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Essays on Financial Crisis and Institutions

by

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Committee in charge:

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Professor Atif Mian
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Abstract

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In late 2008, economies worldwide underwent close to complete economic paralysis in what has now been established as the worst financial crisis since the Great Depression. In response, economic research focused on understanding how a well-developed financial market such as the U.S. could fall victim to a severe financial crisis, behavior typically associated with less-developed economies. While important, the examination of the Great Recession is in some respects limited, as it is impossible to understand the long-term effects of the crisis and subsequent government response without post-crisis data. Further, information regarding the details of the implementation of government policy is typically politically sensitive and therefore not readily available to researchers. For these reasons, the empirical economic literature leaves several first order questions regarding the long term effects of financial crisis and subsequent government response unanswered.

This dissertation hopes to fill that gap. Using micro-level longitudinal data from the Asian financial crisis of 1997 in Indonesia, I closely examine the long term effects of financial crisis and several government policy responses on firms in the financial and real side sectors. While the economic and institutional environment in Indonesia at that time had unique characteristics, similar reforms were carried not only then in other Asian countries, but during the Great Recession in economies worldwide. In particular, I carry out to my knowledge the first empirical assessment of the long term effects of a bank bailout program. This dissertation, therefore, hopes to provide general insight for economies undergoing severe financial distress, not only those in other emerging markets.

Chapter 1 of this dissertation analyzes the long term effects of a bank bailout program on two central policy variables; lending and risk-taking. Using confidential information regarding the selection process of banks for government support, I show that the program was successful at increasing lending but not without increasing the riskiness of investment, even controlling for the

amount of lending. This result provides evidence that a bailout policy aimed at simultaneously increasing lending while not engendering increased risk-taking is untenable.

Chapter 2 focuses on how patterns of industry evolution in the manufacturing sector change over a financial crisis. As productivity is seen as key for economic growth, it is important for policymakers to understand which firms survive over a financial crisis, and how survivorship impacts long term industry productivity. If financial crisis facilitates "creative destruction", governments may not want to interfere by financially supporting failing firms. However, if gains to productivity following a crisis are not a direct result of creative destruction, other modes of government intervention may be favorable. Using industry decompositions for the population of manufacturing firms over a fifteen year period, I find that the crisis coincided with dramatic changes in productivity patterns within the manufacturing sector and that many of these changes were sustained in the long run. Further, results indicate that post-crisis growth was largely driven by new entry, providing preliminary evidence that reforms aimed at financially supporting lower productivity firms may be misplaced.

The final chapter looks at the impact of privatization, another policy reform implemented as a response to the crisis, on firm-level productivity. This paper aims to understand if privatization is successful at increasing productivity in the Indonesian context, and also the mechanisms through which privatization leads to changes in efficiency. I find that privatization increases productivity via change in ownership *per se*, and that an increase in the competitiveness of the environment does not have a significant effect on changes to the efficiency of firms.

For my family - Abram, Hannah, and Aviva, who never stopped encouraging me.

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Chapter 1

The Long Term Effects of a Bank Bailout Program: Evidence from an Emerging Market

"What all this amounts to is an unintended and unanticipated extension of the official safety net…The obvious danger is that with the passage of time, risk-taking will be encouraged and efforts at prudential restraint will be resisted."
-Paul Volcker, September 2009

1.1 Introduction

Over the past two years, much of the world narrowly sidestepped complete financial crisis as lending slowed significantly and capital markets experienced a downturn second only to the Great Depression. Perhaps the most contentious element of many governments' responses to this and previous financial crises is the bailout of the banking sector. In the U.S, the bailout was implemented through the Troubled Assets Recovery Program (TARP) that recapitalized banks. Political opinion regarding recapitalization is polarized and has been a major campaign issue in the 2010 mid-term elections; Opponents argue that providing a safety net for banks will lead to moral hazard, i.e. bank managers to respond strategically, taking on more risk because they believe that the government will bailout any losses. Proponents, on the other hand, believe that TARP adds liquidity to the economy by stimulating lending to borrowers who invest those funds, thereby facilitating recovery from the financial crisis. Despite the intensity of the political debate, little rigorous evidence exists to address the fundamental question of how bailouts affect risk-taking and lending in the long term.

The intent of TARP, and other programs like it worldwide, is to stabilize the banking sector and stimulate lending by recapitalizing banks through the provision of capital and the purchase of so-called toxic assets. The hypothesis is that providing banks with capital and purchasing toxic assets will strengthen bank balance sheets, and thereby allow bank managers to resume lending. The execution of the program, however, has generated widespread skepticism because there are little restrictions on the use of the additional capital or on bank behavior. Hence, bank managers may not only use the capital for purposes besides lending, but also respond strategically to being rescued from failure by increasing risk-taking in the long term.

Theory provides some guidance to these questions. Characterized by decreases in deposits, loan losses and the hesitancy of banks to lend under uncertain conditions, financial crises often result in a negative shock to credit supply. By subsidizing bank capital, recapitalization should in theory lead to increased lending to borrowers, relieving the bank lending channel from distress. In terms of the relationship between recapitalization and risk-taking, economic theory is less clear. Because of the simultaneous presence of external agency costs generated from the relationship between managers and the government, and the internal agency costs between equityholders and debt holders of the firm, recapitalization may serve either to increase risk-taking or decrease it. External agency costs arise as a result of the relationship between managers and the government. As discussed earlier, by providing a safety net for banks, recapitalization may induce behavior consistent with moral hazard, which would imply increased risk-taking at recapitalized banks. On the other hand, recapitalization may also address agency costs internal to the firm that arise due to the differing payoff structures of equity holders and debt holders. By recapitalizing, the classic asset substitution problem between equity holders and debt holders may be mitigated, leading to less risk-taking on the part of managers. The predicted effects from both the moral hazard and asset substitution viewpoint are likely to be simultaneously present following recapitalization. Ultimately, therefore, it is an empirical question as to whether on-balance, recapitalization is associated with more or less risk-taking by bank managers.

This paper addresses the fundamental question of whether bank recapitalization leads to increased lending and whether bank managers strategically respond to being rescued by taking on more risk in the future. We use data from a TARP-like program in Indonesia following the Asian financial crisis over the 1993-2008 period to analyze the long term effects of a bailout program on risk taking and lending. Similar to TARP, the Indonesian Bank Restructuring Agency (IBRA) recapitalized banks in order to stimulate lending and stabilize the distressed Indonesian banking sector. We estimate the impact of IBRA on lending and risk-taking using a differences-in-differences methodology supported by IBRA selection criteria used to determine which banks would be recapitalized, information rarely available in program analysis. The results indicate that recapitalization leads to a 40% net increase in risk-taking. The change is robust to the stock of lending, indicating that recapitalized firms not only lend more, but also these assets are on average more risky. Further, the results indicate that recapitalization increases lending flow by 3.6 million Indonesian rupiah (IDR), which is several standard deviations above the pre-crisis control group mean. Further, this affect is larger for larger banks.

The potential impact on the outcome variables of alternative mechanisms other than recapitalization is also considered, in particular the impact of political connections and borrower demand. It is well established in the literature that prior to the crisis, connections to President Suharto were valuable for firms and that firm value changed almost immediately as a response to changes in these connections (Fisman 2001). We reject the hypothesis that changes in political connections resulting from the fall of Suharto are the primary cause of differences in the outcome variables because these changes do not occur in the year (or year after) Suharto left power. Supplementary evidence to reject the potential for political connections to confound the results is provided in Section 7. Finally, we consider the effect of borrower demand by examining the creditor changes of approximately half the manufacturing firms in Indonesia over

the financial crisis. Evidence indicates that observed increases in lending by bailed out banks is not driven by the switching of manufacturing firms with non-recapitalized to recapitalized banks.

Collectively, the results inform both the current political debate concerning the bailout and also future government policy regarding banking sector crisis. On the one hand, to the extent that the increase in lending provided by recapitalization helps to buffer the real-side economy from an economic downturn, this paper provides evidence that recapitalization is a successful policy mechanism. On the other hand, the results also show that fears of recapitalization leading to increased risk-taking in the long run are indeed justified, suggesting that recapitalization may have unforeseen consequences. Finally, with evidence that managers at non-recapitalized banks take significantly less risk in the long run, the results suggest that a bailout program may have unintended consequences on the entire sector, not just those firms provided aid.

This paper is one of few pieces that empirically analyzes the long term effects of a bailout program on lending and the risk-taking behavior of bank managers. While the current financial crisis has motivated a resurgence of work on the effects of financial crisis in general (Ivashina and Scharfstein 2008, Campello, Graham and Harvey 2010), few papers empirically analyze the effects of a bailout program, and those that do suffer from the issue of having few post-bailout time periods, limiting the analysis to short term effects (Veronesi and Zingales 2010). This paper, however, benefits from eleven post-crisis and eight post-intervention years, enabling comparison of before-and after outcomes and allowing for the analysis of long term effects.

More generally, research on the relationship between regulation and risk-taking typically looks at how changes to government banking policy such as the introduction of deposit insurance and capital requirements affect risk-taking has mixed results (Laeven and Levine 2008, John, Litov and Yeung 2008, Saunders, Strock and Travlos 1990). These papers, however, are often limited to cross-country analysis and do not look at the effect of providing capital to banks during distress per se. This paper contributes to this literature by utilizing panel data, which provide for controlling for observed and unobserved firm specific time-invariant characteristics which may otherwise confound identification and also directly addressing how recapitalization as a government intervention changes outcomes. Finally, this paper contributes to the bank lending channel literature by examining the effects of a positive, rather than negative liquidity shocks for banks. Previous work examines whether banks pass on negative liquidity shocks to borrowers (Bernanke and Lown 1991, Dell' Ariccia, Detraiagche and Rajan 2008, and Peek and Rosengren 2000, Khwaja and Mian 2008), while it remains unexplored whether a positive shock such as recapitalization has the complementary effect.

The paper proceeds as follows. Section 2 discusses the institutional environment of the Indonesian banking sector and the details surrounding the crisis. Section 3 discusses the theoretical predictions regarding the relationship between being bailed out and the outcome variables. Section 4 describes the data and methods implemented to address the research questions. Section 5 discusses the results. Section 6 discusses robustness of the results, while Section 7 looks at additional analyses. Section 8 concludes.

1.2 Institutional Description

1.2.1 The Indonesian Banking Sector

The financial system in Indonesia has traditionally been dominated by banks (Enoch et al 2001). The period of the most significant growth in the banking sector, however, was the 1980s, when a series of reforms aimed at decreasing the dominance of state owned banks and promoting growth were implemented. These reforms, focused on deregulation, lead to a dramatic increase in the number of banks and a diffusion of market power. From 1988 to 1995, the number of banks more than doubled from 111 to 240, while the five largest banks controlled only 17% of total bank assets and a similar percentage of total market share (Sato 2004). Many of these new banks were private domestic banks, opened explicitly to provide credit for affiliated companies (Bongini et al 2009).

By the 1990s, however, problems in the banking sector began to emerge. Non-performing loans increased, and it became apparent that connected lending restrictions were violated. Several other banks were also struggling during the early 1990s. In late 1992, Indonesian authorities solicited a $300 million dollar loan from the World Bank to help bail out suffering state banks and several private banks that faced high non-performing loan ratios and very low capital adequacy ratios. In total, this bailout was estimated to have cost about two percent of GDP. Despite these problems, from 1994 to 1997 the Indonesian economy and financial sector witnessed very rapid growth. Bank credit grew three times faster than the steadily increasing GDP.

Although the banking industry witnessed rapid growth over this time period, problems began to emerge. In early 1992, the central bank, the Bank of Indonesia (BI), became aware that several banks faced high non-performing loan ratios and low capital adequacy ratios. In response to these problems, Indonesian authorities solicited a $300 million dollar loan from the World Bank to help bail out these banks. In total, this bailout was estimated to have cost about two percent of GDP. This was the first incident of government bailout in the banking sector, but would not be the last.

1.2.2 The Asian Financial Crisis in Indonesia

The steady growth of the Indonesian economy was interrupted in 1997 by the influence of the rapid devaluation of the Thai baht. In July 1997, currency speculators moved out of large positions in the Thai currency, which initiated doubt by investors in the economic viability of other Southeast Asian countries as well. Thus what started as a currency crisis in Thailand, spread all over the regions, including Indonesia. The currency crisis quickly became a banking crisis and political crisis ensued as well, leading to the termination of President Suharto's more than thirty year rule over Indonesia as well as three decades of trade surpluses, low inflation, large foreign exchange reserves and constant growth. A timeline of the crisis is provided in Table 1a and 1b.

What started as a currency crisis quickly spread to the banking sector in Indonesia because several existing lending practices created systemic problems under conditions of currency volatility. First, it was commonplace for Indonesian companies in the non-financial corporate sector to hold foreign denominated debt. The devaluation, therefore, left many companies unable to service their debt. Further, banks and their borrowers had established the convention of contracting with short term obligations and instead continually extending loan terms rather than contracting in long term obligations. By maintaining short term obligations, firms could take advantage of typically lower interest rates. Banks, on the other hand, were obliged to maintain this standard practice to attract and retain customers. When the crisis began, banks were no longer willing to extend these loans, further increasing the amount of non-performing loans in the system.

As these problems emerged, they contributed to a widespread loss of confidence in the banking sector. As a result, depositors began withdrawing funds, causing banks runs. With decreased deposits available to fund lending, bank managers then became even more hesitant to lend. This cycle resulted in the virtual elimination of available credit, making firms less likely to service their debt and threatening the function of the non-financial sector (Sato 2004).

By October 1997, the banking crisis became so severe that the Indonesian government solicited the help of the IMF. This began a series of agreements between the IMF and the Indonesian government that would last several years. In exchange for financial and operational support to address the crisis, the Indonesian government agreed to many IMF-lead reforms. One of the first actions to directly address the banking crisis was the closure of 16 small insolvent banks with no public notice on November 1, 1997. The surprise nature of the closures consequently triggered a bank run. So rather than improving confidence in the banking sector, this government intervention had the opposite effect (Chou 1999). By mid-December 1997, 154 banks had experienced a run on deposits as a result. By 2004, over 60 banks would be closed as a result of the financial crisis (see Table 2).

The financial crisis also instigated political instability. Although the 30 year reign of President Suharto was characterized by steady growth, firms with political connections also enjoyed economic advantages (Sato 2004). During the crisis, attention began to shift towards the detrimental effect these relationships may have had on the economy. As a result, public sentiment towards the President grew hostile, and by June 1998 Suharto stepped down.

1.2.3 Government Intervention and the Establishment of IBRA

To facilitate the restoration of stability in the banking sector, government intervention in the earlier stages of the crisis was aimed at providing immediate assistance to liquidity-strapped banks in order to prevent the complete failure of the banking system and the spread of the crisis to the non-financial sector. In the early stages, the government began to provide liquidity support, recapitalizing banks. BI used several criteria to assess the viability of these banks including: the size of the bank (number of employees, number of deposits, and several other

measures), quality of governance, and several measures of financial stability (capital adequacy, non-performing loans, solvency).

In January 1998, the Indonesian government created a centralized institution to carry out the bank bailout, the Indonesian Bank Restructuring Agency (IBRA). The government delegated three main duties to IBRA: implement recapitalization, recover bank assets, and recover state funds disbursed to the banking sector by selling the transferred assets of recapitalized banks. IBRA would implement the recapitalization by providing banks government bonds, in exchange for common shares.

The first step in the intervention process by IBRA was the establishment of guidelines with which to determine the set of banks to be recapitalized. Based largely on the qualifications used by BI to provide liquidity support at the beginning of the crisis, IBRA measured the banks on several dimensions. In order to maintain an independent evaluation process, IBRA employed an international consulting firm to analyze banks based on the predetermined criteria. The intent was that banks would survive based on the strict application of transparent criteria, not by non-market based rules.[1]As a result of the evaluations based on these criteria, IBRA would then make the final decision as to how to proceed: whether to let the bank stand alone, to recapitalize the bank or to shut it down. The aim was to close banks that were not viable even with IBRA assistance, and among remaining banks determine which banks should be recapitalized.

Three main characteristics were used to determine which banks would be recapitalized: the role in the economy of the bank, the financial viability and the quality of governance, called the "fit and proper" test. The bank's role in the economy was assessed using the following measures: the number of employees, number of branches, number of deposits and the geographic reach of the bank. In general, the intent was to support banks that were influential in the economy. Due to the geographic dispersion of the Indonesian archipelago, IBRA wanted to save banks in regions of the country with fewer banks to ensure access to banking services for Indonesians in remote areas. Financial viability, on the other hand, was measured using several financial variables including the capital adequacy ratio, non-performing loan levels, and the ability of shareholders to provide 20% of the recapitalization amount from private sources. Called the Settler Agreement Plan, the provision of private assets by shareholders was intended to prevent moral hazard as well as help fund the program.

In addition, banks were also evaluated based on the quality of their governance. IBRA used two criteria to determine whether a bank was fit and proper. The impetus for including this as a characteristic to determine recapitalization was an increased focus by the new government on good governance. The post-Suharto government realized that inadequate bank governance may have led to inefficiency and failure in the application of good management principles and caused fundamental weaknesses at the micro level in the financial markets (Goeltom 2008). Lending did not escape political influence, similar to the case in other countries, where lending has been shown to have a political element (Khwaja and Mian 2008). Even in state banks, for instance, lending decisions were thought to have been subjectively influenced by government intervention,

[1] With the exception of government owned banks, all of which would be recapitalized.

with the result that many loans were extended by reason of political connections and not based on objective assessment of the investment). Further, it was widely believed that people connected to Suharto contributed disproportionately to loaning large amounts of capital in related lending transactions[2] (Sato 2004). Thus, the fit and proper test was part of the new focus aimed at improving the quality of governance in the banking sector from the Suharto era.

The quality of governance was measured in two ways. The first was an assessment of the quality of the governance of board members, management, and shareholders. First, IBRA checked whether these names were listed on two lists as participants in loan transactions. Compiled by BI, the "Daftar Kredit Macet" list or "Daftar Other Receivables" lists, were both lists of "bad loans", deemed uncollectible and requiring full provisioning. At the time, this determination was made by the BI using international standards developed in the Basel II accounting standards and could apply to personal or business-related loans. For most banks, having a shareholder, or manager on either list resulted in being considered not fit and proper.

Beyond forcing banks to acknowledge their losses, these lists also serve a political purpose. Anecdotally, most of the names on the DKM/DOR lists were people connected to the former President Suharto and their inclusion on these list suggested a form of political retribution. Thus, if managers, shareholders, or board members were on the DKM/DOR lists, they were likely to be connected to Suharto, and these banks were less likely to receive the support of the new government.

The second main component of whether a bank satisfied the governance requirements of IBRA was whether the bank had a history of violating certain BI regulations. This determination was based mostly on whether the bank adhered to LLL and net open position (NOP) requirements. The LLL at the time of the crisis was 20% to unrelated parties and 10% to related parties.

