liquidity of collateral requirements under a CCP (compared with less uniform and more flexible collateral practices in bilateral OTC markets) could also aggravate procyclicality."); Nicole Abruzzo and Yang-Ho Park, *An Empirical Analysis of Futures Margin Changes: Determinants and Policy Implications*, cit.; David Murphy, Michalis Vasios and Nicholas Vause, *An Investigation into the Procyclicality of Risk-Based Initial Margin Models*, Bank of England Financial Stability Paper No. 29 (2014); Committee on the Global Financial System, *The Role of Margin Requirements and Haircuts in Procyclicality*, CGFS Papers No. 36 (2010); Rama Cont, *The End of the Waterfall: Default Resources of Central Counterparties*, cit., p. 14; Dan Nixon and Amandeep Rehlon, *Central Counterparties: What are They, Why Do They Matter, and How Does the Bank Supervise Them?*, cit., p. 6; Claudio Borio, *Market Distress and Vanishing Liquidity: Anatomy and Policy Options*, Bank of International Settlements (BIS) Working Papers, No. 158 (2004).

⁹¹⁵ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 17-18. See, also, Pirrong, Craig, *Clearing and Collateral Mandates: A New Liquidity Trap?*, cit., pp. 67-73; David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., pp. 325-326 and accompanying notes 30-32; Claudio Borio, *Market Distress and Vanishing Liquidity: Anatomy and Policy Options*, cit.; Kiyotaki, Nobuhiro and Moore, John, *Credit Cycles*, *Journal of Political Economy*, Vol. 105, No. 2, pp. 211-248 (1997); Patrick A. Pintos and Yi Wen, *Excessive Demand and Boom-Bust Cycles*, Federal Reserve Bank of St. Louis, Working Paper 2008-014B (2008); Markus Brunnermeier and Lasse Pedersen, *Market Liquidity and Funding, Liquidity*, *Review of Financial Studies*, cit.; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 263; Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral and Capital*, cit., pp. 106, 177-178, 201, 362.

⁹¹⁶ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 18. See, also, Craig Pirrong, *No Margin for Error*, *Streetwise Professor Blog* (May 09, 2011) (noting that "[t]his is a classic example of the tension between microprudential and macroprudential policies. The information and incentive structures tend to induce microprudentially sensible actions based on the price/volatility taking assumption. But those actions can be destabilizing. CCPs acting in their own self-interest, and those of their clearing members, may not choose the systemically optimal actions."); Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., pp. 817-818 (noting that "[t]he primary goal for regulating financial risk is micro-prudential: maximizing economic efficiency within the financial system. Systemic risk is a form of financial risk, so efficiency should certainly be a goal in its regulation. But systemic risk also represents risk to the financial system itself. Any framework for regulating systemic risk therefore should also include that macro-prudential goal: protecting the financial system itself"); Samuel G. Hanson, Anil K. Kashyap and Jeremy C. Stein, *A Macroprudential Approach to Financial Regulation*, *Journal of Economic Perspectives*, Vol. 25, No. 1, pp. 3-28 (2011).

A recent report by the BIS warns against the described risk of procyclicality.⁹¹⁷ As the report correctly points out, the increased reliance by the financial system on high-quality collateral creates the risk that some market players could become severely collateral-constrained if risk premia rise sharply across the market. Moreover, demands and dispositions of OTC CCPs could trigger large shifts in collateralized markets, thus, contributing risk aversion and exacerbating pressure to reduce leverage procyclically.⁹¹⁸

- With respect to variation margin, the risk is that large price moves may trigger “systemic margin calls.”⁹¹⁹ In such a case, many CMs with losing positions will be required to make large variation margin payments in a very tight frame, and will be forced to raise funds simultaneously. This rush to liquidity will, then, create severe strains for CMs with destabilizing effect for OTC CCPs, as well. Prof. Pirrong explains this point, noting that “[s]ystemic crises are associated with huge price movements ... [which] lead to huge variation margin calls that must be funded either by the sale of assets, or borrowing ... within a very short time window, measured in hours at most. Failure to make a margin call puts the offending party in default to the CCP. If the missed margin payment is sufficiently large, the CCP may be unable to meet its obligations to those with winning positions. This would put the CCP itself into default, with potentially catastrophic consequences for market stability.”⁹²⁰

The needs to fund large margin calls on a rigid time schedule may also cause huge spikes in the demand for liquidity precisely during periods when the availability of liquidity is severely limited.⁹²¹ In addition, the need to raise liquidity to meet large margin calls and the need to reduce (or close) positions because of the inability to meet such margin calls may create tight coupling and can lead to chaotic fire sales that further exacerbate price movements.⁹²² The fire sales of

⁹¹⁷ See, Dietrich Domanski, Leonardo Gambacorta and Cristina Picillo, *Central Clearing: Trends and Current Issues*, cit., pp. 69-70, 72.

⁹¹⁸ Id., p. 72 (noting that “[f]or example, CCPs are now huge players in reverse repo markets. ICE (one of the largest clearers of credit default swap contracts) held some \$68 billion in collateral at end-2014, of which approximately \$40 billion was in cash (Intercontinental Exchange Inc (2015)). LCH.Clearnet Ltd held comparable sums, amounting to \$76 billion and \$30 billion, respectively (LCH.Clearnet Grou (2015)).”). See, also, Committee on Payment and Settlement Systems (CPSS) and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles For Financial Market Infrastructures*, cit. (requiring margin models not to be “overly” procyclical); Committee on Payments and Market Infrastructures (CPMI) and Board of the International Organization of Securities Commissions (IOSCO), *Consultative Report - Resilience and Recovery of Central Counterparties (CCPs): Further Guidance on the PFMI*, cit., pp. 34-37, Guidance No. 5.2.33 - 5.2.44.

⁹¹⁹ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 166; David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 325.

⁹²⁰ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., pp. 18-19.

⁹²¹ Ibidem. See also Matt Cameron, *Clearing members fear \$5 billion intra-day funding burden. The intra-day funding burden*, Risk.net (November 7, 2012).

⁹²² Id., pp. 19-20 (noting that “[d]efaulters’ positions must be hedged and replaced, which can tax trading market liquidity and exacerbate price movements. Even if losing traders do not default, they may so stretch their credit that they must liquidate positions to reduce their exposure to future losses, or liquidate other assets to maintain losing positions. These liquidations can exacerbate price movements and spark a vicious feedback loop. Furthermore, defaulters’ collateral must be liquidated, which can also cause movements in the prices of the assets used as collateral and related assets, resulting in further knock-on effects. These effects are more acute, the less liquid are the markets for the defaulted instruments and the assets used as collateral.”); Craig Pirrong, *An Elegant Answer to the Wrong Question (or an Incomplete One)*, Streetwise Professor Blog (March 30, 2015); Craig Pirrong, *All Pain, No Gain: The CFTC’s Rule on CCP Qualifying Liquid*

assets may have spillover adverse effects that go far beyond derivatives transactions to impact any institution or firm holding the assets subject to fire sales, including those that don't have any (direct or indirect) counterparty exposure to market participants trading cleared derivatives.⁹²³

Uncertainty about the solvency of market participants may induce chaotic information contagion.⁹²⁴ The risk of liquidity strains, deleveraging spirals and fires sales discussed above could be “anticipated” by the market, with the effect of triggering “runs” on derivatives market participants that are perceived as particularly vulnerable. The mere doubts or fear of insolvency or illiquidity of major market participants and/or the OTC CCP may have severe adverse consequences.⁹²⁵ As observed by Pirrong, OTC CCPs typically make fewer risk disclosures and opacity of OTC CCPs can contribute to financial fragility by increasing the risk of runs on OTC CCPs.⁹²⁶ In particular, the risk is that those CMs with winning positions who doubt of other CMs’ solvency (or ability to obtain credit) may attempt to liquidate positions and withdraw funds from OTC CCPs. Similarly, those CMs who fear that the OTC CCP won’t be able to meet its obligations may seek to quickly liquidate their positions. These liquidations, in turn, may exacerbate price volatility, and may result into a severe decline in trading market liquidity.”⁹²⁷

6.12.4. Margins and Wrong-Way Risk

More extensive and rigid margining at OTC CCPs may have also the negative effect of creating “wrong-way risk” (WWR).⁹²⁸ The need to finance large margin calls during a crisis may lead to sharp increases in the demand for liquidity precisely when liquidity supply evaporates. This, in turn, may contribute to the liquidity crises, may cause vicious spirals, and ultimately may increase instability within the financial system.⁹²⁹

6.13. Brexit Margin Calls

As discussed in section 2.4.6, on June 23, 2016, the UK voted to leave the EU (“Brexit”). The Brexit vote inflicted severe stress on CCPs and their CMs.

Resources, Streetwise Professor Blog (November 22, 2013). See, also, Bank of International Settlements, *Asset Ecumbrance, Financial Reform, and the Demand for Collateral Assets*, CGFS Papers No. 49 (2013).

⁹²³ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., pp. 1685-1690; Craig Pirrong, *Disconnected About Interconnections: Regulators Still Don't Get the Systemic Risks in Central Clearing*, cit.

⁹²⁴ See, Mark J. Roe, *Clearinghouse Overconfidence*, cit., p. 1688 (arguing that “[t]hese two contagion channels [that is, system-wide asset price deterioration and system-wide information opacity] were critical in the crisis but clearinghouse liquidity is not designed to address them, and can readily exacerbate in a crisis. We turn in the next section to this drawback, which is severe.”).

⁹²⁵ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 25.

⁹²⁶ *Ibidem*.

⁹²⁷ See, Craig Pirrong, *A Bill of Goods: CCPs and Systemic Risk*, cit., p. 19.

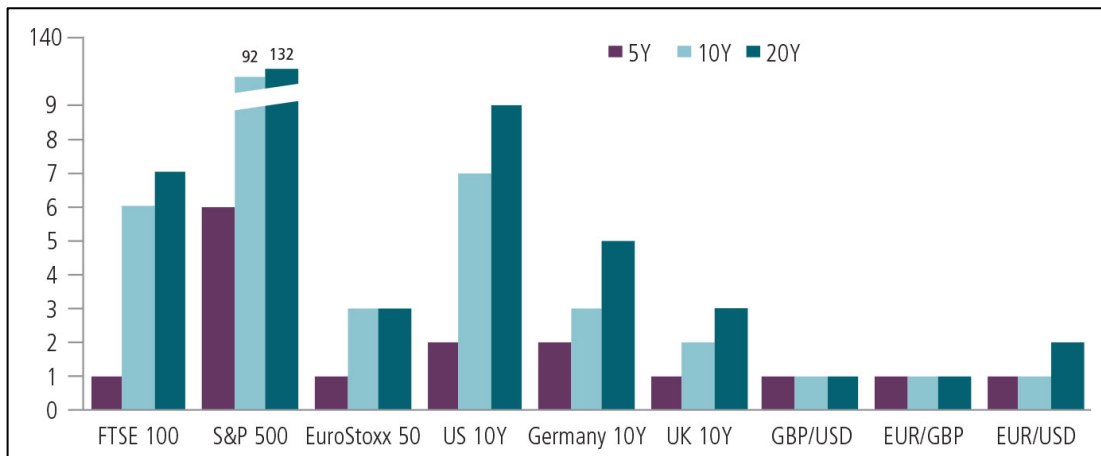
⁹²⁸ See section 6.10 above for further discussion on this point.

⁹²⁹ See, e.g., Craig Pirrong, *Creeping Recognition that Regulation Has Created a Liquidity Death Star*, cit.; Craig Pirrong, *The Fifth Year of the Frankendodd Life Sentence*, cit.; Craig Pirrong, *Clearing Angst: Here Be Dragons Too*, cit.; Craig Pirrong, *Where Have You Read This Before?*, cit.; Craig Pirrong, *When the Levee Breaks*, cit.; Craig Pirrong, *There *Is* an Echo in Here*, cit.

A recent article published on Risk.net indicates that, according to analysis conducted by UBS, a number of assets experienced record-breaking moves on June 24, 2016 (see, [Figure 42](#)):⁹³⁰

- Sterling posted its biggest intra-day trading range in more than twenty years against both the Euro and the US dollar.
- The Euro/US dollar recorded its second-biggest intra-day range in ten years.
- The FTSE 100 and EuroStoxx 50 saw their biggest intra-day moves in five years, as did yields of 10-year UK government bonds.

Figure 42. Relative rank of intra-day range on June 24, 2016.



Note: A rank of 1 means the intra-day range on June 24, 2016, was the largest for the respective period. For instance the EUR/USD intra-day range was the largest in comparison with the intra-day ranges of the last five and ten years, and the second largest when twenty years of data are used. The S&P 500's moves on the day rank 92nd relative to the last 10 years and 132nd over the last 20.

Source: UBS.

In addition, 10-year US Treasuries reached a record-low yield level: yields on 10-year US Treasuries tumbled 29bp, from a high of 1.70% (see, [Figure 43](#)). In 10-year gilts, the intra-day move was less dramatic; however, after a further day of trading, yields had declined from a high June 23 1.39% to 1.01%. By June 30, 2016, yields had declined further to 0.86% (see, [Figure 44](#)).

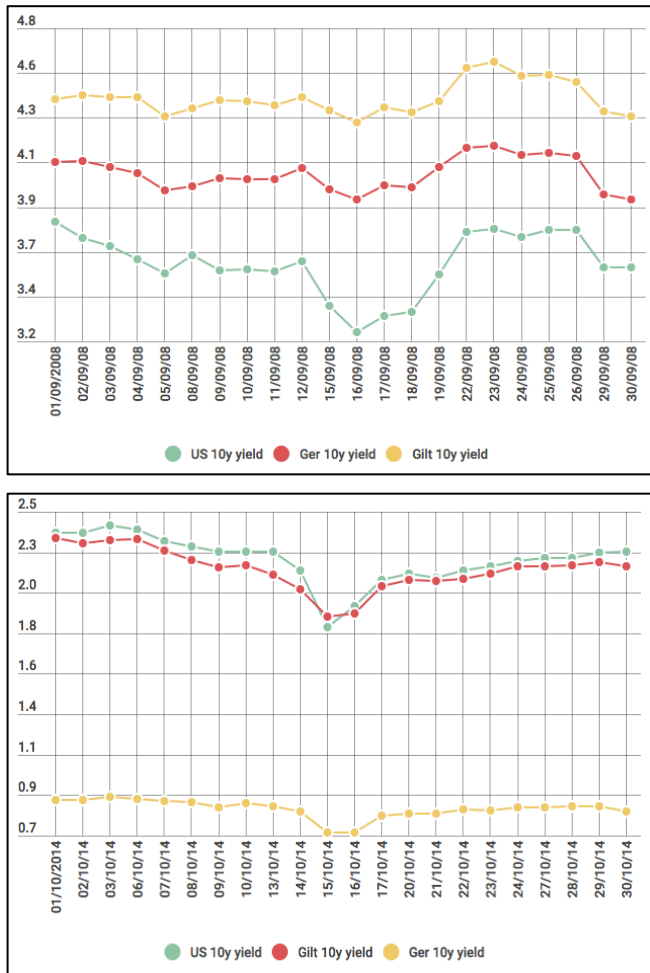
⁹³⁰ See, Peter Madigan, *Huge Brexit margin calls stoke intra-day funding fears. Calls on June 24 may have topped \$40 billion; critics urge regulators to review episode*, Risk.net (October 31, 2016).

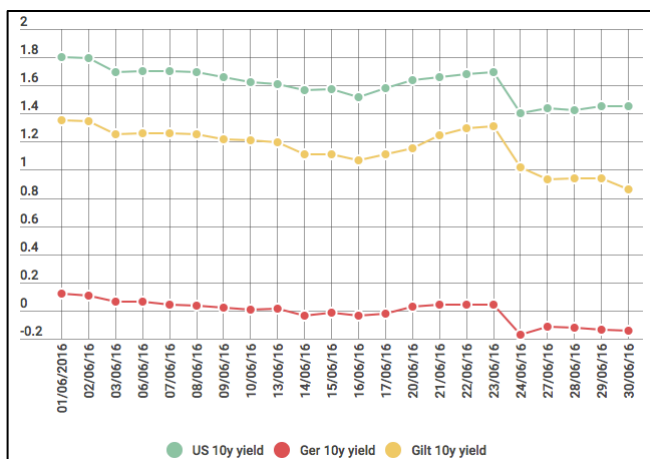
Figure 43. Treasury 10-year note yield plunges on Brexit.



Source: Bloomberg.

Figure 44. 10-year treasury yields during three periods of market volatility (September 2008, October 2014, June 2016).





Source: Peter Madigan, *Huge Brexit margin calls stoke intra-day funding fears. Calls on June 24 may have topped US\$40 billion; critics urge regulators to review episode*, Risk.net (October 31, 2016).

