Title
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Permalink
https://escholarship.org/uc/item/97k6t78z

Authors
Fligstein, Neil
Brundage, Jonah S
Schultz, Michael

Publication Date
2014-09-01

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Neil Fligstein, Jonah Stuart Brundage, and Michael Schultz

Berkeley
UNIVERSITY OF CALIFORNIA

Why the Federal Reserve Failed to See the Financial Crisis of 2008:

The Role of "Macroeconomics" as Sense-Making and Cultural Frame*

Neil Fligstein

Jonah Stuart Brundage

Michael Schultz

Department of Sociology

University of California

Berkeley, CA 94720

September 2014

Word count 16,667

Abstract

One of the puzzles about the financial crisis of 2008 is why the regulators were so slow to recognize the impending collapse of the financial system. In this paper, we propose a novel account of what happened. We analyze the meeting transcripts of the Federal Reserve's main decision-making body, the Federal Open Market Committee (FOMC), to show that they had surprisingly little recognition that a serious economic meltdown was underway even after the collapse of Lehman Brothers on September 15, 2008. This lack of awareness was a function of the inability of the FOMC to connect the unfolding events into a narrative reflecting the links between the housing market, the subprime mortgage market, and the financial instruments being used to package the mortgages into securities. We use the idea of sense-making to explain how this happened. The Federal Reserve's main analytic framework for making sense of the economy, macroeconomic theory, made it difficult for them to connect the disparate events that comprised the financial crisis into a coherent whole. We use topic modeling to analyze transcripts of FOMC meetings held between 2000 and 2008, demonstrating that the framework provided by macroeconomics dominated FOMC conversations throughout this period. The topic models also suggest that each of the issues involved in the crisis remained a separate discussion and were never connected together. A close reading of the texts supports this argument. We conclude with implications for future such crises and for thinking about sense-making and the role of economics in policymaking more generally.

"Economic growth appears to have slowed recently, partly reflecting a softening of household spending. Tight credit conditions, the ongoing housing contraction, and some slowing in export growth are likely to weigh on economic growth over the next few quarters. Over time, the substantial easing of monetary policy, combined with ongoing measures to foster market liquidity, should help to promote moderate economic growth. Inflation has been high, spurred by the earlier increases in the prices of energy and some other commodities. The Committee expects inflation to moderate later this year and next year, but the inflation outlook remains highly uncertain. The downside risks to growth and the upside risks to inflation are both of significant concern to the Committee." Federal Open Market Committee Statement, September 16, 2008.

Introduction

The Federal Open Market Committee (located within the Federal Reserve System) is charged with making monetary policy for the United States. Its meetings (about every six weeks) are widely watched by participants in the financial markets for clues regarding the future trajectory of the economy (Holmes, 2014). On September 16, 2008, the day after the investment bank Lehman Brothers collapsed, precipitating the largest financial meltdown in postwar history (Swedberg, 2010), members of the Federal Open Market Committee (hereafter, FOMC) met and issued the above statement.

Why was the FOMC so sanguine in its economic projections, given the signs that the financial system was already in free fall (something which the transcripts of that meeting reveal an awareness of)? In this paper we make a provocative claim: the FOMC failed to see the depth of the problem because of its overreliance on macroeconomics as a framework for making sense of the economy. As a result, Committee members failed to see the deeper connections between housing and finance, specifically the degree to which the fortunes of the entire financial sector

were tied to the housing market via the securitization of mortgages and the use of related financial instruments. Thus, they significantly underestimated the degree to which the economy was in danger of collapse.

We draw upon several strands of theory to illustrate this point. We use the concept of sense-making which suggests that in order for people to make decisions and act, they must continuously construct an interpretation of the signals being sent to them by the exterior world (Weick, 1995). This interpretive work necessarily relies on preexisting categories of perception. A wide variety of scholars have recently converged on these ideas, proposing that people have more or less taken-for-granted viewpoints and orientations that allow them to interpret their worlds, what have been called "frames" or "habitus" (Weick, 1995; Fligstein and McAdam, 2012; Bourdieu, 1990; Goffman, 1974). These enable people to "comprehend, understand, explain, attribute, extrapolate, and predict" (Starbuck and Milliken, 1988, p. 51).

The case of the FOMC is not just interesting as a site to study sense-making. The FOMC offers us insight into how professional expertise shapes economic policymaking and financial regulation. The Federal Reserve and the FOMC offer us an extreme case where professional expertise has maximum autonomy (Brint, 1990; Lindvall, 2009; Fourcade, 2009). But to exercise power, professionals require a set of common assumptions amongst participants about how the world works and a set of tools that can be used to make sense of what is going on in order to justify policy changes. We argue that these tools can be considered a form of "market devices" (Callon, et al., 2007; Hirschman and Berman, 2014). We show that the FOMC is dominated by people with Ph.D.'s in economics and a high degree of specialization in macroeconomics.

4

Abolafia (2004, 2010) has analyzed previous FOMC meetings from the perspective of sense-making. He shows that the meeting participants construct a narrative account of what is going on in the economy (Abolafia, 2010). He argues that their engagement in this task involves framing their interpretations to convince others of their viewpoint, thereby creating a micro politics whereby the winners of the framing contest greatly affect the outcome of the meeting (Abolafia, 2004). We expand Abolafia's theoretical perspective by using insights from work on professional expertise and the use of market devices. We are less interested in how consensus emerges from these discussions and more interested in the terms in which arguments are framed in the first place.

We show that the cognitive limits of FOMC members are set, first and foremost, by their training as macroeconomists. The FOMC's discussions reveal that their main intellectual tools for simplifying massive flows of information are the categories of macroeconomics and their use of macroeconomic models. Their conversations focus on standard macro-level indicators like the inflation rate, the unemployment rate, and growth in GDP. They view these indicators as aggregates of an economy composed of sectors and regions, each with different growth rates that are not necessarily in sync. When they draw links between economic sectors, they focus on connections within the "real economy," such as the impact of the housing sector on construction, appliances, and home sales. The FOMC rarely devoted sustained attention to the financial sector. They were thus poorly attuned to the ways in which the "real" economy had become integrated into the financial economy.

As a direct result of this perspective, the FOMC failed to see the links between the house-price bubble, the subprime mortgage market, the mortgage-backed security (MBS) market, and the use of related financial instruments like collateralized debt obligations (CDOs) and credit default swaps (CDSs), as these markets rose and fell during the 2000-2008 period. They never understood just how intertwined these markets were. Thus, they grossly underestimated the extent to which the downturn in housing prices would affect the entire economy. It was not until the summer of 2007 that the Federal Reserve began to notice the connections between the mortgage market and the functioning of financial markets, and even then, no one expected the problems generated by bad mortgages to cascade into a full-blown financial collapse.

We also extend Abolafia's analysis empirically, in two ways. First, we examine how the FOMC conceptualized the economy over a relatively long period of time by analyzing every meeting between 2000 and 2008 (72 meetings in total). Second, in interpreting the texts, we make use of topic modeling, a machine learning method for identifying thematic structures in texts (for an introduction, see Blei, 2012). Topic modeling is a technique that searches documents to find patterns of words that appear together. The basic idea is to search particular documents in order to find sets of words that form a theme or "topic" of conversation. Topic models use an algorithm that allows researchers to identify the occurrence of topics in texts. When texts are ordered temporally, it is possible to observe changes in the prevalence of different topics over time. Our results provide a picture of how the FOMC made sense of the economy through macroeconomic theory and the use of models, and, consequently, their

inattention to the connections between the problems unfolding in the housing and financial sectors.

The paper is structured as follows. First, we introduce the case of the FOMC meetings as an important site to study sense-making. Then, we elaborate our theoretical perspective using the conceptual tools just discussed. These insights help us develop an argument about the impact of the FOMC's intellectual framework on its analysis of and its actions on the American economy. Next we explicate topic modeling as a technique to examine sense-making and report the results of our models. We then buttress these results with a more conventional, qualitative analysis based on a close reading of a number of meeting transcripts. We end by drawing conclusions about economists' role in regulatory and policymaking institutions, which is best understood as a problem in culture, sense-making, and market devices.