The recapitalization of the banks was implemented over the years 1999 and 2000, although due to the continued loan resolution process, IBRA remained open until 2004. Over the course of both the initial BI intervention and subsequent participation of IBRA, 63 banks were recapitalized and IBRA acquired approximately 33 billion USD in assets, approximately 70% of GDP. Of the 63 banks recapitalized, 14 also transferred assets to IBRA for resolution. Ultimately, 76 banks closed over this period, accounting for 16% of total 1996 commercial bank assets. (Sato 2005). Summary statistics of the recapitalized versus non-recapitalized banks are located in Table 3.

1.3 Theory

1.3.1 Government Intervention and Risk-Taking

[2] Related lending encompasses lending to a "related party"; any natural person or company/entity exercising control over the bank, whether directly or indirectly, through ownership, management, and/or financial links. These types of transactions were not illegal, however, were limited by law.

The effect of IBRA on the risk behavior of bank managers operates through the agency costs generated by the manager's relationship with stakeholders. The theory that motivates these relationships is drawn from standard agency theory. Depending on whether internal versus external agency costs are relatively more influential, managers may be more or less inclined towards risk-taking following recapitalization. An intervention such as recapitalization may address agency costs arising from the relationship between equityholders and bondholders leading to decreased risk-taking, while on the other hand, intervention may exacerbate moral hazard issues that arise between the government and managers when a public safety net is provided.

The coexistence of these agency costs results from the fact that a government intervention into the banking sector involves several stakeholders. The stakeholders considered here are: the government/depositors, shareholder/managers, and debtholders. An equity injection into a bank may affect risk-taking by either reducing or exacerbating the agency costs between the separate parties.

The internal agency costs between equityholders and debtholders in a firm are a result of the differences in the payoff structures faced by these two stakeholders, which may create an incentive for equityholders to invest suboptimally. When a firm is insolvent, payout to equityholders is limited to zero due to limited liability, while when the firm is solvent, equityholders receive all cash flow left over after debt obligations are satisfied.[3] On the other hand, debtholders enjoy greater certainty of payouts, regardless of whether the firm is solvent or not. Further, when the firm is insolvent, debtholders receive payouts before equityholders.

As a result of these payoff structures, equityholders may benefit from investing in riskier projects which increase firm value in a boom and decrease firm value in a recession. Due to the residual claim of equityholders vis-a-vis debtholders, equityholders capture increases in firm value during a boom, without limit. In a recession, however, equityholders liability is limited. This asymmetric payoff structure results in bondholders effectively subsidizing equityholders if the risky project is chosen. Managers, therefore, may have incentive to choose the risky project, even if it is ultimately value-decreasing. Equityholders may bear this cost to debtholders when the debt is issued, however, if debtholders correctly anticipate this incentive. Thus, the cost of the incentive to invest in value-decreasing projects may ultimately be borne by equityholders who issue the debt. This effect, generally called the asset substitution effect, is the internal agency cost of debt financing.

A capital infusion from recapitalization may help to mitigate this cost. By increasing the value of equity in the firm, the subsidy from bondholders to equityholders for the risky project is reduced, as equityholders now have more at stake to lose during a recession. This decreases the incentive of equityholders to choose the risky project. Thus, recapitalization may lead to less risk-taking on the part of managers (if managers are acting in the best interest of equityholders).

[3] Insolvency is defined here as the inability of a firm to service its debt obligation from current assets.

The relationship between the three main stakeholders in the government intervention also may generate external agency costs. In this case, because the social implications are such that the government cannot afford not to recapitalize banks, the government will serve as a lender of last resort to troubled banks.[4] With confirmed expectations that they will be provided a public safety net, managers of supported banks may engage in activities consistent with moral hazard type behavior, as several papers show Cordella and Yeyati 2003, Freixas and Rochet (1997), Boot and Greenbaum (1993), Dewatripont and Tirole (1993), and Matutes and Vives (1995). Increasing the public safety net weakens incentives for managers to avoid behavior that may increase private benefit at the cost of the firm. After being bailed out, managers may be more inclined to invest in an inefficient gambling asset that can yield high private returns for the manager if the gamble pays off but imposes costs on the government by endangering depositors if the gamble fails rather than a prudent asset yielding high expected returns (Cordella and Yeyati 2003). Further, being bailed out may decrease the incentives of depositors and peer banks to monitor managers, enabling managers to freely pursue value-decreasing projects that enhance their private benefit with no consequence. Bailing out a bank may also weaken incentives for managers to aggressively pursue bad borrowers, and recognizing this, borrowers would have less incentive to service their debt.

Thus, recapitalization may help alleviate internal agency costs but risk increasing external agency costs. The issue is whether the private benefits associated with moral hazard will be large enough to offset whatever incentives equityholders may provide for the manager to act in the equityholders' best interest. Both elements of internal and external agency costs are likely to be simultaneously present. Ultimately, it is therefore an empirical question whether on-balance recapitalization results in more or less risk-taking on the part of managers.

1.3.2 Government Intervention and Lending

Another important policy question is whether a government intervention such as recapitalization will successfully stimulate lending in supported banks (from a supply side point standpoint). Lending to borrowers may be constrained during a financial crisis for many reasons. Bank panics often occur during periods of systemic financial distress, causing depositors to remove their accounts from the banking system causing a bank run. Given that banks use deposits to fund new lending, a bank panic will reduce funds available for lending. In addition, the inability of borrowers to service their debt during a period of financial distress may further decrease the supply of funds available for lending. Thus one of the typical consequences of financial crisis is the severe decline of bank lending to borrowers, which may prevent even positive NPV projects from receiving funding. A recapitalization may address the lending problem and help avoid economic contraction by loosening bank lending constraints relative to prior to recapitalization. As long as banks do not use the liquidity infusion for other purposes,[5] and managers are willing to lend, a recapitalization should serve to increase lending to borrowers.

[4] The lender of last resort refers to the discretionary provision of liquidity to a financial institution.
[5] For instance, to pay out dividends, or for investment.

1.4 Data and Methods

1.4.1 Data

Several datasets, some previously not available for analysis, others never before digitized, and others publicly available, are used to analyze the effect of IBRA on risk-taking and lending. The data are used to implement a differences-in-differences approach validated by analysis of the selection criteria showing that selection was based on time-invariant characteristics of the firm. The primary dataset consists of the complete financial statements of each commercial bank in the banking sector collected annually by the Bank of Indonesia (henceforth the "BI dataset"). The BI dataset includes balance sheet, income statement and off-balance sheet information for the population of banks operating in the Indonesian banking sector from the years 1993-2000, which previously had not been digitized or translated from Indonesian into English and data from 2001-2008, which are made publicly available by BI. The BI dataset provides the information used for the risk-taking and lending variables. Further, from this dataset we observe if banks were recapitalized, by the presence of government bonds on the asset side of balance sheet during the period of IBRA existence.[6] In addition, the BI dataset includes descriptive information about each bank, including information on the geographic location of the bank, the number of employees, as well as ownership and governance information. The ownership information includes the type of ownership (government, private domestic, etc), the names of each shareholder and the percentage held by each shareholder. Similarly, the governance information includes the names of each board and oversight committee member.[7]

This dataset was combined with the results of the bank evaluation conducted by the independent consulting firm hired by IBRA to evaluate the banks. These initial reports included the results of the first 54 banks put under the auspices of IBRA in 1998. The evaluation reports, compiled by the third party international consultancy, contain information on the three criteria discussed in Section 3.3 used to determine if a bank would be recapitalized.

In terms of consistency of the data between the BI dataset and the IBRA dataset, information that is included in both datasets is not statistically different. Since IBRA began evaluation in early 1998, the information in the IBRA dataset is compared to the BI dataset for year 1997. Several values overlap including: total assets, total deposits, number of employees, capital adequacy ratio, and others. This provides confidence that combining the two datasets is acceptable and that substituting information from the BI dataset for banks not included in the IBRA dataset is adequate. In terms of quality of the data, the similarity in the two datasets also implies that even if the quality of the BI dataset was not satisfactory, statistically similar data was used at the time to select banks for recapitalization, which is arguably more important for supporting the validity empirical methodology used.

[6] Prior to this time period, there is no evidence of government bonds on the asset side of bank balance sheets.
[7] Every Indonesia limited liability company is required to have a two-tiered board, consisting of a Board of Directors and a Board of Commissioners, the latter of which oversees the former. Publicly listed companies also have an Audit Committee which assists the Board of Commissioners.

For the banks not included in this sample, which were already audited, the information based on this criteria is culled from several sources. Measures of size and financial viability can be found in the information provided in the BI dataset. In order to reconstruct the governance measure, another dataset is appended. This proprietary dataset, obtained from a prominent Indonesian political consultancy firm, contains information on 500 political actors in Indonesia (henceforth referred to as the "political actors dataset")[8]. The political actors dataset includes information on ministers, cabinet members, key director generals, party leaders, parliamentary faction heads, parliamentary commission chairs and other influential players. For each actor, the political actors dataset contains information regarding their family, education, government positions held, other party positions held, and private sector affiliations. More tacit information is also available including details about friendships, involvement in scandals, membership to country clubs, etc. To reconstruct the fit and proper variable, the names of the most influential actors prior to the crisis are matched to the names of board members and shareholders of the banks in the BI dataset. In addition, the tacit information from the political actors dataset is also analyzed for connections to the Suharto regime. Over 30% of the banks listed have at least one board member or shareholder that was also an influential political actor under Suharto using this method.

The data above are used to estimate the impact of the bank recapitalization program on risk-taking and lending. The primary measure of risk is the z-score, which measures the distance a firm is from insolvency (Roy 1952). (See the Appendix for the derivation.) The z-score equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A higher z-score indicates that the bank is more stable. Because the z-score is highly skewed, the natural logarithm of each z-score measure is used, which is normally distributed. The other outcome variable used is lending volume. Lending volume is measured as the change in disbursed credit in IDR from the previous year. [9]

1.4.2 Summary Statistics

The starting point is the set of all commercial banks that existed in 1994 and survived over the crisis period until 2008. This provides a sample of 149 banks over the 15 year period 1994-2008, a total of approximately 2,200 firm-year observations. By IBRA's closing in 2004, 63 banks had received liquidity support: 5 state banks, 35 private domestic banks, 16 private non-foreign exchange, 12 regional development banks, 5 joint venture banks and 6 foreign owned banks. Prior to recapitalization, banks that would later be bailed out were on average larger, and less profitable, although this is primarily driven by government owned banks[10] (See Table 3).

1.4.2.1 How Firms Were Chosen for Recapitalization

In order to understand how firms were chosen for recapitalization, several analyses of the selection criteria provided by IBRA are conducted. Whether the actual allocation of firms into

[8] These politicians were determined by the political consultancy firm to be "the most influential."
[9] This is done for purposes of iid random variables. Alternatively, results remain robust using lending stock.
[10] All of the results remain robust to the exclusion of government owned banks.

the recapitalized and non-recapitalized groups corresponds to the stated selection criteria can be verified using the selection criteria provided in the IBRA dataset. Table 4 column 1 provides the parameter estimates from a probit analysis of recapitalization on the selection criteria provided by IBRA. Table 4 column 2 provides the parameter estimates of a probit analysis with the selection criteria provided by IBRA plus other covariates that may have determined recapitalization, but were not provided by IBRA.[11] These results provide a great deal of information concerning the allocation process and the attributes significant in determining recapitalization.

Several aspects of the results are particularly helpful in understanding the selection of firms for intervention. First, geographical dispersion, governance, and the ownership parameter estimates are all significant in determining recapitalization (and governance in particular is a strong predictor of recapitalization). In addition, the significance of the parameter estimates are robust to the inclusion of the additional covariates. Finally, post-estimation diagnostics indicate that approximately 96% of the firms were correctly classified based on the selection criteria.

Taken together, these results provide evidence that the actual selection criteria decided by IBRA corresponds to the stated selection rule. Robustness to the inclusion of additional covariates further verifies that IBRA used the selection criteria provided to allocate firms to their respective groups. Verifying the use of the selection criteria also confirms that the selection process was based on time-invariant characteristics. The decisions regarding recapitalization were made at one point in time; there were no additional rounds of data collection based on additional time periods.

1.4.2.2 Differences in Recapitalized and Non-Recapitalized Firms

The main results are anticipated in Figure 1 and 2, which display the average value of the outcome variable for the recapitalized and non-recapitalized banks each year. Before the recapitalization program was implemented, the two sets of firms exhibit similar patterns in changes in the outcome variables. After the bailout program was implemented, however, the trends between the two groups appear to diverge.

1.4.3 Identification and Estimation

The intent here is to measure the effect of the intervention on the outcome variables of interest. Ideally a researcher would have at their disposable a group of firms that received the intervention and the same group that did not receive the intervention at precisely the same point in time. In this scenario, there does not exist differences between the two groups created by the heterogeneity of firms or time-varying shocks common to all firms. Resulting changes in the outcome variables after the intervention can therefore be attributed solely to the intervention

[11] Several are additional proxies for size (age, cash), others include a measure of the concentration of ownership (average shares held by each shareholders), and finally, a measure of the proportion of loans to related parties, which is commonly used as an additional proxy for governance. The failure of a firm that is widely held may have a broader social impact, implying that the government may be more inclined to save it from distress.

itself. Random assignment of firms into the recapitalized and non-recapitalized groups would provide an equally bias-free environment for measuring the casual impact of the intervention.

In the absence of either scenario, a difference-in-differences approach controls for observable and unobservable firm-specific heterogeneity and time-varying shocks common to all firms that might be correlated both with selection for intervention and with the outcome variables. The fundamental assumption of the difference-in-differences approach is that changes in the control group are a good estimate of the counterfactual; i.e. changes in the group receiving intervention if in fact that group did not receive intervention. Although we cannot measure this directly, we can measure whether changes in the two groups prior to the intervention are statistically different from one another. The idea is that if secular changes in the pre-intervention periods are the same, then it is likely they would have been the same had the recapitalized firms not been recapitalized. The secular trends are tested by regressing the outcome variable on interactions terms of the indicator for (eventual) treatment and each year, including both firm year fixed effects. The hope is that parameter estimate of the interaction term of treatment and each year are no statistically different from zero prior to the intervention.

Figures 3 and 4 depict the results of the regression testing for pre-intervention differences in changes between the two groups. Each square demarcates the parameter estimate for the interaction effect of that particular year (interacted with treatment). The bars indicate the confidence interval for each parameter estimate. For the years before 2001 (the first year post-recapitalization), these intervals include zero for both the risk and lending outcome (for all but one year).

Thus, even though the selection criteria were significant in predicting recapitalization and in particular the governance variable, it appears that even though the two sets of firms have differences in perceived governance, they do not have differences in outcomes, at least prior to the intervention. This suggests that the separation of firms into treatment and control groups are based on something unrelated to prior performance. So while trying to separate firms based on a criterion that mattered to performance, Figures 3 and 4 provide evidence that perceived differences in governance were not correlated with differences in pre-intervention outcomes. This suggests that allocation to the non-recapitalized group based on governance may not have been based on bad management per se, but on political retribution, as anecdotes suggest.

The following equation specifies the difference-in-differences model used for estimating the effect of recapitalization on the outcome variables:

$$Outcome_{it}=\beta(Recapitalization*Post)_{it}+\delta_i+\alpha_t+\varepsilon_{it} \quad (1)$$

where Recapitalization is an indicator equal to one for those firms that were recapitalized, Post is a variable equal to one for post-recapitalization years, δ_i is a firm fixed effect and α_t is a time fixed effect. Controlling for firm fixed effects in this specification has the further benefit of effectively controlling for the selection criteria, as the selection criteria used to determine which firms to recapitalize are time invariant (See Section 5.2.1.)

1.5 Results

1.5.1 The Impact of Bailout on Risk-taking and Lending Volume

Table 5 shows results of the impact of recapitalization on risk-taking and lending. Column 1 of Table 5 presents the results of equation (1) for the primary risk measure. This result indicates that recapitalization is associated with a decrease in zscore (increase in risk-taking) by approximately 40%. The net change in average risk-taking is approximately a 1.5 standard deviation increase from the pre-recapitalization control group average risk-taking measure.

To understand the magnitude of this change better, a placebo differences-in-differences analysis was calculated using only the pre-recapitalization data. The restricted sample of data prior to 1997 was divided into two time periods, and the same analysis from equation (1) was repeated. That is, the years 1993, 1994 were considered "pre-recapitalization" years and 1995, 1996 were considered "post-recapitalization" years. The results of the analysis are located in Table 7. This exercise provides two important pieces of information. First, the parameter estimate of recapitalized variable is not significant, providing further evidence that the differing patterns between the recapitalized and non-recapitalized banks in the full sample are not simply the result of a pre-existing trend. Although the parameter of interest is not significant, there is a net decrease in the risk measure between the two groups over the placebo time period. This net change, however, is only a .02 standard deviation decrease from the pre-recapitalization control group average, compared to the 1.5 standard deviation increase from the pre-recapitalization control group in the full sample.

These results provide evidence for behavior that is consistent with the moral hazard view, which suggests that bank managers increase risk-taking due to ex-ante and ex-post reliance on government support. In line with the theory discussed earlier, this suggests that the impact of recapitalization on risk-taking is greater through the external agency cost channel between the manager and the government than the internal agency costs between shareholders and debtholders.

Although the parameter estimates support the moral hazard view Figure 1 suggests a more nuanced explanation for the results. The parameter estimate of the regression results represent the difference-in-differences between the recapitalized and non-recapitalized firms. Figure 1, shows that post-recapitalization, the control group seems to have a more dramatic change in than the recapitalized set of firms. More specifically, there seems to be a large increase in the zscore for non-recapitalized firms, which means a decrease in the risk. Here, the within-group difference for the non-recapitalized firms is significant, while the within-group difference for the recapitalized group is significant only with one measure. This implies that the differences-in-differences parameter estimate, which is significant, may be largely driven by the changes over time within the non-recapitalized firm. This provides evidence that recapitalization may have more of an impact on those firms not receiving support rather than the firms that did.

The influence of the change in behavior of non-recapitalized banks provides interesting policy implications. Government intervention here may lead to a change in behavior, but not in the sense anticipated. Similar to a moral hazard argument that assumes managers change their behavior because they believe they will be bailed out, managers perhaps change their behavior as when they know they will not be bailed out in the future. The behavior seen here is consistent with a view that firms left to standalone substitute the absence of a government safety net with their own internal safety net by taking less risk.

Table 5 column 3 presents results of the model looking at the relationship between recapitalization and lending. The parameter estimates for recapitalization are significant and positive, indicating that the recapitalization has been successful at stimulating credit availability. Recapitalization increases lending flow by 3.6 (millions IDR), which is several standard deviations above pre-crisis control group average lending flow. The results of the placebo analysis using lending volume instead of risk-taking show that lending flow actually decreased over the placebo crisis (see Table 7). This implies that, similar to the risk-taking value, the lending flow patterns between recapitalized and non-recapitalized banks for the entire time period cannot be the result of a long-term trend.[12]

Table 6 provides evidence that bank managers not only take on more insolvency risk by lending more, but also on average lend to riskier projects. This analysis conducts the same regression as Table 5, looking at the relationship between recapitalization and insolvency risk, but also controls for lending stock. Conditional on the amount of lending, recapitalized banks take on more insolvency risk than non-recapitalized firms, indicating that managers are both lending more and to riskier projects.