The described movements, then, translated into huge margin calls by multiple CCPs. Estimates of the combined margin calls issued by derivatives CCPs on the day after the Brexit vote range from US\$ 25 billion to US\$ 40 billion or even more.⁹³¹ Some individual banks are estimated to have faced margin calls for multiple billions from multiple CCPs. At the point of each margin call, these banks were asked to make the required payment in an hour or so. Failure to make the required payment would have resulted in their default (and the perception of difficulties in making the payment could have triggered panic).

In the aftermaths of the Brexit vote, every margin call was ultimately met. However, the important thing to note is that those margin calls showed severe limits of central clearing and proved the existence of dangerous vulnerabilities that central clearing creates in the financial system.⁹³² In particular, margin calls triggered by the Brexit vote:

- Showed that the process of central clearing does not completely eliminate risk, rather it substitutes liquidity risk for counterparty risk.
- Unveiled the pro-cyclical effects of CCPs' margin practices and how simultaneous margin calls from multiple CCPs may contribute to a severe slowdown in liquidity in the financial system.

⁹³¹ Ibidem (noting "The size of the calls was so large because of two factors: the violence of the market moves, and the increased size of the portfolios on which they were acting. Regulation is pushing more over-the-counter derivatives into CCPs, and these trades – being bigger and less liquid than their listed cousins – consume more margin. Taking regulatory disclosures from LCH as an illustration of the market's growth, total initial margin for the CCP's interest rate swap portfolio jumped 48% during the first half of this year, from £48.5 billion to £71.9 billion (\$59 billion–\$87.6 billion). As the cleared portfolio grows, so do the potential liabilities of a CCP's members during periods of stress.")

⁹³² In this sense, see, e.g., Alexander Campbell, *Brexit margin calls, SwapAgent and the roots of op risk losses*, Risk.net (November 4, 2016); Duncan Wood, *A referendum on clearing. Brexit margin calls show swaps CCPs are relying on funding strength of a handful of banks*, Risk.net (November 1, 2016); Craig Pirrong, *A Brexit Horror Story That Demonstrates the Dangers of Clearing Mandates*, Streetwise Professor Blog (October 31, 2016) (noting that "[m]uch of the additional margin was to top up initial margin, meaning that the cash was sucked into the CCPs and kept there, rather than paid out to the net gainers, where it could have been recirculated." Further noting that "recirculating [the cash] would have been a panacea. Timing differences between flows of VM into and out of CCPs creates a need for liquidity. Moreover, recirculation by extension of credit is often problematic during periods of market stress, as that's exactly when those who have liquidity are most likely to hoard it.").

- Revealed how tightly coupled the financial system is and how most of the volume in the OTC derivatives market goes through a very limited number of dominant players.
- Unveiled the existence of dangerous externalities. Hence, the more CCPs tried to protect themselves and their CMs by increasing margins in response to severe market movements, the more the pressure that CCPs imposed on other CCPs and their CMs that were already suffering from those market movements.
- Highlighted the absence of coordination among CCPs. In the aftermaths of the Brexit vote, each CCP acted independently and called margin to protect first, and foremost, its own interests, without consideration of the strain that its margin calls would (directly and indirectly) impose on other CCPs and their CMs.⁹³³

Since the aftermaths of the Brexit vote, regulators have increased their scrutiny on the margining practices of CCPs.⁹³⁴ Significantly, as noted by Prof. Pirrong, the margin calls triggered by the Brexit vote were even more warning if one considers that the Brexit vote was a known event and a known risk, and that financial institutions and other market participants had planned for it.⁹³⁵ This raises the concern of whether the system would be able to resist and handle a surprise shock, which could strike suddenly and be far larger than the post-Brexit vote movements. One certainty in such scenario is that financial regulators, CCPs and their CMs/CM clients would need a more coordinated tried-and-tested response. Chapter 7 and Chapter 8 will discuss this point in detail.

⁹³³ See Chapter 7 for further discussion on this point.

⁹³⁴ See, e.g., Lukas Becker, Peter Madigan and Duncan Wood, *LCH under scrutiny after outsized Brexit margin calls. Intra-day calls criticised by banks; FIA working group pushing for change*, Risk.net (October 19, 2016); Peter Madigan, *CFTC 'puzzled' by CPMI-losco plan on margin pro-cyclicality. Prescriptive models could increase systemic risk at CCPs, market participants warn*, Risk.net (October 7, 2016).

⁹³⁵ See, Craig Pirrong, *A Brexit Horror Story That Demonstrates the Dangers of Clearing Mandates*, cit.

CHAPTER 7: PRICING BEHAVIOR

Systemic risk-related financial regulation has long sought to protect the financial system from systemic crises in two ways: first, by limiting the chance of occurrence of an initial spark that could trigger systemic risk; and second, by interrupting the cascade of systemic destabilizing events and limiting contagion losses that could ultimately knock-down the whole financial system.⁹³⁶

The GFC, however, has demonstrated that systemic risk-related financial regulation cannot always prevent the initial spark,⁹³⁷ nor it can always promptly interrupt the transmission of its systemic risk destabilizing effects.⁹³⁸ Based on this realization, following the GFC a number of scholars have suggested that systemic risk-related financial regulation should also focus on the development and implementation of tools that could help manage periodic systemic failures in a controlled manner and stabilize the parts of the financial system affected by such failures.⁹³⁹ Prominent among these scholars is Prof. Schwarcz, who has noted that this new approach to systemic risk-related financial regulation takes inspiration from chaos theory “insofar as that theory holds that remedies should also focus on limiting the consequences of failures.”⁹⁴⁰

Arguably, managing periodic failures in a controlled manner and stabilizing systemically important firms and markets impacted by such failures is one key role of OTC CCPs.⁹⁴¹ As discussed in Chapter 2, in absence of central clearing the uncoordinated replacements of a large number of defaulted positions through the use of ordinary market mechanisms may lead to distorted price changes, which, in turn, may induce dangerous asset fire sales and severe knock-out effects resulting in significant system-wide instability.⁹⁴² In contrast, in a centrally

⁹³⁶ Cf., e.g., Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit.; Steven L. Schwarcz, *Regulating Financial Change: A Functional Approach*, cit.

⁹³⁷ See, e.g., Steven L. Schwarcz, *The Functional Regulation of Finance*, Working Paper (2014), p. 31 (arguing that “[b]ecause the financial system exhibits the characteristics of—and effectively comprises—a high-risk system [due to its “interactive complexity” and “tight coupling”] that is susceptible to “normal accidents,” regulators cannot predict, and therefore cannot eliminate, all the triggers of systemic shocks.”).

⁹³⁸ Id., pp. 35-37 (arguing that “[t]o break the transmission of systemic failures in the financial system would require that the transmission mechanisms all be identifiable. It is probably not feasible, however, to identify all those mechanisms in advance. Regulators are nonetheless experimenting with this approach, especially with ring-fencing.”).

⁹³⁹ Id., pp. 37-49. See, also, Iman Anabtawi and Steven L. Schwarcz, *Regulating Ex Post: How Law Can Address the Inevitability of Financial Failure*, *Texas Law Review*, Vol. 92, pp. 75-131 (2013); Steven L. Schwarcz, *Ex Ante versus Ex Post Approaches to Financial Regulation*, Keynote Address at the 2011 Chapman Law Review Symposium “From Wall Street to Main Street: the Future of Financial Regulation,” Chapman University School of Law (January 28, 2011); Romney B. Duffey, *The Quantification of Systemic Risk and Stability: New Methods and Measures*, NBER Working Paper Series No. 17022 (2011).

⁹⁴⁰ See, Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., at pp. 827, 829 and accompanying note 44 and 56 (noting that “[o]ne aspect of chaos theory is deterministic chaos in dynamic systems, which recognizes that the more complex the system, the more likely it is that failures will occur. Thus, the most successful (complex) systems are those in which the consequences of failures are limited. In engineering design, for example, this can be done by decoupling systems through modularity that helps to reduce a chance that a failure in one part of the system will systemically trigger a failure in another part.”).

⁹⁴¹ In this sense, see, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 20-21.

⁹⁴² In this sense see, Craig Pirrong, *A Potential Clearing Structure*, Seeking Alpha (April 26, 2010) (quoting Greenwald–Stein’s work on “circuit breakers” and arguing that a coordinated auction-type mechanism would be similar to the “Greenwald–Stein recommendation for circuit breakers that replace continuous trading with a call auction” with a key difference that “the Greenwald–Stein circuit breakers are price contingent” whereas a coordinated auction-type mechanism “is default contingent.”); Bruce C. Greenwald and Jeremy C. Stein, *Transactional Risk, Market Crashes, and the Role of Circuit Breakers*, *The Journal of Business* Vol. 64, No. 4, pp. 443-462 (1991); Craig Pirrong, *Nationalize the Clearinghouses?*, cit. (noting that “leaving things to be handled in an ad hoc way at the time of failure is a recipe for disaster (in large part because how market participants would respond to the uncertainty when a CCP teeters on the

cleared market, upon the default of a CM, the OTC CCP can activate a centralized default management process, which can facilitate the orderly transfer of open positions from defaulted CM and the orderly close-outs of the defaulted CM's outstanding positions. As explained in Chapter 4, this would be typically accomplished through a centralized auction of the defaulted CM's open positions, macro-hedges of key risks in the defaulted CM's portfolio, and the utilization of a pre-defined default waterfall to absorb related losses.

Thus, the present analysis will build on, and will further extend, the research on systemic risk-related financial regulation conducted following the GFC by applying the new approach inspired by chaos theory onto the OTC derivatives clearing context through a two-step analysis. First, Chapter 7 will focus on the OTC CCP's coordinated default management process as a means to manage periodic systemic failures in a centralized and organized manner, and will discuss how to improve it by considering behavior aspects in the pricing and structuring of an OTC CCP's default waterfall. Second, Chapter 8 will examine additional resources and stabilizing mechanisms that could be activated in the remote (but still possible) scenario in which an OTC CCP's coordinated default management process backfires.

7.1. OTC CCP's Coordinated Default Management Process: Cooperative Behavior vs. Competitive Behavior

In the event of default of one or more major CM(s), surviving CMs have a "second loss" position, that is they are short an out-of-the-money option representing their possible losses via their contributions into the mutualized default fund.⁹⁴³ This implies two things:

- First, if surviving CMs believe that the initial margin and the default fund contributions of the defaulting CM together with the first tranche of the OTC CCP's equity (collectively "defaulter's resources") are sufficient to cover the default losses, then they will not have any incentive to cooperate during the default management process. In such a scenario, surviving CMs that bid during the auction will have strong incentives to take on positions at a profit because they know that the defaulter's resources will pay for such a profit and their optimal strategy will be to utilize all such resources, as they will, otherwise, be returned to the bankruptcy administrator.⁹⁴⁴

brink."); Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 30-31, 139-143; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 34-37.

⁹⁴³ In this sense, see, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 184-185.

⁹⁴⁴ Id., p. 185 (noting that there is some evidence of the this behavior in practice "[f]or example, in the Lehman bankruptcy, there were claims that CME members profited from participating in the auction. It should be noted that taking on large (and potentially relatively illiquid) portfolios in the aftermath of a large default creates substantial risks that cannot easily be hedged. Participating in an auction exposes clearing members to the risks of positions they take on as, even though these risks can be hedged or offset, there is still exposure to market moves during this period. This risk may be especially problematic for large and relatively illiquid OTC derivatives positions. If an auction does not run smoothly then it may escalate problems and expose a CCP to an extended close out period, as well as increased market volatility and illiquidity.").

- Second, if surviving CMs believe that default losses may exceed the defaulter’s resources and be mutualized by them via the default fund, then surviving CMs will have the strong incentive to better behave.⁹⁴⁵

The following sections will analyze these incentives of surviving CMs in the context of an OTC CCP’s default management process through the lens of two coordination games: a cooperative game, the “stag hunt,” and a competitive game, the “prisoner’s dilemma.” In both games, a strategic interaction is at work whereby payoffs depend on cooperation among participants. Moreover, in both games, each participant’s decision depends on what he/she expects the other participant(s) to do (that is in both games expectations influence outcomes). Finally, in both games each participant would need to take into account other participants’ strategies when making its own decisions and would need to consider that the other participants will make the same sort of contingent evaluation. Despite these similarities, the two games have different strategic problems, which will be outline in detail below.

7.1.1. The Stag Hunt Game

The stag hunt game refers to a scenario where a group of hunters could hunt either a stag or hares.⁹⁴⁶ Neither hunter knows what the other hunter is going to choose. To catch the stag all hunters must cooperate. If they capture a stag, they all eat. Contrary, if a hunter defects and decides to hunt a hare, then all hunters will loose the collective goods (the stag).

For instance, assume that there are two hunters, that the hunt is worth 4, and that the hare is worth 1. If the two hunters decide to hunt the stag and cooperate, then the two hunters share the stag for payoff of 2 each. Contrary, if one of the hunters decides to hunt a hare, he will get a hare for himself for a payoff of 1. At that point, if the other hunter is hunting a stag, he will get nothing (because no one is helping him) and his payoff will be 0. If, instead, the other hunter is hunting a hare he will get a hare for himself too, for a payoff of 1. This is illustrated in [Table 14](#) below.

Table 14. The “stag hunt” 2x2 payoff matrix.

		HUNTER 2	
		Stag	Hare
HUNTER 1	Stag	(2;2)	(0;1)
	Hare	(1;0)	(1;1)

⁹⁴⁵ Ibidem.

⁹⁴⁶ Cf., e.g., Douglas G. Baird, Robert Gertner and Randal Picker, *Game Theory and the Law*, Harvard University Press (1998); Brian Skyrms, *The Stag Hunt and The Evolution of Social Structure*, Cambridge University Press (2004); Eric A. Posner, Kathryn E. Spier and Adrian Vermeule, *Divide and Conquer*, John M. Olin Program in Law and Economics Working Paper No. 467 (2009); Morgan Ricks, *The Money Problem: Rethinking Financial Regulation*, University of Chicago Press (2016), pp. 58-72.

As illustrated above, in the stag hunt game there are two so-called Nash equilibria (highlighted in red).⁹⁴⁷ The first Nash equilibrium is the stag-stag scenario: Hunter 1 gets 2 (as opposed to 1 if he hunts a hare), and Hunter 2 gets 2 (as opposed to 1 if he hunts a hare). The second Nash equilibrium is the hare-hare scenario: Hunter 1 gets 1 (as opposed to 0 if he hunts a stag), and Hunter 2 gets 1 (as opposed to 0 if he hunts a stag). The stag-stag scenario is the Pareto optimal solution. Therefore, one could expect that the choice of all hunters would be to pursue the stag. However, experimental findings show that cooperation may not always work out and that the hunters might choose to pursue the hares, thus achieving collectively weaker but individually satisfying gains.

The behavior of surviving CMs could arguably resemble the stag hunt cooperative game described above.⁹⁴⁸ In the event of default of a CM, surviving CMs (the hunters) would have the choice of either cooperating or defecting. If surviving CMs decide to cooperate, they will actively participate to the auction and hedging of the defaulted CM's outstanding positions. This way they will be able to achieve an optimal collective result: the OTC CCP will close out the open positions most efficiently and will minimize losses to the default fund. Contrary, if surviving CMs decide to defect, they will seek individual gains and will not cooperate. Their non-cooperative behavior can manifest in actions such as resigning from the OTC CCP, or trying to avoid participation to the auction, or bidding conservatively in the auction. If they leave the OTC CCP stricken by defaults or they obstruct the auction, losses will, then, concentrate on a smaller number of surviving CMs. If all (or a large majority of) the surviving CMs decide not to cooperate, then the default management process will likely fail with resulting highly destabilizing effects.

As previously mentioned, in the stag hunt game, the mutual cooperation scenario (stag-stag) constitute a Nash equilibrium and the Pareto optimal solution. When translated into the clearing context, this means that mutual cooperation among CMs represents a Nash equilibrium and the Pareto optimal solution. It is important to note that, in the stag hunt game mutual cooperation is a stable outcome only to the extent that the payoffs from defecting (hunting the hare) are always less than the payoff of mutual cooperation. When applied onto the central clearing context, this means that mutual cooperation among all surviving CMs constitutes a stable outcome only to the extent that the individual gain that a surviving CM could achieve by resigning from the OTC CCP or by bidding conservatively in the auction is less than the payoff that the same surviving CM could achieve from mutual cooperation. This point is critical. Hence, the analysis in Chapter 6 has shown that in times of severe market turbulence the very same features and mechanisms that OTC CCPs utilize to mitigate systemic risk may contribute further instability to the financial system and the default management process may backfire. Thus, based on the analysis in Chapter 6, one could

⁹⁴⁷ The term "Nash equilibrium" refers to a profile of strategies in which each player's strategy is his/her best response to the other player's strategy. For further discussion on this point, see, e.g., Thomas Schelling, *Strategy of Conflict*, Harvard University Press (1980). The existence of multiple Nash equilibria poses a problem of equilibrium selection. Shelling suggested that a single strategy may emerge without an explicit agreement due to a shared understanding of the environment within which the game is played. The author referred to this as "focal point effect."