The Federal Reserve and the Federal Open Market Committee

The Federal Reserve is the central bank of the United States. It is charged with making monetary policy and with partially regulating the country's banking system (Blinder, 1998). In practice this means three things. The Federal Reserve supervises and sets regulations for a variety of commercial banks, including capital reserve requirements. It sets the discount rate, which is the rate at which banks can borrow from the Federal Reserve. Finally, it engages in open market operations, the buying and selling of U.S. Treasury Securities and other assets, in order to control the federal funds rate and thereby indirectly influence money supply in the U.S.

economy.[1] The Federal Reserve has a Congressional mandate to set monetary policy consistent with achieving maximum employment and price stability.[2]

The FOMC is the primary policymaking body of the Federal Reserve. The FOMC consists of 12 members: the seven members of the Federal Reserve Board of Governors, the president of the Federal Reserve Bank of New York who serves as vice chair, and four of the other 11 Reserve Bank presidents, who serve on an annually-rotating basis. All other Reserve Bank presidents attend Committee meetings, presenting reports and participating in discussion, but they cannot vote (Blinder, 1998).

The FOMC holds eight regularly scheduled meetings per year, about once every six weeks. The main purpose of these meetings is to discuss economic and financial conditions in the United States and to make monetary policy decisions. The meetings are highly structured (Abolafia, 2012; Baez and Abolafia, 2002). Every meeting begins with a round of oral reports on the current conditions and future direction of the economy. These reports fall into two categories, those presented by staff and those presented by each Committee member and Reserve Bank president. Staff reports always include general data about growth and inflation, but they may also be geared to a special topic that the FOMC wishes to explore. The reports by the governors and presidents concern their own analyses and forecasts of output and inflation. The presidents' reports also cover current business conditions in their respective districts. They are based largely on surveys of, and informal discussions with, district business contacts like CEOs.

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[1] The federal funds rate is the rate at which depository institutions lend to each other overnight.

[2] Officially, the Fed has a triple mandate: maximum employment, stable prices, and moderate long-term interest rates. In practice, however, the first two objectives are considered its "dual mandate" (Buiter, 2008, p.5-6). This contrasts with most comparator central banks, which have a single mandate to combat inflation.

The second part of the meeting is devoted to the FOMC's policy decision: traditionally, setting the target for the federal funds rate. First, the staff presents the likely policy alternatives. Then Committee members discuss whether to raise, lower or hold constant the federal funds target rate.[3] At the end of that discussion, Committee members vote on the policy decision. The result is announced publicly in a press release immediately following the meeting, which states the balance of risks to growth and inflation and notes the reasons for the (relatively rare) dissenting vote.[4] The FOMC's actions are widely watched by Wall Street and the financial community at large as a harbinger of the future direction of the real economy, inflation, and interest rates. These actions move financial markets in the United States and the world (Holmes, 2014).

Theoretical Considerations and the Case of the Federal Reserve

We draw on three literatures relevant to the relationship between experts, ideas, and decision making at the Federal Reserve. We use these literatures to analyze what the FOMC knew and how they came to make policy. First, the literature on sense-making conceives of the problem of organizational decision making in the broadest possible terms (Weick, 1995). Sense-making implies that in order for organizational actors to make decisions under uncertainty, they

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[3] In monetary policy parlance, raising interest rates is called tightening and lowering rates is called loosening. A policy regime of high interest rates relative to output and inflation is referred to as restrictive, while a low interest rate regime is referred to as accommodative. Since the financial crisis, the FOMC has pursued a near-zero target rate, maintained by the use of quantitative easing.

[4] The meeting minutes, which provide a much more detailed summary of discussion, are released at the time of the following meeting. Minutes attempt to capture the central tendency of Committee sentiment and explain key areas of disagreement.

need to have a framework to analyze the disparate data being sent to them by the world around them. Second, the literature on the role of experts in policy decisions is considered. The main issue we review involves the conditions under which experts influence policymaking. Here, we argue that the Federal Reserve is controlled by economists who exercise a fair amount of power. Finally, we consider how the literature on the "performativity" of economics would approach the problem of sense-making in policy organizations. We use the idea of "market devices" to capture how macroeconomists engage in sense-making on an ongoing basis and try and persuade one another about what the "right" policies are. We suggest that the Federal Reserve actively works to convince the financial markets that its perspective on the economy is accurate.

The idea of sense-making is central to modern sociological understandings of culture and action. Sociologists have increasingly come to view actors not just as positions in social structure, but as agents who interpret their worlds and construct courses of action with reference to their implicit cultural frames (for a review, see DiMaggio, 1997). Scholars have forwarded a range of positions as to how such processes work. Some view culture as a toolkit whereby actors take the symbolic materials at hand and fabricate a course of action (Swidler, 1986). From this perspective, action entails the possibility of reflection and discussion. Others view action as more habitual and pre-reflexive, whereby socially acquired dispositions, or habitus, generate skilled performances that require no strategic intention (Bourdieu, 1990; Bourdieu and Wacquant, 1992). Vaisey (2009) proposes a dual-process model of culture. Drawing on recent work in cognitive psychology, Vaisey argues that both forms of cognition occur. Sometimes tacit knowledge shapes our behavior in our day-to-day practices in a relatively unthinking fashion.

But, on occasion, we do come to reflect on what we are trying to do and we are able to reason, plan, and behave strategically.

The case of the FOMC combines both of these elements. On the one hand, the common training of FOMC members provides them with tacit knowledge about how to think about the economy. Members of the FOMC are mostly Ph.D. economists and most of these economists wrote Ph.D. dissertations in macroeconomics. Thus, they take for granted that the right way to make sense of the economy is through the lens and models provided by macroeconomics. At the same time, the FOMC meetings are contexts in which actors rationally attempt to take collective action under uncertain circumstances.

Particularly useful in this regard is Weick's (1995) theory of sense-making in organizations. Weick maintains that agents actively evaluate courses of action (Weick, 1995, p. 17). But he emphasizes that they do so in highly structured ways, drawing from preexisting frameworks shaped by "institutional constraints, organizational premises, plans, expectations, acceptable justifications, and traditions inherited from predecessors" (Weick et al., 2005, p. 409). Members of the FOMC know that their task is difficult and their decisions are based on incomplete data. But, what makes the reflexive discussion possible is that members of the FOMC are like-minded individuals who all have access to the same data. This illustrates Weick's version of sense-making, which focuses on how common decision making premises and the structure of decision making processes in organizational settings help actors draw a conclusion.

In this paper, we are concerned with sense-making in a particular kind of organizational setting: a government agency whose interpretations and actions involve the economic sphere.

11

This requires us to consider the degree to which professional economists at the Federal Reserve have the autonomy to affect decision making. There has been a longstanding interest in the sociology of professions and expertise in how experts do and do not affect policymaking. There is also a more general interest in the role of ideas in policymaking (for a review, see Campbell, 2002).

Brint argues that professional expertise is least likely to be important in situations where new forms of institutions are being negotiated or groups are fighting over highly politicized outcomes (1990: 367). But, professions can have a great deal of impact in arenas where their expertise is deemed socially important, where they are able to turn political issues into narrow technical issues, and where political authorities are organizationally subverted. In this context, Brint explicitly mentions the economics profession and its role in government agencies. Because of the centrality of the market in modern societies, economists' claim to have arcane but valuable knowledge is recognized. In political arenas where that knowledge can be exercised using narrow technical expertise by eschewing a political interpretation of what they are doing, economists can have a great deal of autonomy of action.

The empirical research on the role of economists in making government policy shows that their power is highly variable and reflects the political situation in which they are located as Brint suggests (Reay, 2012; Lindvall, 2009; Holmes, 2014; Fourcade-Gourinchas and Babb, 2004; Blyth, 2002; Chwieroth, 2010; Babb, 2001). The FOMC is an organizational arena that is clearly at one end of the continuum, displaying all of the criteria Brint proposes for autonomy. The Federal Reserve's job is by definition somewhat arcane. It claims to act in a nonpolitical

fashion. The theory it uses to justify its policy role is an expertise on what is going on in the economy and a justification of policy decisions based on the knowledge of how monetary policy affects the working of markets.