1.6 Robustness

The empirical approach used and the addition of the availability of the selection criteria employed to choose which banks to recapitalize helps to resolve typical issues regarding the effect of policy implementation on the firm level. Here, several other remaining concerns are addressed.

Bank Size

One concern may be that the results are confounded by bank size. If larger banks respond differently to the recapitalization than smaller firms, and being recapitalized is a function of size, then the effect of recapitalization may be measuring the effect of size on the outcome variables instead. Table 8 show the regression results from equation (1) , controlling for the differential effect of bank size on the risk-taking and lending volume, respectively. Each of the parameter estimates regarding risk-taking are robust to including the size control. Bank size, therefore, does not change the risk-taking result. Not surprisingly, the parameter estimate of the relationship of recapitalization to lending volume remains significant when including the size control, but the magnitude decreases. This implies that recapitalization will increase lending volume, but more so

[12] The fact that the lending volume actually decreases prevents the comparison of magnitudes discussed for the risk-taking variable.

for larger banks, which may have a greater capacity to lend because of their size (more loan officers, greater monitoring capabilities, etc).

Political Connections

The Asian financial crisis was also a period of political change in Indonesia (see Table 1a), precipitated by the fall of President Suharto in January 1998. Prior to the crisis, a firm's political connection to Suharto had the potential to provide abnormal economic returns (Fisman 2001). His removal from power, therefore, may have dramatically altered the business environment for these firms. If the change in the political connection caused changes in manager's behavior, then the effect being measured here may in fact be the result of political connections rather than recapitalization. If the fall of Suharto changed manager behavior and this is what is driving differences in the outcome variables between the two groups, these changes should be reflected in the 1998 data, when Suharto was removed from power. It is evident from the time series, however, that the changes in outcome variables between the two groups happen later, during the recapitalization period (1999-2000).

Further, many of the Suharto-connected banks were associated with Suharto-connected firms. If the change in the political regime were causing the change in behavior, Suharto-connected banks would experience a decrease in lending, as many Suharto-connected firms were being investigated or dismantled over this same period. In the data, however, non-recapitalized bank lending does not decrease after the bailout.

Attrition Bias

As discussed earlier the paper, a set of banks do not survive over the period used for analysis. Evidence suggests, however, that their pre-intervention trends are different than the treatment and control group. While this may indicate the potential for attrition bias, the validity of the empirical identification rests on the assumption that the treatment and control group have similar intervention trends. If those firms that exit exhibit different pre-intervention trends, they would not have been appropriate control firms to begin with. Since the average treatment on the treated is being measured, we are satisfied with the control group not including the failed firms. Further, the control group used has been validated by the test of common pre-intervention trends (see Figures 3 and 4). Additional evidence of the similarity in the trends of the treatment and control group is that these trends remain similar over two major changes in the economic environment: the financial crisis itself in 1997 and the fall of Suharto in 1998.

Alternative Measures of Risk

While the z-score measure is the primary measure of risk, the results are robust to using alternative bank risk measures. The primary z-score measure is calculated using the standard deviation within firm over time. In addition, the results remain robust to using the capital adequacy ratio (CAR) as the measure of risk. Similar to the z-score, CAR measures the capacity of the bank in terms of meeting the time liabilities and other risks such as credit risk, operational

risk, etc. In the simplest formulation, a bank's capital is the cushion for potential losses, which protects the bank's depositors or other lenders. Banking regulators in most countries define and monitor CAR to protect depositors. The details of the CAR calculation are located in Appendix. As shown in Table 5, Column 2, the main regression results remain robust to this alternative measure as well.

Outliers

All of the results are robust to truncating the data at the 1st and 99th percentile of observations on risk and lending volume. In addition, the results remain robust when the sample is limited to only non-government owned banks.

1.7 Additional Analyses

1.7.1 Borrower Demand

Thus far, changes in lending have been ascribed to the dramatic increase in capital for recapitalized firms, without considering demand side changes that may have been occurring simultaneously. Demand side changes would be driving the systematic differences between the non-recapitalized and recapitalized firms, only if: a) borrowers are systematically switching from non-recapitalized to recapitalized banks, b) recapitalized banks have systematically larger borrowers, after the recapitalization program or c) new borrowers systematically borrow from recapitalized rather than non-recapitalized banks.[13]

In order to analyze the demand side change, the transition probabilities of switching from a non-IBRA to IBRA creditor are analyzed. A panel dataset of approximately one-third of the firms in the manufacturing sector in Indonesia in 1994, 200, 2005, and 2009, is used to conduct this analysis. Information in this dataset includes: creditor names, total investment amounts separated by equity and loans, firm address, number of employees, legal status and ownership structure, and industry. This manufacturing dataset shows whether manufacturing firms are switching creditors over time. By connecting this additional manufacturing dataset to the original banking sector dataset, whether manufacturing firms are switching creditors from a non-IBRA to IBRA creditor can be observed.

Results in Tables 9 and 10 indicate that borrowers are typically not switching from non-recapitalized to recapitalized banks. Over 90% of manufacturing firms in the sample used that begin the crisis with creditors that will not be recapitalized stay with their non-recapitalized creditor after the bailout program is implemented. This exercise cannot rule out, however, that there may have been demand increases for IBRA banks caused by firms with non-surviving creditors systematically entering IBRA banks. More data would allow for analyzing the questions more closely in the future.

[13] These explanations for the salience of demand side features assume that the market for loans is not perfect. If it were, borrowers would be indifferent to bank type, as the price of the same loan between banks should take into borrower preferences.

1.8 Conclusion

A great deal of attention as of late has been generated by the bailouts of financial sectors worldwide mainly because the costs of such an intervention are significant and effects on manager's strategic choices are unknown. Although the intent of government intervention is to decrease systemic risk and restore lending, a major engine of economic growth, recapitalization may create perverse long term incentives to pursue risk-taking, as this paper suggests. Further, recent critics of the U.S. program have pointed to evidence that recapitalized banks are not increasing lending but rather funneling the increased capital elsewhere. This paper conducts an empirical assessment of whether recapitalization leads to changes in two central variables in bank manager's decision making - risk and liquidity, and on-balance whether the relationships are positive or negative.

The results indicate that recapitalization is associated with increased insolvency risk, providing evidence for behavior consistent with moral hazard-type. However, there is also evidence that this relationship is more nuanced. Namely, this effect is also driven by the increased risk taking of recapitalized in addition to the change in behavior of non-recapitalized banks. This has further implications for bank regulation going forward and for all bank stakeholders. In addition, a bank recapitalization program may induce changes in the two groups that are long-lasting. This implies that policymakers are justified in their concerns that recapitalization may have significant consequences in the future.

From a business policy perspective the results have implications for all bank stakeholders following the implementation of a bailout program. For shareholders and depositors, evidence that bank managers may increase risk-taking after being bailed out provides information relevant to decision making regarding which bank to conduct business with in the future based on risk preferences, as managers in recapitalized banks may take on more risk while those in non-recapitalized banks take less risk. For the government, the results indicate that recapitalization is a successful tool for stimulate lending, but most effective for larger banks. Finally, the bailout program is also seen to engender greater risk-taking, implying that although the program is successful at stimulating lending, it does not come without the unintended consequence of increasing risk-taking in the long term.

1.9 Figures

Figure 1. Time Series of Risk Measure Between Recapitalized and Non-Recapitalized Banks

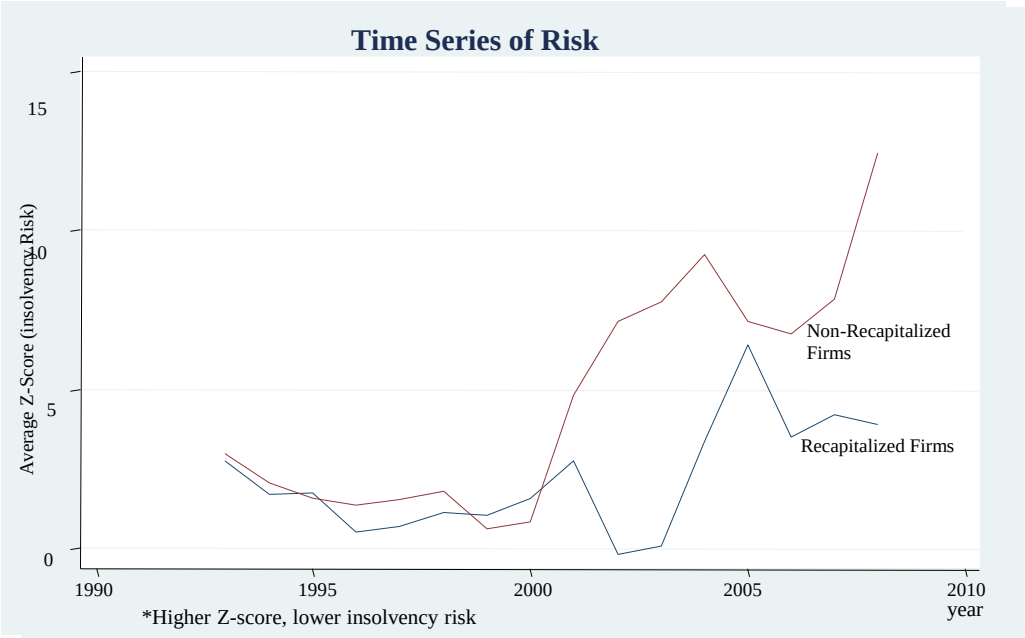


Figure 2. Time Series of Average Lending Volume between Recapitalized and Non-Recapitalized Banks

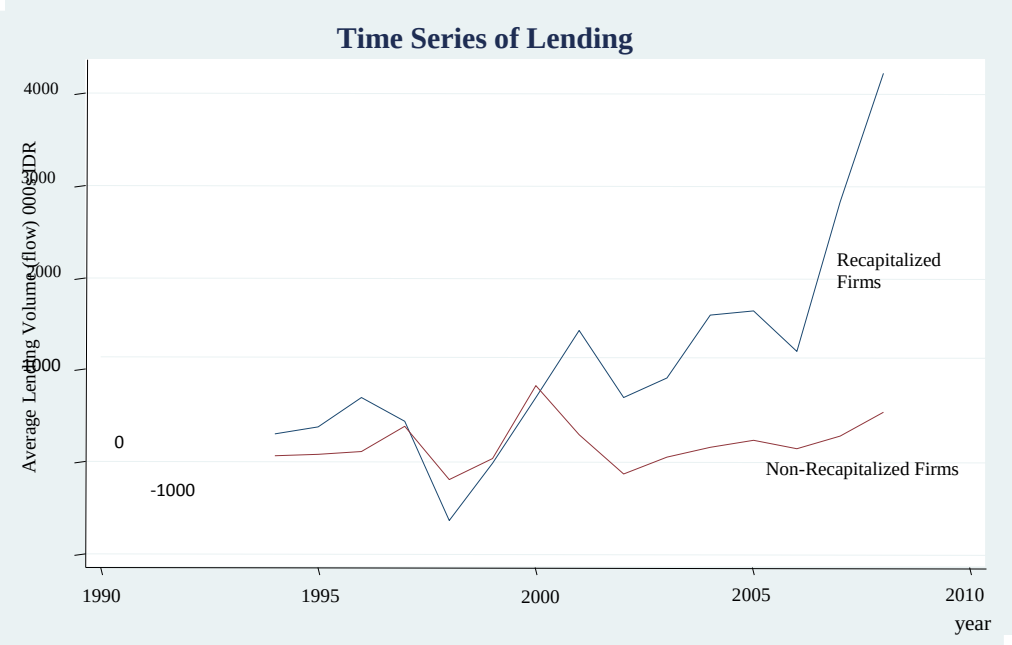


Figure 3. Secular Trends: Zscore

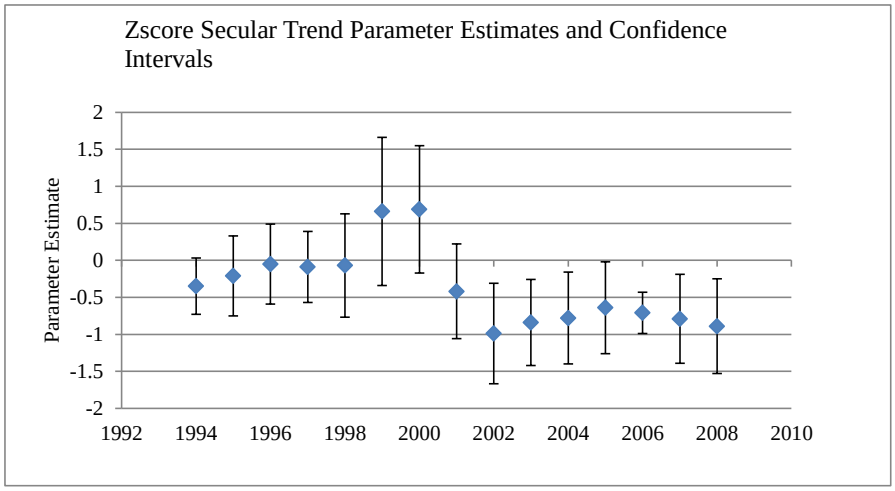
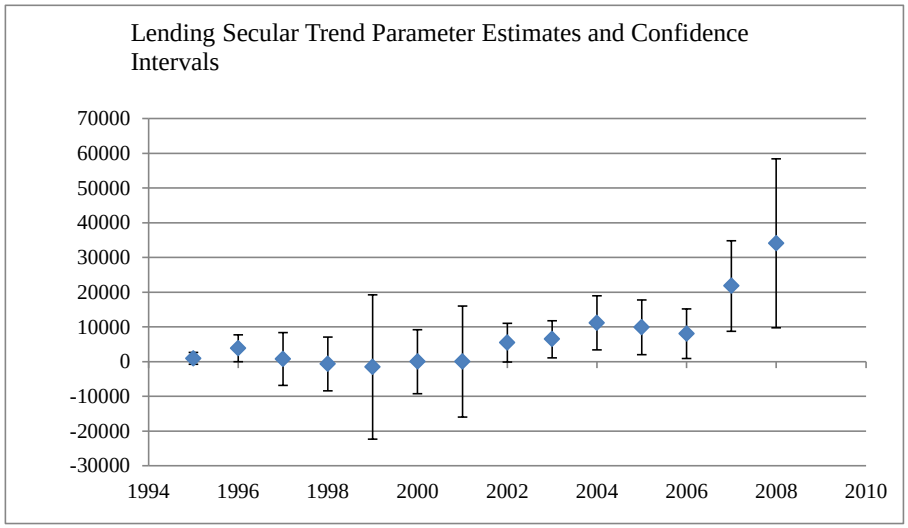


Figure 4. Secular Trends: Lending



1.10 Tables

Table 1a. Asian Financial Crisis Timeline

Pre-July 1997	30 year period of steady economic growth
Jul-97	Devaluation of the Thai baht
Aug-97	Indonesia rupiah (IDR) begins period of volatility
Oct-97	First IMF package announced; 16 banks closed immediately
Jan-98	Indonesian Bank Restructuring Agency (IBRA) established
May-98	President Suharto resigns
1999,2000	Recapitalization implemented
Apr-04	IBRA closed

Table 1b. Asian Financial Crisis Graphical Timeline

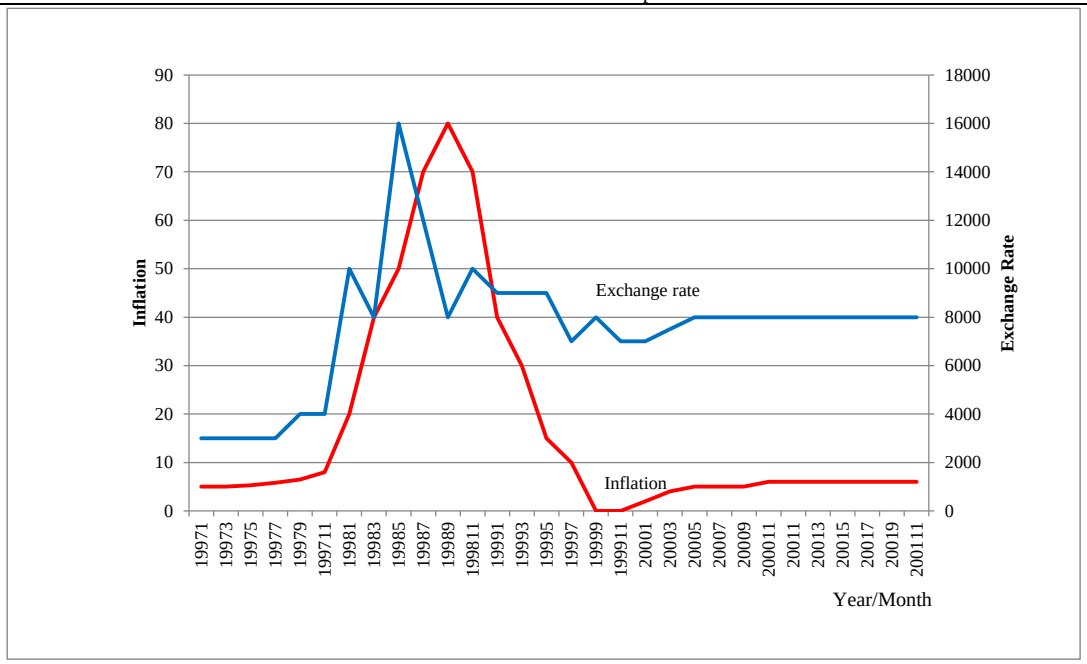


Table 2. Bank Survival and Recapitalization

	1997	2001	Recapitalized	% Survived	Recapitalized / Survivors	Recapitalized / Total
Government	6	5	5	100%	100%	100%
Foreign	12	12	6	100%	50%	50%
Regional	27	25	12	93%	48%	44%
Private	131	82	35	63%	43%	27%
JV	32	25	6	78%	24%	19%
	208	149	64	72%	43%	31%

*This is due to mergers
JV=Joint Venture

Table 3. Summary Statistics Pre-Recapitalization

Mean	Recapitalized	Non-Recapitalized	Difference	Standard Errors
Employees	2202	666	1536	545**
Branches	37	17	20	8.9**
Total assets	39269	9872	29397	7735**
Total deposits	6343	1478	4865	1108**
Total profits	-226	106	332	317

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses
*Total assets, deposits, profits in hundreds IDR