⁹⁴⁸ In this sense, see, e.g., Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, cit., pp. 417-419.

reasonable argue that in times of severe market turbulence the individual gain that a surviving CM could achieve from defecting is greater than the payoff that the same surviving CM could otherwise achieve from cooperating with other surviving CMs and actively participating in the default management process. This, in turn, means that in times of severe market turbulence, the behavior of surviving CMs might deviate from a stag hunt game and become more competitive.⁹⁴⁹ This observation takes us to the second type of coordination game mentioned above, the “prisoner’s dilemma.”⁹⁵⁰

7.1.2. The Prisoner’s Dilemma

A typical statement of the prisoner’s dilemma goes like this: two people have been arrested and they can choose to confess or remain silent. If one of the prisoners confesses and the other accomplice remains silent, the former prisoner will go free and the latter prisoner will get the maximum sentence (3 years). If both prisoners confess, they will both get a reduced sentence (2 years each). If neither prisoner confesses, they will both be prosecuted on a less charge for which conviction is certain (1 year). Each prisoner cares to minimize its own time in prison and it does not know how the other prisoner will behave. This is illustrated in Table 15 below.

Table 15. The “prisoner’s dilemma” 2x2 payoff matrix.

		PRISONER 2	
		Cooperate	Defect
PRISONER 1	Cooperate	(2;2)	(0;3)
	Defect	(3;0)	(1;1)

As illustrated in the matrix above, there are two key differences between the stag hunt game and the prisoner’s dilemma game:

- First, in the prisoner’s dilemma game the payoff from defecting while the other prisoner cooperates (+3) is higher than the payoff that the same prisoner would achieve in a mutual cooperation scenario (+2). This reflects the existence of “free rider” benefits.⁹⁵¹
- Second, although in the prisoner’s dilemma game mutual cooperation is a Pareto efficient scenario, the only Nash equilibrium is mutual defection. This means that, in a scenario where both prisoners have chosen to defect, neither prisoner has then a unilateral incentive to change his strategy.

⁹⁴⁹ In this sense, see, e.g., Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 185-186.

⁹⁵⁰ The prisoner’s dilemma is often analogized to situations of market failure. A typical example is a “tragedy of the commons,” a form of collective action problem. See, section 3.3 above for further discussion of the “tragedy of commons” in the context of systemic risk.

⁹⁵¹ There are two main versions of the free riding: the “strong free rider hypothesis,” whereby everyone will free ride; and the “weak free rider hypothesis,” whereby some people will free ride while others will cooperate. See, Earl R. Brubaker, *Free Ride, Free Revelation, or Golden Rule?* Journal of Law and Economics, Vol. 18, No.1, pp. 147-161 (1975).

When applied into the central clearing context, the above means that, in the event of default of one (or more) major CM(s), it will be in the best interest of all surviving CMs to cooperate and actively participate in the coordinated default management process conducted by the OTC CCP. However, similar to the prisoners in the prisoner's dilemma, surviving CMs are self-regarding when making risk-taking decisions: because the payoff that a surviving CM can achieve from defecting is greater than the payoff that the same surviving CM can achieve from mutual cooperation, each individual CM has the strong incentive to defect and seek individual gains. The collective optimum in this game is a mutual cooperation by surviving CMs, but the only Nash equilibrium is mutual defection. This means that, when all (or a significant number of) surviving CMs adopt the defection strategy, neither of them will have the unilateral incentive to change its strategy. At that point, the situation will become highly destabilizing: absent cooperation, the default management process will likely fail, dangerous systemic instability will be generated and all surviving CMs will be worse off.

These destabilizing externalities and free riding behaviors may be further exacerbated by the existence of multiple OTC CCPs linked to each other directly (through interoperability mechanisms) and/or indirectly (through overlapping membership or collateral and liquidity channels). Hence, in a scenario characterized by multiple OTC CCPs connected to each other, there is a non-competitive game between OTC CCPs, as well. The OTC market developments triggered by the Brexit vote in June 2016 offer interesting guidance in this respect. In the immediate aftermaths of the Brexit vote each CCP acted independently and called margin to protect its own interests. Each CCP had a strong incentive to demand margin to protect itself, and to demand it before other CCPs did. As a result, numerous CCPs made large margin calls without consideration of the strain that their margin calls would (directly and indirectly) impose on other CCPs and their CMs: the more a CCP tried to protect itself and its CMs by increasing margins in response to the severe post-Brexit vote market movements, the more the pressure that the CCP imposed on other CCPs and their CMs that were already suffering from those market movements. As noted by Prof. Pirrong, "the equilibrium in this game is inefficient because there is an externality between CCPs, and between CCPs and those who must meet the calls."⁹⁵²

7.1.3. Group Cooperation and Collective Action

Previous sections have shown how participants in the OTC derivatives market (OTC CCPs, CMs, and CMs' clients) face a common challenge: their capacity for effective collaboration will determine the success of their efforts and will allow the OTC derivatives market to thrive. This observation raises the question of how participants in the OTC derivatives market can effectively collaborate.

⁹⁵² See, Craig Pirrong, *A Brexit Horror Story That Demonstrates the Dangers of Clearing Mandates*, cit.

The problem of coordinating groups for collective action has long been investigated.⁹⁵³ An extensive literature has developed attempting to explain the cooperative behavior and to identify factors that may affect cooperation.⁹⁵⁴

⁹⁵³ Experimental findings show that, given a sufficient large group of subjects that provides a public good to its members, there is a strong incentive for the group members to follow his/her own self-interest with the hope that other members of the group will contribute the resources necessary for the group effort to be successful. See, e.g., Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups*, Harvard University Press (1971) (arguing that the free-riding problem is particularly acute in large groups, because in such groups each member has a lower share of the benefits and organizational costs tend to be higher.). Further experiments conducted both in and outside laboratories have also shown that individuals do not always free ride and, contrary, they sometime manifest a cooperative behavior. Experimental evidence suggests that the strong free rider hypothesis may be wrong and that subjects, contrary to their self-interest, often do contribute positive amounts to the common good. For instance, studies by Marwell and Ames have shown that a certain level of contribution to the public good can be achieved in a variety of circumstances: both in the case where the participants to the game are experienced subjects and the case where they are playing the game for the first time; both in the case where the game is played among small groups of people, and the case where the game is played in larger groups; both in the case involving a minimum monetary amount at stake and the case with larger monetary amount at stake. Significantly, Marwell and Ames found only one major deviation from the average 40-60 percent contribution rate, when the subjects participating to the experiment were thirty-two first-semester graduate students in economics at the University of Wisconsin. These students were much more likely to free ride compared to any other groups of subjects examined by Marwell and Ames. In this case the contribution rate dropped to only 20 percent. See, e.g., Marwell Gerald and Ruth Ames, *Economists Free Ride, Does Anyone Else?*, *Journal of Public Economics*, Vol. 15, No.3, pp. 295-310 (1981).

⁹⁵⁴ For instance, scientists interested in the evolution and sustainability of cooperative behavior have focused on the role of replication and have looked at the repeated version of the public goods game. Results from their experiments show that the contribution rate typically starts at 40-60% and then declines quickly with repetition. One explanation for these findings is that individuals learn to free ride through repeated trials. Another explanation is that individuals develop multi-period strategies that promote some cooperative behavior, even after the free riding incentives are learned. See, e.g., Kim Oliver and Walker Mark, *The Free Rider Problem: Experimental Evidence*, *Public Choice*, Vol. 43, No.1, pp. 3-24 (1984); Mark R. Isaac, James M. Walker and Susan H. Thomas, *Divergent Evidence on Free Riding: An Experimental Examination of Possible Explanations*, *Public Choice*, Vol. 43, No. 2, pp. 113-149 (1984); Mark R. Isaac, Kenneth F. McCue and Charles Plott, *Public Goods Provision in an Experimental Environment*, *Journal of Public Economics*, Vol. 26, No. 1, pp. 51-74 (1985). *But*, see, James Andreoni, *Why Free Ride? Strategies and Learning in Public Goods Experiments*, *Journal of Public Economics*, Vol. 37, No.3, pp. 291-304 (1988); David Goetze David and John M. Orbell, *Understanding and Cooperation*, *Public Choice*, Vol. 57, No. 3, pp. 275-279 (1988). Additional studies have also shown that a purely symbolic reminder of being watched can promote improved behavior. See, e.g., Melissa Bateson, Daniel Nettle and Gilbert Roberts, *Cues of Being Watched Enhance Cooperation in a Real-World Setting*, *Biology Letters*, Vol. 2, No. 3, pp. 412-414 (2006). Other studies have focused on the role of reciprocal altruism, as a possible explanation of cooperative behavior. Findings of these experiments, show that a cooperative act (or a reputation for cooperation) is likely to be reciprocated with cooperation. In particular, interesting studies have been conducted by Robert Axelrod, where individuals played repeatedly against the same opponent. A tournament was organized in which computer programs played 200 consecutive rounds of prisoner's dilemma with each other. In each round, two competing programs were offered the choices given to the two prisoners. The winning strategy was a program called TIT-FOR-TAT, proposed by the game theorist Anatol Rapoport, whereby a player begins by cooperating and then chooses the same response the other player has made on the previous trial. Significantly, it has been shown that any person or small group of people practicing the described reciprocal altruism will have a statistical tendency to receive higher payoffs "in the long run" compared to those who don't practice it. Further studies have then focused on the evolution of cooperation via reciprocal altruism and have suggested that, when the benefits of altruism fall to relatives, cooperation evolves by inclusive fitness; contrary, when benefits fall to nonrelatives, cooperation evolves by reciprocal altruism. See, e.g., Robert Axelrod and William D. Hamilton, *The Evolution of Cooperation*, *Science*, New Series, Vol. 211, No. 4498, pp. 1390-1396 (1981); Robert Axelrod, *The Evolution of Cooperation*, Basic Books (2009). Additional experiments have shown that the level of cooperation decrease in cases where there is no possibility of future reciprocity from others, in situations of anonymity, in "one-shot" single trial experiments, or during the last period of multi-trial games. See, e.g., David M. Kreps, Paul Milgrom, John Roberts and Robert Wilson, *Rational Cooperation in Finitely Repeated Prisoner's Dilemmas*, *Journal of Economic Theory*, Vol. 27, pp. 245-52 (1982). *But*, see James Andreoni, *Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving*, *The Economic Journal*, Vol. 100, No. 401, pp. 464-477 (1990) (providing evidence against the reciprocity hypothesis). Further experimental findings have also shown that individuals, who tend to cooperate with others, often elicit cooperation from them, and attract other cooperators. Moreover, further experiments have also suggested that cooperators are capable to identify one another and can interact selectively to exclude defectors. See, e.g., Robert H. Frank, *If Homo Economics Could Choose His Own Utility Function, Would He Want One with a Conscience?* *The American Economic Review*, Vol. 77, No. 4, pp. 593-604 (1987); Robert H. Frank, *Passions Within Reason: The Strategic Role of the Emotions*, W.W. Norton & Company (1988); Robert H. Frank, Thomas Gilovich and Dennis Regan, *The Evolution of One-Shot Cooperation: An Experiment*, *Ethology and Sociobiology*, Vol. 14, No. 4, pp. 247-256 (1993). Additional experiments have then demonstrated that cooperative individuals are "conditional cooperators," that is they tend to cooperate until experience shows them that those individuals with whom they are interacting are defectors. Robert H. Frank, *If Homo Economics Could Choose His Own Utility Function, Would He Want One with a Conscience?*, cit.

Of particular interest for the purpose of the present analysis are the studies conducted by Robyn M. Dawes, John M. Orbell, Randy T. Simmons, and Alphons J.C. Van de Kragt.⁹⁵⁵ Their laboratory experiments involve a step-level game in which a “bonus,” or public good, is provided to all group members in the event some specified number of them make a fixed contribution. If the required number of contributions is not achieved, no bonus is provided. During these experiments, subjects are required to make their decision between contributing or not contributing simultaneously, anonymously, and only once.

In particular, in the full dilemma (the standard version of this game), seven strangers are given a US\$ 5 promissory note each. If enough people contribute their money to the public good (either three or five depending on the experiment), then every member of the group will receive a US\$ 10 bonus whether or not they contributed. As a result, if enough contributions are made and the bonus is provided, then each subject that has contributed his/her US\$ 5 will have a payoff of US\$ 10 whilst each subject that has not contributed his/her US\$ 5 will leave with a payoff of US\$ 15. Contrary, if too few contributions are made and the bonus is not provided, then each subject that has contributed his/her US\$ 5 will leave with nothing whilst each subject that has not contributed his/her US\$ 5 will have a payoff of US\$ 5. The game involved no communication, no opportunity for persuasion or coercion, no possibility of side payments or reciprocity, and no disclosure of individual choices.

In the context of the described game, the authors have identified three reasons for not contributing:

- Wasting One’s Contribution - Subjects have an incentive for not contributing when they are afraid that they will contribute but too few others will, so their contribution will be futile. This motive for defecting was termed “fear.”
- Being Redundant - Subjects have an incentive for not contributing when they hope that enough others will contribute so that they can free ride other members’ effort and receive US\$ 15 instead of US\$ 10. This motive for defecting was called “greed.”
- Being Critical - Subjects have an incentive for contributing when they believe their contribution will be critical or necessary for the provision of the public good (that is when k contributions are required, and $(k-1)$ others will contribute so that the individual’s contribution will make the difference).

The authors set aside the possibility of criticalness, as subjects who contributed did not generally believe that their contribution was necessary. The focus was on the first two possible explanations for defecting: fear and greed. The authors

⁹⁵⁵ See, Robyn M. Dawes, John M. Orbell, Randy T. Simmons and Alphons J.C. Van de Kragt, *Organizing Groups for Collective Action*, *The American Political Science Review*, Vol. 80, No. 4, pp. 1171-1185 (1986). For more recent researches on this topic, see, e.g., Kitts A. James, Diego F. Leal, Will Felps, Thomas M. Jones and L. Berman Shawn, *Greed and Fear in Network Reciprocity: Implications for Cooperation among Organizations*, *PLOS ONE*, Vol. 11, No. 2 (2016).

further examined the relative importance of these two factors by modifying the rules of the game. Two half dilemmas game have, thus, been developed in which one of the fear factor or the greed factor was removed:

- In the money-back guarantee half dilemma, the “fear” factor is removed. In this scenario, contributors are given “a money back guarantee”: if a subject contributes his/her US\$ 5 but there are not enough contributions by others to ensure provision of bonus, then the subject will receive his/her US\$ 5 back. Thus, contributors will not loose if the group effort fails. However, in this condition subjects could still free rider on the contribution of others: if a subject does not contribute his/her US\$ 5 and enough others contribute so that the public good is provided, the non contributor (the free rider) will get a payoff of US\$ 15, while contributors will receive only US\$ 10.
- Under the enforced contribution half dilemma, the “greed” factor is removed. Payoffs are changed so that if the number of contributors is sufficient and the bonus is provided, then all subjects will receive US\$ 10.⁹⁵⁶ In this condition there is no possibility of free riding. However, subjects could still lose their contribution and be “suckered:” if a subject contributes but not enough other subjects do so, then the subject who contributed will lose his/her US\$ 5.

Dawes et al., then, compared the relative efficiency of the money-back guarantee half dilemma and the enforced contribution half dilemma in enhancing cooperation. The results of their experiments suggested two things. First, greed was a more important factor than fear in causing free riding. In the full dilemma (the standard version of this game) contribution rate averaged c. 51%. In particular, in the money-back guarantee half dilemma (the “no fear” game) average contribution rate rose to c. 58%, but in the enforced contribution half dilemma (the “no greed” game) average contribution rate went up to c. 87%.⁹⁵⁷ Second, the authors noted that the “no greed” condition produced a stable equilibrium, while the “no fear” condition could not. The explanation is as follows:

- If subjects in the “no greed” condition believe that the enforced contribution mechanism works to motivate others to contribute, their belief will lead to a decrease in the subjective probability that the good will not be provided by others’ contributions – that is, their belief will make group failure and the reason for not contributing less likely. As a result, their incentive to contribute will be enhanced as well, because the only negative result of contributing will occur if enough others do not contribute.

⁹⁵⁶ Cutting payments at \$10 is logically equivalent to forcing all subjects in the group to contribute their \$5 if the bonus is provided.

⁹⁵⁷ See, Robyn M. Dawes, John M. Orbell, Randy T. Simmons and Alphons J.C. Van de Kragt, *Organizing Groups for Collective Action*, cit., p. 1183. The authors noted that in the three replications conducted the enforced contribution device was superior to the standard dilemma at a high level of statistical significance; in two out of the three replications, it was significantly superior to the money-back guarantee and was marginally better in the third. Contrary, in no replication the money-back guarantee device yield results superior to those in the standard dilemma at standard levels of significance.