Much of the recent sociological work on the relationship between economic ideas and the economy falls into the "performativity of economics" literature. Callon (1998) argues that economists use economic theories to construct markets. MacKenzie and Millo (2003) show that the Black-Scholes-Merton formula for option pricing, the product of academic economists, worked not because it discovered a preexisting price structure, but because financial market participants used it in ways that remade markets to conform to the model. Recently, the studies presented in MacKenzie et al. (2007) have demonstrated several other ways in which economic theory does or does not shape markets.

We borrow several elements from the performativity toolkit. First, we want to consider how the economists at the Federal Reserve "perform" the economy by making policy based on a certain view of the way that the economy works (Hirschman and Berman, 2014). This involves at least two important elements. First, are the ways in which the Federal Reserve creates "market devices" which are defined as the "material and discursive assemblages that intervene in the construction of markets" (Callon, et al., 2007: 2). We are interested in discussing the tools used by the FOMC to make sense of the economy. Second, we are interested in how the Federal Reserve communicates their view of the economy to outsiders (in particular, the financial markets for stocks and bonds). The FOMC issues a statement on the day of their meetings summarizing the results of the meeting (illustrated at the top of this paper) and by the time of the

next meeting provides a synopsis of the discussion in order that market participants can understand the FOMC's view of the economy. These statements are intended to shape expectations of market actors and therefore affect market prices.

Indeed, any cultural tool that is created to evaluate, facilitate, or calculate what market actors are doing can be viewed as a market device (Espeland and Stephens, 2001; Carruthers and Kim, 2011). Market devices can be viewed as mechanisms for sense-making (Karpik, 2010). The attempt to formalize how one calculates some feature of the world is useful precisely because it can be used to make sense of what is going on in the world. So, for example, credit scores, bond ratings, and models of option pricing are abstract ways to enable decision making by market actors. Buying and selling can be based on the logic of using market devices to facilitate transacting.

The Federal Reserve employs a whole set of "market devices" in order to engage in sense-making in deciding how to set the federal funds target rate. First and foremost are the massive amounts of economic data that are collected from a wide variety of sources on a period to period basis. These data are summed up for the FOMC in the "Greenbook," which is published eight times a year and summarizes quantitative and qualitative data on the state of the economy. Second, at the core of the FOMC discussions is the econometric modeling of the data that is uses to make sense of the current state of the economy and produce economic forecasts.

Finally, the common knowledge of the Federal Reserve staff and the members of the FOMC is what both creates these market devices and facilitates their use. It is here that sense-making requires a theory of "how the world works." Without such a theory, actors will find it

difficult to decide which facts to collect. They will also find it almost impossible to interpret those facts and use them to make predictions. The primary sense-making framework at the Federal Reserve is macroeconomic theory. Macroeconomics focuses on aggregate-level economic indicators such as GDP, unemployment, and inflation. Macroeconomists' models explain the relationships among these and related factors like savings, investment, and consumption. They view the economy as a collection of distinct industrial sectors, each making an independent contribution to GDP and impinging upon one another only insofar as the inputs and outputs of different sectors are directly connected to one another. Macroeconomic theory offers a framework for the construction and interpretation of relevant facts, thereby enabling prediction of future economic trends.

A second purpose of this construction of the economy using market devices is to convince the financial markets that trade stocks and bonds about the future direction of the economy. This attempt on the part of the Federal Reserve to lobby the markets reflects the intentional construction of a "community" by the direct actions of the central bankers. Holmes (2014) has undertaken a study of central banks around the world in the past 40 years. He makes the provocative argument that before the 1980s, central bankers did not feel the necessity to communicate with participants in financial markets. This is because they thought that that their actions raising and lowering interest rates and controlling the money supply would work because of the underlying "truth" of their models in affecting monetary aggregates.

But during the extended bout of inflation in the 1970s and 1980s, central bankers realized that their credibility to control inflation was at stake. Holmes shows that central bankers used a

key new idea in economics, the idea of rational expectations, to change how they would interact with financial market participants (2014:14-16). Rational expectations theory suggests that market actors develop expectations about the near future that guide their behavior. In the context of inflation, if each person believes that central banks will not work to control inflation, then they will raise prices in expectation of continued inflation. If this occurs across the economy, it creates a self-fulfilling prophecy of increased inflation. Once such a cycle is set into place, it is very difficult to dislodge.

As a result, central bankers decided to try and control the expectations about inflation. They began to experiment with communicating their policy intentions to the financial community by providing them with more information about how they saw the current state of the economy and how their policy decisions reflected that analysis. Holmes shows that this resulted in several new features of communication (2014: 216-218). Members of the Federal Reserve Board work very hard to interact with market participants to hear their views and to explain their actions. The FOMC issues statements after their meetings about current conditions and they follow that up with a synopsis of the meetings several weeks later. By committing themselves to fighting inflation by raising interest rates and providing inflation targets, central bankers built a new system of expectations for financial markets about the future of the economy.

To be able to authoritatively speak the language of macroeconomics, one needs to have legitimacy. Such legitimacy is largely provided by professional credentialing (Abbott, 1988). Table 1 shows data on the 34 voting members of the FOMC serving between 2001 and 2008. It identifies their name, their position, the years they served, their prior work background, their

education and, if they have an economics PhD, the topic of their thesis. Twenty-three members

had PhDs in economics and another eight had MBAs. Twenty of the twenty-three PhDs wrote

dissertations on topics related to macroeconomics. Eleven FOMC members had worked

exclusively in the public sector and twelve had spent significant time in academia. Only four

members came exclusively from the private sector while ten had both private and non-private

sector experience. In sum, we can see that the FOMC is mostly comprised of professional

economists trained in macroeconomics who have spent their careers either in government or the

academy.[5]

(Table 1 about here)

Our account of sense-making and its application to the FOMC provides us with a way to

understand how FOMC members discover what they think is going on in the economy and

communicate that to the financial markets. The FOMC meetings should be structured around the

language and measures of macroeconomics. One-off events should be interpreted through the

lens of the macroeconomic master narrative. So, for example, when Hurricane Katrina hit in

2005 and the FOMC sought to assess its economic effects, the story centered on the extent to

which the disaster would increase gasoline prices as refineries in the Gulf were shut down by the

storm. This, in turn, was of interest insofar as such price increases would pass through to

inflation.

We hypothesize that this style of analysis hindered the FOMC's conceptual ability to

apprehend deeper relationships between what their macroeconomic framework regarded as

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[5] We also found that, despite their status as central *bankers*, only 7 of 34 FOMC members had spent any time working in the financial industry (result not shown in table 1).

discrete economic indicators. As the financial crisis began to unfold, the FOMC was unable to understand the links between house prices, the growth of subprime and unconventional mortgages, and the explosion of financial instruments surrounding the securitization of those mortgages (see Fligstein and Goldstein, 2010). The tendency of the FOMC was to view the sectors where these problems existed as relatively small in the context of the larger economy and the connections between them and the "real economy" as relatively minor. When they considered the degree to which market actors might be "irrational," as in the case of whether or not a housing bubble existed, they found reasons to believe that house price increases were being driven by the "fundamentals" of supply and demand.

Data and Methods

The process of sense-making implies that FOMC members will identify relevant data, analyze that data, and draw conclusions in ways that fit with their basic intellectual framework, in this case the macroeconomic understanding of the world. In the analysis that follows, we will try to isolate two features of the FOMC conversations. First, we will examine the degree to which terms from macroeconomics dominate the discussion. Then, we will assess how the FOMC analyzed the housing market in particular, and the degree to which they were or were not able to make connections between the housing bubble, the nonconforming mortgage market, the mortgage-backed security (MBS) market, and the risks of a broader financial crisis.