Table 4: Probit Estimates of Recapitalization		
VARIABLES	=1 if Recapitalized	=1 if Recapitalized
Employees	0.17	0.133
Deposits	0.001	0.003
Assets	-0.001	-0.003
Loans	0.002	0.005
CAR	-1.3	-1.42
Fit and proper	0.94***	0.96***
Geographic Location 1	-0.79***	-0.75***
Geographic Location 2	-0.49***	-0.49***
Geographic Location 3	0.10***	0.56
Geographic Location 4	-0.54***	-0.51***
Ownership Type 1	-0.58***	-0.57***
Ownership Type 2	0.56**	0.85***
Ownership Type 3	0.14	0.53**
Ownership Type 4	-.01***	-0.82***
Age	.	0.01
Cash	.	-0.01
Average Shares Held	.	0.01
Proportion of Connected Loans	.	0.33
Observations	145	145
Firms Correctly Classified	96%	97%

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

Geographic Location 1= Jakarta, Geographic Location 2= Multiple Metropolitan Areas, Geographic Ownership Type 1= Joint Venture, Ownership Type 2= Private Domestic, Ownership Type 3= Employees, assets, deposits, loans cash multiplied by 10,000

Table 5: Estimates of the Impact of Recapitalization on Risk and Lending

VARIABLES	(1) Z-score	(2) CAR	(3) Lending
Recapitalized * Post	-.44***	-0.45*	36000***
	(.16)	(0.24)	3796
Post	-.65***	1.58***	-6400*
	(.23)	(0.22)	(3720)
Constant	.49***	-3.50***	1009
	(.12)	(0.15)	(1355)
Observations	2227	2227	1671
R-squared	.34	0.26	.18
Firms	149	149	149

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses clustered at the firm level

Recapitalized=1 if a firm was recapitalized

Post=1 for post-recapitalization years

Z-score= $\log((ROA_{it}+CA)_{it}/\sigma(ROA)_i$

CAR=log((Tier 1 capital + Tier 2 capital) /Risk-weighted Assets)

Lending is lending flow in hundreds Indonesian rupiah (IDR)

Table 6: Estimates of the Impact of Recapitalization on Risk Controlling for Loan Stock

VARIABLES	(1) Z-score	(2) CAR
Recapitalized * Post	-.56***	-0.62*
	(.16)	(0.22)
Post	2.0***	1.97***
	(.39)	(-.54)
Lending stock	-.01	-.16
	(.004)	(.05)
Constant	.21***	-3.97***
	(.07)	(-.13)
Observations	2227	2227
R-squared	.36	.32
Firms	148	149

*** p<0.01, ** p<0.05, * p<0.1

Recapitalized=1 if a firm was recapitalized

Post=1 for post-recapitalization years

Robust standard errors in parentheses clustered at the firm level

Z-score= $\log((ROA_{it}+CA)_{it}/\sigma(ROA)_i$

CAR=log((Tier 1 capital + Tier 2 capital) /Risk-weighted Assets)

Table 7: Estimates of the Impact of Recapitalization on Risk (Placebo)		
VARIABLES	(1) Z-score	(2) Lending Volume
Recapitalized * Post	-0.007	179005
	(0.195)	(116031)
Post	-0.383***	-21613
	(0.119)	(23183)
Constant	0.06	122584***
	(0.041)	(32701)
Observations	513	403
R-squared	0.171	0.047
Firms	143	141

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses clustered at the firm level

Recapitalized=1 if a firm was recapitalized

Post=1 for post-placebo recapitalization years

Z-score = $\log(zscore)_{it}=((ROA_{it}+CA)_{it}/\sigma(ROA)_i$

Lending is lending flow in hundreds Indonesian rupiah (IDR)

Table 8: Estimates of the Impact of Recapitalization on Risk with Additional Controls			
VARIABLES	(1) Z-score	(2) CAR	(3) Lending Volume
Recapitalized * Post	-0.45***	-0.47*	2790*
	(0.16)	(0.24)	(1600)
1996 Employee count * Post	-.02	.11	4.18***
	(.002)	(.003)	(.19)
Post	0.80***	1.57***	-6090***
	(0.19)	(0.23)	(2326)
Constant	0.50***	-3.51***	2097***
	(0.12)	(0.15)	(727)
Observations	1,685	1,747	1,801
R-squared	0.33	0.26	0.238
Firms	149	149	149

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses clustered at the firm level

Post=1 for the post-recapitalization years

Z-score= $\log((ROA_{it}+CA)_{it}/\sigma(ROA)_t$ which measures solvency risk using within firm variation over time

CAR=log((Tier 1 capital + Tier 2 capital) /Risk-Weighted Assets)

Table 9: Transition Probabilities of Switching Creditors by Borrowers		
	Non-IBRA/Survive	IBRA
Non-IBRA/Non-survive	23%	73%
Non-IBRA/Survive	91%	9%
IBRA	5%	95%

Table 10: Linear Regression of Switching Creditors by Borrowers	
Non-IBRA/Non-survive	-0.13***
	(.04)
Non-IBRA/Survive	-0.849***
	(0.035)
Size Controls	X
No. observations	592
Pseudo R-Squared	0.47

Left hand side=1 if borrower switched creditor
Omitted group: IBRA

Chapter 2

Financial Crisis and Industry Evolution

2.1 Introduction

The proper government response to a financial crisis is the subject of considerable debate, both in the academic literature and also in policy circles. On the one hand, a financial crisis might facilitate the process of "creative destruction" (Schumpeter 1942). An abrupt loss of access to finance may foster an exit of the least productive firms and a reallocation of output shares from less to more productive firms. If creative destruction is an important for determining how the productivity of an industry evolves, policymakers may not want to intervene during crises, except to the extent that they can foster a rapid restructuring of the economy while making the transition as painless as possible.

However, the experience of the Great Depression suggests that timid government responses can be catastrophic, and without them, financial crises can result in persistently low demand and high unemployment. The negative effects on employment outcomes for workers entering the labor market during recessions persist throughout their lives (Kahn, 2010). The process of creative destruction can be slow and messy, as moving capital from less productive to more productive uses does not happen overnight. If major gains to productivity come not come through creative destruction channels, but are instead the product of the adoption of new technologies or a surge of new entrants, then governments should act to quickly end recessions so that these processes can continue unhindered.

Without proper evidence on how firms and industries fare in response to a financial crisis, it is hard to know how a policymaker should best respond. Unfortunately, although financial crises are frequent and ubiquitous (Reinhart and Rogoff, 2009), we still know very little about how they impact firm-level productivity distributions. Even descriptive evidence on the impact of crises is scant, as it requires detailed, firm-level datasets collected over long periods of time. In

this paper, we attempt to fill this gap in the literature by studying the experience of manufacturers in Indonesia during and after the Asian Financial Crisis of 1997-1998. Our dataset gives us an annual snapshot of the universe of Indonesian manufacturers every year from 1990 to 2005, providing us with sufficient breadth to understand what was going on before the crisis and what happened afterward. The rich, detailed variables on firm inputs, output, sources of finance, and market orientation enable us to estimate firm-level productivity residuals, to create measures of aggregate productivity, and then to decompose changes in aggregate productivity before, during, and after the crisis.

A financial crisis may affect firm-level productivity through a variety of channels, but most operate through investment. As investment contributes to the adoption of new technologies and the purchase of inputs, changes to investment directly affect the productivity of a firm. The existing literature has identified two main channels through which exchange rate depreciations, such as those experienced by Indonesia in 1997-1998, may affect investment (see for example Krugman, 1999). First, exchange-rate depreciations increase the competitiveness of firms in export markets and lead to higher export revenues. This "competitiveness effect" increases the profits and net worth of exporters, encouraging them to invest.

However, during exchange-rate depreciations, firms that hold debt that is denominated in foreign-currency face an increase in the domestic value of their liabilities. This "balance sheet effect" reduces firms' net worth, undermining their access to capital, eroding the value of their collateral, and reducing their ability to invest.[1] Moreover, banking crises typically increase banks' lending risk because more customers may face bankruptcy. Further, bank closures during a crisis break relationship-specific ties between lenders and their borrowers, leading to a loss of tacit information, further amplifying banks' hesitance to lend and decreasing access to credit for firms. Both the "balance sheet effect" and the banking crisis undermine firms' ability to invest, though the impacts on domestic firms (especially those with foreign-currency denominated debt) should be larger.

A nice feature of our dataset is that it allows us to disentangle the extent to which changes in productivity are being driven by exporters and importers during the crisis, enabling us to better understand what actually drives changes in productivity. If productivity gains are being driven by investments in new technologies, then we should expect to see large investment-driven real-productivity gains for exporters in the post-crisis period, especially foreign-owned exporters who are not as subject to "balance-sheet" impacts. However, if productivity gains are instead being driven by churning and entry and exit, then these "competitive effects" should not be as important. With data on firm ownership, we can strengthen the decomposition by separating out changes for domestic and foreign firms.

Our paper is closest in spirit to the literature examining how productivity distributions change after a trade liberalization (Levinsohn and Petrin1999, Trefler 2004, Pavcnik 2002). While these papers carefully detail how productivity changes as function of real productivity, reallocation, and churning, the economic environment during trade liberalization versus financial crisis is

[1] As the literature on the financial accelerator shows (Bernanke and Gertler1989), in a world of imperfectly competitive capital markets, changes to the net worth affect firms' access to external funds and hence do have real effects.

markedly different, presumably resulting in different changes to productivity evolution and growth. The part of the literature which focuses on the impact of financial shocks on investment (Blalock et al., 2008) do not disentangle changes in productivity between real productivity changes, reallocation changes or changes resulting from churning. We hope this paper begins to bridge that gap.

The rest of the paper proceeds as follows. Section 2 provides some background on the Asian financial crisis in Indonesia and information regarding the banking sector. Section 3 discusses the data used and outlines the empirical strategy. Section 4 presents the results of the analyses. Finally, Section 5 concludes.

2.2 Indonesian Manufacturing and the Asian Financial Crisis

Prior to the crisis, the Indonesian manufacturing sector experienced thirty years of unprecedented growth. Deregulation in banking in the 1980s made cheap credit available for investment, and the simultaneous easing of export restrictions encouraged growth in tradable sectors. Growth in manufacturing was driven by low-skill labor-intensive products, including textiles, garments, and footwear, and by resource-intensive products. A more favorable investment environment in China and other parts of Southeast Asia resulted in a large growth in FDI to Indonesia and an increased foreign presence in the ownership of Indonesia's firms. This rapid growth enabled in Indonesia to have one of the largest manufacturing sectors among developing countries worldwide by the mid-1990s (Radelet et al., 1998). The manufacturing sector emerged not only as the major source of foreign exchange earnings over this period, but also as the country's primary engine of economic growth.

In 1997, however, manufacturing-driven economic growth in Indonesia was disrupted by a severe financial crisis. Both a currency crisis and a banking crisis, the crisis caused changes to the non-financial sector as well, leading to a 13.5% contraction in output and a 40% decrease in investment. The crisis began when pressure on the Thai currency lead speculators to reverse large positions in several other Southeast Asian currencies, including the Indonesian rupiah. Even though the currency crisis began in Thailand, the massive capital outflow triggered a currency devaluation in Indonesia, contributing to a lack of confidence in the Indonesian economy as a whole. As the currency devaluation intensified and the lack of confidence spread, severe problems began to arise in the banking sector. Many borrowers had debts denominated in foreign currency, and the exchange rate depreciation resulted in many borrowers being suddenly unable to service their loans. This contributed to a growth in bank runs, bank closures, and made the lenders who remained to be increasingly wary of risk. Altogether, this lead to a rapid, severe decline in access to credit.

During the crisis, firms in the manufacturing sector experienced tremendous financial difficulty. First, since many manufacturing firms relied on foreign denominated debt for investment, loan repayment became difficult. Further, the manufacturing sector was not excluded from the severe decline in credit. Prior literature documents an almost 50% decline in credit over the crisis to manufacturing firms (Blalock et al., 2008, Dwor et al., 2000, Agung et al., 2001).

With this contraction in available credit, firms no longer had the funds to invest and those that relied on bank loans for operations were forced to close. As a result, in 1998, almost all of the manufacturing sectors underwent a dramatic decrease in the growth rate of output (See Figure 2). Figures 3, 4, and 5 indicate that the decrease in output growth was not restricted to a particular group of firms. Exporters, non-exporters, domestic and foreign firms all experienced a dramatic drop in output growth during the crisis. Figure 1 indicates that the decrease in the growth rate of output in manufacturing lasted until approximately 2000, when finally the growth rate of output in most industries began to increase.

While output growth began to recover by 2000, the entry of manufacturing firms in the post-crisis years slowed. Table 1 displays the change in entry patterns with respect to several key firm characteristics over the crisis period. As compared to prior to the crisis, the entry of new firms in the manufacturing sector decreased significantly over this time period, with certain industries and firms faring better than others in terms of survival. First, certain industries underwent increases in entry (Food and Beverage), while other experienced decreases (Textiles). Further, exporting seemed to be associated with differences in entry patterns over the crisis. In particular, while exporters are less likely to enter relative to pre-crisis, non-exporters are more likely to enter post-crisis. We examine the effect of entry and exit on productivity more closely in Section 2.4.

2.3 Empirical Analysis

2.3.1 Data

The empirical analysis is based on data from the Republic of Indonesia's Badan Pusat Statistik (BPS), the Central Bureau of Statistics. The principal dataset is the Survei Tahunan Perushahaan Industri Pengolahan (SI), the annual manufacturing survey. Here, we examine the years 1990-2005, a long panel including a significant number of years pre-crisis, crisis, and post-crisis. The SI dataset is designed to be a complete enumeration of all manufacturing establishments with 20 or more employees. This data has the structure of an unbalanced panel and the information provided tracks plants over time, including plants entering during the sample period as well as plants exiting. Depending on the year, the SI includes as many as 160 variables, including industrial classification (5-digit ISIC code), ownership information, investment information, and input information for approximately 20,000 factories. Due to the way the data is reported, we treat plants as firms, although surely some firms are multi-plant. BPS suggests, however, that less than 5% are multi-factory firms. BPS also ensures that firms leaving the dataset truly cease operations rather than becoming non-compliers by sending field agents to visit each non-respondent. Therefore, we attribute a firm leaving the dataset to firm exit.

The comprehensiveness of the data set provides many advantages. First, the database includes both privately owned and publicly traded firms, spanning all of the sectors in manufacturing. In addition, as already mentioned, the data represent the population of manufacturing firms, rather than a sample, strengthening the internal validity. Further, the newly available years 2002-2005 enable analysis of industry evolution over a long period of time post-crisis, information that is not readily available for many crisis episodes.

The variables used in the productivity analysis include a measure of output, measures of labor and capital inputs. Real value added is the real value of output adjusted for the real cost of all intermediate inputs. Labor is the wage bill and firms distinguish between blue collar and white collar employees. Electricity and fuels are measured in the real value of their volume consumed. All of the inputs enter the value-added production function in log-levels.

Real value of output is computed by deflating the total annual sales revenues of a firm with an industry level price deflator constructed by the Bank of Indonesia. This deflator will control for changes in output prices over time resulting from inflation. It will also control for changes occurring because of industry level demand shocks. Having controlled for these time-varying effects, we then rely on price-taking behavior at the firm level to get comparable quantities across time and between firms. The industries we look at have hundreds of firms so price-taking behavior seems a reasonable assumption. However, we remain concerned about the potential for differences that may arise form imperfect competition within more granular definitions of industries. Without firm-level prices or quantities, we cannot directly address this concern.

2.3.2 Methodology

The empirical approach in this paper has several components. First, we estimate firm-level production functions using the control-function approach developed in (Levinsohn and Petrin1999) and (Levinsohn and Petrin2003). This approach uses a two-step procedure. In the first step, an intermediate input is used control for productivity, correcting for simultaneity between productivity shocks and input choices. In the second step, survival probabilities are estimated and entered into a non-linear least squares routine which overcomes the problem of selective attrition in unbalanced panels.

In our work, the production function for firm i at time t is specified as:

$$y_{it} = \alpha + \beta_k k_{it} + \beta_s l^s_{it} + \beta_u l^u_{it} + \beta_a a_{it} + \varepsilon_{it}$$

where y_{it} denotes value added, k_{it} denotes capital, l^s_{it} denotes production labor quantities, l^u_{it} denotes non-production labor quantities, and a denotes the age of the firm.[2] All variables are expressed in logs. In the estimation, the total kilowatt hours of electricity consumed by the firm was used as the intermediate input in the control function step.

We estimate this function separately for all firms belonging to each 2-digit ISIC code. Table 2 displays the results. All four variables are significant for nearly every industry, and the magnitudes of the coefficient estimates are plausible. For instance, Food and Beverages (ISIC 31) and Textiles (ISIC 31) are estimated to be more labor intensive than Iron and Steel (ISIC 37) and Metal and Machines (ISIC 38).

After estimating these log-linear production functions, we calculate the productivity of firm i in year t by exponentiating the residuals:

$$\omega_{it} = \exp(y_{it} - \beta_k k_{it} - \beta_s l^s_{it} - \beta_u l^u_{it} - \beta_a a_{it})$$

[2] All variables, including capital, were deflated using industry-specific wholesale price indices.

After estimating firm-level productivity, we aggregate to the industry-level using an output-share weighted average:

$$\Omega_t = \sum_{i=1}^{N} s_{it}\omega_{it}$$

where s_{it} is plants i's share of industry output in year t. The focus of most of our empirical analysis will be on $\Delta\Omega$, the change in industry-level output over time, and in decomposing these changes into those resulting from reallocation of output shares from less to more productive firms, real productivity gains for continuing firms, and entry and exit of firms:

$$\Delta\Omega = \sum_{i\in C} s_{it}\Delta\omega_{it} + \sum_{i\in C} \Delta s_{it}\omega_{it} + \sum_{i\in B} s_{it}\omega_{it} - \sum_{i\in D} s_{i,t-1}\omega_{i,t-1}$$

where C is the set of continuing firms, B is the set of entrants, and D the set of exiting firms. The difference operator delta, denotes the difference between year t and t-k. The first term in this expression denotes the "real productivity" component of the total change, essentially the share weighted average of continuing plants changes in productivity. The second term denotes the "reallocation" component of the total change, the productivity weighted average of changes in market share. The third term represents the changes in productivity that can be attributed to entry of new firms, and the fourth term represents the changes that can be attributed to exit. Models of firm heterogeneity which capture stories in which in any given time period, some firms thrive, others lose market share, and entry and exit is constantly occurring are consistent with this decomposition (Jovanovic 1982, Hopenhayn 1992, Levinsohn and Petrin1999).

2.4 Results

In this section, we summarize our results on what determines the evolution of industrial productivity in Indonesia, taking care to note how this changes between the pre and post-crisis periods. In the first sub-section, we provide an overview of how industries fared before, during, and after the crisis. Our aim is to provide a rich picture of productivity evolution, discussing not only how each of the contributors to productivity growth change over time, but also how the impact of each element relative to the others may change. In the next subsection, we break down the productivity decompositions not only by industry, but also by firm characteristics. This allows us to examine whether productivity patterns differed over time depending on domestic market exposure and financing constraints.