- If subjects that has been given a “money-back guarantee” believe that such guarantee will encourage others to contribute, they will be tempted to free ride. This is because the belief that the guarantee works in promoting contribution will lead to an increase in the subjective probability of the goods being obtained without the need of the subject’s contribution and, thus, an increase in the probability that the free-riding attempt will be successful.

As previously mentioned, in the experiments conducted by Dawes et al. the subjects were required to make their decision between contributing or not contributing simultaneously, anonymously, and only once. Moreover, no communication, no opportunity for persuasion or coercion, no possibility of side payments or reciprocity and no disclosure of individual choices was allowed. Other studies have changed these rules to investigate the effect of communication on cooperation. Experimental findings have, thus, shown that when subjects are permitted to talk to each other they organize themselves by specifying precisely the number of required contributions and who should contribute (either through a lottery, volunteering, or through utility comparison).⁹⁵⁸ Further experimental findings have also shown that discussion raises cooperation particularly when the subjects believe that cooperation will benefits members of the group. Thus, group identity appears to be a crucial factor to fostering cooperation within the group.⁹⁵⁹ when a common identity is created among participants to an experiment (or participants are encouraged to think at themselves as being part of a group), then individual actions on behalf of the group are facilitated.⁹⁶⁰

The findings of these experiments on collective group action are certainly relevant in the context of central clearing of OTC derivatives. Hence, as previously explained, surviving CMs that resign or do not actively cooperate during the default management process are essentially free riding on the efforts of others. CMs utilize the services of the OTC CCP and will collectively benefit from a positive workout of the default management process. However, in a default scenario, each CM has the incentive to defect (that is, to not participate actively in the auction) and to maximize only its own payoff in the hope that other surviving CMs will cooperate and will use their resources to solve the problem.⁹⁶¹ This behavior on the part of surviving CMs can be thought of as a form of collective action failure.

⁹⁵⁸ See, Alphons J.C. Van de Kragt, John M. Orbell and Robyn M. Dawes, *The Minimal Contributing Set as a Solution to Public Goods Problems*, *American Political Science Review*, Vol. 77, No. 1, pp. 112-122 (1983).

⁹⁵⁹ See, e.g., Robyn M. Dawes and Richard H. Thaler, *Anomalies: Cooperation*, *The Journal of Economic Perspectives*, Vol. 2, No.3, pp. 187-197 (1988).

⁹⁶⁰ Cf., e.g., Roderick M. Kramer and Marilyn B. Brewer, *Effects of Group Identity On Resource Use in a Simulated Commons Dilemma*, *Journal of Personality and Social Psychology*, Vol. 46, No. 5, pp. 1044-1057 (1984); Roderick M. Kramer and Marilyn B. Brewer, *Social Group Identity and the Emergence of Cooperation in Resource Conservation Dilemmas*, in Henk A. M. Wilke, David M. Messick and Christie G. Rutte (eds.), *Psychology of Decisions and Conflicts: Experimental Social Dilemmas*, Frankfurt: Verlag Peter Lang (1986), pp. 205-234; Henri Tajfel and John C. Turner, *An Integrative Theory of Intergroup Conflict*, In William G. Austin and Stephen Worchel (eds.), *The Social Psychology of Intergroup Relations*, Brooks-Cole (1979), pp. 33-47; John C. Turner and Howard Giles, *Intergroup Behavior*, University of Chicago Press (1981).

⁹⁶¹ See, e.g., Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 28.

The above analysis is important as it raises the question of how to influence CMs' behavior. As noted by Prof. Kahneman, the proof that one truly understands a pattern of behavior is that he knows how to revert it.⁹⁶² The remaining part of this Chapter will take on this challenge. In particular, the following sections will identify and discuss innovative structures of OTC CCPs' pre-funded mutualized default fund(s) that can help create the correct incentive for all CMs to cooperate and actively participate in the macro hedging and auctioning of the defaulted CM's positions during the default management process.

7.2. Innovative Design of OTC CCPs' Default Fund(s)

The following sub-sections will begin by looking at the relative advantages and disadvantages associated with different levels of margin and default fund, and the interaction between the various choices. They will, then, identify and examine innovative default fund structures, incorporating features such as asset class segregation, default fund tranching, and "those who bid in the auction pay next." Finally, they will conclude by considering possible implications of different levels of mutualization within an OTC CCP's default waterfall structure.

At present, the design of OTC CCPs' pre-funded mutualized default fund(s) is still fluid. As the cleared OTC derivatives market is moving towards a more mature phase, there may be scope for a new generation of OTC CCPs to appear with advanced structures that are more sensitive to CMs' behavior.

7.2.1. Initial Margin vs. Default Fund

Chapter 4 above has analyzed the role of margins and the default fund within an OTC CCP's default waterfall. As correctly observed by Gregory,⁹⁶³ the right combination of initial margin and default fund contributions is a delicate balance, which is both product- and market-specific and which depends on the valuation of the overall shape of the distribution. Figure 32 in sub-section 4.9.1 above graphically illustrates this point.

A key question that arises when comparing margin and default fund is whether initial margin should be set at a higher or lower level relative to the default fund, and what would be the relative implications and effects on CMs' behavior.⁹⁶⁴ There are two alternative options:

- Choice 1: Higher Initial Margin and Correspondingly Lower Default Fund.

A first choice could be to set higher initial margin level and correspondingly lower default fund level. This choice would have a number of advantages. First, putting more financial contributions into initial margins rather than the default fund helps incentivize better behavior on the part of the CMs (and their clients) and reduces moral hazard. This is because, in this scenario, CMs (and their clients) are more

⁹⁶² See, Daniel Kahneman, *Thinking, Fast and Slow*, cit., p. 133.

⁹⁶³ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 177.

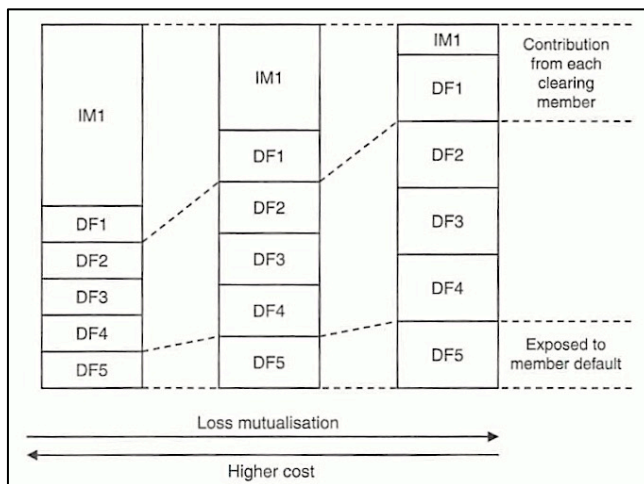
⁹⁶⁴ See, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 232-233.

likely to pay for their own defaults and are required to cover a large portion of their own risk via initial margin. Second, higher initial margin and correspondingly lower default fund can facilitate portability, which has the advantage to protect the clients of a defaulted CM by enabling the transfer of their positions to another CM. This, in turn, ensures continuance of trading and helps increase overall stability.⁹⁶⁵

On the other hand, the choice of setting higher initial margin and correspondingly lower default fund levels may pose a number of challenges.

First, this choice makes clearing more expensive, because larger amounts of margins will need to be contributed by individual CMs to achieve a target size of default resources. This point is illustrated in Figure 45 below: in the three cases represented in Figure 45 the overall level of loss absorbency is the same, but different combinations of margin and default fund levels are utilized.

Figure 45. Comparison of different choices of initial margin and default fund contribution.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 176.

Second, unless initial margin is very large, a relative lower level of default fund can create significant residual risk: multiple defaults by CMs may generate credit losses larger than margin, which may eventually breach all remaining OTC CCP financial resources. Moreover, using higher margin (relative to default fund contributions) may also encourage the search of “alternative forms” of collateral,⁹⁶⁶ and may expose OTC CCP to excessive levels of investment risk.

- Choice 2: Lower Initial Margin and Correspondingly Higher Default Fund.

The alternative choice would be to set smaller initial margin and correspondingly larger default fund level. This structure would make central clearing cheaper and OTC CCPs more robust, even when the level of CMs default co-movement is

⁹⁶⁵ See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 213-214.

⁹⁶⁶ See discussion on collateral transformation trades in section 6.12 above.

elevated (that is, they would be essentially more “crisis-proof”).⁹⁶⁷ Moreover, higher default fund contributions could help compensate for some degree of imprudence or model risk in margin calculations.⁹⁶⁸

However, setting lower levels of margin relative to default fund contributions raises a number of issues. First, it creates the risk that margin calls will be more likely to occur. Second, when default fund contributions are higher compared to margin, CMs will be required to subsidize each other and the direct payment by CMs (and their clients) for their own risks will be very limited.⁹⁶⁹ As a result, CMs will face a greater risk that their resources will be used to absorb the losses of other CMs (even without a really extreme loss event). Knowing that the risks will be largely spread across all CMs, CMs (and their clients) will be incentivized to take on excessive risk. Third, the larger mutualization of risk may reduce the incentives to do due diligence on cleared OTC derivatives counterparties on the part of the CMs (and their clients). As a result, putting more financial resources into the default fund instead of initial margin may come at the cost of increasing moral hazard. This means that OTC CCP makes OTC derivatives liabilities close to being a joint and several liability of all CMs.⁹⁷⁰ In this scenario, “free riding” will be rational.⁹⁷¹ Fourth, large default funds and smaller initial margins may also disincentive portability: if margins are insufficient, portability will become problematic, not least because the transferee CM accepting the positions will need to pay more into the OTC CCP default fund.⁹⁷²

The pros and cons of different levels of initial margin and default fund are summarized in Table 16 below.

Table 16. Strengths and weaknesses between higher and lower initial margins and default funds.

	Higher Initial Margin Level Lower Default Fund Level	Lower Initial Margin Level Higher Default Fund Level
Cost of Clearing	Higher	Lower
Level of Mutualization	Lower	Higher
Residual Risk	Higher	Lower
Search for Alternative Forms of Collateral	Encouraged	Not Encouraged

⁹⁶⁷ In this sense, David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 233.

⁹⁶⁸ For a discussion on the complexities associated with initial margin calculation, see section 4.5 above.

⁹⁶⁹ Using default fund in place of initial margin requires CMs to subsidize the risk of their clients because non-clearing members do not contribute directly to the default fund of an OTC CCP. Hence, clients only contribute directly to the risk of their own portfolios through the initial margin that the OTC CCP imposes on the CMs, which in turn will be imposed on them. However, the default fund sizing issue is still relevant to clients, because CMs will likely seek to recoup costs incurred in providing client clearing through higher clearing fees. In this sense, see, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p177; David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 252 note 448.

⁹⁷⁰ In this sense, see, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 252 note 450 and p. 253 note 456.

⁹⁷¹ *Ibidem*.

⁹⁷² See, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 218-220 (discussing the problem of net margin and portability).

Investment Risk for OTC CCP	Higher	Lower
Model Errors	Errors in Default Fund Calculation Can Be Compensated	Errors in Initial Margin Calculation Can Be Compensated
Moral Hazard	Lower	Higher
Portability	Easier	More Difficult

7.2.2. Splitting the Default Fund

Chapter 4 has examined the typical default waterfall structure of an OTC CCP, which is characterized by a single pre-funded mutualized default fund providing coverage across all derivatives products cleared by the OTC CCP. Some OTC CCPs, however, offer clearing services across different instrument classes. For instance, a same OTC CCP may clear both traditionally exchange-traded derivatives and OTC derivatives; moreover among the OTC derivatives, a same OTC CCP may clear both IRSs and CDSs. When more than one asset class is cleared by the same OTC CCP, a need arises to isolate losses within the particular asset-class clearing service in which such losses occur.⁹⁷³

Isolating losses within a clearing service would have several advantages, including the following:

- The risk of default losses faced by CMs will be aligned with the derivatives products they clear. This means that CMs will not be exposed to default risk from products that they do not participate in at all.
- Moral hazard problems will be mitigated and the opportunities for free riding by CMs discussed in previous sections will be reduced.
- CMs will better manage their exposure to the OTC CCP. This is important because CMs that only clear liquid exchange-traded products might not have the resources and risk-management capability necessary to manage the risks of more illiquid, long dated and more complex OTC derivatives.
- The risk that losses arising from the default of a CM in a clearing service may spread across other clearing services will be reduced. Reducing the risk of contagion, in turn, will help lower the risk of insolvency of the entire OTC CCP.
- When loss-allocation rules involve contractual tear-ups, only the contracts relating to the relevant product line will be affected. This is important from a systemic-risk perspective because tearing up all contracts of an OTC CCP (particular those of a large systemically-important OTC CCP) is likely to

⁹⁷³ See, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., p. 149; David Elliott, *Central Counterparty Loss-Allocation Rules*, cit., p. 10; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., pp. 178-179, 186-187; International Swaps and Derivatives Association (ISDA), *CCP Default Management, Recovery and Continuity: A Proposed Recovery Framework*, cit, p. 5; International Swaps and Derivatives Association (ISDA), *Principles for CCP Recovery*, p. 6 note 13.

cause severe market disruption. Contrary, resolving products individually will ensure that the OTC CCP could continue its clearing services for the other product lines cleared and would help minimize the risk of system-wide instability.

To achieve the described benefits, an OTC CCP may consider two alternative structures: a limited recourse clearing service structure and a full recourse clearing service structure.⁹⁷⁴

Under the former structure - a limited recourse clearing service structure - the same legal entity clears all different product lines, but each product line is “ring-fenced” from other product lines. This segregation is achieved by splitting the OTC CCP default resources into asset class-specific structures. To this purpose, the OTC CCP will establish a specific package of financial resources (including margins, a mutualized default fund, OTC CCP’s equity contribution and additional non-prefunded resources) for each single product line. Thus, for example, there will be a specific package of financial resources exclusively dedicated to IRSs, one only for CDSs, and so on. The key point is that the financial resources contained in each specific package will only be available to cover default losses arising from the default of a CM clearing that particular product. If an event of default occurs, then the OTC CCP will terminate the contracts of the CMs participating in that product and, for each of them, it will estimate a termination amount payable either to or by the OTC CCP. Net amounts paid to the OTC CCP will be aggregate with the financial resources for that relevant product. If no enough financial resources are available to satisfy the net termination amounts due by the OTC CCP, then net amounts will be subject to pro-rata haircuts. When the OTC CCP has paid all termination amounts to the relevant CMs, the OTC CCP’s payment obligations will be extinguished and no CM participating in that product will have further recourse in respect of those obligations vis-a-vis the OTC CCP or any of its assets. This means that losses arising from the default of a CM clearing a given product won’t automatically force the OTC CCP to close out its positions across all other product lines. This, in turn, will help reduce the risk of OTC CCP’s default and insolvency.⁹⁷⁵

In contrast, the latter structure - the full recourse clearing service structure – is characterized by multiple separate legal entities (that is, multiple OTC CCPs), each clearing only a particular derivatives product. Within this structure losses arising from the default of a CM clearing a particular product may potentially trigger the default of the OTC CCP clearing that particular product, which, in turn, will cause the close-out of all the OTC CCP’s positions pursuant to its close-out

⁹⁷⁴ In this sense, see, e.g., International Swaps and Derivatives Association (ISDA), *CCP Loss Allocation at the End of the Waterfall*, cit., pp. 17-18, 20.

⁹⁷⁵ *Id.*, pp. 17-18 (arguing that “a CCP that clears a number of different products and that employs a limited recourse structure for each product should nevertheless provide for close-out netting that would be triggered by the CCP’s insolvency or other default. Otherwise, clearing participants subject to Basel III would be unable to calculate trade exposures to the CCP using net exposure amounts. Under Basel III, a clearing participant will be allowed to net exposures of transactions only where they are subject to a “netting agreement,” defined as an agreement that provides for close-out of those transactions in the event the CCP “fails to perform” due to “default, bankruptcy, liquidation or similar circumstances.” The presence of close-out netting provisions that match the requirements of “netting agreement” or “qualifying master netting agreement” is key. If a CCP provides for ring-fenced products but not for close-out netting, clearing participants would not be able to obtain a close-out netting opinion.”).

netting rules. On the other hand, however, the default and insolvency will be limited to the relevant OTC CCP and won't result in the default or insolvency of any of the other separate entities acting as OTC CCP for other products.

In practice, a number of existing OTC CCPs have amended their loss-allocation rules to allocate default losses only to those CMs operating within the particular clearing service in which the default losses occur, as indicated in Table 17 below.

Table 17. Comparison of default fund structures adopted by major OTC CCPs.