We use topic models to do this. Topic models are a class of statistical methods that attempt to describe underlying semantic regularities in a set of documents by mapping recurring relationships between words (Blei, 2012). These algorithms use patterns of word co-occurrences to generate sets of words with varying strengths. Though simply termed "topics," these word groups are often interpreted as frames, themes, or motifs (Mohr and Bogdanov, 2013). Topic models are attractive to researchers because they provide a reliable and objective way to code large sets of documents (Blei, 2012). Due to their flexibility and relationality, topics produced by topic modeling algorithms tend to be highly interpretable and are often quite similar to those produced by experts (Mimno et al., 2011). Moreover, the words used in different topics are not constrained to be mutually exclusive. This means that topic compositions are determined independent of one another, which has the effect of allowing words in topics to overlap.

Within a topic, both the meaning and importance of each word are determined relative to every other word. Word frequencies within a topic only gain significance relative to their overall frequency and to the frequencies of other words in that topic. Words also gain their meaning in conjunction with other words in the topic. For example, the appearance of the word *CEO* in a topic along with the words *corporate* and *leadership* would likely mean "chief executive officer," while *CEO* in a topic along with *asset*, *equity*, or *CDO* would likely mean "collateralized equity obligation." This ability to capture instances of polysemy is one of the unique advantages of topic models. Topic models, however, require issue-area experts to ensure that topics be meaningfully interpreted before they can be used (DiMaggio et al., 2013).

Topic modeling uses observed words within documents to infer the unobserved topics that compose those documents. The documents are understood as combinations of topics, rather than of words. Topic models therefore attempt to simultaneously estimate the word content of each topic and the topic content of each document. This places topics in a mediating position in the relationship between words and documents. It also assumes that topics exist in advance of any documents.

For our topic models, we use Latent Dirichlet Allocation (LDA) as the underlying statistical model, which is both the simplest and most widely applicable algorithm (Blei and Lafferty, 2007). LDA begins with the "bag of words" assumption, that the order of words within a document is not important. This allows documents to be treated as a list of word frequencies or probabilities, which are modeled as the product of topic specific word probabilities, $\varphi^{(k)} = P(w_i \mid z_i = k)$, and document specific topic probabilities, $\theta^{(d)} = P(z_i = k \mid D = d)$.[6]

$$P(w_i \mid D = d) = \sum_{k=1}^{K} P(w_i \mid z_i = k) \, P(z_i = k \mid D = d)$$

This model assumes that words in each document are generated by first choosing a topic and then choosing a word from that topic. The distributions of words within topics and topics within documents are both assumed to be multinomial distributions. Each of these distributions are drawn from a Dirichlet distribution,[7] which is a multivariate distribution of the beta function and

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[6] Following standard conventions, we use d to represent documents, *w* to represent words, *z* to represent topic assignments for each word, and *k* to represent topics.

[7] The Dirichlet distributions for the topic probabilities and word probabilities are determined by hyperparameters α and η, respectively.

conjugate prior of multinomial distributions, allowing estimates of $\varphi^{(k)}$ and $\theta^{(d)}$ to be updated with new information while still remaining multinomial.

The "bag of words" assumption has some important implications. A single sentence may include words generated from many different topics and instances of a topic may be dispersed through the text. It also means that topic words are recognized without accounting for their context. A discussion about how rising house prices are *not* a source of inflation will be indistinguishable from a discussion about how house prices are a source of inflation. The strength of a topic does not indicate the direction of belief about the topic.

There are two potential caveats to our use of topic models in the context of FOMC meeting transcripts. First, meetings are not the typical use of topic models. LDA is designed to model static texts with predetermined topics (Blei, 2012), rather than discussions based on interaction, adaptation, and the joint construction of meaning. To date, the overwhelming majority of applications of LDA to language have been written documents, such as articles (Blei and Lafferty, 2007; DiMaggio et al., 2013), press releases (Grimmer, 2010), bureaucratic records (Miller, 2013), or formal speeches (Mohr et al., 2013). The assumptions on which inference is based are violated in the case of conversation or other interactive uses of language. Nonetheless, as DiMaggio et al. (2013) point out, even a single text contains multiple, competing "voices" (the idea of "heteroglossia" developed by Bakhtin [1982]). If texts themselves are not as stable as we might expect, then the difference between textual and conversational analysis becomes much less significant. We thus argue that LDA still allows a great deal of insight, provided conclusions are approached with caution.

Second, topics as the content of discussion must be distinguished from topics as the meaning of discussion. LDA estimates the former. This disparity reflects the gap between content analysis and hermeneutics (Mohr and Bogdanov, 2013). However, this difference does not imply that topic modeling cannot be helpful to study meaning. Meaning in conversations is conveyed through multiple channels besides the content, including timing, context, tone, and actions (Goodwin and Heritage, 1990). Meaning is at best reflected in the content and at worst loosely coupled to content. The trick is to determine the degree of separation between the two.

We address these concerns in two ways. First, our analyses consider the distribution of the topics, rather than the topics in isolation. For example, it would be inaccurate to simply say that the FOMC was discussing housing in 2006 based solely on the strength of the use of that word. Rather, based on the three topics that were highly represented, they were discussing the ways that housing *and* inflation would affect the overall economy and deciding what policy decisions to make in response. The meaning of home prices, rents, mortgage rates, and the like vary with their context. Second, we pair our statistical analysis of the content of discussion with an interpretation of the discussion based on a close reading of the texts. This approach serves to validate individual topics (Mimno et al. 2011) and identify the mechanisms of sense-making (Abolafia, 2004, 2010). While the topic models tell us which words are associated, our reading of the texts shows how the topics produce meaningful discourse.

Data came from the transcripts of the meetings of the Federal Open Market Committee between 2000 and 2008. A total of 72 scheduled meetings occurred during this observation period, including the eight scheduled meetings per year and excluding conference calls.

Additionally, there was one unscheduled meeting in 2003. The FOMC creates transcripts from recordings of the meetings, allowing very accurate accounts of discussions. Once edited,[8] transcripts are held for five years and are released together as a full year. The period from 2000 to 2008 was chosen to utilize the most recent available records at the time of writing and to provide adequate historical background to the financial crisis.[9]

For analysis, transcripts were preprocessed by removing front-matter, page numbers, and identification of the speakers.[10] Next, the text was simplified by removing the most common English words, typically called 'stop words', and proper names. The text was stemmed to remove suffixes (e.g. *inflation → inflat*) and combine variants of the same word (e.g. *economy*/*economic → economi*).[11] For legibility in the graphs and tables below, these stems have been replaced by the most common unstemmed word. Stems that occurred fewer than four times in the whole corpus were dropped from the text.

Measures of model fit exist for topic models and can be useful for determining the number of topics. These measures are less than ideal for our case. Perplexity[12] and similar predictiveness metrics typically require division of the documents into a training set and a test set

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[8] The published transcripts are slightly short of verbatim records as speakers' words may have been "lightly edited" to facilitate understanding. Confidential information pertaining to foreign officials, businesses, or private persons was also removed.

[9] Including earlier years does not appear to affect the results for the focal period. Analyses were conducted on transcripts from 1995 to 2008. Results were qualitatively identical to the 2000 to 2008 period.

[10] Though some variants of LDA allow for distinctions by speaker, the standard version of LDA does not. Additionally, we are interested in the behavior of the Fed as a whole, rather than the internal dynamics. Secondly, the composition of meetings changes over time, meaning that changes in speakers would be conflated with changes in topic.

[11] Stemming was done with the standard Porter2 algorithm in Python. Some manual stemming was done for uncommon words, largely financial acronyms, e.g. *cdos → cdo, lbos → lbo*.

[12] Perplexity is a measure of the uncertainty in the predictions expressed as the number of sides a fair die would need to be equivalently unpredictable.