2.4.1 All Firms: Pre-Crisis (1990-1996)

Table 3 describes the evolution of industrial productivity in the pre-crisis period, 1990-1996. The first column of Table 3 lists the total change in productivity, while the remaining columns

decompose this total change into the real-productivity, reallocation, birth and death components, as in equation (1). The real productivity effect can either be positive or negative, depending on whether for a given distribution of market shares, firms on average become more or less productive. The reallocation effect can also be either positive or negative, depending on whether the market is reallocating market share to relatively more or less efficient firms. The impact of births, or new entrants, is always positive by construction. Similarly, the last set of columns list the results of the effect of deaths, or exiting firms on productivity, which by construction is always negative. It therefore remains an empirical question whether the net impact of churning is positive or negative. The sum of these four components, by construction, is the total change in productivity. The percentage columns report the share of each category in the total absolute changes in productivity.

It might be helpful for the reader to walk through a single row of Table 3. The first row of Table 3 indicates that for the Food and Beverages industry, 34% of the total change in within industry productivity can be attributed to changes in real productivity. However, since the sign of the real productivity is negative, this means that over this period, the average productivity of firms in this industry was decreasing. The reallocation of market share to more efficient firms was positive but only contributed 3 percent to the total change in productivity. Entering firms were responsible for 49% of the total change in productivity, while exiting firms were responsible for 14% of the total change in productivity.

The final row of this table shows the total changes for the entire manufacturing sector, and how each element affects the total change. Overall, in the pre-crisis years, entry was the most significant element of productivity change on the manufacturing sector level, accounting for 45% of the total change in productivity during this time. Further, looking across industries, entry is the most significant element of productivity in the largest number of industries. In the majority of industries (industries 31-34, 36 and 39), entry comprised the largest percentage share of the total absolute changes in productivity.

Interestingly, in four out of the nine industries (industries 31, 33, 35, and 39) changes in productivity that were associated with "real productivity" gains were negative. Strikingly, due to a large negative effect for food and beverages (ISIC 31), the real productivity effect across all industries is also negative. This suggests that continuing firms were becoming less productive, on average, over this period. This result may be a product of crony-capitalism and nepotism characteristic of Suharto's final years, but since we don't have firm-level political connections in our database, we have no way of testing this hypothesis.

Reallocation effects were largely positive over this period, though small for most industries. Instead, in majority of industries (ISIC 31-34, 36, and 39), entry comprised the largest percentage share of total absolute changes in productivity. This suggests that most of the changes in productivity in the pre-crisis period were not coming through reallocation or real-productivity growth, but were instead due to churning, the entry of newer, more productive firms and the exit of less productive firms.

2.4.2 All Firms: Crisis (1996-2000)

However, during the crisis these patterns changed. Table 4 presents the results of the same industry decomposition as Table 3, except we focus on the crisis years (1996-2000). According to Table 4, the crisis coincided with decreases in total productivity both in terms of the manufacturing sector as a whole and also in many industries. While prior to the crisis, only one industry (industry 39) experienced a decrease in total productivity, during the crisis years a majority of the industries experienced decreases in total productivity. Further, while in the years prior to the crisis entry had the greatest impact on total productivity both on the manufacturing and industry level, the decrease in productivity during the crisis was driven by firm exit. The last row of Table 4 indicates that 46% of the total change in productivity came from exiting firms.

The effect of real productivity underwent significant changes over the crisis as well. While prior to the crisis, real productivity effects were negative in three industries, during the crisis, the negative real productivity effect spread to seven of the nine industries. Although real productivity became negative in more industries during the crisis, the relative impact of real productivity with respect to the other components of the productivity decomposition diminished (both on the manufacturing sector level and industry level). So while firms were becoming on average less productive during the crisis, the importance of this decrease in determining productivity on the industry level decreased.

Finally, total productivity changes became more concentrated over this time. Prior to the crisis, no single industry had a disproportionately large impact on total manufacturing productivity changes. However, during the crisis, one industry (31) has a much larger impact on total manufacturing sector productivity than the others. In fact, the magnitude of the productivity change in this industry was almost twice as large as the industry with the next largest magnitude. In terms of the four components of productivity within each industry, the concentration between these elements also increased during the crisis. In the years preceding the crisis, the change in productivity on the industry level was more evenly distributed among the four elements of productivity. During the crisis, however, the impact of the majority of the productivity change came from one of the four components, typically either exit or entry.

2.4.3 All Firms: Post-Crisis (2000-2005)

In the years following the crisis, Table 5 indicates that there is some evidence of recovery of the manufacturing sector in terms of productivity. Total manufacturing sector productivity increases over this time, driven mostly by the entry of new firms. Total productivity on the industry level, however, did not recover fully, as many more industries continued to experience decreases in total productivity. Further, real productivity did not rebound after the crisis. Seven of the nine industries continued to experience negative real productivity effects in the post-crisis years. Finally, the concentration of productivity within a single component of the decomposition also continued in the post-crisis years.

Altogether, these decompositions indicate that the crisis had a significant and long-lasting impact on industry dynamics. While churning remains important both in the pre-crisis, crisis and recovery years, total within-industry productivity and changes in real productivity do not rebound. The increased concentration of productivity changes on the manufacturing and industry level and the decreasing impact of real productivity on total within-industry productivity also

indicate that the mechanisms through which growth is occurring, i.e. the structure of productivity growth, changed over this time. While all four elements were important contributors to productivity growth in the pre-crisis period, productivity growth in the post-crisis period is largely driven largely by the effects of churning.

The importance of churning in the pre-crisis and post-crisis periods and the negative impact of real productivity during these periods is especially noteworthy. In general, the negative contribution of this element implies that there are periods of time during which the productivity of firms is decreasing. This suggests the existence of market imperfections in the sense that market share is not getting reshuffled to more productive firms and that negative productivity firms are not forced out of the market. Alternatively, this may also suggest negative productivity firms may remain open because the bureaucratic costs of exit are higher than remaining open (this may include the costs of filing for bankruptcy, amount of time for creditors to recover their losses, etc). Further, the negative real productivity, especially in the pre-crisis years is interesting because the state of the manufacturing sector as a whole was one of growth. As noted in Section 2, GDP was increasing at a steady rate, and the manufacturing sector was in an expansionary phase during the pre-crisis period. Negative real productivity coupled with an increase in growth implies that growth in the manufacturing sector was driven by entry, and not by increases in the actual productivity of firms.

2.4.4 Differences Between Firms: Pre-Crisis (1990-1996)

The decompositions we have analyzed so far do not differentiate between characteristics of firms which may lead to differences in productivity evolution. We examine how contributions to productivity growth are different across different types of firms in Tables 5, 6 and 7. These tables present the results of productivity growth decompositions, identifying the contributions of foreign exporters, domestic exporters, foreign non-exporters and domestic non-exporters to different factors affecting productivity growth. By separating firms into these groups, we can analyze more generally the differences between foreign and domestic owned firms, and we can also look in more detail at differences between the subgroups. Tables 5, 6, and 7 allow us to observe within each industry, how different types of firms affect productivity growth in different ways.

Table 6 shows the productivity decompositions for the different groups of firms in the pre-crisis period. The first column indicates the total change in productivity in each industry for each firm type. The next columns present the levels and percentage shares of each element of productivity. The included percentages are the impact of that particular component of productivity for that type of firm on within industry productivity. For example, in the first column of Table 6, in industry 32 (Textiles), the real productivity change for foreign exporters made up 7% of the total productivity change for that industry, which includes all of the other firm types (domestic exporters, foreign non-exporters, and domestic non-exporters).

Prior to the crisis, each type of firm contributed equally to aggregate manufacturing sector productivity in terms of the magnitude of their total change in productivity on the manufacturing sector level. However, there were also systematic differences between the sets of firms. In particular, domestic firms play a much larger role in changes to productivity both on the

manufacturing sector as a whole as well industry-by-industry. On the manufacturing sector level, the total contribution of domestic firms across all industries was negative. Further, in term of each component of productivity, domestic firms display systematic differences from foreign owned firms. Examining the last row of each panel, particularly the percentage impact of each element of productivity in each group, we find that for almost each component of productivity, domestic firms have the largest share as compared to foreign firms.

Domestic firms were also the only set of firms to experience decreases in the real productivity component over this time. Not only are the total manufacturing level real productivity changes for domestic firms negative (see the second column, last row of Panel B and Panel D), but on the industry level, the majority of domestic firms had negative real productivity effects in the pre-crisis years. Recall from the discussion in Section 2.4.1 and Table 3, that the aggregate impact of real productivity in the pre-crisis years was negative. Since domestic firms were the only set of firms to have negative real productivity, this provides evidence that the negative real productivity on the manufacturing sector level was driven only by domestic firms.

In addition, exporters exert a larger influence on productivity relative to non-exporters. In a larger number of industries, exporting firms had a larger share of total absolute industry productivity changes. From the perspective of which element of productivity had the greatest impact, Table 6 reinforces the findings of Table 3, namely that the entry of new firms had the greatest contribution to changes in industry productivity.

2.4.5 Differences Between Firms: Crisis (1996-2000)

During the crisis, most of these patterns changed. Table 7 displays the results of the productivity decomposition across all sets of firms during the crisis years. Not surprisingly, total manufacturing level productivity was decreasing across all firms except foreign exporters. Foreign exporters were the only set of firms to contribute positively to total manufacturing sector productivity during this time. Further, domestic firms no longer had a larger contribution to total aggregate manufacturing productivity or industry-level productivity while exporters retained their larger influence over productivity evolution relative to non-exporters.

On the industry level, exporters contributed a larger share of the total absolute changes in productivity in the most industries. Finally, similar to the evidence provided by Table 4, Table 7 indicates that exit had the largest share of total productivity in the largest number of industries across all firm types. The real productivity effect also changed during the crisis. As mentioned earlier, the negative effect of real productivity spread to several more industries post-crisis, and these were no longer concentrated primarily in domestic firms. Rather, each type of firm experienced drops in the average productivity over this period.

2.4.6 Differences Between Firms: Post-Crisis (2000-2005)

Finally, in the recovery years (Table 5), domestic firms again exert a greater influence over the productivity change than foreign firms, while the productivity of exporters retains its influence over non-exporters. We also observe that the negative real productivity effect does not recover post-crisis. In fact, for all firm types, real productivity changes remain negative in the recovery

phase. Finally, entry recovers during this period to become once again the most influential component of the productivity decomposition.

2.5 Discussion

The productivity decomposition tables on the manufacturing level and by firm type provide several key insights regarding industry evolution over a financial crisis. As a whole, the industry decompositions tell a story of growth that is driven by birth and death, and not by improvements in the productivity of existing firms. Regardless of firm type, within each industry, entry seems to be the dominant component of the total change in productivity in most industries during the pre-crisis years. Over the financial crisis, however, the significance of new firm entry is replaced by the exit of firms who cannot survive. Once recovery is reached, the entry of new firms resumes.

Of interest as well is the role of real productivity. Throughout the period examined, real productivity negatively contributes to total manufacturing, as well as industry level manufacturing in several industries, and this effect increases during the financial crisis. Negative real productivity effects indicate that continuing firms are becoming less productive on average. In the pre-crisis era, the only firms with negative real productivity were the domestic firms, while after the crisis, the decreasing average productivity of firms spread to all firm types. This is contrary to the existing literature, which finds that improvements within firms are in general the most important component of productivity growth (Okamoto and Sjoholm 2005).

Additionally, the decompositions provide information regarding which group of firms' influence on productivity is more sensitive to change. Over the three time periods, exporters remain an important influence on within-industry productivity within many industries. On the other hand, the influence of domestic firms relative to foreign firms is more sensitive to change. Specifically, prior to the crisis, domestic firms had a significant impact on within industry productivity evolution in more industries than foreign firms. This changed during the crisis, when domestic non-exporters exerted influence on the change in productivity in a smaller number of industries. Post-crisis, the productivity of domestic firms again became important in productivity evolution.

The industry evolution of the four different subgroups provide further details on the industry evolution of the different types of firms. The change in the impact of domestic firms is driven mostly by changes in domestic non-exporters, as the impact of exporters (domestic exporters included) remains constant throughout all three periods. Domestic non-exporters have a much larger impact on productivity evolution in the pre-crisis years, yet this impact, on the manufacturing level, is negative. Over the crisis, the importance of these firms to within industry productivity evolution is destroyed, leading to foreign firms having a greater impact in the crisis period. Domestic non-exporters being the most affected by the crisis suggests that exposure to international markets enabled exporters not to lose their impact on industry productivity.

Beyond understanding the components of productivity and identity of firms that matter for productivity evolution, these tables also provide interesting evidence on the similarity of productivity evolution among industries. While industry comparisons are often complicated by

the vast differences in various aspects of the production process and external environment, including production technologies, capital/labor ratios, output, regulations, here, we observe that similar changes in productivity evolution occur across industries. In terms of entry/exit patterns and the elements of productivity that influence productivity change, industries exhibit similar patterns over time.

2.6 Conclusions

The paper has explored the evolution of industry productivity over a financial crisis. We conduct industry decompositions for the manufacturing sector as a whole, and sets of firms based on domestic/foreign and exporters/non-exporters to better understand systematic patterns in industry evolution between firms and across time. Using the population of manufacturing firms in Indonesia over a time period capturing a significant number of pre-crisis and post-crisis years, we are able to observe long run trends in industry evolution and changes in industry evolution associated with a financial crisis.

We find that the financial crisis coincided with significant changes to industry productivity, its components and the productivity evolution of different sets of firms, and some of these change were long-lasting. We find that the financial crisis coincided with dramatic decreases in total productivity in the manufacturing sector, and on the industry level, driven mostly by the exit of firms. While entry picked up again later on, decreases in firm-level productivity became a more pervasive phenomenon in the manufacturing sector during this time and did not recover. Finally, we find that firms exhibit systematic differences in their productivity evolution over time, depending on export and ownership. The only set of firms to be able to maintain increases in productivity over the crisis was the foreign exporters, providing preliminary evidence that perhaps only exposure to both international markets (the competitiveness effect) and access to internal borrowing may help smooth investment, and subsequent productivity growth over a financial crisis. From a government and firm policy perspective, this implies that domestic firms should be encouraged to export as well as be provided with alternate supplies of funding over a financial crisis.

This paper represents a first step in understanding industry evolution over a financial crisis. While we begin to disassemble how firms with different liquidity constraints display different industry evolution patterns, more attention should be given to understanding which firms are exiting over the crisis, and driving the dramatic drop to productivity. In the future, more structure will be added to better understand the characteristics of exiting firms, using a regression framework.

2.7 Figures

Figure 1: Total Manufacturing Output

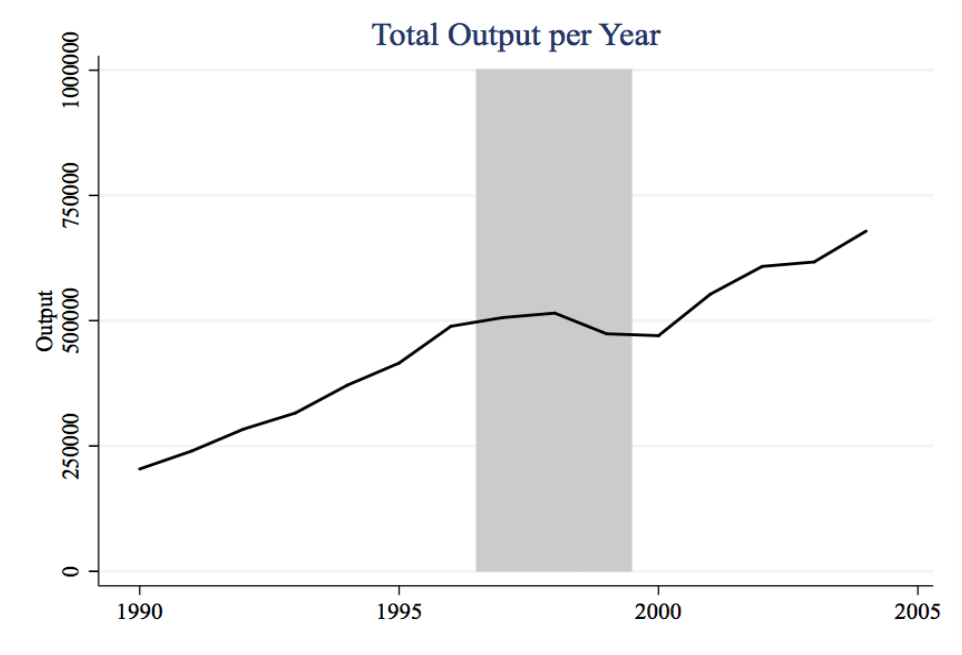


Figure 2: Total Manufacturing Output (By Industry)

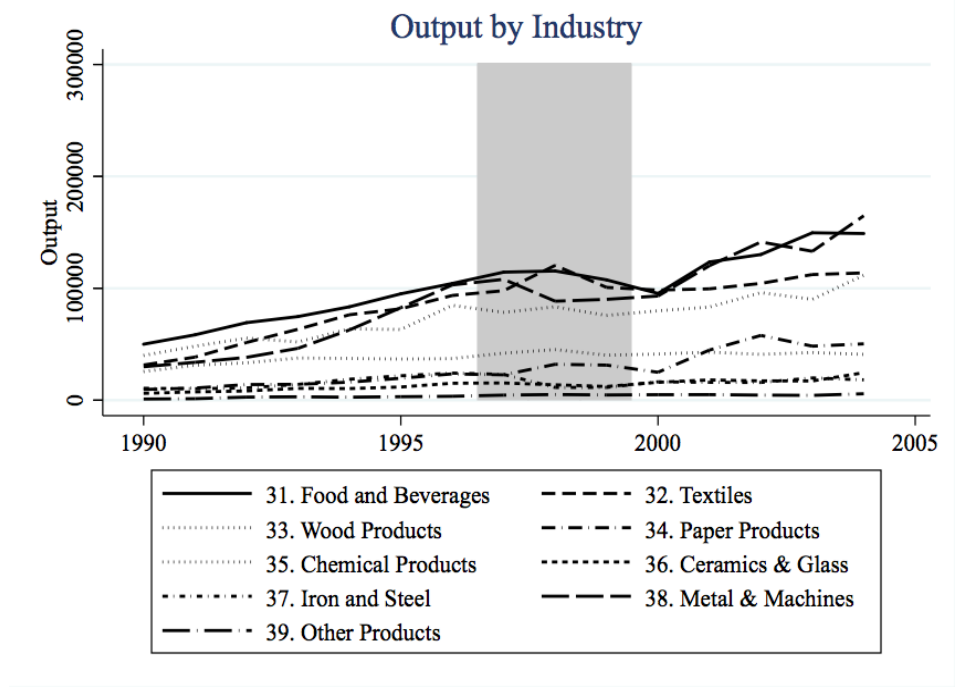


Figure 3: Total Manufacturing Output (By Owner)