	DEFAULT FUND STRUCTURE
CME ⁹⁷⁶	<ul style="list-style-type: none"> • Three independent and distinct financial safeguards packages with individual Guaranty Funds, divided per asset classes: one for IRS, one for CDS, and one for futures and cleared OTC products other than IRS or CDS (the Base Guaranty Fund). • The funds of one financial safeguards package cannot be used to cure the losses within a different financial safeguards package.
Eurex Clearing ⁹⁷⁷	<ul style="list-style-type: none"> • One Default Fund that aggregates the funds contributed by all clearing members combined default fund for listed and OTC products, with the sole exception of Eurex Credit Clearing, which is covered via a separate default fund. • The Default fund is divided into Default Fund Segments (DFS) that are each associated with a certain group of products (Liquidation Groups). • The size of each DFS depends on the exposure of the clearing members active in the relevant Liquidation Group relative to the overall exposure of this member. The sum of the DFSs is the size of the Clearing House's total Default Fund. • The default of a clearing member in a particular Liquidation Group can only be covered using the respective DFS associated with that Liquidation Group, unless there is a known surplus from other, already completed Liquidation Groups. • The segmentation discussed above ensures that losses that need to be covered by the Default Fund are distributed first among those clearing members that are active in the respective Liquidation Group(s). • The segmentation concept is also applied to the other lines of defense.
ICE ⁹⁷⁸	<p>ICE Clear Europe</p> <ul style="list-style-type: none"> • Two segregated mutualized guaranty funds: a CDS Mutualized Guaranty Fund and a Futures & Options (F&O) Mutualized Guaranty Fund. • The F&O Guaranty Fund consists of two segments: energy segment and financials & softs segment. In the event of a clearing member's default where default losses exceed the defaulter's initial margin, its contributions to the F&O Guaranty Fund and ICE's initial F&O Guaranty Fund contributions, then non-defaulting clearing members' contributions and ICE's <i>pari passu</i> contribution will be used to cover remaining default losses. Where the remaining default losses relate to financials & softs contracts, the financials & softs segment will be exhausted prior to the member contributions to the energy segment, and vice-versa. Losses will be distributed on a pro-rata basis. • A separate Guaranty Fund is established for European CDSs. <p>ICE Clear U.S. provides clearing services for ICE Futures U.S. and has established its own Guaranty Fund.</p> <p>ICE Clear Credit (formerly ICE Trust), clearing index and single-name CDS instruments across North American, European and emerging markets, has established its own separate Guaranty Fund.</p>
LCH ⁹⁷⁹	<ul style="list-style-type: none"> • Three separate product specific default funds: a commodities fund, a listed interest

⁹⁷⁶ For further information, please refer to the CME Inc., CBOT, and NYMEX rulebooks published on CME Group's website (www.cmegroup.com).

⁹⁷⁷ For further information, please refer to Eurex Clearing Rule and Regulation published on Eurex Clearing's website (www.eurexclearing.com).

⁹⁷⁸ For further information, please refer to ICE Risk Management on ICE's website (www.theice.com).

⁹⁷⁹ For further information, please refer to LCH Risk Management on LCH's website (www.lch.com).

	<p>rate derivatives fund, and an equities and equity derivatives fund.</p> <ul style="list-style-type: none"> • Each default fund is dedicated to a specific product line and can only be used to cover default losses arising from the selected product line.
Nasdaq OMX⁹⁸⁰	<ul style="list-style-type: none"> • Semi-mutualized (i.e. semi-combined) default fund structure. The structure applies initial separation of the Commodities, Seafood, and Financial markets in the waterfall in order to create a buffer that separates each market's counterparty risks: <ul style="list-style-type: none"> - The Commodities Default Fund (CDF) operates as the second layer in the event of a counterparty default where the loss has arisen in the commodity market. Contributions to the CDF are only available to cover default losses in the commodity market. - The Financial Default Fund (FDF) operates as second layer in the event there is a counterparty default where the loss has arisen in the financial market. Contributions to the FDF are only available to cover default losses in the financial market. - The Seafood Default Fund (SDF) operates as second layer in the event of a counterparty default where the loss has arisen in the seafood market. Contributions to the SDF are only available to cover default losses in the seafood market. • Upon exhaustion of the resources contained in either of the CDF, the FDF, and the SDF as applicable, NASDAQ Clearing' Senior Capital is used as a third layer. Contributions to the NASDAQ Clearing' Senior Capital are available to cover default losses occurring in either of the markets. • Mutualized (combined) Default Fund (MDF) is a buffer provided by the clearing members from the commodity market, the seafood market and the financial market. The MDF operates as fourth layer in the event of a counterparty default. Contributions to the Mutualized Default Fund are available to cover default losses occurring in the commodity market, and/or the seafood market and/or in the financial market (that is, it is mutualized between the commodity, seafood and financial markets).

7.2.3. Tranching the Default Fund(s)

As previously explained, surviving CMs, who resign and do not actively cooperate during the default management process, are essentially free-riding on the efforts of other CMs: non cooperating CMs benefit from the services of the OTC CCP and the positive workout of the default management process, but they do not contribute to it in the hope that other surviving CMs will cooperate and will use their resources to solve the problem.

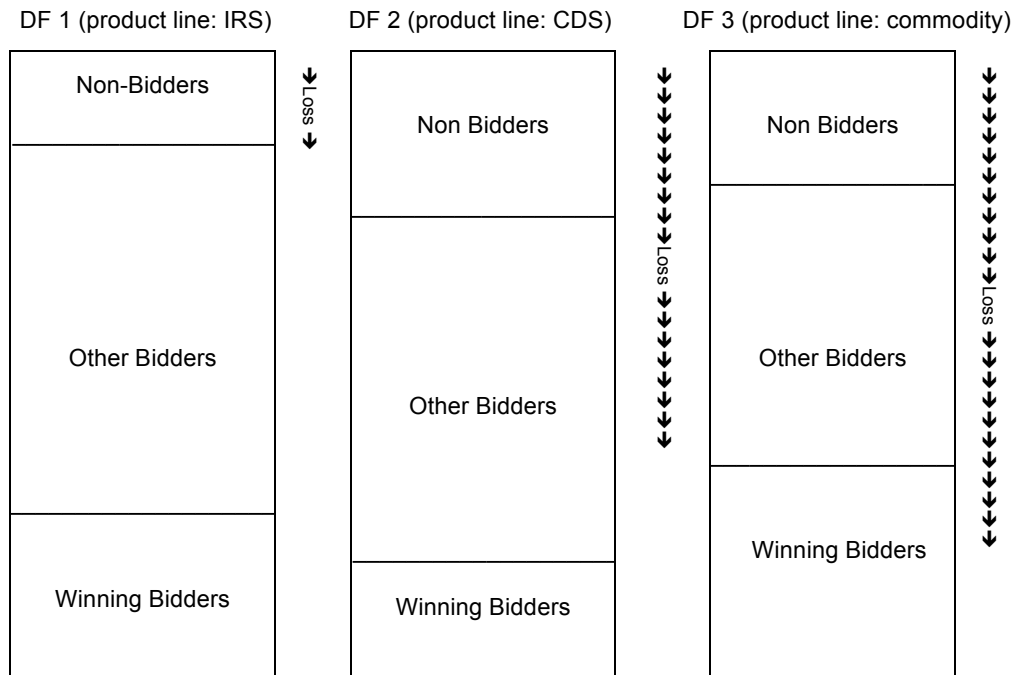
This section will discuss how to structure an OTC CCP's default fund to mitigate this free-riding behavior on the part of CMs and, thus, encourage them to act in the common good.⁹⁸¹

To achieve this goal, a key idea would be to divide the default fund(s) into multiple tranches and allocate losses across the tranches of the default fund(s) according to the competitiveness of CMs bidding in the auction for a particular product. For example, assume there are three separate default funds, one for IRSs (DF1), one for CDSs (DF2) and one for commodities (DF3). In each of the default funds, losses will be allocated in sequence: first to non-bidders, then to non-winning bidder ("other bidders"), and finally to winning bidders. Figure 46 below illustrates this tranching mechanism.

⁹⁸⁰ For further information, please refer to Nasdaq OMX Risk Management on NASDAQ OMX's website (<http://business.nasdaq.com/trade/clearing/nasdaq-clearing/index.html>).

⁹⁸¹ In this sense, see, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit. pp. 186-197.

Figure 46. Illustration of tranching of three separate default funds based on the competitiveness of CMs bidding in the auction.



Source: Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 187.

Figure 46 above shows relatively small losses on DF1, larger losses on DF2 and largest losses on DF3. With respect to DF1, all bidders will be protected, as non-bidders will absorb all default fund losses. In DF2, winning bidders will be protected, as the relatively larger losses will be covered by non-bidders and non-winning bidders. As per DF3, winning bidders will be affected by default losses, but they will be required to cover default losses only after exhaustion of the default fund contributions by non-bidders and non-winning bidders.

Two points to consider:

- CMs who bid in the auction can still experience losses in two circumstances. First, within each default fund, when default losses breach the default funds contributions by non-bidding CMs. In this case, losses will be covered in sequence by non-winning bidders and winning bidders. Second, when default losses arising from a particular product exceed the default resources in the default fund dedicated to such product line and the capital structure adopted by the OTC CCP requires these losses to be absorbed by the remaining DFs.⁹⁸²
- CMs would be required to participate only into the auctions for products within the product line that they clear. Hence, CMs will not need to bid in the auction for products that fall within a certain product line if they did not

⁹⁸² See, section 7.2.2 above, for a discussion of limited recourse clearing service structure and full recourse clearing service structure.

make any contribution to the default fund dedicated to that particular product line.

In practice, an increasing number of OTC CCPs have begun to pay closer attention to the described tranching default fund structure.⁹⁸³ The related advantages are significant: CMs will have the strong incentives to cooperate during the default management process, to help the OTC CCP during the hedging process, and to actively participate to the auction.

7.2.4. Degree of Mutualization

As previously discussed, risk pooling mechanisms can have positive benefits, but they can also create a variety of perverse incentives and informational problems, most notably moral hazard and adverse selection on the part of CMs (and their clients).⁹⁸⁴ Hence, loss mutualization may decrease CMs' incentives to perform accurate due diligence and encourage them to take on excessive risks, knowing that default losses will be spread across CMs.

One way to address these distorted incentives could be to lower the level of mutualization and differentiate the treatment of CMs.⁹⁸⁵

Rethinking the egalitarian treatment among clearing members, in turn, raises two questions: First, on which basis should the CMs be treated differently? Second, should the lower level of mutualization precede, or should it replace, the OTC CCP's complete/full mutualization via the default fund (and additional non-prefunded resources) in the waterfall?

As per the first question, a viable approach could be to differentiate among CMs based on the level of trading with the defaulted CM. This way, surviving CMs that did not trade with the defaulted CM would not run the risk (or would run only a limited risk) of loss mutualization. This would help mitigate the moral hazard problem as well as the danger of free-riding behavior on the part of CMs (and their clients): CMs (and their clients) would have the incentive to conduct accurate due diligence and properly monitoring their initial counterparties, and would be encourage to improve their risk-management activities.

As per the second question, one approach could be to maintain the complete/full mutualization via the default fund (and additional non-prefunded resources) in the default waterfall, but have it preceded by a lower level of mutualization. Thus, for example, the default fund contributions of surviving CMs that did not trade with the defaulted CM would be used to cover losses only after exhaustion of the default fund contributions of surviving CMs that traded with the defaulted CM. Alternatively, a different approach would be to replace the complete/full mutualization via the default fund (and additional non-prefunded resources) in

⁹⁸³ An interesting application of the tranching mechanism is provided by the Auction Incentive Pools (AIPs) used by LCH.Clearnet. See, LCH.Clearnet Ltd Default rules section 2.5, available at <http://www.lch.com/rules-regulations/rulebooks/ltd>.

⁹⁸⁴ See section 6.8 above for further discussion on this point.

⁹⁸⁵ The idea is that, when the level of loss mutualization is high and all CMs are equally treated, OTC derivatives liabilities are essentially close to being a joint and several liability of all CMs. In this sense, see, e.g., David Murphy, *OTC Derivatives: Bilateral Trading and Central Clearing. An Introduction to Regulatory Policy, Market Impact and Systemic Risk*, cit., pp. 236-237.

the default waterfall with a lower level of mutualization, whereby the default fund contributions of surviving CMs would be at risk only to the extent that they had traded with the defaulter CM.

7.2.5. Communication

As discussed in section 7.1.3 above, communication can significantly promote cooperation and can facilitate collective group action. Experimental findings show that when subjects are permitted to talk to each other they organize themselves by specifying precisely the number of required contributions and who should contribute to the common good.

This is a key point, particularly for the purposes of coordinating CMs' collective action in the context of the default management process. In fact, to work effectively, the default management process requires access by the OTC CCP and its CMs to accurate and comprehensive data and information about the defaulted CM's positions, the exposures of surviving CMs to the defaulted CM, the relative amount of their contributions to aggregate default resources and the state of recovery. The OTC CCP is well positioned to maintain information systems, as well as to collect and process the relevant data and information. Access to the described information and data is likely to be material to create the necessary incentives for surviving CMs to actively participate to the auction process and to coordinate their collective action for the common good. Moreover, access to this information can help reduce transactions costs and uncertainty, and mitigate price volatility associated with the hedging and replacement of the defaulted CM's positions. This, in turn, can help reduce the risk of disruptions and contagion knock-on losses resulting from large price changes that would otherwise be triggered by a large default.

CHAPTER 8: WHERE DOES THE SYSTEMIC RISK ULTIMATELY GO?

Chapter 7 has discussed how to design an OTC CCP's pre-funded mutualized default fund(s) for the purposes of incentivizing CMs to cooperate and to help the OTC CCP during the default management process by participating actively in the macro hedging and auctioning of the defaulted CM's positions. This Chapter will complete the previous analysis by identifying and discussing additional resources and stabilizing mechanisms that could be activated in the remote (but still possible) scenario in which an OTC CCP's coordinated default management process backfires.

8.1. Bail-In and Contingent Capital

Since the aftermaths of the GFC, increasing attention has been paid on investigating available mechanisms for dealing with troubled systemic relevant financial institutions without the involvement of costly public bailouts. One instrument that has gained particular attention is a form of "bail-in / contingent capital," whereby a significant percentage of a major financial institution's debt securities converts into an equity security at the occurrence of pre-agreed events.⁹⁸⁶

This bail-in / contingent capital can be integrated into an OTC CCP's default waterfall. Two are the relevant scenarios:

- First, as discussed in Chapter 4, market participants have expressed the view that losses incurred by non-defaulting CMs through VMGH should be compensated and that such compensation could take the form of new shares or senior convertible debt instruments, backed by the OTC CCP's recovery on the defaulted CM's estate, and/or a pro-rata share in the current and future OTC CCP's revenues/profits.⁹⁸⁷
- Second, an OTC CCP could issue contingent capital to third-party market investors (that is, investors who are neither CMs nor CMs' clients), which will convert onto equity upon resolution of the OTC CCP.⁹⁸⁸

Significantly, different from assessment calls, bail-in / contingent capital would provide the OTC CCP with pre-funded resources, which would be utilized to support the OTC CCP's operations during a target period (e.g., 12-month period) and absorb the maximum loss estimated to occur during a stress event.⁹⁸⁹

⁹⁸⁶ See, e.g., Mark J. Flannery, *No Pain, No Gain? Effecting Market Discipline via "Reverse Convertible Debentures"*, in Hal S. Scott (ed.), *Capital Adequacy Beyond Basel: Banking, Securities and Insurance*, Oxford University Press (2005), pp. 171-196; Mark J. Flannery, *Stabilizing Large Financial Institutions with Contingent Capital Certificates*, Working Paper (2009); Robert L. McDonald, *Contingent Capital with a Dual Price Trigger*, Working Paper (2010); Steven L. Schwarcz, *The Functional Regulation of Finance*, cit. For a thoughtful analysis of key features of convertible bonds, see Moorad Choudhry, *Convertible Bonds*, in Tony Rhodes (ed.), *Euromoney Encyclopedia of Debt Finance*, Euromoney Books (2006), pp. 103-123; Frank J. Fabozzi, *Bond Markets, Analysis and Strategies*, cit., pp. 465-482.

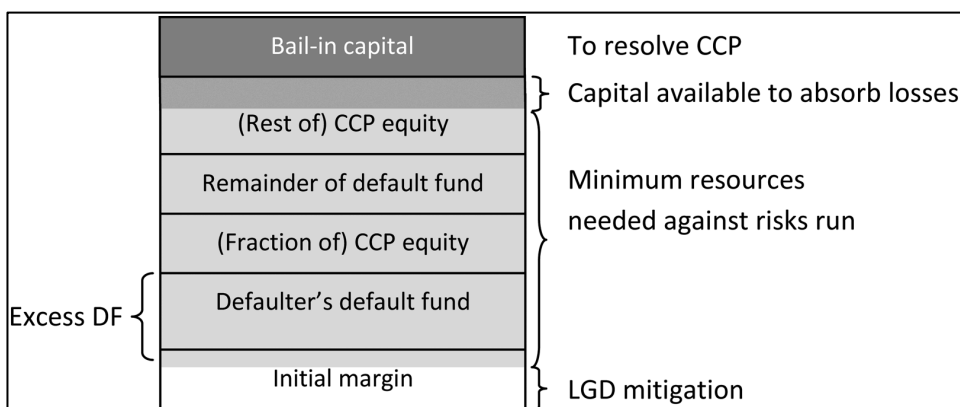
⁹⁸⁷ See, e.g., BlackRock, *Response to Discussion Note of the Financial Stability Board re Essential Aspects of CCP Resolution Planning*, cit., p. 8.