(Asuncion, et al. 2009). The training set is used to fit the model (i.e., to estimate the number and content of topics) while the test set is used to evaluate the predictiveness of the fitted model. Our design is not particularly amenable to such an approach for two reasons. First, transcripts reveal that there are specific single meetings of great significance and on distinct topics. Second, given that our analysis hinges on changes in topics as a result of discussion, there is no reason to expect that the topic distribution is constant throughout the meeting or over time. After considering these limitations, we chose to follow the approach of DiMaggio et al. (2013), evaluating models by their interpretability and external validity. Trade-offs between topic specificity and model simplicity led us to choose 15 topics. Runs of the model with different numbers of topics produced qualitatively similar results. Topics produced by these other models were particularly robust in reproducing the main findings below.

Results

The top 30 words for each of our 15 topics are shown in table 2. Words were ordered by their frequency within a topic and how indicative of that topic they were.[13] We found three types of topics: those involving the general mission of the Fed, those involving meeting-related business, and those involving concerns about current events and developments.

(Table 2 about here)

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[13] More specifically, ordering was done according to *p(w/k)p(k/w)*.

The general purpose of the FOMC meetings was the subject of four different topics. The *Macroeconomics* topic captured a large part of the conversation. These debates revolved around decisions to raise or lower the interest rate (*rate*, *point*, *percent*) in order to promote and sustain economic growth (*growth*, *economy*) and price stability (*inflation*). Predictions of future economic developments (*year*, *months*, *forecast*, *continue*) and the reaction of the market to the actions taken were important considerations (*market*, *expectations*). The *Portfolio* topic deals with the Federal Reserve's own investment portfolio, the System Open Market Account (SOMA), consisting largely of Treasury and other federal agency securities (*treasury*, *agency*, *securities*, *sovereign*, *debt*), held outright or with repurchase agreements (*outright*, *repo*, *rps*, *collateral*). The buying and selling of these securities is the Federal Reserve's primary monetary policy tool, known as open market operations (*operations*). The *Objectives* topic reflects discussion about the Federal Reserve's Congressional mandate to achieve maximum employment and stable prices (*congress*, *dual*, *mandate*, *price*, *stability*, *inflation*). Lastly, the *Policy Response* topic emphasizes the tools and actions available to the FOMC to conduct the Federal Reserve's economic mission (*target, quantitative, program, facility, rate, tools, policy*).

Two topics deal with the "market devices" we discussed earlier. The *Models* topic reflects references to reports and data prepared by staff and offered during presentations that help guide decisions (*chart*, *model*, *exhibit*, *coefficient*). The *Minutes* topic deals with discussions about policies surrounding announcements about decisions and releases of the minutes, both of which are closely monitored by financial markets (*minutes*, *release*, *statement*, *public*, *announcement*, *decision*).

Of the topics related to developments in the economy, two topics dealt extensively with inflation and inflation-related issues. The *Inflation* topic primarily covers general indicators of inflation, core personal consumption expenditures, rising compensation, commodity prices, and energy prices. The *Housing* topic appears to indicate concerns about both the housing market and inflation (*housing*, *inflation*, *residential*). A close inspection of the top words reveals that it captures the optimism of the mid-2000s housing boom (*trend*, *growth*, *comfortable*) as well as the uncertainty about a possible house-price correction and its impact on the economy (*subprime*, *uncertainty*, *slowing*). The *Productivity* topic largely involves the non-accelerating inflation rate of unemployment (NAIRU) and related words indicating concerns that excessively low unemployment would lead to high inflation (*acceleration*, *labor*, *unemployment*, *workers*). A lesser component of this topic appears to be discussion of economic growth, with some consideration of energy and stock prices, particularly tech stocks.

Two topics are explicitly tied to the outlook for the economy. The *Employment* topic covers general employment related issues (*hiring*, *job*, *payroll*), largely in a positive light (*improvement*, *recovery*, *expansion*, *pickup*). The *Weakness* topic reverses this positive outlook. Tech stocks reappear, but now in the context of weakness and decline in the economy (*recession*, *cut*, *negative*, *weakening*, *unemployment*), lowered consumer spending (*sales*), and a weakening manufacturing sector (*auto*, *inventory*, *stock*).

Finally, the remaining four topics deal with issues that are historically specific. The *Energy* topic captures concerns about rising oil and gas prices, in large part dealing with supply problems caused by Hurricane Katrina (*gasoline*, *energy*, *disruptions*, *supply*, *prices*). The

26

Housing Bubble topic deals with the possibility of a housing bubble, as suggested by indicators such as the ratio of home prices to rent (*overvalued*) and the loan to value ratio.[14] The *Financial Markets* topic covers credit markets and financial products (*mortgage*, *loans*, *subprime*, *CDO*, *CLO*, *SIV*, *tranche*) and their negative effect on the economy (*turmoil*, *downside*, *turbulence*, *losses*, *crunch*). The *Bank Liquidity* topic is similar except that it focuses more heavily on financial health of specific banks (*lehman, stearns, merrill, institutions, solvency*) and recent events and short-term predictions.

Topics as Sense-Making

As sense-making is a process that unfolds over time, the temporal ordering and evolution of these topics is as important as their content when it comes to interpretation. This implies that the topics we have discovered will be of two varieties. First, we should expect topics related to active sense-making to be relatively coherent and not prone to wild fluctuations across meetings. So, for example, if we are correct that macroeconomic tools are frequently used in the discussion, we should expect that those topics consistently appear across documents over time. Second, as issues come onto the economic agenda, topics that focus narrowly on particular themes should come and go. So, as already mentioned, Hurricane Katrina forms a distinct topic that concerned the FOMC for a couple of meetings around the time it could have affected the macro economy.

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[14] The *Housing Bubble* topic also includes debates about the effects of the Iraq War.

LDA does not account for any temporal ordering. This means we can use the

independence of consecutive documents to help distinguish topics related to sense-making in

general from topics that change as economic conditions change. As shown in detail in Appendix

A, one can assess the degree to which this is true using an analysis looking for autocorrelation.

The *Macroeconomics* topic has an autocorrelation close to zero and highest appearance

frequency, confirming that it has a largely constant proportion and is thus a framing topic. Eight

topics (*Inflation*, *Weakness*, *Employment*, *Housing*, *Productivity*, *Financial Markets, Bank

Liquidity, Policy Response*) have extremely high correlations, consistent with our

characterization of them as topics that vary temporally. The rest appear more randomly but not as

frequently as the *Macroeconomics* topic suggesting that while they play a role in framing they

are not as central to the discussions.

Topics over Time

Figure 1 shows the over-time distribution of the seven topics that we identified as

constituting the sense-making apparatus of the FOMC. The largest topic is *Macroeconomics*,

which appears consistently and at a high rate throughout all of the meetings. This confirms our

view that macroeconomics "speak" is the main lens. There appears to be evidence that one of the

topics that indexes the use of market devices, *Models*, is consistently a featured part of the

discussions. The other topics related to the FOMC's mission appear more or less randomly

across time.

(Figure 1 about here)

Figure 2 shows the temporally coherent topics discovered above. The sequence of discussion topics described by figure 2 provides a clearer picture of the nature of each topic. The *Productivity* topic is dominant from 2000 to 2001. This period of economic growth and market expansion was brought to an abrupt end in 2001 with the rapid fall in tech stocks and cascading declines in manufacturing and employment, as demonstrated in the *Weakness* topic. Both *Employment* and *Weakness* remain strong topics of conversation through 2003. Concern with *Weakness* finally ends with rising discussion over geopolitical uncertainty, notably the U.S. invasion of Iraq. With the economy rebounding, discussion again shifts away from *Employment* to *Inflation*. It is worthwhile to note that inflation remains a highly mentioned topic even as the housing market drops and the financial crisis looms.

(Figure 2 about here)

Accompanying the concern with inflation is a slow increase in discussion around *Housing* issues. Focus on this topic rises sharply in early 2006. In March 2007, the issue of *Financial Markets* is raised in response to early troubles for subprime lenders. Although problems in the subprime market worsened, these issues were framed as housing and mortgage related issues, as shown by the increased emphasis in *Housing* in May 2007. By August 2007, after two Bear Stearns CDO hedge funds had failed, the emphasis on housing and subprime had disappeared and financial markets dominated the conversation.