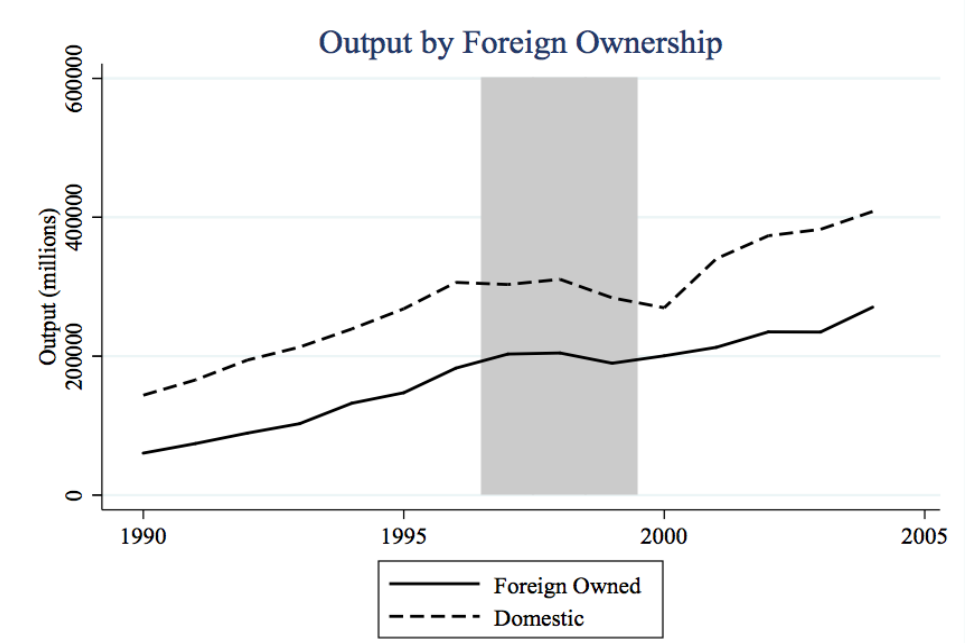


Figure 4: Total Manufacturing Output (By Exporter)

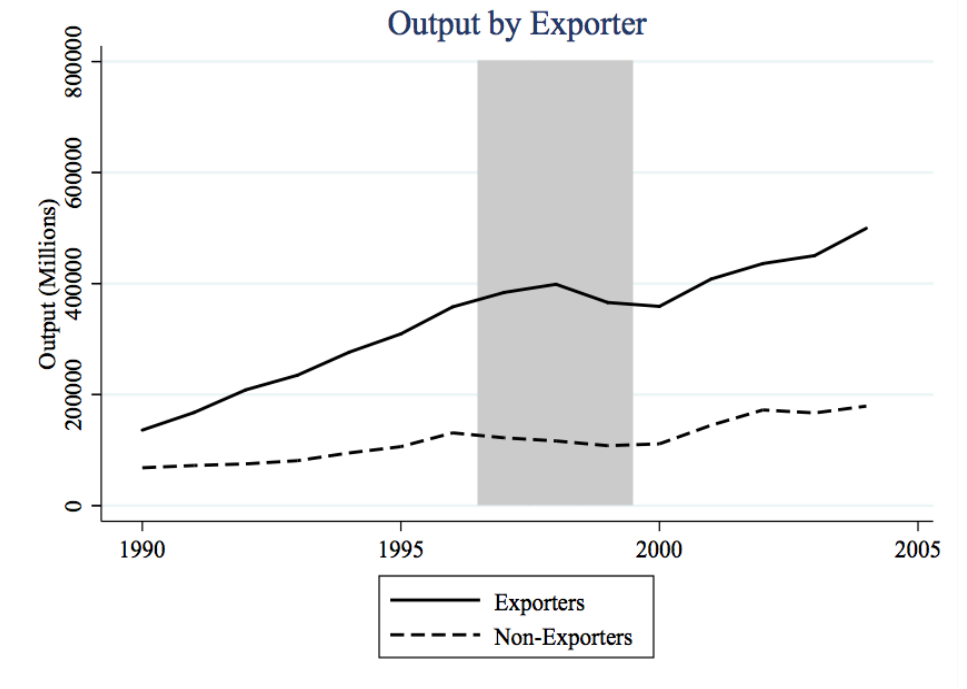
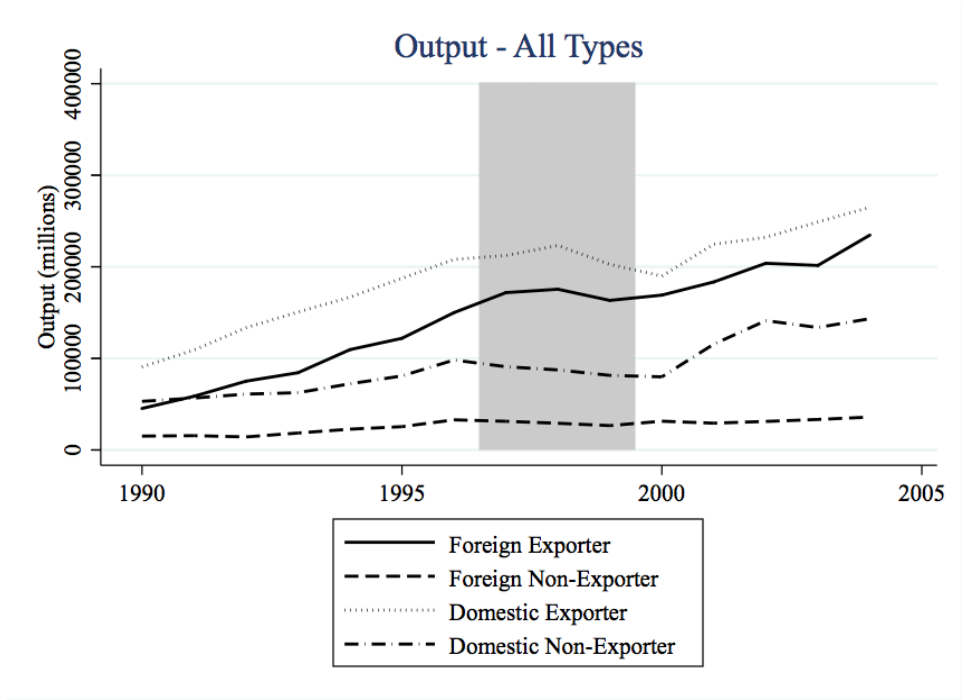


Figure 5: Total Manufacturing Output (By Exporter)



2.8 Tables

Table 1: Descriptive Statistics: Entering Firms

	Entering Establishments		
Mean Annual Entry/Exit	Pre-Crisis (1990-1996)	Post-Crisis (2000-2005)	p-value*
# Firms per Year	2551.70	1236.20	0.00
Size distribution			
20-30 Employees	0.45	0.45	-0.72
31-50 Employees	0.19	0.21	0.00
51-100 Employees	0.15	0.15	-0.21
100+ Employees	0.22	0.19	0.00
Sector Distribution			
31. Food and Beverages	0.22	0.28	0.00
32. Textiles	0.25	0.22	0.00
33. Furniture and Wood Products	0.17	0.18	-0.37
34. Paper Products	0.04	0.03	-0.04
35. Chemical Products	0.09	0.08	-0.01
36. Ceramics and Glass	0.09	0.07	0.00
37. Iron and Steel	0.01	0.01	-0.35
38. Metal and Machines	0.11	0.10	-0.03
39. Other Manufacturing	0.03	0.03	-0.02
Exporting and Ownership			
Any exports?	0.27	0.20	0.00
No exports	0.73	0.81	0.00
Foreign owned '(50\% or more)	0.05	0.06	-0.02
Locally owned	0.95	0.95	-0.02
Foreign Exporters	0.04	0.03	0.00
Foreign Non-Exporters	0.01	0.02	0.00
Local Exporters	0.23	0.16	0.00
Local Non-Exporters	0.72	0.78	0.00

*Reported p-values for a two-sample equality of means test with unequal variances.
Source: SI and authors calculations. Size distribution are calculated as averages of the median number of employees for each firm.

Table 2: Estimates of Production Functions, By 2-Digit Industries

	31	32	33	34	35	36	37	38	39
ln_Lprod	0.546	0.608	0.606	0.441	0.266	0.521	0.324	0.439	0.663
	(0.017)***	(0.012)***	(0.015)**	(0.028)***	(0.018)***	(0.022)***	(0.080)*	(0.020)***	(0.034)***
ln_Lnprod	0.284	0.216	0.21	0.399	0.451	0.217	0.425	0.366	0.225
	(0.011)***	(0.011)***	(0.011)**	(0.031)***	(0.017)***	(0.016)***	(0.067)*	(0.016)***	(0.030)***
ln_a	-0.051	-0.051	0.021	-0.027	0.018	-0.06	0.157	-0.033	0.086
	(0.009)***	(0.009)***	(0.011)**	-0.022	-0.016	(0.012)***	(0.065)*	(0.014)***	(0.027)***
ln_K	0.169	0.122	0.112	0.172	0.155	0.157	0.161	0.146	0.083
	(0.011)***	(0.010)***	(0.011)**	(0.023)***	(0.011)***	(0.020)***	(0.034)*	(0.012)***	(0.030)***
N	43478	33854	26069	8294	23621	11549	1681	20332	3397
Wald Test of CRS	6.2	40.8	7.7	0.1	18.6	26.9	0.3	8.8	1.7

Dependent variable is the log of value added

Source: Authors calculations, based on Levinsohn and Petrin (1999).

*denotes significant at the 10% level, ** denotes significant at the 5% level, and *** denotes significant at the 1% level

Table 3: Decomposition of the Evolution of Productivity, 1990-1996

	Total Change	**Real Productivity**		**Reallocation**		**Entry**		**Exit**	
	$\Delta\Omega$	Level	%	Level	%	Level	%	Level	%
31. Food and Beverages	201.00	-1782.50	0.34	154.80	0.03	2545.60	0.49	-717.00	0.14
32. Textiles	490.20	140.10	0.13	141.90	0.13	519.10	0.47	-311.00	0.28
33. Wood Products	379.40	-44.00	0.03	178.50	0.10	880.80	0.51	-635.90	0.37
34. Paper Products	87.80	34.90	0.33	6.60	0.06	55.90	0.52	-9.50	0.09
35. Chemical Products	332.40	-215.40	0.13	627.60	0.38	362.90	0.22	-442.70	0.27
36. Ceramics & Glass	39.40	40.80	0.09	2.10	0.00	193.10	0.45	-196.60	0.45
37. Iron and Steel	118.10	40.20	0.30	70.40	0.53	14.40	0.11	-7.00	0.05
38. Metal & Machines	708.30	87.30	0.07	557.40	0.44	346.70	0.27	-283.20	0.22
39. Other Products	-3.50	-0.50	0.02	-2.80	0.11	11.60	0.43	-11.80	0.44
Total	2353.00	-1699.10	0.15	1736.60	0.16	4930.10	0.45	-2614.50	0.24

Source: Author's calculations, based on Levinsohn an Petrin (1999). The percentage columns report the share of each category in the total absolute changes in productivity

Table 4: Decomposition of the Evolution of Productivity, 1996-2000

	Total Change	**Real Productivity**		**Reallocation**		**Entry**		**Exit**	
	$\Delta\Omega$	Level	%	Level	%	Level	%	Level	%
31. Food and Beverages	-1236.6	-642.5	0.17	727.4	0.19	546.6	0.14	-1868.1	0.49
32. Textiles	-155	-245.7	0.18	446.6	0.33	156	0.11	-511.8	0.38
33. Wood Products	-302.3	-39.6	0.02	317.2	0.17	462.3	0.25	-1042.2	0.56
34. Paper Products	-76.8	-16.3	0.05	63.6	0.21	46.1	0.16	-170.2	0.57
35. Chemical Products	-583.2	-9.5	0	726.7	0.29	228.7	0.09	-1529.1	0.61
36. Ceramics & Glass	334.2	55.5	0.06	139.5	0.16	414.4	0.47	-275.2	0.31
37. Iron and Steel	-89.8	-123.8	0.5	50.7	0.21	28	0.11	-44.8	0.18
38. Metal & Machines	765.1	-229.3	0.08	329.5	0.12	1406.1	0.52	-741.2	0.27
39. Other Products	60.5	1.7	0.02	15.5	0.2	51.6	0.67	-8.3	0.11
Total	-1283.8	-1249.5	0.09	2816.7	0.21	3339.9	0.25	-6191	0.46

Source: Author's calculations, based on Levinsohn an Petrin (1999). The percentage columns report the share of each category in the total absolute changes in productivity

Table 5: Decomposition of the Evolution of Productivity, 2000-2005

	Total Change	**Real Productivity**		**Reallocation**		**Entry**		**Exit**	
	$\Delta\Omega$	Level	%	Level	%	Level	%	Level	%
31. Food and Beverages	3084	224.7	0.05	404.7	0.08	3295.2	0.69	-840.6	0.18
32. Textiles	-165	-226.8	0.27	64.9	0.08	280.1	0.33	-283.2	0.33
33. Wood Products	27.3	-392.4	0.18	101.8	0.05	988.9	0.46	-671	0.31
34. Paper Products	436.2	20	0.04	50.8	0.09	432.7	0.76	-67.4	0.12
35. Chemical Products	2455.9	-120.8	0.04	1730.7	0.51	1204.9	0.35	-358.9	0.11
36. Ceramics & Glass	266.7	-66.5	0.05	80.6	0.06	673.5	0.54	-421	0.34
37. Iron and Steel	-17.7	-34.9	0.15	0.1	0	108.1	0.46	-91	0.39
38. Metal & Machines	-722.2	-222.2	0.09	554.7	0.23	296.3	0.12	-1351.1	0.56
39. Other Products	-26.3	-34.4	0.38	-3.2	0.04	31.7	0.35	-20.3	0.23
Total	5338.9	-853.2	0.06	2985	0.2	7311.6	0.48	-4104.5	0.27

Source: Author's calculations, based on Levinsohn an Petrin (1999). The percentage columns report the share of each category in the total absolute changes in productivity

Table 6: Decomposition of the Evolution of Productivity, 1990-1996 (Shares of Total Changes)

	Total Change	Real Productivity		Reallocation		Entry		Exit	
	ΔΩ	Level	%	Level	%	Level	%	Level	%
Panel A: Foreign Exporters									
31. Food and Beverages	-23.8	13	0	16.8	0	28.8	0.01	-82.4	0.02
32. Textiles	220.4	79	0.07	27.2	0.02	128.6	0.12	-14.3	0.01
33. Wood Products	133.8	61.9	0.03	10.3	0.01	99.7	0.05	-38.2	0.02
34. Paper Products	68.9	67.8	0.35	3.3	0.02	0	0	-2.2	0.01
35. Chemical Products	173.8	160.6	0.07	0.3	0	30.4	0.01	-17.6	0.01
36. Ceramics and Glass	25.7	112.1	0.19	5.9	0.01	27	0.05	-119.4	0.2
37. Iron and Steel	86.9	49.7	0.27	33.4	0.18	4.5	0.02	-0.7	0
38. Metal and Machines	231.8	36	0.03	168.1	0.13	44.3	0.03	-16.6	0.01
39. Other Products	2.9	-0.6	0.02	-0.6	0.02	4.6	0.15	-0.5	0.02
Total	920.4	579.5	0.05	264.7	0.02	368	0.03	-291.8	0.02
Panel B: Domestic Exporters									
31. Food and Beverages	758	-39.1	0.01	54.9	0.01	887.6	0.16	-145.4	0.03
32. Textiles	217.5	60	0.05	106	0.1	260.7	0.23	-209.2	0.19
33. Wood Products	265.9	-59.1	0.03	166.3	0.09	446.9	0.24	-288.3	0.15
34. Paper Products	-1.5	-11.6	0.06	-9.4	0.05	19.6	0.1	-0.2	0
35. Chemical Products	20.9	-313.3	0.14	315.4	0.14	126	0.06	-107.1	0.05
36. Ceramics and Glass	71.1	-47.3	0.08	-2.6	0	130.1	0.22	-9.1	0.02
37. Iron and Steel	-21.2	-17.9	0.1	-4.1	0.02	1.1	0.01	-0.2	0
38. Metal and Machines	184.7	-7.6	0.01	86.8	0.07	118.3	0.09	-12.8	0.01
39. Other Products	5	1.9	0.06	-1.5	0.05	5.6	0.18	-1	0.03
Total	1500.5	-434	0.03	711.9	0.06	1995.9	0.16	-773.3	0.06
Panel C: Foreign Non-Exporters									
31. Food and Beverages	723.1	92.7	0.02	54.9	0.01	719.3	0.13	-143.8	0.03
32. Textiles	11.7	-0.1	0	-0.1	0	12	0.01	-0.1	0
33. Wood Products	67.9	0	0	0	0	80	0.04	-12.2	0.01
34. Paper Products	0.7	0.1	0	0.1	0	0.5	0	0	0
35. Chemical Products	153.4	118.8	0.05	234.9	0.11	30.7	0.01	-231.1	0.1
36. Ceramics and Glass	-5	0	0	-0.1	0	3.8	0.01	-8.7	0.01
37. Iron and Steel	54.7	11.9	0.06	42.8	0.23	0	0	0	0
38. Metal and Machines	120.4	3.2	0	1.9	0	116.6	0.09	-1.3	0
39. Other Products	0	0	0	0	0	0	0	0	0
Total	1126.8	226.7	0.02	334.4	0.03	963	0.08	-397.2	0.03
Panel C: Domestic Non-Exporters									
31. Food and Beverages	-1256.4	-1849	0.34	28.2	0.01	909.9	0.17	-345.4	0.06
32. Textiles	40.5	1.2	0	8.8	0.01	117.8	0.11	-87.4	0.08
33. Wood Products	-88.1	-46.8	0.03	1.8	0	254.1	0.14	-297.2	0.16
34. Paper Products	19.7	-21.4	0.11	12.6	0.07	35.7	0.19	-7.2	0.04
35. Chemical Products	-15.7	-181.5	0.08	77	0.03	175.8	0.08	-86.9	0.04
36. Ceramics and Glass	-52.3	-24	0.04	-1.2	0	32.2	0.06	-59.3	0.1
37. Iron and Steel	-2.4	-3.5	0.02	-1.6	0.01	8.8	0.05	-6.1	0.03
38. Metal and Machines	171.4	55.7	0.04	300.7	0.23	67.5	0.05	-252.5	0.2
39. Other Products	-11.5	-1.8	0.06	-0.8	0.03	1.4	0.05	-10.3	0.34
Total	-1194.8	-2071.3	0.16	425.6	0.03	1603.2	0.13	-1152.3	0.09

Source: Author's calculations, based on Levinsohn an Petrin (1999). The percentage columns report the share of each category in the total absolute changes in productivity

Table 7: Decomposition of the Evolution of Productivity, 1996-2000 (Shares of Total Changes)