⁹⁸⁸ In this sense, see David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., pp. 329. See, also, Joel Clark, *The Debate over CCP Central Bank Liquidity*, Risk.net (January 10, 2011); Allan D. Grody, *Central Counterparties — New Uses for a Century-Old Market Mechanism*, *Journal of Risk Management in Financial Institutions*, Vol. 4, No. 2, pp. 112-116 (2011).

⁹⁸⁹ See, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 334 note 45.

Figure 47 illustrates an OTC CCP's default waterfall, including a bail-in / contingent capital component.

Figure 47. OTC CCP's default waterfall and financial resources requirements.



Source: David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, *Journal of Risk Management in Financial Institutions*, cit., p. 329.

The use of bail-in / contingent capital, however, is not without problems. First, debt investors may rationally fear being locked into a sinking OTC CCP and/or being forced to bear a loss to support its stockholders or senior creditors. To address this concern the convertible instrument should be designed in a way that minimize the likelihood of any wealth transfer from bondholders to common stockholders.⁹⁹⁰ Moreover, there is the risk that the market's anticipatory reaction to the conversion of the bail-in / contingent capital could trigger destabilizing effects. One way to address this concern would be to design the contingent capital so that the conversion would occur on a gradual and incremental basis, and the equity exchanged upon conversion would be senior nonconvertible preferred stock with cumulative dividends and voting rights.⁹⁹¹ As noted by Prof. Coffee, this design would have a number of advantages: first, it would help dilute the equity in a manner that deters excessive risk taking; second, it would create a class of voting preferred shareholders who would be rationally risk averse and would resist common shareholder pressure for increased leverage and risk taking; and third, it would avoid an "all or nothing" transition, which may evoke political resistance and bureaucratic indecision, by instead structuring a more incremental change."⁹⁹²

Notwithstanding the described benefits, it may still be the case that, after the conversion of existing contingent instruments into substantial amounts of new equity, an OTC CCP won't have enough resources to mitigate risks. If the OTC

⁹⁹⁰ In this sense, see, John C. Coffee, Jr., *Systemic Risk After Dodd-Frank: Contingent Capital and the Need for Regulatory Strategies Beyond Oversight*, *Columbia Law Review*, Vol. 111, pp. 795-847 (2011), p. 828 (noting that "former bondholders will experience losses if their firm continues to decline after the time of conversion. The point here is only that they should not be asked to subsidize or share losses with the common shareholders through a conversion formula that writes down their claims.") and p. 829 (discussing alternative conversion formulas).

⁹⁹¹ *Id.* pp. 830-831 (arguing that multiple incremental conversions should be preferred to a single major conversion because "the market's anticipatory reaction to each incremental conversion will be less dramatic than to the approach of a single 100% conversion." and that "Possibly the most important rationale for early and incremental conversion is to enable the new preferred shareholders to exercise influence on the corporate board as voting shareholders.").

⁹⁹² *Id.*, p. 795.

CCP's default management process is not effective in limiting the systemic consequences of the initial failure, losses will continue accumulating. At that point, alternative resources and stabilizing mechanisms will need to be considered. This takes us to the following section.

8.2. Liquidity-Provider of Last Resort

As discussed in Chapter 4, one option for an OTC CCP that has exhausted all its loss-absorbing resources could be to access credit lines extended by banks and/or other commercial providers of liquidity. Any of these facilities, however, would likely be very expensive due to the applicable capital requirements under Basel III. Moreover bank credit lines and liquidity resources provided by other private financial institutions may become unreliable during period of severe market stress, as the same turbulences that have caused problems to the OTC CCP may have also severely hit such banks and other financial institutions. In this situation, to avoid a liquidity-induced OTC CCP failure, the provision of liquidity support from a government entity, such as a central bank, may be considered.⁹⁹³

As observed by Prof. Schwarcz, a central bank can facilitate systemic stability in two ways: first, liquidity from central bank can be used to stabilize systemically important financial institutions and prevent these entities from defaulting (or preventing defaulting financial entities from failing); and second, liquidity from central bank can be utilized to stabilize systemically important financial markets and provide the resources they need to continue operating.⁹⁹⁴

In the former case, a central bank would act as institutional liquidity-provider of last resort. This role is not without criticisms. Prof. Pirrong observes that the role of central banks as liquidity provider of last resort to troubled financial institutions, including OTC CCPs, has been "one of the most contentious policy issues arising out of clearing mandates."⁹⁹⁵ Two are the main concerns:

- First, there is the concern that giving troubled OTC CCPs access to central bank liquidity will operate as a government bailout. The assurance of this bailout, in turn, will foster moral hazard on the part of OTC CCPs (particularly those that believe, and/or are perceived to be, "too big to fail"), thus encouraging excessive risk taking. One way to address this

⁹⁹³ The U.S. Federal Reserve Bank has traditionally acted as a lender of last resort to banks and other financial institutions in "unusual and exigent circumstances". See, Jeffrey N. Gordon and Christopher Muller, *Confronting Financial Crisis: The Case for a Systemic Emergency Insurance Fund*, Yale Journal on Regulation, Vol. 28, No. 1, pp. 151-211 (2011) (describing the history of emergency lending by the Federal Reserve under § 13(3) of the Federal Reserve Act). Given the global nature of the OTC derivatives market and the fact that OTC CCPs are active internationally, close attention will also need to be paid to cross-border coordination of regulatory and supervisory interventions. Thus, for instance, in case of international liquidity demands, an international entity could also act as an international liquidity-provider of last resort. See, David Murphy, *The Systemic Risks of OTC Derivatives Central Clearing*, cit., p. 334, note 45 (arguing that "This problem is complicated in that some central banks, understandably, do not wish to be liquidity providers to the global derivatives system in the event of crisis."). For a discussion on this point, cf., e.g., Steven L. Schwarcz, *Systemic Risk*, cit.; Arshadur Rahman, *Over-the-counter (OTC) derivatives, central clearing and financial stability*, cit.

⁹⁹⁴ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 225 note 196 (arguing that "[t]his also responds directly to the crux of a systemic collapse because systemic risk is (largely) a liquidity phenomenon: market systemic risk is systemic risk that impairs market liquidity, and institutional systemic risk is, at least to the extent it involves banks, systemic risk that impairs money liquidity."); Steven L. Schwarcz, *The Functional Regulation of Finance*, cit., p. 42.

⁹⁹⁵ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 39.

concern could be to give central banks discretion to decide whether or not to provide liquidity to troubled OTC CCPs.⁹⁹⁶ Moreover, to minimize moral hazard problem, central banks could establish rigorous qualification criteria for borrowing and repayment incentives for borrowers, and/or requiring coinsurance.⁹⁹⁷ In addition, OTC CCPs could be subject to close prudential oversight and capital requirements similar to that which applies to systemically important financial institutions.⁹⁹⁸ Finally, to mitigate distorted incentives, closer attention would also need to be paid to OTC CCPs' policies regulating membership requirements and establishing the types of contracts to clear, as these policies significantly affect the risks that OTC CCPs will face.⁹⁹⁹

- Second, related to the above is the concern that giving troubled OTC CCPs access to central bank may ultimately result into high taxpayers costs. One way to avoid preclusive taxpayers costs could be to privatize (at least partially) the role of the liquidity-provider of last resort. This could be achieved, for example, by requiring that the pool of resources, from which to advance liquidity to troubled OTC CCPs, be partially funded by “premia” paid by market participants.¹⁰⁰⁰

In the latter case, a central bank provides liquidity to financial markets. To this purpose, the central bank can purchase market securities at prices that are below their intrinsic values but above their then-current prices securities and/or assume through derivatives contracts only risks that the markets have the greatest difficulty hedging. In so doing, the central bank would essentially operate as market liquidity provider of last resort.¹⁰⁰¹ This approach has significant advantages relative to a liquidity-provider of last resort for financial institutions: first, it can help stabilize financial markets during times of severe turbulence, when securities prices have fallen below their intrinsic values; second, it can help regain confidence in financial markets, by establishing a floor

⁹⁹⁶ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 226.

⁹⁹⁷ *Ibidem*.

⁹⁹⁸ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., pp. 2, 39-40; BlackRock, *Resiliency, Recovery, and Resolution - Revisiting the 3 R's for Central Clearing Counterparties*, cit., pp. 2, 4..

⁹⁹⁹ *Id.*, p. 40.

¹⁰⁰⁰ *Ibidem*. See, also, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., pp. 1404-1047; Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 282 (arguing that “[a]n idea that fits with the systemic risk insurance concept is that a CCP requiring central bank support could be given this by way of a temporary loan. Then going forward, the CCP would charge additional fees to cover the costs of this loan. Conceptually, these provide a means for a CCP to price in the cost of a bailout both pre- and post-crisis).

¹⁰⁰¹ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 229, note 224; Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., p. 1405 note 224 (arguing that “[t]o induce holders of securities to sell them at such prices, the market liquidity provider could employ flexible pricing approaches such as those used in structured financing transactions to buy financial assets of uncertain value.”); Steven L. Schwarcz, *Too Big to Fail?: Recasting the Financial Safety Net*, in Lawrence E. Mitchell and Arthur E. Wilmarth, Jr. (eds), *The Panic of 2008: Causes, Consequences and Implications for Reform*, Edward Elgar Publishing Limited (2010), pp. 94-115; Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., p. 832 (noting that “[f]or example, in response to the post-Lehman collapse of the commercial paper market, the Federal Reserve created the Commercial Paper Funding Facility (“CPFF”) to act as a lender of last resort for that market, with the goal of addressing “temporary liquidity distortions” by purchasing commercial paper from highly rated issuers that could not otherwise sell their paper.”); Dimitris N. Chorafas, *Financial Boom and Gloom: The Credit and Banking Crisis of 2007-2009 and Beyond*, cit., pp. 34-60; See Tobias Adrian, Karin Kimbrough and Dina Marchioni, *The Federal Reserve's Commercial Paper Funding Facility*, Federal Reserve Bank Of New York Staff Report No. 423 (2010); Philip E. Davis, *Debt, Financial Fragility, and Systemic Risk*, Oxford University Press (1995) (suggesting there may be a need for a “market maker of last resort” to protect financial markets).

on prices; third, it can limit moral hazard problems discussed above; and fourth, it can give taxpayers a chance to profit by purchasing securities at a discount to their intrinsic values.¹⁰⁰²

As with the liquidity-provider of last resort for financial institutions, the liquidity-provider of last resort for markets could collect part of the necessary funding from the private sector. This observation, in turn, raises the question of whether the role of a liquidity-provider of last resort for financial markets could be entirely performed by private investors. The answer to this question is likely to be negative (at least) for two reasons. First, individuals at investing firms might not want to jeopardize their reputations (and jobs) by causing their firms to invest at a time when other investors have abandoned the market.¹⁰⁰³ Second, private investors would like to have the option to buy and sell securities without having to wait for their maturities; in contrast a market liquidity provider of last resort should be able to wait until maturity, if necessary.¹⁰⁰⁴

Regulators around the world have largely acknowledged the need of systemically important financial institutions, including OTC CCPs, and financial markets to access liquidity from central bank, although only as a liquidity provider of last resort. In particular, in the United States, under Title VIII of Dodd-Frank, CCPs deemed systemically important financial market utilities (“SIFMUs”) have access to the Federal Reserve’s Discount Window - direct (typically short-term) loans – in “unusual or exigent circumstances,” upon majority vote of the Federal Reserve Board after consultation with the Secretary of the Treasury, and after having demonstrated their inability to secure adequate credit accommodations from other banking institutions.¹⁰⁰⁵ The Dodd-Frank Act defines “financial market utility” as “a person that manages or operates a multilateral system for the purpose of transferring, clearing, or settling payments, securities, or other financial transactions among financial institutions or between financial institutions and the person.”¹⁰⁰⁶ A “payment, clearing or settlement activity” is defined as “any activity carried out by one or more financial institutions to facilitate completion of financial transactions.”¹⁰⁰⁷ By vote of no fewer than two-thirds of its members (including an affirmative vote by the Chairperson), the Financial Stability Oversight Council (“Council”) must determine whether a FMU is, or is likely to become, systemically important. Title VIII provides four specific factors the Council must take into consideration when making its determination, which

¹⁰⁰² See, Iman Anabtawi and Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, cit., pp. 1404-1047.

¹⁰⁰³ See, Steven L. Schwarcz, *Systemic Risk*, cit., p. 229 and accompanying note. Empirical evidence seems to confirm that individuals tend to engage in this type of herd behavior Id., p. 229, note 229. See, e.g., Stephen M. Bainbridge, *Mandatory Disclosure: A Behavioral Analysis*, University of Cincinnati Law Review, Vol. 68, pp. 1023-1060 (2000) (discussing how herd behavior may have a reputational payoff even if the chosen course of action fails, and arguing that where “the action was consistent with approved conventional wisdom, the hit to the manager’s reputation from an adverse outcome is reduced”); Paul M. Healy and Krishna G. Palepu, *The Fall of Enron*, Journal of Economic Perspective, Vol. 17, No. 2, pp. 3-26 (2003) (explaining that a risk-averse fund manager who estimates a stock is overvalued will be apt to “simply follow the crowd” blamed for a poor investment decision if the stock ultimately collapses “since other funds made the same mistake”).

¹⁰⁰⁴ See, Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., p. 833, note 77.

¹⁰⁰⁵ 12 U.S.C. §§ 5462(3), 5462(4), 5465(b) (2012). Note that this liquidity provision is separate from the Federal Reserve Bank’s emergency program provisions in Section 13(3) of the Federal Reserve Act discussed below.

¹⁰⁰⁶ Dodd-Frank Act § 803(6).

¹⁰⁰⁷ Dodd-Frank Act § 803(7).

are incorporated with more detail provided in the Council's regulations regarding the designation of FMUs. The four specific factors are (1) the aggregate exposure of the FMU to counterparties, (2) the aggregate monetary value of transactions processed or carried out by the FMU, (3) the relationship, interdependencies, or other interactions of the FMU with other FMUs or payment, clearing, or settlement activities, and (4) the effects that the failure or disruption of the FMU would have on critical markets, financial institutions, or the broader financial system.¹⁰⁰⁸

At the time of writing, the Council has designated the following eight FMUs as systemically important:¹⁰⁰⁹

- The Clearing House Payments Company, L.L.C., on the basis of its role as operator of the Clearing House Interbank Payments System – [Board of Governors of the Federal Reserve System];
- CLS Bank International - [Board of Governors of the Federal Reserve System];
- Chicago Mercantile Exchange, Inc. – [Commodity Futures Trading Commission (CFTC)];
- The Depository Trust Company – [Securities and Exchange Commission (SEC)];
- Fixed Income Clearing Corporation – [SEC];
- ICE Clear Credit L.L.C. – [CFTC];
- National Securities Clearing Corporation – [SEC]; and
- The Options Clearing Corporation – [SEC].

Thus, under the Dodd-Frank Act, the Federal Reserve can now lend directly to SIFMUs. Because of this, scholars have observed that the Dodd-Frank Act has transformed the Federal Reserve into an “insurer of last resort” for the financial markets¹⁰¹⁰ or, the “market-maker of last resort.”¹⁰¹¹

In addition to the above, Title VIII of the Dodd Frank Act also empowers the Federal Reserve to prescribe risk management standards for SIFMUs - and even to override the standards set by the SEC and CFTC if such standards are insufficient to prevent or mitigate significant liquidity, credit, operational, or other risks to the financial markets or to the financial stability of the United States. Designated FMUs must provide their supervisory agencies with 60-day advance notice of proposed changes to rules, procedures, or operations that could materially affect the nature or level of risks presented by the FMU. Furthermore,

¹⁰⁰⁸ Dodd-Frank Act § 804(a)(2). Title VIII also requires the Council to take into consideration any other factors that the Council deems appropriate.

¹⁰⁰⁹ The Federal agency that has primary jurisdiction over the designated FMU is indicated between square brackets. For further information, please refer to the Designated Financial Market Utilities on the Federal Reserve System's website at www.federalreserve.gov/paymentsystems/designated_fm_u_about.htm.

¹⁰¹⁰ See, Felix B. Chang, *The Systemic Risk Paradox: Banks and Clearinghouses Under Regulation*, cit., p. 788 and note 132.