Our reading of the FOMC transcripts focuses on the four topics with direct relevance to the housing and financial crisis: *Housing Bubble*, *Housing*, *Financial Markets*, and *Bank*

29

Liquidity.[15] The first thing to note is that all four of these topics barely make an appearance prior to mid-2005. We can thus see that while housing-related topics dominated FOMC discussion as the housing market began to turn down in 2006, they were largely absent from discussion during that market's precipitous and, in hindsight, bubble-induced rise. Their relatively late peaks provide support for our claim that the Federal Reserve was largely unconcerned with the very existence of a housing bubble. Moreover, the particularly late emergence of the *Financial Markets* topic suggests that even after the Federal Reserve turned to housing, it failed, at least initially, to appreciate the latter's implications for the financial industry via MBS and related financial instruments. The rise and fall of topics indicates that the FOMC appears to be responding to crises as they happen and not connecting the crises together.

Our goal in what follows is to pursue the idea suggested by the topic models that the FOMC took up housing and financial issues as separate from one another. In order to do this, we turn to a direct textual analysis of the transcripts to capture how the FOMC was thinking about housing, the bubble, and the link to finance. We show that in their attempts to make sense of what was going on, the FOMC tried to use macroeconomics to show that markets were working rationally, even in the case of the housing-price bubble. When events proved difficult to ignore, their reasoning shifted toward trying to make sense of how crises would or would not affect the macro economy. Their conclusions were usually cautious and tended to downplay the significance of any crisis being discussed.

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[15] *Policy Response,* which gains prominence at the very end of 2008, also relates directly to the financial crisis. However, we forego extensive discussion of this topic due to the brief period of observation and the risk of misconstruing the overall trend of the topic.

Housing Market "Fundamentals"

As the topic models have shown, housing was relatively marginal to the FOMC's discussions between 2000 and 2005. Yet it was by no means marginal to the economy. House prices nearly doubled during this period. Rising home values directly stimulated residential investment and indirectly boosted consumption as borrowers' extracted equity when they refinanced. By the end of 2003, however, the market for conventional mortgages was saturated, and so mortgage originators began aggressively targeting borrowers unable to qualify for prime loans. As a result, subprime and other nonconforming mortgages proliferated over the course of 2004, exceeding conventional mortgage originations for the first time (Fligstein and Goldstein, 2010).

The meeting transcripts reveal that Committee members were aware of the historic run-up in housing prices. But they made sense of that run-up by referring to the "fundamentals" of supply and demand in the physical stock of housing. At the August 13, 2002 meeting, for instance, Chairman Alan Greenspan raises, but quickly rejects, the possibility of a housing bubble:

"There is clearly concern at this stage about a housing value bubble that is going to burst. But I think that most of those who look at this in some detail question whether that's a valid notion … the impact of immigration superimposed upon the difficulty of finding viable land for homebuilding is keeping significant upside pressure on home prices over and above the construction productivity issue. So the likelihood of any really important contraction in the housing area would in my view require a very major contraction in the economy overall" (FOMC 2002: 74).

Federal Reserve Governor Ned Gramlich concurs with Greenspan's assessment, adding: "I agree that there is no bubble. I agree that there is no productivity change in housing construction. So the relative price of housing is rising compared with income and other prices *for what we'll call real reasons*" (FOMC 2002: 82; emphasis added). The causal model of house-price appreciation employed by Greenspan and Gramlich thus assumes the following form: immigration—a "real," demographic factor—is increasing the demand for homes (relative to a fixed supply of land and static construction productivity), which in turn is raising the price of housing.

Committee members were attentive to the wave of mortgage refinancing that preceded the subprime expansion. Yet when the refinancing boom subsided in late 2003, the FOMC showed little recognition that subprime mortgages were replacing refinancing as the driving force behind mortgage and housing markets. Indeed, a simple search of the transcript corpus reveals that the word "subprime" appears a mere *four times* prior to mid-2005—and not it all during 2004, when the subprime market became the largest part of the mortgage market.[16] In fact, the first time that the Committee made any reference to changes in the composition of the mortgage market was February 2005, *after* these changes had already occurred (FOMC 2005a: 119).

A Bubble in the Housing Market?

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[16] A similar trend holds for related mortgage products: prior to mid-2005, the term "adjustable-rate mortgage"/ "ARM" appears only twice, and neither "nonconforming" nor "alt-A" appears at all.

Housing-related topics begin to ascend in 2005. The first topic to peak is *Housing Bubble*, which has its major spike at the June 29-30, 2005 meeting. On this date, the FOMC held a special discussion on the possibility of a housing-price bubble and its implications for monetary policy. The opening presentation, by staff economist Josh Gallin, introduced the relevant data:

"The first point to note is that the measured price-rent ratio is currently higher than at any other time for which we have data … Most notably, in the first quarter of 2002, the last observation for which we have a reading for the subsequent three-year change in house prices, the price-rent ratio stood at 22. Although the regression suggests that real prices should have been about flat since then, real prices actually increased more than 20 percent, and the price-rent ratio rose to about 27—literally off the chart." (FOMC 2005b: 5-6).

Committee members continue to explain the house-price run-up in terms of economic "fundamentals." Alan Greenspan focuses on the price of land, asking: "Is it credible that we can have a consistently more rapid rise in prices of existing homes unless the value of land is rising faster for those homes?" (FOMC 2005b: 70). Other members adopt similar frames. Governor Mark Olson's assessment focuses on land values and "the incidence of teardowns," while Dallas Reserve Bank President Richard Fisher stresses "land use restrictions" (FOMC 2005b: 39-41). Thus, Committee members fit housing prices into a narrative of "hard," observable factors affecting supply and demand.

Not surprisingly, then, many participants question the very notion of a bubble. New York Reserve Bank Vice President Dick Peach captures this sentiment:

"Hardly a day goes by without another anecdote-laden article in the press claiming that the U.S. is experiencing a housing bubble that will soon burst, with disastrous consequences for the economy. Indeed, housing market activity has been quite robust for some time now … But such activity could be the result of solid fundamentals underlying the housing market. After all, both nominal and real long-term interest rates have declined substantially over the last decade.

Productivity growth has been surprisingly strong since the mid-1990s, producing rapid real income growth primarily for those in the upper half of the income distribution. And the large baby-boom generation has entered its peak earning years and appears to have strong preferences for large homes loaded with amenities." (FOMC 2005b: 11).

Consequently, Peach suggests, "home prices actually look somewhat low relative to median family income" (FOMC 2005b: 13).

Similarly, St. Louis Reserve Bank President William Poole only half-jokingly argues: "Just for the hell of it, I'd like to offer the hypothesis that property values are too low rather than too high" (FOMC 2005b: 57). House prices, in Poole's understanding, are a function of low real interest rates, which in turn reflect transformed fundamentals in the global economy. Poole concludes: "I offer those observations because, if we are in a world that is going to have much lower real rates of interest for some time to come, one would expect to see the price-to-rent ratio go up. Maybe this line in the chart has another 40 percent to go to get to equilibrium!" (FOMC 2005b: 58). Jeffrey Lacker, President of the Richmond Reserve Bank, concurs:

"It seems to me as if there are a lot of plausible stories one can tell about fundamentals that would explain or rationalize housing prices. Obviously, low interest rates have to top the list. Strong income growth among home owning populations would be on the list, as would land use restrictions, which were mentioned earlier, and the recent surge in spending on home improvement … So from that point of view, it's hard for me to see how it would be reasonable to place a great deal of certainty on the notion that housing is significantly overvalued, or that there's a bubble, or that it's going to collapse really soon." (FOMC 2005b: 62-63).

San Francisco Reserve Bank Senior Vice President John Williams was one of the few participants who unequivocally accepted the existence of a bubble. But even he conceded that "the magnitude of the current potential problem is much smaller than, and perhaps only half as large as, that of the stock market bubble [of the late 1990s]" (FOMC 2005b: 18).