	Total Change	Real Productivity		Reallocation		Entry		Exit	
	$\Delta\Omega$	Level	%	Level	%	Level	%	Level	%
Panel A: Foreign Exporters									
31. Food and Beverages	227.3	15.4	0	60.3	0.02	226.2	0.06	-74.5	0.02
32. Textiles	-48.5	-36.9	0.03	95.1	0.07	77.3	0.06	-184.1	0.14
33. Wood Products	64.8	-18.5	0.01	42.3	0.02	221.4	0.11	-180.4	0.09
34. Paper Products	-76.3	-2.7	0.01	-0.3	0	0.9	0	-74.2	0.25
35. Chemical Products	282.7	41.6	0.02	323.6	0.13	70.7	0.03	-153.3	0.06
36. Ceramics and Glass	1	-1.5	0	31.5	0.04	130.7	0.15	-159.7	0.18
37. Iron and Steel	-94.9	-81.3	0.3	7.4	0.03	2.4	0.01	-23.3	0.09
38. Metal and Machines	1200.9	-156.4	0.06	112.5	0.04	1289.2	0.48	-44.4	0.02
39. Other Products	9.5	1.8	0.02	8.3	0.11	1.9	0.03	-2.5	0.03
Total	1566.5	-238.5	0.02	680.6	0.05	2020.7	0.15	-896.3	0.07
Panel B: Domestic Exporters									
31. Food and Beverages	-657.2	-718.6	0.18	282.9	0.07	115.3	0.03	-336.8	0.09
32. Textiles	-19.1	-144.9	0.11	303	0.22	31.3	0.02	-208.4	0.15
33. Wood Products	-140.6	70.9	0.04	257.7	0.13	137.8	0.07	-607	0.3
34. Paper Products	0.2	1.7	0.01	4	0.01	25.8	0.09	-31.3	0.1
35. Chemical Products	-338.4	-3.9	0	252.4	0.1	83.4	0.03	-670.4	0.26
36. Ceramics and Glass	309.2	61.1	0.07	95.2	0.11	233.3	0.26	-80.3	0.09
37. Iron and Steel	70.1	5.8	0.02	44.1	0.16	22.9	0.09	-2.7	0.01
38. Metal and Machines	-61.2	-52.5	0.02	160.1	0.06	6.6	0	-175.4	0.06
39. Other Products	46.2	-0.1	0	6.9	0.09	43.1	0.56	-3.7	0.05
Total	-790.9	-780.6	0.06	1406.3	0.1	699.4	0.05	-2116	0.16
Panel C: Foreign Non-Exporters									
31. Food and Beverages	-503.3	44.7	0.01	180.2	0.05	15.9	0	-744.1	0.19
32. Textiles	-7.6	0.1	0	4.2	0	0.3	0	-12.2	0.01
33. Wood Products	-80	0	0	0	0	0	0	-80	0.04
34. Paper Products	2.8	-0.5	0	3	0.01	0.3	0	0	0
35. Chemical Products	-429.6	-13.6	0.01	32.7	0.01	1.9	0	-450.6	0.17
36. Ceramics and Glass	0	-0.4	0	-1.2	0	1.8	0	-0.2	0
37. Iron and Steel	-63.9	-43.7	0.16	-4.5	0.02	2.3	0.01	-18	0.07
38. Metal and Machines	-28.9	-2	0	39.8	0.01	56.4	0.02	-123.1	0.05
39. Other Products	3.1	0	0	0	0	3.1	0.04	0	0
Total	-1107.5	-15.4	0	254.2	0.02	82.1	0.01	-1428.3	0.11
Panel D: Domestic Non-Exporters									
31. Food and Beverages	-303.4	15.9	0	204.1	0.05	189.3	0.05	-712.7	0.18
32. Textiles	-79.8	-64.1	0.05	44.4	0.03	47.1	0.03	-107.2	0.08
33. Wood Products	-146.5	-91.9	0.05	17.2	0.01	103	0.05	-174.8	0.09
34. Paper Products	-3.5	-14.8	0.05	56.9	0.19	19	0.06	-64.6	0.22
35. Chemical Products	-97.9	-33.6	0.01	117.8	0.05	72.7	0.03	-254.8	0.1
36. Ceramics and Glass	24	-3.7	0	14	0.02	48.7	0.05	-35	0.04
37. Iron and Steel	-1.1	-4.5	0.02	3.8	0.01	0.5	0	-0.8	0
38. Metal and Machines	-345.6	-18.4	0.01	17.1	0.01	53.9	0.02	-398.3	0.15
39. Other Products	1.8	0	0	0.3	0	3.5	0.05	-2	0.03
Total	-952	-215	0.02	475.6	0.03	537.8	0.04	-1750.3	0.13

Table 8: Decomposition of the Evolution of Productivity, 2000-2005 (Shares of Total Changes)

	Total Change	Real Productivity		Reallocation		Entry		Exit	
	$\Delta\Omega$	Level	%	Level	%	Level	%	Level	%
Panel A: Foreign Exporters									
31. Food and Beverages	276.2	29.5	0.01	-58.5	0.01	387.4	0.07	-82.2	0.02
32. Textiles	27.6	39.1	0.04	14.4	0.02	60.6	0.06	-86.5	0.09
33. Wood Products	196.2	-16.7	0.01	59.4	0.03	400	0.19	-246.5	0.11
34. Paper Products	260.9	0.5	0	5.5	0.01	255.1	0.42	-0.3	0
35. Chemical Products	515.8	-158.8	0.04	637.8	0.18	179.4	0.05	-142.5	0.04
36. Ceramics and Glass	-128	26.6	0.02	-19.9	0.01	6	0	-140.7	0.11
37. Iron and Steel	-52	-3.1	0.01	-2.3	0.01	1.4	0.01	-48	0.2
38. Metal and Machines	-1089.2	-115.5	0.05	117.4	0.05	45.1	0.02	-1136.1	0.45
39. Other Products	4.1	-2.1	0.02	1.3	0.01	15.6	0.15	-10.6	0.1
Total	11.6	-200.6	0.01	755	0.05	1350.6	0.09	-1893.4	0.12
Panel B: Domestic Exporters									
31. Food and Beverages	2291.1	494.3	0.09	207.6	0.04	1946.3	0.36	-357.1	0.07
32. Textiles	-204.4	-262.5	0.28	36.4	0.04	160.3	0.17	-138.6	0.15
33. Wood Products	-156.1	-327	0.15	31.6	0.01	486.1	0.23	-346.8	0.16
34. Paper Products	94.7	-14.9	0.02	11.8	0.02	113.7	0.19	-16	0.03
35. Chemical Products	828.2	18.3	0.01	700.4	0.19	238.2	0.07	-128.7	0.04
36. Ceramics and Glass	420	-85.1	0.06	99.5	0.07	633.1	0.47	-227.5	0.17
37. Iron and Steel	-68.3	-27.3	0.11	0.8	0	0.6	0	-42.4	0.18
38. Metal and Machine	25.3	-152.6	0.06	203.4	0.08	21.3	0.01	-46.8	0.02
39. Other Products	-34.1	-31.3	0.31	-9.4	0.09	12.3	0.12	-5.7	0.06
Total	3196.5	-388	0.03	1282.2	0.08	3611.9	0.24	-1309.6	0.09
Panel C: Foreign Non-Exporters									
31. Food and Beverages	-13.5	-264.9	0.05	1.7	0	271.8	0.05	-22.2	0
32. Textiles	-2.6	-2.6	0	-0.5	0	0.6	0	-0.1	0
33. Wood Products	0.1	0	0	0	0	0.1	0	0	0
34. Paper Products	-2.9	-0.3	0	-0.1	0	0.2	0	-2.7	0
35. Chemical Products	188.2	94.2	0.03	111.4	0.03	12.2	0	-29.6	0.01
36. Ceramics and Glass	-2.8	-0.5	0	-0.1	0	1	0	-3.3	0
37. Iron and Steel	59.7	-2.2	0.01	-0.5	0	62.5	0.26	0	0
38. Metal and Machines	49.8	23.1	0.01	98.8	0.04	20.4	0.01	-92.5	0.04
39. Other Products	-3.1	0	0	0	0	0	0	-3.1	0.03
Total	272.8	-153.1	0.01	210.8	0.01	368.7	0.02	-153.6	0.01
Panel D: Domestic Non-Exporters									
31. Food and Beverages	530.3	-34.2	0.01	253.8	0.05	689.8	0.13	-379.1	0.07
32. Textiles	14.4	-0.8	0	14.5	0.02	58.6	0.06	-58	0.06
33. Wood Products	-12.9	-48.7	0.02	10.7	0	102.7	0.05	-77.6	0.04
34. Paper Products	83.5	34.6	0.06	33.6	0.06	63.8	0.11	-48.4	0.08
35. Chemical Products	923.7	-74.5	0.02	281.1	0.08	775.1	0.21	-58.1	0.02
36. Ceramics and Glass	-22.5	-7.5	0.01	1.1	0	33.4	0.03	-49.5	0.04
37. Iron and Steel	42.9	-2.3	0.01	2.2	0.01	43.6	0.18	-0.6	0
38. Metal and Machines	291.9	22.8	0.01	135.1	0.05	209.6	0.08	-75.6	0.03
39. Other Products	6.8	-1	0.01	4.9	0.05	3.8	0.04	-0.9	0.01
Total	1858	-111.5	0.01	737	0.05	1980.4	0.13	-747.9	0.05

Chapter 3

How Privatization Impacts Performance: Evidence from Indonesia

3.1 Introduction

Although historically policymakers have employed privatization as a strategy to improve the efficiency of state-owned enterprises (SOEs), the mechanisms through which these changes occur is not completely understood. Theory predicts privatization addresses principal-agent problems inherent in state owned firms by altering the objective function of the firm to focus on efficiency rather than activities that may deviate from profit maximization. Another channel through which privatization is thought to alter the efficiency of a firms is through increased exposure to competitive forces. This paper takes aim at understanding the relative effects of the changes in ownership title and competitiveness that privatization as a strategy to increase efficiency theoretically provides.

Using a panel data set of 20,000 Indonesian manufacturing firms over a nineteen year period, I exploit the exogenous shock of the Asian financial crisis to more closely examine the relative effects of the channels through which privatization is thought to affect efficiency. The empirical environment of this study offers many benefits. First, work in this area traditionally suffers from lack of data while here, the complete census of manufacturing firms in Indonesia is used. Further, selection bias is not considered an issue since the privatization requirement was exogenously imposed by outside influences (although a selection analysis is conducted to ensure this). After the Asian financial crises, the International Monetary Fund (IMF) mandated that the Indonesian government privatize firms in virtually all industries. The shock of the crisis, therefore, created a quasi-experimental environment to study the relative effects of ownership versus the environment on firm performance. Those state owned firms which were not privatized were also affected by the crisis in that the capability of the government to financially support state owned firms was jeopardized. Thus, state owned firms were separated into those that remained state owned while all firms were exposed a more competitive environment.

The empirical results suggest that privatization is associated with an increase in firm efficiency, and that this efficiency operates through the change in ownership rather than the change in the competitive environment. This implies that privatization can be successful in altering within-firm incentives without changing the competitive environment of the firm by removing government financial support. The results have interesting implications for firms and policymakers in countries not only where privatization is still occurring (Indonesia, China, Brazil) but also more generally in countries where the government plays a persistent role in the private sector. More specifically, the results suggest that the efficiency of recently privatized firms may not suffer if the government continues to provide aid during periods of distress. This may be of special interest to governments providing aid to private sector firms in the wake of the financial crisis of 2008.

This paper follows in the following order: Section 2 discusses the theoretical background surrounding the relationship between ownership and performance. Section 3 discusses the specific institutional background in Indonesia. Section 4 and 5 present the empirical analysis and results, respectively, while Section 6 concludes and suggests implications for further research.

3.2 Theoretical Background

Agency theory provides insight into how privatization reduces the inefficiency of a state-owned firm. In general, the agency theory approach to the effects of privatization suggests that when assets are publicly owned, the public manager has relatively weak incentives to make either quality-improving or cost-reducing investments, because the manager receives only a fraction of the return that these changes generate (if he/she receives any remuniary benefit at all), while these investments require effort, which is costly. A more specific subset of models focuses on the allocation of time between several tasks: monitoring, building firm-specific human capital and the private endeavors of firm managers (Ehrlich 1994). While owners would invest in firm specific human capital to maximize the value of the firm, non-owners would expend (non-zero) effort in these three main endeavors, including spending time on private endeavors. On the other hand, due to the residual claimancy of ownership, owners are assumed to assign zero effort to the private (non-profit maximizing) activities, while non-owners lack the incentive to do so. When managers and employees become owners of the state-owned enterprises, their incentives to limit effort devoted to activities that may divert attention away from profit maximizing private endeavors is increased (Haskel and Sanchis 1995).

The agency theory approach to the changes in ownership title is limited, however, since it assumes that privatization means managers and/or employees become owners, which is not always the case. Beyond pure agency responses, changes in ownership title result in changes in the objective function of firm owners. Since public sector firms are assumed to be social welfare maximizers, the utility of employees is considered in decision making in state-owned firms. To this end, state-owned firms may choose maximal, though not optimal, levels of certain variables (in the profit-maximizing sense). Further, public sector firms may allow the objective function to be decreasing in the effort of workers if workers dislike effort, and workers can bargain lower effort levels with public sector firms than with private, contributing to the inefficiency of state owned firms (Shleifer and Vishny 1994). In this sense, privatization may lead to changes in the

objective function reflecting the preferences of the new owners, which are likely to be more aligned with profit maximization, rather than the interests of employees.

On the other hand, privatization may also affect firm efficiency by changing the competitive environment that the firm operates in. State-owned firms are thought to face a "soft" budget constraint, since instruments from the government such as subsidies and tax exemption allow for the growth and survival of a firm beyond its own financial strength. An organization faces a soft budget constraint if it receives support from other organizations to cover its deficit and it is not forced to reduce or cease its activity if the deficit persists (Kornai et. al 2003).[1] By protecting firms from the true competitiveness of the business environment, soft budget constraints effectively subsidize these firms, enabling them to stagnate in terms of efficiency and even innovation. A budget constraint is considered hard , on the other hand, if the constraint is enforced: the firm can spend only as much money as it has (Kornai 1979). Although additional credit beyond its own income may be obtained from private sources such as a bank, this is only done through what is assumed to be an orthodox evaluation process based on projected future performance. In theory, privatization increases efficiency by hardening the budget constraint of SOEs, forcing them into an unprotected competitive environment. Changing the rigidity with which the firm is forced to adhere to current financial constraints has two main results: the competitive environment within which the firms operates is changed and in response, the behavior of firm employees also may change. If privatization impacts efficiency through changes in government support, we expect government investment to exhibit a significant correlation with productivity, even controlling for the change in ownership. We look for this correlation to better understand the mechanisms through which privatization is related to efficiency in the empirical analysis.

Managers as well as employees may change their behavior as a results of the hardening of their budget constraint. If managers and workers of SOEs can expect to be insulated from the failure of their firm, these expectations may result in moral hazard problems since the financial situation of the firms does not constrain action. By lifting this reliance, the attenuation of worker effort may be diminished, implying that lifting or eliminating instruments that soften the budget constraint may lead to behavior mores strictly aligned with profit maximization.

3.3 Indonesian Institutional Background

The Indonesian government has long played a significant role in the private sector. Over the period from 1965-1998, the relationship between the government and the industrial sector was dominated by the power of President Suharto (see Table 1). Also called the "New Order" state, the government during this time period was characterized by a strong commitment to a nationalist economic agenda involving heavy and direct state intervention in the economy (Rosser, pg. 17). Rather than attempting to industrialize through the promotion of internationally competitive industries, the government focused on industrialization policy that aimed at increasing domestic control over the economy through protectionist policies and state ownership.

[1] Note that this definition does not exclude private firms from being provided with such instruments.

Although protectionist policies limited competitive interaction, the government was receptive to policy change, particularly during periods of economic shock. Following the collapse of international oil prices in the early to mid-1980s, a range of reforms were introduced that reduced the extent of government intervention in the economy. Further, with the onset of the Asian financial crisis in 1997-1998, the process of liberalization was greatly accelerated, having a significant effect on the ownership status of firms in Indonesia.

The Asian financial crisis ushered in a period of dramatic economic and political change in Indonesia. Starting in late 1997, the crisis was the most significant both economically and politically that the country had ever experienced. By late 1997, the Indonesian currency had lost more than fifty percent of its value. Within months, the effects of the devaluation of the Indonesian rupiah could be felt in corporate balance sheets, and lead to massive inflation and civil unrest. By October 1997, the Indonesian government sought the help of the IMF, signing an agreement worth more than $40 billion. As these negotiations proceeded, the IMF made it clear that the quid pro quo for its assistance would be a wide range of reforms aimed at improving governance and promoting competition, including privatization and the elimination of government instruments to protect firms. The rationalization of these reforms was that privatization provides a commitment to growth through a well-functioning market economy. The IMF insisted that by committing to privatization, the Indonesian government would assure investors that they were paying attention to reforms consistent with plans for rapid growth. The IMF's rationale for the dismantling of SOEs, was that these organizations were previously used as instruments for the distribution of patronage by way of artificially high buying prices and low selling prices, privileged access to jobs and cheap loans or even grants, and that the dismantling of these organizations was essential to economic growth (Rosser, pg. 172). As a result of the IMF's beliefs that privatization would aid growth, the privatization of firms in several industries, therefore, remained a requirement in the first package as well as several follow-up aid packages to Indonesia.[2]

3.4 Empirical Analysis

The empirical analysis on the channels through which privatization increases performance is based on data from the Republic of Indonesia's Budan Pusat Statistik (BPS) and the Central Bureau of Statistics. The principal dataset is the Survei Tahunan Perushahaan Industry Pengolahan (SI), the annual manufacturing survey. The SI dataset is designed to be a complete enumeration of all manufacturing establishments with 20 or more employees from 1975 onwards. Depending on the year, the SI includes up to 160 variables including industrial classification (5-digit ISIC code), ownership information, investment information, and the input and output information for approximately 20,000 factories.

The comprehensiveness of the data set provides many advantages. First, the database includes both privately owned and publicly traded firms, spanning a wide variety of sectors. Further, unlike other studies in this field, the data are on the plant level, eliminating problems associated with conglomerate level data. Further, according to BPS, fewer than 5% of firms are multi-plant firms providing evidence that this data can be used to approximate firm level responses.

[2] See IMF-Supported Programs in Indonesia, Korea and Thailand 1999.

The analysis here incudes years 1981-2005, since investment information is only available from this time onwards. The key variables are described and summarized in Appendix A.

3.5 Methods

In this section we describe the methods used to estimate the effects of ownership on performance. The intent of the empirical analysis is to examine the extent to which changes in ownership changes firm productivity, and how these shifts are mediated by government investment. First the empirical model is specified, and then the key variables are described. Finally, the econometric identification and limitations to the empirical analysis are discussed, with suggestions for further research.