¹⁰¹¹ *Id.*, p. 788, note 133.

the Federal Reserve, SEC, and CFTC may also conduct examinations of, request information from, and pursue enforcement actions against SIFMUs concerning their risks, safety and soundness, and compliance with regulations.

On the other hand, however, the Dodd-Frank Act has limited the authority of the Federal Reserve to make emergency loans to individual or insolvent financial firms, while maintaining the Federal Reserve's ability to create broadly based facilities.¹⁰¹² In particular, the Dodd-Frank Act has amended Section 13(3) of the Federal Reserve Act (12 U.S.C. 344) to require the Federal Reserve to consult with, and receive approval from, the Secretary of the Treasury to ensure that any emergency lending is designed to provide liquidity to the markets and not to aid a financially failing firm. On December 18, 2015, the Fed promulgated a final rule implementing these changes.¹⁰¹³

8.3. Private Systemic Risk Insurance Fund

An alternative method to stabilize system-wide effects triggered by troubled OTC CCPs could involve the use of a private systemic risk insurance fund. To this purpose, financial resources could be collected from CMs and pooled together into a private fund to cover rarely occurring extreme losses after all other resources to support the OTC CCP have been exhausted. Upon the default of one (or more) CM(s), a waterfall approach would still apply and financial resources in form of margin, default funds contributions and OTC CCP's equity will be utilized to cover default losses as discussed in Chapter 4. When all these resources are exhausted, and only at that point, the reserves pooled into the private systemic risk insurance fund will be used to cover the remaining losses.

This approach raises a number of questions.

A first question arises as to who should be responsible for establishing and administrating the private systemic risk insurance fund. For instance, Koepl and Monnet¹⁰¹⁴ suggest that the private systemic risk insurance fund could be established and administrated by an OTC CCP, which would charge its CMs a premium for taking on net derivatives positions. According to Koepl and Monnet, an OTC CCP would be the most qualified institution to administer the fund because of its core business, which already involves trade repository, netting, setting and administering margins and default funds.¹⁰¹⁵ The combination of these services – the authors argue – puts the OTC CCP into a unique position. The OTC CCP would be able to leverage its expertise and information to assess risk from a systemic perspective. Furthermore, by enforcing rigorous margin and default fund policies, the OTC CCP would also be able to safeguard against individual failures thereby reducing the likelihood of contagion and systemic events. Because of these reasons, the authors

¹⁰¹² Dodd-Frank Act § 1101(a)(6).

¹⁰¹³ See, e.g., Marc Labonte, *Federal Reserve: Emergency Lending*, Congressional Research Service 7-5700 (2016).

¹⁰¹⁴ See, Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., p. 3 (arguing that "systemic risk insurance should be a pivotal component of central clearing in this market.")]

¹⁰¹⁵ Id., pp. 11-15, 17.

conclude, administrating a private systemic risk insurance program would be an additional service that logically complements existing OTC CCP's services.¹⁰¹⁶

In practice, however, a number of factors could limit the possibility of having a single OTC CCP running the fund as suggested by Koepl and Monnet. In particular, OTC derivatives are traded across many different market places, and the activities of OTC CCPs might be restricted by the legal jurisdiction under which their CMs operate, the type(s) of derivatives contracts they specialize in clearing, and/or the currency denomination of the derivatives contracts they clear. Alternative options should, therefore, be considered.

One alternative approach could be to have the private systemic risk insurance fund set up and administered across multiple OTC CCPs by a "meta-CCP." The meta-CCP would operate as a sort of CCP for OTC CCPs at the top of the clearing infrastructure, and would oversee the many OTC CCPs specialized in different market segments.¹⁰¹⁷ By leveraging its strategic position, the meta-CCP would, then, be able to set up and administrate the private systemic risk insurance fund.

Alternatively, a government entity could also establish and administrate the private systemic risk insurance fund. In this case, the resources to build up the fund would be collected by taxing CMs, either directly or indirectly (that is, by taxing OTC CCPs, which will then charge their CMs for these costs).¹⁰¹⁸

Additional questions arise with respect to the size of the private systemic risk insurance fund. The premium charged on CMs (or the amount of the government-imposed tax, if the fund is established and administrated by a government entity) could be either fixed or (more likely) variable. In the latter

¹⁰¹⁶ Ibidem.

¹⁰¹⁷ See, Jorg Maegerle and Thomas Nellen, *Interoperability Between Central Counterparties*, cit., pp. 20-21 (noting that "[a] meta-CCP reduces multilateral relationships between CCPs into bilateral relationships between CCPs and the meta-CCP (essentially, this is the same as what a CCP does for its participants)"). See, also, Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*, cit., p. 282.

¹⁰¹⁸ Prof. Schwartz has analyzed the design and implications of systemic risk insurance funds built up throughout government-imposed taxes on systemically important financial institutions and market players. The findings of his study are relevant in the context of a systemic risk insurance fund for OTC CCPs, as well. See, Steven L. Schwarcz, *The Functional Regulation of Finance*, cit., p. 42, note 189 (arguing that "[a] government-imposed tax would be necessary because private market participants, even if they had the ability to do so, will intervene only where they perceive it to be in their best interests to do so."); Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., pp. 829-830 and accompanying note 58 (arguing that "[a]lthough it is possible that the financial industry itself might voluntarily create and contribute to such a fund, I believe that is highly unlikely. Because systemic financial externalities are imposed on parties outside the financial industry, the industry, qua industry, would not necessarily have an incentive to do that ... Moreover, even if there were incentive, the financial industry may be too fragmented and heterogeneous to efficiently self-coordinate"). See, also, Viral V. Acharya, Lasse H. Pedersen, Thomas Philippon and Matthew Richardson, *Measuring Systemic Risk*, cit. (arguing that in order to address the systemic risk externality, financial institutions must be charged a "systemic-risk related tax" that is based on the extent to which it is likely to contribute to systemic risk); Viral V. Acharya, Lasse H. Pedersen, Thomas Philippon and Matthew Richardson, *Regulating Systemic Risk*, cit., pp. 283-303 (proposing to measure how much of the economy's capital is being put at risk by each financial institution and then tax each financial institution accordingly based on the amount of the assets they hold and their contribution to systemic risk. This tax would create incentives to allocate risk efficiently and would generate levies that would go towards a "systemic risk fund" to be used in the future by the regulators to inject capital into the system (at their discretion)); Viral V. Acharya, Lasse Pedersen, Thomas Philippon and Matthew Richardson, *A Tax on Systemic Risk*, CEPR conference paper (2010) (proposing two schemes to estimate a "systemic-risk related tax:" (i) pricing of contingent capital insurance for systemic risk, that is, an insurance for each firm against itself becoming undercapitalized when the financial sector as a whole becomes undercapitalized; and, (ii) market-based discovery of the price of such risk insurance that financial institutions must purchase partly from the private sector and mostly from the government or the central bank); Narayana Kocherlakota, *Taxing Risk and the Optimal Regulation of Financial Institutions*, Federal Reserve Bank of Minneapolis Economic Policy Paper No. 10-3 (2010) (proposing to impose a tax to internalize systemic-risk externalities).

case, the premium (or the amount of the government-imposed tax) could increase with the net position for any given market participant. To avoid gaming behavior and to properly internalize the costs associated with systemic risk externalities, the premium would need to cover all market participants whose activities contribute to systemic risk.¹⁰¹⁹ The premium should also be non-refundable, and should be periodically recalculated to properly reflect the contribution to systemic risk of each individual CM.

A related question would arise as to how to invest the premiums. As observed by Koepl and Monnet, returns on investing reserves are likely to be low precisely when these reserves need to be paid out.¹⁰²⁰ This restricts available investment portfolio options for the private systemic risk insurance fund.

Finally, the optimal path for building up fund reserves through premiums or government-imposed taxes is also an open question. Considering the unpredictable nature and size of the systemic risk event, a key problem is how fast and to what degree insurance reserves should be built up. Collecting and pooling together the necessary resources is expensive and might take long time. Moreover, once the reserves in the fund have been utilized, collecting additional resources to rebuild the fund might be extremely costly and even not feasible. In such a scenario, a combination of private and public liquidity support/ public bridge financing might be considered.¹⁰²¹

The advantages of a systemic risk insurance private fund could be significant:¹⁰²²

- First, the fund will help mitigate public concerns and reduce public costs that would have otherwise arisen from a government bail-out.
- Second, the fund will help reduce risk concentration in the system.¹⁰²³
- Third, the fund will reduce moral hazard, by discouraging fund contributors from taking on excessive risks.¹⁰²⁴
- Fourth, the fund can help internalize externalities associated with the trading of OTC derivatives.¹⁰²⁵ As observed by Prof. Schwarcz, the

¹⁰¹⁹ See below for further discussion on this point.

¹⁰²⁰ See, Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., pp. 12-13 and accompanying note 20.

¹⁰²¹ Id., p. 13 (arguing that “in case it is needed, some sort of public liquidity support should be provided to smooth out over time as much as possible the costs of this aggregate risk insurance. The support should take the form of a temporary loan to the CCP at market rates in the event that the systemic risk fund is not enough to cover the costs of a wide-spread default. To pay back the loan, the CCP would raise additional fees on clearing members beyond standard clearing fees and margin requirements. In this way, the cost of a bailout would also be levied on dealers post crisis.”).

¹⁰²² See, Steven L. Schwarcz, *The Functional Regulation of Finance*, cit., pp. 42-45; Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., pp. 829-830.

¹⁰²³ In this sense, see, Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., p. 14 (arguing that “systemic risk insurance will charge OTC derivatives transactions directly for increasing systemic risk and, thus, will counteract - albeit not eliminate - risk concentration in this sector.”).

¹⁰²⁴ Although the problem of moral hazard appears to be less of a concern in the context of the private systemic risk insurance fund (compared to the case of a government liquidity-provider of last resort), it would not be completely eliminated. See, e.g., Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., pp. 14-15 (arguing that “insurance is only for the entire system, but not individual counterparties. This implies that clearing members would have to coordinate their actions in order to actively increase system-wide risk beyond what is covered through the premium charged. In other words, the systemic risk fund would be primarily subject to collective moral hazard” and suggesting that “systemic risk insurance could be complemented with other macro-prudential instruments that would limit this problem.”).

likelihood that systemically important firms will have to make additional contributions to the fund to replenish bailout monies will motivate those firms to cross-monitor each other and thereby help control each other's risky behavior.¹⁰²⁶

Notwithstanding the described benefits, the use of a systemic risk insurance private fund can also raise a number of problems, including the following:

- First, as discussed above, concerns exist as per the timing and costs of building up the necessary resources.
- Second, considerations of national regulatory oversight and jurisdictional issues could create additional barriers to cross-market and cross-border operations of the fund.
- Third, in the event either a meta-CCP or a government entity is responsible for establishing and administrating the private systemic risk insurance fund, the resulting tiered structure could create additional problems in term of information fragmentation, monitoring hurdles, and regulatory arbitrage.
- Fourth, this approach would essentially result into an additional pooled fund placed at the top of the capital structure of an OTC CCP (or at the top of multiple OTC CCPs, if the fund is established and administrated by a meta-CCP or a government entity). Chapter 6 has explained in detail how the different levels in the default waterfall of an OTC CCP are accessed in sequence, much like the tranches of a CDO. As previously discussed, the defaulted CM's margins and mutualized default fund contribution together with the first piece of the OTC CCP's equity correspond to the CDO's equity and junior tranches. This means that the defaulted CM and the OTC CCP (with respect to the first tranche of its equity contribution to default resources) have a "first loss position" in the hypothetical CDO. In addition, the contributions to the mutualized default fund made by non-defaulting CMs together with their other loss allocation exposures (e.g., rights of assessment, variation margin gains haircutting and other loss allocation methods) and the second tranche of the OTC CCP's equity are analogous to CDO's senior and super-senior tranches.

¹⁰²⁵ See, Steven L. Schwarcz, *The Functional Regulation of Finance*, cit., p. 43; Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., pp. 830-831. Prof. Schwarz notes out that there are strong precedents for requiring the private sector to contribute to systemic-risk insurance funds that would help to internalize externalities. For instance, the U.S. Federal Deposit Insurance Corporation (FDIC) requires member banks to contribute to a Deposit Insurance Fund to ensure that depositors of failed banks are repaid. Similarly, U.S. law requires each owner of a nuclear reactor to contribute financial resources to a fund to compensate for possible reactor accidents. *But*, see, See, e.g., Thorsten V. Koepl and Cyril Monnet, *Central Counterparty Clearing and Systemic Risk: Insurance in OTC Derivatives Markets*, cit., p. 15 note 26 (arguing that "[t]here are ... important differences with deposit insurance for banks which was introduced to build up a fund to insure depositors against losses. The fund is not nearly large enough to cover a large proportion of deposits in the banking sector. This can be understood from the fact that the primary function of this fund is to prevent bank runs based on mere rumors about the health of individual banks").

¹⁰²⁶ See, Steven L. Schwarcz, *The Functional Regulation of Finance*, cit., p. 43; Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, cit., pp. 830-831; Steven L. Schwarcz, *Marginalizing Risk*, cit., pp. 510-511; Jeffrey N. Gordon and Christopher Muller, *Confronting Financial Crisis: Dodd-Frank's Dangers and the Case for a Systemic Emergency Insurance Fund*, Yale Journal on Regulation, cit. (calling for a systemic emergency insurance fund that is funded by the financial industry).

This means that non-defaulting CMs and the OTC CCP (with respect to the second tranche of its equity contribution to default resources) have a “second loss position” in the hypothetical CDO.

Given this structure, placing a private systemic risk fund at the top would be like adding a “super-super senior” tranche to a CDO structure. This tranche will be the most concentrated in terms of systemic risk, tail risk and wrong way risk. Moreover, because CMs must contribute the insurance resources, CMs will be the investors in this tranche. This is a key point, because in so doing CMs will take on a risk-exposure very similar to the one they had during the period immediately prior to the GFC when large banks invested heavily in senior and super senior tranches of CDOs and CLOs. This, in turn, means that the systemic risk was, and will remain, within the core banking system. This is exactly the danger that the post GFC financial regulatory reforms, including clearing mandates, have sought to eliminate.

- Fifth, and related to the above, requiring CMs to contribute resources to build up the private systemic risk fund (either in form of risk premium or government-imposed tax) would be equivalent to requiring them to provide self-insurance: the systemic risk insurance will be provided by the very same institutions that pose the systemic risk and need to buy the insurance. This, in turn, raises the question of “who should insure the insurer?” Said it differently, set aside the case of a government entity acting as liquidity-provider of last resort discussed in section 8.2 above, the question is “who should act as third-party systemic-risk insurer of last resort?” The following section will address this question in detail.

8.4. Third-Party Systemic Risk Insurance

To answer the question of who should act as third-party systemic risk insurer of last resort one should first consider the nature of systemic risk. Systemic risk is a classic example of non-diversifiable risk. As mentioned in Chapter 6, risks can be broadly distinguished between diversifiable risks and non-diversifiable risks. When the risk is diversifiable, risk sharing is efficient: through risk sharing mechanisms, the risk is widely dispersed and vanishes. Risk sharing mechanisms, however, are less efficient when applied to non-diversifiable risks because these risks do not vanish when widely shared. Therefore, it’s critically important for non-diversifiable risks (including systemic risk) to be held by those entities better able to assess and manage these risks.

One available approach could involve the use of credit derivatives instruments. As discussed in Chapter 1, in OTC derivatives markets, market participants often buy insurance in form of CDSs. When applied into the central clearing context, this suggests the idea of having CDSs written on OTC CCPs (or perhaps a portfolio of CDS on CMs). This approach, however, would then raise the questions of who could sell CDS protection and who could ever clear those

CDSs. As Prof. Pirrong argues, this “[s]ounds like the wrong way risk from hell.”¹⁰²⁷

An alternative approach could involve the use of a third-party insurer (or a group of insurers) that would provide insurance coverage to OTC CCPs when default losses cause their waterfalls to run dry. This way, insurance arrangements would reallocate the risk of extreme default losses from the OTC CCP (and its CMs) to the insurer(s).¹⁰²⁸ In an interesting article published on Bloomberg, Matt Leising analyzes the implication of this approach.¹⁰²⁹ Leising reports that a group of about 20 insurers, brought together by GCSA LLC, a New York-based underwriter, for the first time offers coverage for OTC CCPs’ risks. In particular, the insurers will cover up to US\$ 6 to US\$ 10 billion in losses across multiple OTC CCPs, including CME Group Inc. and LCH.Clearnet Group Ltd. Their coverage will kick in once all resources into the CCP’s default waterfall are exhausted. As further reported by Leising, the idea is that OTC CCPs will pay for this insurance with their own resources, and not CMs’ funds.