Several participants did note the possibility that demand for securitized mortgage debt

and the associated proliferation of novel mortgage products may be driving a bubble. Yet they

remain skeptical of the idea. For instance, Janet Yellen, President of the San Francisco Reserve

Bank, questions the notion that "creative financing" is producing a bubble:

"One view that I think is very prevalent is that the use of credit in the form of piggyback loans, interest-only mortgages, option ARMs [adjustable-rate mortgages], and so forth, involves financial innovations that are feeding a kind of unsustainable bubble. But an alternative perspective on that is that high house prices, in fact, are curtailing effective demand for housing at this point and that house appreciation probably is poised to slow. So the increasing use of creative financing could be a sign of the final gasps of house-price appreciation at the pace we've seen and an indication that a slowing is at hand." (FOMC 2005b: 36).

In sum, given the "real" supply and demand factors thought to be driving the housing

market, most participants judge that evidence of a bubble is at best inconclusive and perhaps

even non-existent. As Chicago Reserve Bank President Michael Moskow concludes, "I come

away somewhat less concerned about the size and consequences of a housing bubble than I was

before" (FOMC 2005b: 48).

Housing-Price "Correction"

Following this discussion of bubbles, housing markets stayed on the FOMC agenda, as

indicated by the *Housing* topic, peaking in May 2007. By early 2006, Committee members are

anticipating a "correction" in housing prices and an associated "cooling" in housing activity, but

they remain broadly optimistic about its consequences.[17] The risks posed by housing to the real

economy involve two principal channels, according to the narrative constructed by the FOMC.

First are the direct effects on the residential construction and real estate industries. Second are

the indirect effects on consumer spending through declining home equity and, even less directly,

declining consumer confidence.

Neither of these channels constitutes a major source of concern. First, from the FOMC's

macroeconomic perspective, the contribution of the housing sector to GDP is not that large. As

Federal Reserve Chair Ben Bernanke notes in March 2006: "residential investment is, of course,

only about 6 percent of GDP" (FOMC 2006a: 97). Even when including the potential damage to

associated manufacturing industries like appliances and furniture, Bernanke reminds the

Committee in December 2006 that "this is about 15 percent of the economy compared with 85

percent of the economy" (FOMC 2006c: 81). Second, Committee members believe that

consumption will be cushioned by strong employment, rising real wages, and supportive lending

conditions. Gary Stern, President of the Minneapolis Reserve Bank, captures the general

consensus: "as long as employment continues to go up, incomes continue to go up, and mortgage

rates remain relatively moderate, then I would expect that we would avoid severe difficulties in

housing except for a few markets that are particularly inflated at this point" (FOMC 2006a: 55-

56).

Over the course of 2006, as incoming housing data grow increasingly weak, members

begin talking of a "bimodal economy"—softening housing, manufacturing, and autos versus a

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[17] Alan Greenspan captures this spirit of optimism most succinctly on December 13, 2005: "It's hard to imagine an
American economy that is as balanced as this one is" (FOMC 2005c: 66).

robust service sector. Yet the Committee maintains that as long as the housing correction fails to produce "spillovers" into other sectors—which, they agree, is unlikely—it will actually be good for the long-run stability of the economy. As Federal Reserve Governor Frederic Mishkin argues in September 2006, "we're actually moving resources from a sector that had too much going into it, into sectors that need to have more resources at the present time. So in that sense, I'm actually quite positive" (FOMC 2006b: 85). Mishkin sticks to this rebalancing narrative as late as June 2007, *after* the deterioration of the subprime market is underway:

"My view of what has been happening in the economy is that we have been basically going through a rebalancing. We had a sector that was clearly bubble-like with excessive spending, and now we are getting the retrenchment, which is taking a bit longer than we expected. But the good news is that we are going through a rebalancing in which we are just moving resources to other sectors and that is actually going much along the lines that we want to see." (FOMC 2007b: 87).

In fact, while the FOMC sees housing as the major threat to growth during this period, the Committee's predominant concern is not growth at all but inflation. Until September 2007, official FOMC statements continue to maintain—and most members agree—that inflation remains the principal risk to the dual mandate.[18]

This analysis reflects the macroeconomic framework that the FOMC employs to make sense of housing. Committee members visualize the economy in terms of sectors, each making an independent contribution to GDP. They betray a deep-seated bias toward primary markets (home sales, home loans) and the non-financial sectors of the "real economy" (construction, manufacturing), rather than secondary markets embedded in the "financial economy" (MBSs,

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[18] This is consistent with the results of our topic models: even the *Housing* topic is partially constituted by inflation-related terms (*inflation*, *core*).

CDOs, CDSs, and the financial institutions that hold them on their books).[19]

The structure of the Federal Reserve System reinforces this sectoral thinking and bias toward non-financial markets. A large part of every FOMC meeting is devoted to the oral presentations of Reserve Bank presidents regarding business conditions in their respective districts. Much of this discussion involves presidents' reports from CEOs and other business contacts in their districts. But, while there are twelve districts in the Federal Reserve System, the financial industry is overwhelmingly concentrated in a single physical location, lower and midtown Manhattan. Consequently, when presidents talked to their contacts about the housing market, they overwhelmingly talked to homebuilders, realtors, construction companies, and regional mortgage originators, actors attuned precisely to local real estate conditions rather than the financial economy. This made it difficult for members of the FOMC to see where the dangers from housing really resided—at the heart of the financial industry itself.

The Onset of Financial Crisis

If the internal sense-making of the FOMC did not lead members to readily associate housing and financial markets, external events would eventually force that association upon them. In February 2007, an unexpected jump in delinquencies and defaults on subprime adjustable-rate mortgages began to produce turmoil in the subprime and associated securities

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[19] Even the language of "spillovers" (a top word in the *Housing* topic) reinforces the imagery of distinct and independent sectors. A spillover implies an abnormal or deviant situation, a departure from the usual workings of an economy in equilibrium.

markets. The following FOMC meeting, on March 21, 2007, marks the first major spike in the

Financial Markets topic (top five words: *financial*, *credit*, *banks*, *turmoil*, *risk*). In June,

subprime turmoil increases in the wake of severe losses at two Bear Stearns hedge funds that

were heavily invested in subprime. Up to this point, the *Financial Markets* topic is still

significantly outweighed by *Housing*, which peaks on May 9. But beginning at the August 7

meeting, the *Financial Markets* topic ascends massively, remaining the FOMC's dominant issue-

specific topic for the rest of 2007 and much of 2008.

While the foreclosures in the subprime markets are a significant theme beginning in

March, the modal *way* in which Committee members make sense of subprime is through a

narrative that minimizes the risks involved. Jeff Lacker captures the continued optimism of most

members:

"On the national level, risks seem to have risen lately, but my sense is that prospects are still reasonably sound. Subprime mortgages, obviously, have dominated the financial news in recent weeks. Concerns about the welfare of families suffering foreclosures are quite natural, and anecdotes about outright fraud suggest some criminality. But my overall sense of what's going on is that an industry of originators and investors simply misjudged subprime mortgage default frequencies. Realization of that risk seems to be playing out in a fairly orderly way so far." (FOMC 2007a: 41).

As they do for the economy as a whole, Committee members view the mortgage market

as a collection of distinct sectors, rather than an integrated network or system. This framework

leads them to further downplay the risks from subprime. Thus in March 2007, Mishkin finds it

reassuring that the subprime market "is a fairly small part of the overall mortgage market,"

concluding: "the subprime market has really been overplayed in the media, and I do not see it as

that big a downside risk" (FOMC 2007a: 69-70).

This optimism was belied by incoming data. By August 2007, in the wake of renewed financial turmoil, the FOMC was forced to acknowledge that problems in the mortgage market had spread beyond subprime and that the CDO market was severely impaired. On September 18, 2007, a Committee member—Ben Bernanke himself—referred to the presence of a "financial crisis" for the first time (FOMC 2007c: 93).[20] In their presentations to the FOMC, staff also began to acknowledge the limitations of macroeconomic models for grappling with unfolding financial events. As staff economist David Stockton explained, also on September 18, "the financial transmission mechanisms in most of the workhorse macro models that we use for forecasting are still rudimentary. As a result, much of what has occurred doesn't even directly feed into our models" (FOMC 2007c: 20).