3.5.1 Measurement

The key variables used in the analysis are measures of total factor productivity (TFP), output, ownership and government support. I measure TFP for each firm-year observation using a Cobb-Douglas production function:

$$\ln(\text{output})_{it}=\beta_0 \ln \text{capital}_{it}+\beta_1 \ln \text{labor}_{it}+\beta_2 \ln \text{materials}_{it}+\omega_{it}+\eta_{it} \quad (1)$$

where is ω_{it} is a productivity shock observed by the firm and η_{it} is an error term uncorrelated with other inputs. To avoid potential simultaneity of the error term, I employ the Levinsohn-Petrin production function estimation technique using the Stata command documented in Levinsohn, Petrin and Poi 2004. I measure TFP per 2-digit industry code to allow the returns to vary across industries.

After obtaining estimates of the returns to inputs, I compute TFP as the residual of equation 1. Therefore,

$$\text{tfp}_{it}=\exp(\ln(\text{output})_{it}-\beta_0 \ln \text{capital}_{it}+\beta_1 \ln \text{labor}_{it}+\beta_2 \ln \text{materials}_{it})) \quad (2)$$

Ownership is measured here as a percentage of capital. A firm is considered state-owned if 100% of the firm capital is owned by the central or local government, while a private firm has less than 100% state ownership of capital. Finally, I proxy for government support using government investment in the firm.

The estimation relates firm ownership to performance outcomes. I take several approaches to control for potential endogeneity. First, equation (3) eliminates any unobserved differences between public and private enterprises that are fixed over time, such as local characteristics, different prices, or a different product mix. Further, time fixed effects are included in order to control for unobserved, time varying effects that are constant across firms, such as changes in national regulatory policy. Thus, the specification is intended to measure the effect of ownership of firm i in year t on performance outcomes controlling for other factors that may affect performance.

3.5.2 Specification

I utilize the shock of the Asian financial crisis to analyze the magnitude of the effect of privatization of SOEs on performance and decompose the benefits of privatization between those related to ownership title and those related to changes in the budget constraint. An increased performance outcome of both privatized and non-privatized SOEs implies the strong influence of the changes in the objective function, rather than ownership per se, since both groups were subject to a hardened budget constraint after the crisis, as IMF policy demanded. The increased performance of only the privatized firms, however, implies that perhaps the agency issues surrounding ownership title have a more salient effect on decreasing public sector inefficiency.

In order to control for firm heterogeneity, I utilize a differences-in-differences approach, which compares the change in outcomes in the treatment group (privatized SOEs) before and after the intervention to the change in outcomes in the control group (non-privatized SOEs). By comparing changes, I control for observed and unobserved time-invariant firm characteristics.

Specifically, equation 3 estimates the effect of the crises on performance outcomes:

$$\ln(\text{PerformanceOutcome})_{it}=\beta_0(\text{Priv}*\text{Post})_{it}+\beta_1\text{GovInv}_{it}+\alpha_i+\gamma_t+\varepsilon_{it} \quad (3)$$

Where Priv∗Post is a dummy variable equal to one indicating a firm that is state owned as of 1997, and privatized at some point following the crisis (and equal to zero for a firm that remains state owned), Post is a post-crisis year indicator, and GovInv is a proxy for the soft budget constraint or government support. Finally α_i, and γ_t are firm, and time fixed effects, respectively. The performance outcome used here is total factor productivity as measured above. In this specification, β_0 represents the percentage change in the outcome variable attributable to ownership for SOEs. The interaction term allows the effect on performance of the crisis to depend on ownership. If β_0 is significant, this indicates that ownership matters to the change in performance outcomes. If β_1 is significant, this implies that differences in government support in the two sets of firms were also related to differences in productivity between the two sets of firms.

This differences-in-differences approach uses the firms that remained state owned during the post-treatment period as the counterfactual for how privatized firms would have performed if they were not privatized. Unbiased estimates from a differences-in-differences approach requires two assumptions about the similarity between the state owned and privatized firms: (1) that both groups would respond similarly to treatment, and (2) that the state owned firm's performance should mimic the privatized performance during the pre-privatization period. To examine this, a selection analysis looking at the differences between state-owned firms and privatized firms is conducted. (See Selection Analysis in the Results section below).

3.6 Results

3.6.1 Descriptive Statistics

As mentioned earlier, a firm that is state owned has 100% capital ownership by the local or central government as of 1997. A privatized firm is a firm that is state owned in 1997, and at some point thereafter, a nonzero percentage of capital is sold to private interests. Approximately

450 firms are in either category, and the industry distribution for these groups is given in Table 2. The largest frequency of firms in the sample is in the food, beverages and tobacco industry. Table 3 highlights the annual differences in the average number of employees, income and investment between the privatized and state owned firms. State owned firms that are privatized seem smaller in terms of number of employees, have lower income as well as lower investment levels, although of these measures only the difference in employees is statistically significant.[3]

3.6.2 Selection Analysis

A major concern for the empirical analysis is that firms that the government privatized were systematically different from state-owned firms that were not privatized. In that case, the correlation between privatization and performance would be confounded by prior features of the firm. Here, selection into treatment based on industry, firm characteristics and firm performance is explored. To examine whether selection by industry threatens the data, I look at the composition of industries in the entire sample, within industry composition of privatized and non-privatized firms and the composition of industries between the treatment and control groups (illustrated in the Appendix).

Although Figure 1 illustrates that industry 31 (Food, Beverages and Tobacco) composes a substantial portion of state-owned firms as of 1997, this is consistent with the industry composition of the entire population of manufacturing firms on the whole. Further, from Figure 2, it is evident that not all privatized firms came from one industry. In fact, every industry (except industry 39, in which there is only one firm for the sample) contains both privatized and state owned firms. Finally, from Figure 2, it is evident that the composition between treatment and control groups is similar, indicating that the composition of industries between the two groups is similar.

To further examine the possibility of selection into privatization based on firm features and prior performance, a differences-in-means analysis on firm characteristics and several performance measures is conducted. Here, the only performance metric that is significantly different between the state owned and privatized firms prior to privatization is sales per employee (See Table 3). In addition, a pooled probit analysis is also conducted to determine if firm characteristics or prior performance were used to systematically determine which firms the Indonesian government privatized. The dependent variable is a dummy coded one the year a privatized firm becomes privatized. The key variables to detect a selection effect are firm characteristics such as number of employees, investment, output, and performance metrics such as total factor productivity, and sales per employee. (For each performance measure, the average of the five year lag is used to prevent many observations from dropping out of the sample, which contains many missing values). I also include year dummies. The entire sample is included, but privatized firms are dropped after the year that they privatize to avoid confounding the selection analysis with any potential effects of privatization.

[3] To determine this, t-tests were performed on the difference in means on an annual basis.

Table 4 presents the probit results. I report standard errors clustered by firm to account for non-independence among observations from the same firm. Although privatized and state-owned firms seem to differ in terms of employment-level related features in the descriptive statistics, controlling for other firm characteristics and performance, this feature does not seem to influence the likelihood of privatization. Here, in the probit analysis, none of the firm characteristics are significant and none of the performance metrics are significant, suggesting that there does not seem to be a systematic pattern over which firms are selected into privatization. Due to the fact that the privatization of manufacturing enterprises is part of a widespread economy-wide mandate to deregulate the Indonesian economy,and occurred in all sectors, it is reasonable to accept that ownership is exogenously determined, especially given these probit results.

3.6.3 Estimation Results

Table 5 presents the results of estimating equation (3). These results suggest that ownership has a significant effect on firm performance. The results imply that the methods through which privatization is thought to affect performance via change in ownership title may in fact be at work. The variable proxying for the hardness of the budget constraint is also not significant indicating that changes in the competitive environment separate from ownership did not influence performance.

In particular we find that depending on the control variables included, privatization may increase productivity of firms by approximately 30-40%. This magnitude is in line with previous estimates from other studies finding a positive relationship between privatization on firm productivity (Bartelsman et. al 2000). However, these results typically look at the impact of privatization without untangling the mechanisms through which this change is occurring. Here, we begin to attempt to separate these differences. By finding that government investment is not significant, we begin to provide evidence for economic theory supporting the idea that changes in productivity may occur as a result of changes in ownership, and not necessarily changes in the competitive environment.

3.7 Conclusion

An unanswered question in the debate on public sector inefficiency is how ownership change versus changes in the competitive environment affect firm performance. In this paper, we begin to directly address this question. A differences-in-differences estimation is used to understand the relative effects of ownership and the competitive environment on efficiency looking at the differences between privatized and state owned firms. The results here suggest that the effect of a change in ownership is significant, while changes in the competitive environment are not.

Evidence that ownership change rather than changes in the competitive environment affect productivity has important implications, both for policymakers and firm managers. This provides evidence against the view by policymakers that government owned firms will become more efficient only through the removal of government financial support. For state owned firms transitioning to private ownership, this means that increases in efficiency do not require complete removal of government ownership. For governments interested in retaining revenue from these firms, or that are hesitant to change from 100% state owned to 100% private ownership

suddenly, this provides evidence that a transition in ownership may still produce desired results in terms of increased efficiency, without the complete removal of the financial support from the government.

Further research should more closely explore the financial changes that accompany privatization. Since the setting of the Asian financial crisis provides a unique opportunity to study the effect of privatization, this context may be able to support analyses into other changes in firm policy. While economic theory and the existing literature focuses on the relationship between privatization and efficiency, changes in the financial decision making of managers is also important. For instance, understanding the debt to equity mix as a function of privatization would be relevant to potential investors of previously government owned firms in emerging markets. Further, a non-trivial number of privatized firms maintain some level of government ownership. These firms with hybrid ownership may also be useful to explore the precise relationship between gradations in capital ownership and changes in firm policy, which have not been studied. The strict definitions commonly used in the privatization literature can be relaxed in order to explore whether there is a specific percentage change in ownership necessary to observe changes in firm characteristics and performance. This would provide more insight into how much of a change in ownership an investor can confidently expect when purchasing shares of a formerly state owned firm and from the government perspective, how much of the firm needs to be sold to observe increases in efficiency.

3.8 Tables

Table 1: Indonesian Economic and Political History

1965	Suharto comes into power
1984-1988	Deregulation
1989-1995	Investment boom
Jul-97	Asian financial crisis; rupiah collapse
Sep-98	IMF agreement signed, including privatization clauses
May-98	Suharto forced to step down, Vice President Habibie becomes President
Oct-99	Wahid elected to power
Jul-01	Megawati elected President
Oct-04	Susilo Bambang Yudhoyono elected President

Table 2: Industry Distribution for State Owned and Privatized Firms

Industry	Industry Description	Privatized Firms	Public Firms	Total
31	Food, Beverages and Tobacco	66	127	193
32	Textiles, Garments and Leather	21	11	32
33	Wood Products	5	11	16
34	Paper, Printing and Publishing	13	14	27
35	Chemicals, Rubber and Plastic	29	70	99
36	Non-Metallic Minerals	16	6	22
37	Basic Metals	2	2	4
38	Metal Products & Machinery	12	27	39
39	Other Manufacturing	1	0	1

Table 3. Summary Statistics: Public and Privatized Firms*

	Average Number of Employees		Average Income (000s)		Average Investment (000s)	
Year	Privatized	Public	Privatized	Public	Privatized	Public
1981	424	896	5019	8623	533	1528
1982	453	910	5497	8932	6948	23400
1983	469	915	6336	12000	3273	13200
1984	447	906	7015	17200	8183	7477
1985	462	852	7867	13100	8858	13200
1986	466	866	8476	14900	12200	28300
1987	504	904	9520	18900	11600	20400
1988	502	807	9040	20900	1070	9032
1989	487	822	11200	25600	19000	53300
1990	487	825	12300	27400	3793	17800
1991	432	948	12800	31000	5184	15000
1992	510	829	11900	29300	2826	18500
1993	735	794	12600	31900	1406	16900
1994	477	765	13600	34700	1004	8464
1995	428	691	14700	44700	1230	7202
1996	418	656	14900	60200	1025	7022
1997	363	611	21100	51600	3159	14800
1998	350	698	28800	78600	17100	26100
1999	350	688	35000	82400	4089	3485
2000	308	680	37400	64800	3048	2716

*Public refers to 100% government ownership in 1997 and after, private refers to less than 100% government and privatizatized refers to firms public as of 1997 that were privatized thereafter.

Table 4. Results of Probit Model to Determine Selection

Dependent variable: Privatized that year	(1) dF/dx	(2) SE	(3) dF/dx	(4) SE
Firm Characteristics				
number of employees (lagged)	-47	55	-297	140
government invesment (lagged)	-0.02	0.01	-0.04	0.03
total investment (lagged)	-0.01	0.00	0.00	0.01
output	0.00	0.00	0.00	0.00
output growth	0.00	0.00	-0.01	0.01
Firm Performance				
tfp (lagged)	-0.03	0.02	-0.23	0.18
tfp growth (lagged)	0*	0.05	1.57	0.85
log(sale/employee)	16495	19275	-500000*	102848
Time Dummy	N	N	Y	Y
Predicted probability at X-hat	0.03	0.02	0.09	0.09
Observations	3479	3479	1329	1329

This table presents the results of the probit model used to estimate propensity scores. Depedent variables multipled by 10000000 for ease of reporting. Even columns contain robust standard errors clustered by firm: *p<.10, **p<.05, ***p<.01. The odd numbered columns display the changes in the probability of adoption for an infinitesemal change in each independent variable evaluated at the mean of all variables. Observations for privatized firms are omitted after their privatization year.

Table 5. Effect of Ownership on Total Factor Productivity		
Differences-in-Differences		
Privatization*Post	0.44	0.34
	(0.17)**	(.16)**
Post	1.2	1.8
	(0.07)**	(.08)**
Government Investment		0.00
		(-.34)
Total Investment		0.00
		(1.96)
Employees		0.00
		(8.30)**
Observations	5871	5871
Number of Firms	1367	1367

Includes firm fixed effects and time fixed effects
Standard errors in parentheses
* significant at 5%; ** significant at 1%

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Appendix A - Appendix to Chapter 1

Risk Measures

Z-score

A modified distance to default measure is used to measure risk. When π is the value of profits and K is capital, and insolvency is presumed to occur when current losses exhaust capital $-\pi>K$, estimates of the likelihood of insolvency, p may be obtained by noting that

$(\pi/A)<-(K/A)$ (1)

is equivalent to this likelihood p, where (π/A)represents the return to assets (ROA) and (K/A) the capital-assets ratio (CA). Then standardizing both sides of (1), insolvency occurs when

$((ROA-\mu_{ROA})/(\sigma_{ROA}))<((-CA-\mu_{ROA})/(\sigma_{ROA}))$, (2)

It follows that the probability of insolvency is equal to

$\Phi((-CA-\mu_{ROA})/(\sigma_{ROA}))$ (3)

and assuming symmetry of the distribution can be written as

$\Phi((\mu_{ROA}+CA)/(\sigma_{ROA}))$ (4)

where $((\mu_{ROA}+CA)/(\sigma_{ROA}))$represents the number of standard deviations between the expected value of the return to assets and (negative values of) the capital-assets ratio, and σ_{ROA} is the standard deviation of the return on assets. Then, if profits are normally distributed, the inverse of the probability of insolvency (4) equals:

$((\mu_{ROA}+CA)/(\sigma_{ROA}))$ (5)

The value in (5) is defined as the z-score, a widely used measure of insolvency risk (Laeven and Levine 2008, Hannan and Hanweck 1998, Scott 1980).[1]

A higher z-score indicates that the bank portfolio is less risky and more stable.

A higher z-score indicates that the bank is more stable. Because the z-score is highly skewed, and for purposes of interpretation, we use the natural logarithm of the z-score, which is normally distributed.

[1] The normality assumption can be relaxed. Then, a bound for the probability of insolvency p can be obtained using Chebyshev's inequality such that $p\leq(1/2)\sigma_{ROA}^2/((E(ROA)+CA)/(\sigma_{ROA}))^2$

CAR Calculation

CAR=Tier1 Capital +Tier2 Capital
Risk-Weighted Assets

Tier 1 Capital

Current earnings
Current year's profit after tax
Decrease in the value of portfolio equity
Designated reserves
Last year's profit after tax
Other capital contributions
Paid in capital
Positive adjustments
Retained losses

Tier 2 Capital

General provisions
Hybrid instruments
Subordinated debt
Undisclosed reserves

Assets

Zero weight
Cash
Government bonds
Three Percent Weight
Outstanding foreign exchange contracts
Fifty Percent Weight
Mortgage loans
Performance bonds warranties
Revolving underwriting commitments
One Hundred Percent Weight
Other loans
Standby letters of credit
Fixed assets
Other assets
Loan repayment guarantees and acceptances
Purchase and resale agreement (reverse repo)

Further details on IBRA

Following recapitalization, the extent of operational restructuring by IBRA in banks that actually took place is not clear. Initially, the intent was to install IBRA employees and/or replacement management from state banks to supervise the recapitalized banks and participate in management. Whether the implementation proved too difficult or ideology changed, it is unclear whether these supervisory and management changes were carried out (Enoch et. al 2001). Even within the IBRA organization, manpower issues were difficult to overcome. Because thousands of Indonesian personnel were required just to staff IBRA, employees of several international consulting and accounting firms were hired to supplement the workforce and often were placed directly in banks in supervisory roles. There was even a limit to the ability of this foreign staff to meet the shortfall in domestic personnel, given the complexities of operating in Indonesia and the sheer magnitude of the project (Pangetsu et. al 2002).

Appendix B - Appendix to Chapter 3

Description of Variables Used in TFP Estimation

Both the book value and the estimated value of capital are asked for in the survey. The estimated value is used as the capital measurement here, however, if the estimated value is missing and the book value is not missing, the book value is used. Each year the survey also asks for the number of workers. Further, workers are separated between paid and non-paid as well as production and non-production workers. I combine the former categorization to form firm-year values for production and non-production workers. For electricity, the rupiah amount of electricity purchased from the state owned electricity company is added to the amount purchased from private electricity firms to calculate the total amount of electricity purchased. For output, the nominal rupiah value of production output is used in the analysis.

Description of Variables Used in Empirical Specification

Two survey questions relate to establishment ownership. First, establishments report the percentage of capital owned by the local or state government or by private concerns. Second, each firm is asked whether they operate under a domestic or foreign license. All new enterprises in Indonesia must obtain an operating license from the Badan Koordinasi Penanaman Modal (BKPM), the Investment, Coordinating Board. In addition, each establishment reports the percentage of capital owned by the local or central government or private investors. Analysis is restricted to the first measurement after it was found that survey questions regarding legal ownership were not consistent from year to year regarding legal status of ownership.

Correction for Outliers and Missing Values in Industrial Surveys

I have cleaned the input variables as well as output variables to correct for non-reporting. Further, I have identified and deleted outliers using the technique developed by Hadi (1994), which uses a measure of distance from an observation to a cluster of points in order to address issues associated with identifying outliers in multivariate samples.