The described approach is not without problems.¹⁰³⁰ First, no information is provided regarding the insurance price. The coverage is likely to be very expensive. This observation, in turn, raises a number of questions: how will insurers calculate the applicable premiums (that is, how will they price systemic-risk)? Can OTC CCPs afford this coverage? How will this insurance affect the costs of OTC derivatives clearing? Will OTC CCPs seek to recover part of the insurance costs from CMs? If so, how will CMs price the (indirect) costs of the insurance into the OTC derivatives that they trade?

Second, and most important, the described approach doesn’t seem to appreciate the wrong way risk factor inherent in the structure of OTC CCPs. As discussed in Chapter 6, losses hitting the default fund are expected to occur during periods of extreme market turbulence, right at the time when CMs are least able to bear such losses. Thus, as noted by Prof. Pirrong “[i]t would have been truly interesting if insurers would have been willing to share losses with CMs. That would have mitigated the wrong way risk problem. But the insurers were evidently not willing to do that.”¹⁰³¹ One possible explanation for this choice by the insurers might be the need to mitigate moral hazard problems. Hence, as noted by Prof. Pirrong “[m]embers would have less incentive to mitigate risk if some of that risk is offloaded onto insurers who don’t influence CCP risk management and margining the way member firms do.”¹⁰³²

Third, there are reasonable doubts that a group of insurers could effectively take on extreme losses, which are the most concentrated in terms of systemic-risk, tail risk, and wrong way risk. As reported by Leising, the consortium has explicitly

¹⁰²⁷ See, Craig Pirrong, *You Can’t Mutualize, Insure, or Diversify Systematic Risk*, cit.; Craig Pirrong, *Clearing Angst: Here Be Dragons Too*, cit.

¹⁰²⁸ See, Craig Pirrong, *The Economics of Central Clearing: Theory and Practice*, cit., p. 9 (noting that “[h]istorically, some CCPs purchased insurance that covered some losses in the event of a default in excess of the defaulter’s margins.”).

¹⁰²⁹ See, Matthew Leising, *Catastrophe Prevention Drives Insurance Pitch to Clearinghouses*, Bloomberg (March 11, 2014).

¹⁰³⁰ See, Craig Pirrong, *CCP Insurance for Armageddon Time*, Streetwise Professor Blog (March 11, 2014).

¹⁰³¹ *Ibidem*.

¹⁰³² *Ibidem*.

addressed this concern. Without disclosing the identity of single insurers, David Hardy (chairman of GCSA) has indicated that three kinds of companies are involved in the project: companies active in the Lloyd's of London market, insurers incorporated in Bermuda, and European reinsurers.¹⁰³³ None of these insurers – Hardy explained - is connected to the derivatives market or the banks that serve as CMs.¹⁰³⁴ Yet, the explanation provided by the consortium is not conclusive. Although the independence of the insurers could (at least in theory) reduce the concentration of risk in the event of failure of major CMs or OTC CCPs, it does not guarantee that the insurers will be able to stand during the worst scenario and provide the agreed upon systemic risk insurance coverage.

Because of the complexities involved in the use of third-party systemic risk insurance discussed above, additional (complementary) resources should be considered. This leads us to the following section.

8.5. Systemic-Risk Catastrophe Bonds

Related to the concept of third-party systemic risk insurer discussed in the previous section is the idea of “systemic-risk catastrophe bonds.”

Catastrophe bonds (also known as “cat bonds”) are a type of financial security designed to transfer risk associated with natural catastrophe events and large-scale disasters. If no such event occurs, investors in catastrophe bonds will earn attractive yields and will receive the principal back at maturity (typically a three-year period). Contrary, if a catastrophe event occurs, principals will be forgiven and the company issuing catastrophe bonds will use these amounts to pay off its claim holders.¹⁰³⁵ Insurance and re-insurance companies have long issued catastrophe bonds as an alternative means to re-insurance or retrocession markets in order to protect themselves from losses incurred during extreme events.¹⁰³⁶

When applied to systemic risk insurance for OTC CCPs, the above suggests the idea of having a third-party systemic risk insurer – similar to the GSCA group discussed above – issuing “systemic-risk catastrophe bonds” to alleviate some of the risks it would face upon the occurrence of a systemic risk crisis.¹⁰³⁷

This approach raises the questions of “who might be interested in investing in systemic-risk catastrophe bonds?” and “why?”. A look at the market of catastrophe bonds could be instructive.

¹⁰³³ See, Matthew Leising, *Catastrophe Prevention Drives Insurance Pitch to Clearinghouses*, cit.

¹⁰³⁴ Ibidem.

¹⁰³⁵ For a review on catastrophe risk insurance, see, e.g., Frank J. Fabozzi (ed.), *Handbook of Finance, Financial Markets and Instruments*, John Wiley & Sons (2008), pp. 390 seq.; Christian Gollier, *Some Aspects of the Economics of Catastrophe Risk Insurance*, CESifo Working Paper Series No. 1409 (2005); Joshua D. Coval and Jakub W. Jurek, and Erik Stafford, *Economic Catastrophe Bonds*, cit.

¹⁰³⁶ Cf., Frank J. Fabozzi, *Handbook of Finance, Financial Markets and Instruments*, cit., pp. 390 seq.

¹⁰³⁷ A number of scholars have analyzed the implications of catastrophe bonds in the context of systemic risk insurance. For a thoughtful discussion see, e.g., Gregor N. F. Weiss and Deneza Bostandzic and Felix Irresberger, *Catastrophe Bonds and Systemic Risk*, 26th Australasian Finance and Banking Conference (2013); Daniel Schwarcz and Steven L. Schwarcz, *Regulating Systemic Risk in Insurance*, University of Chicago Law Review, Vol. 81, No. 4, pp. 1569-1640 (2014); Daniel Schwarcz and Steven L. Schwarcz, *Macprudential Insurance Regulation: Anticipating New Sources of Systemic Risk in Insurance*, in Andromachi Georgosouli and Miriam Goldby (eds.), *Systemic Risk and the Future of Insurance Regulation*, Routledge (2015).

Catastrophe bonds have long appealed investors, because they offer the opportunity to diversify the risks in a portfolio of investments. Catastrophe bonds tend to have near zero-beta, which make them valuable uncorrelated assets.¹⁰³⁸ Significantly, when catastrophe bonds first appeared in mid-1990s, the market for these securities was relatively small (compared to reinsurance market) and only very specialized investors (such as, hedge funds or other asset managers with expert knowledge of catastrophic risk) were willing to buy these securities. Starting in late 1990s, however, the market for catastrophe bonds began to grow and the pool of investors began to increase in volume and diversity.¹⁰³⁹ During the period between 1998 and 2001 the catastrophe bonds market grew to US\$ 1–2 billion as measured by bonds outstanding. The market continued to grow and peaked in 2007, when it reached c. US\$ 17 billion. Starting in 2008, the market began to decline, as most markets contracted during the financial crisis, but it returned growing again in 2012. By 2013, the catastrophe bonds market reached a new peak of outstandings at US\$20.5 billion and then continued growing in 2014 up to c. US\$ 25 billion. The market ended the first quarter of 2016 with more than US\$ 26 billion of outstanding market capacity.¹⁰⁴⁰

The fact that the catastrophe bond market has been attracting an increasingly diversified pool of investors has the advantage of making this market more deep, liquid, and resilient. On the other hand, however, changes on the investor side raise a number of issues:

- First, in response to growing demand for catastrophe bonds, yields have decreased to the point that experienced investors now warns that the associated returns have fallen too low to justify taking on catastrophe risk.¹⁰⁴¹
- Second, there is a concern that the new larger pool of investors in catastrophe bonds might not be sufficiently informed to understand the modeling and pricing methodologies and that their knowledge of the underlying risks might be appallingly thin.¹⁰⁴² This is a key point as this concern might become even more acute with respect to catastrophe systemic risk bonds. Investors in these securities would ultimately act as re-insurers of OTC CCPs' insurers and will bear the losses most concentrated in terms of systemic risk, tail risk, and wrong way risk. Given the complexities associated with the process of central clearing of OTC derivatives discussed in previous Chapters, there is a serious doubt that even the most sophisticated investor could fully understand the implications (and risks) of this role.

¹⁰³⁸ See, Frank J. Fabozzi, *Handbook of Finance, Financial Markets and Instruments*, cit., p. 393 (noting that “[m]odern portfolio theory asserts that an uncorrelated assets would be an attractive addition to a well-diversified portfolio even at the risk-free rate of return. If cat bonds offer returns in excess of the risk-free rate and do not exhibit systematic risk, then investing in these securities can improve overall portfolio performance on a risk-adjusted basis. Investors who purchase cat bonds can potentially receive an attractive expected return and improve the diversification of their portfolio”).

¹⁰³⁹ Data and statistics on catastrophe bond market from Artemis's website at http://www.artemis.bm/artemis_ils_market_reports/.

¹⁰⁴⁰ *Ibidem*.

¹⁰⁴¹ See, Caroline Chen, *Buffett Warning Unheeded as Catastrophe Bond Sales Climb*, Bloomberg (June 17, 2014).

¹⁰⁴² See, e.g., Paula Jarzabkowski, Rebecca Bednarek and Paul Spee, *Making a Market for Acts of God: The Practice of Risk Trading in the Global Reinsurance Industry*, Oxford University Press (2015).

Thus, if investors that are willing but not most capable to assess and manage systemic risk invest in systemic risk catastrophe bonds, the result will be a scenario where the insurance (and re-insurance) industry for OTC CCPs will exacerbate systemic instability in the larger financial system, rather than mitigate it. This, in turn, will not only frustrate the scope of central clearing mandates for OTC derivatives, but it will also create a distorted structure very much like what happened in the years immediately preceding the GFC with respect to insurers of complex structured products. An interesting metaphor comes to mind that was once suggested by Prof. Pirrong.¹⁰⁴³ The process of insurance and re-insurance of systemic risk associated with OTC derivatives discussed above reminds the Red Queen, running at breakneck speed to stay in the same place:

“Well, in our country,” said Alice, still panting a little, “you’d generally get to somewhere else— if you run very fast for a long time, as we’ve been doing.” “A slow sort of country!” said the Queen. “Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!”¹⁰⁴⁴

¹⁰⁴³ See, Craig Pirrong, *The Red Queen’s Race: Financial Regulation Edition*, cit. Prof. Pirrong use the metaphor of the Red Queen in respect to OTC derivatives clearing and the implications of collateral transformation. This metaphor is certainly correct with respect to systemic risk insurance, as well.

¹⁰⁴⁴ See, Lewis Carroll (author), Roger Lancelyn Green (ed.) and John Tenniel (illustrator), *Alice’s Adventures in Wonderland. Through the Looking-Glass*, Oxford University Press (1998), p. 145.

Conclusion

In the aftermaths of the GFC, policymakers and regulators around the world embarked on far-reaching reforms of the over-the-counter (OTC) derivatives market. A key element in their agenda was the introduction of central clearing mandates for OTC derivatives. The introduction of these mandates was largely driven by the belief shared among policymakers and regulators that central counterparties clearing OTC derivatives (OTC CCPs) could reduce counterparty risk and mitigate systemic risk associated with the trading of OTC derivatives through a variety of mechanisms, including netting, margining, equity, and loss mutualization. These benefits, in turn, were thought to help make the market for OTC derivatives safer, sounder, and more transparent.

During the past seven years, however, the scale and complexity of the process of implementation of central clearing mandates have gradually emerged. This, in turn, has created concerns regarding the system-wide effects of OTC CCPs. Significantly, a dawning debate has arisen around the question of how OTC CCPs may themselves generate and exacerbate systemic risk within the financial system. At the time of writing, this question remains thinly explored.

The present work has addressed the above question in detail and has concluded that the derivatives-centric approach shared among the proponents of central clearing mandates is fundamentally short-sighted. In particular, the author has explained that to identify and understand the system-wide effects of central clearing three key points should be considered. First, counterparty risk is a combination of different types of financial risks and the process of mitigation of counterparty risk may itself generate financial risks. Second, because the OTC derivatives market is a part of a broader financial system, the mitigation of systemic risk associated with the trading of OTC derivatives requires taking a systemic perspective and considering the financial system as a whole. Third, financial participants and financial markets have a tendency to adjust rapidly, especially in response to external stimuli. For this reason, requiring OTC derivatives to be centrally cleared and enforcing related measures to improve the safety of the OTC derivatives market could induce reactions and adjustments by the financial system, and these reactions and adjustments could have profound consequences.

Based on the above observations, the author has, then, shown how key features and mechanisms of OTC CCPs can generate and exacerbate systemic instability within the financial system, particularly during periods of extreme market turbulence. This could occur in a number of ways, including the following:

- Funneling OTC derivatives trading through OTC CCPs may create excessive concentration of multiple risks into one single focal point. This, in turn, may reduce the possibility for diversification and may increase the probability that the failure of an OTC CCP could have system-wide destabilizing effects.
- By concentrating the risk associated with the trades being cleared, OTC CCPs may themselves become systemically important entities and their failure may expose many market participants to severe losses.

- By changing the topology of the network of connections in the OTC derivatives market, OTC CCPs have essentially replaced one set of interconnections with another, which could be as vulnerable (or even more vulnerable) to systemic failures as the previous one.
- Rigorous margin requirements enforced by OTC CCPs may have the effect of increasing operational complexity and rigidity within the OTC derivatives market, which, in turn, may lead to a more tightly coupled financial system.
- OTC CCPs' loss mutualization and risk sharing mechanisms may expose OTC CCPs to problems of adverse selection and moral hazard, and may increase the opacity of OTC derivatives trading, which, in turn, may create the risk of runs on OTC CCPs in the event of default of one or more of their CMs.
- Similar to senior and super-senior tranches in a CDO, the risk exposure of CMs via an OTC CCP's default fund is heavily concentrated in terms of systemic risk and may increase significantly during periods of large market-wide shocks.
- Certain features and mechanisms of OTC CCPs make them particularly vulnerable to wrong-way risk (WWR).
- Multilateral netting and setoff through OTC CCPs change creditor priority by increasing the priority of the OTC CCP and the derivatives counterparties over other claimants on a defaulted CM. In so doing, multilateral netting and setoff through OTC CCPs redistribute value from one group of creditors to other creditors and re-allocate risks of losses from one set of claimants to another. This redistributive effect may be systemically damaging if the risk is transferred to parties that are as systemically important and as vulnerable as (or more systemically important and more vulnerable than) OTC derivatives market participants.
- As shown in the aftermaths of the Brexit vote, OTC CCPs' rigorous margining may create pro-cyclicality problems, and in the event of large price moves it may trigger "systemic margin calls." In such a scenario, many CMs with losing positions would be required to make large variation margin payments in a very tight frame, and would be forced to raise funds simultaneously. This rush to liquidity may, then, create severe strains for CMs with destabilizing effect for OTC CCPs, as well. In addition, the need to raise liquidity to meet large margin calls and the need to reduce (or close) positions because of the inability to meet such calls may create tight coupling and may lead to chaotic fire sales that further exacerbate price movements. The fire sales of assets may have spillover adverse effects that go far beyond derivatives transactions to impact any institution or firm holding the assets subject to fire sales, including those that don't have any (direct or indirect) counterparty exposure to market participants trading cleared derivatives. Last, uncertainty about the solvency of market participants may induce chaotic information contagion and further assets liquidations, which may exacerbate price volatility and may result into severe declines in trading market liquidity.

Based on the analysis of how OTC CCPs can generate and exacerbate systemic risk within the financial system, the present work has, then, suggested considering a new approach to systemic risk-related financial regulation, which has been inspired by chaos theory and has gained significant relevance since the aftermaths of the GFC. This new approach is based on the acknowledgement that systemic risk-related financial regulation cannot always prevent the initial triggering event, nor it can always promptly interrupt the transmission of its systemic risk destabilizing effects. For these reasons, the new approach suggests that systemic risk-related financial regulation should also focus on the development and implementation of tools that could help manage periodic systemic failures in a controlled manner and stabilize the parts of the financial system affected by such failures. Arguably, managing periodic failures in a controlled manner and stabilizing systemically important firms and markets impacted by such failures is one key role of OTC CCPs.

The author has, thus, applied the new approach to systemic-risk regulation onto the OTC derivatives clearing context through a two-step analysis. First, the author has focused on the OTC CCP's coordinated default management process and has discussed how to improve it by considering behavior aspects in the pricing and structuring of an OTC CCP's default waterfall. In particular, the author has examined innovative designs of OTC CCPs' pre-funded mutualized default fund(s), which can create the necessary incentives for CMs to cooperate and to help the OTC CCP during the coordinated default management process by participating actively in the hedging and auctioning of the defaulted CM's positions. Second, the author has identified and discussed additional resources and stabilizing mechanisms that could be activated in the remote (but still possible) scenario in which an OTC CCP's coordinated default management process backfires, including contingent capital, central bank's liquidity, private systemic risk insurance fund(s), third party systemic risk insurance, and systemic risk catastrophe bonds.

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