Despite these admissions, however, the FOMC adhered to its basic conceptual apparatus. For instance, participants continued to take heart from the "resiliency" of the underlying real economy. As Philadelphia Reserve Bank President Charles Plosser explained at the September 2007 meeting:

"The national economy looks more vulnerable to me than it did six weeks ago, but it would be a mistake—and I think Dave Stockton did an excellent job of reminding us—to count out the resiliency of the U.S. economy at this early stage. I think there can be a tendency in the midst of financial disruptions, uncertainty, and volatility to overestimate the amount of spillover that they will exert on the broader economy." (2007c: 47).

If their sectoral thinking led Committee members to minimize the economic risks posed by financial markets, their regional thinking led them to view these risks as geographically

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[20] In retrospect, the FOMC would date the start of the financial crisis to August 2007, which marked a severe and sustained round of financial market turbulence associated with a collapse of confidence in the asset-backed commercial paper (ABCP) market.

dispersed. Plosser insisted on this fact as late as December 2007:

"based on such observations and the news that I hear from my District, I sense that the stresses in the economy vary significantly by region, and we must be mindful that the weaknesses on Wall Street are in those states that have exaggerated housing volatility and may not be representative of the rest of the economy." (FOMC 2007d: 56).

Once again, this optimism was premature. Conditions rapidly deteriorated in the winter of 2007-2008. By January 2008, Sandra Pianalto, President of the Cleveland Reserve Bank, was "detecting the first signals of a credit crunch" (FOMC 2008a: 76). By March, Mishkin could claim: "The reality is that we are in the worst financial crisis that we've experienced in the post-World War II era" (FOMC 2008b: 69). It was also in March 2008 that the staff's economic projections first forecasted a recession, albeit a mild one (FOMC 2008b: 14-16).

The FOMC's chief source of concern during the winter is the development of an "adverse feedback loop" whereby tightening credit conditions restrain economic activity, which further weakens financial markets and thus further tightens credit conditions (see FOMC 2008b: 69). At the same time, participants also begin to worry about the liquidity, and ultimately the solvency, of individual financial institutions. This concern is captured in the *Bank Liquidity* topic, which rises precipitously in the wake of the Bear Stearns collapse of March 2008.[21] As Federal Reserve Governor Kevin Warsh explains on March 18: "Over the past couple of weeks, not just in the episode with Bear Stearns, counterparty risk is becoming the dominant concern in markets. As has been pointed out around this table, it is increasingly difficult to separate liquidity issues from solvency issues." Warsh concludes: "Financial institutions, more broadly than financial markets,

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[21] The *Bank Liquidity* topic is also associated with the short-term lending facilities established by the Federal Reserve in March 2008 to promote liquidity in the financial system: the Primary Dealer Credit Facility (PDCF) and the Term Securities Lending Facility (TSLF). Note that *pdcf* and *tslf* are both top words in this topic.

are having a hard time finding their way" (FOMC 2008b: 61).

From Financial Markets to Inflation Fears

By early 2008, then, the FOMC had managed to make the connection between housing and financial markets that they had missed at the start of the subprime deterioration. But just as external events forced these connections upon them, external events would turn their attention elsewhere. In the spring and summer of 2008, financial turmoil temporarily receded, at the same time as energy, food, and other commodity prices unexpectedly spiked. In consequence, beginning in April 2008 and continuing through the summer, many participants shifted focus away from financial markets to inflation. Inflation concerns are reflected in the *Bank Liquidity* topic itself, which includes such terms as *commodity*, *prices*, and *inflation* among its top words.

Dallas Reserve Bank President Richard Fisher spells out this shift in emphasis at the April 29-30 meeting:

"While there are many who have voiced concern with the adverse feedback loop that runs from the economy to tighter credit conditions and back to the economy, I am very troubled by a different adverse feedback loop—namely the inflation dynamic whereby restrictions in the fed funds rate lead to a weaker dollar and upward pressures on global commodity prices, which feed through to higher U.S. inflation."

Fisher concludes: "I believe the risk posed by inflation is more significant than the extension of further anemia in the economy" (FOMC 2008c: 54).

Some participants even begin to suggest parallels with the inflation environment of the 1970s. As Plosser warns in April 2008, "in the 1970s one of our mistakes was that we

accommodated relative price shocks with very accommodative monetary policy, and in so doing helped convert a relative price shock into sustained inflation. I think we should be careful not to fall into that same trap" (FOMC 2008c: 107-108). To be sure, such claims are a source of conflict. Relative to the high levels of consensus that characterize the FOMC during much of our timeframe, the spring and summer of 2008 represent a period of contestation. Mishkin, for instance, chastises his colleagues for making inappropriate comparisons: "it's very important to emphasize that this is not the 1970s, and I really get disturbed when people point to that as a problem" (FOMC 2008c: 130).

Broadly speaking, the Board of Governors, along with the New York, Boston, and San Francisco Reserve Bank presidents, exhibit comparatively greater concern for financial markets and growth during this period, while most of the remaining presidents stress commodity prices and inflation. Of course, the former group exercises decision-making power although the latter is numerically stronger and thus dominates discussion, if not policy. Even official FOMC statements, however, maintain from April 2008 onward that inflation has reemerged as a risk roughly equaling the risks to growth. At least one member of the Board, Kevin Warsh, goes further. As Warsh insists on August 5, 2008, "my view is that inflation risks are very real, and that these risks are higher than growth risks" (FOMC 2008d: 84).

Thus a mere forty days before the failure of Lehman Brothers and ensuing stock market free fall, most participants maintain that the risks of financial collapse are no longer the Committee's major concern. Making standard reference to the economy's "resilience," Chicago Reserve Bank President Charles Evans summarizes a widely held viewpoint as of early August:

"One year on the economy has withstood the financial shock in a resilient fashion, especially given the add-on shock from oil. I don't know what more we could have hoped for from the vantage point of the fall of 2007" (FOMC 2008d: 107).

Indeed, the FOMC was hesitant to abandon this position even *after* Lehman Brothers filed for bankruptcy on September 15, 2008, the largest such filing in U.S. history. On the following day, at the regularly scheduled FOMC meeting, participants by and large downplayed the significance of the Lehman failure and the financial market turmoil it was causing. As Dennis Lockhart, President of the Atlanta Reserve Bank explained in his briefing, "my view on the national outlook for the economy has not changed materially since our August meeting" (FOMC 2008e: 29). In keeping with their macro-level indicators, Committee members sought to de-emphasize the implications of a single financial event for the real economy. Plosser explained the logic:

"While a lot of attention in the short run is being paid to financial markets' turmoil, our decision today must look beyond today's financial markets to the real economy and its prospects in the future. In this regard, things have not changed very much, at least not yet … I agree that recent financial turmoil may ultimately affect the outlook in a significant way, but that is far from obvious at this point." (FOMC 2008e: 38).

Richmond Reserve Bank President Lacker concurred: "Overall, I don't take what's happened in the last few days as changing much. It's not obvious to me what the implications are for the outlook for inflation and growth, at least at this point" (FOMC 2008e: 48).

Many participants simply reasserted the inflation narrative of previous months. Indeed, they expressed concerns that the visibility of short-term financial events would distract the FOMC from its commitment to long-term price stability. For instance, Thomas Hoenig, Kansas

44

City Reserve Bank President, implored the Committee "to look beyond the immediate crisis, which I recognize is serious. But as pointed out here, we also have an inflation issue" (FOMC 2008e: 31). Strikingly, the FOMC policy statement released on September 16, 2008 and presented at the beginning of this paper continued to suggest that the risks to growth and inflation were roughly equal.

Not all reactions to the Lehman bankruptcy were so sanguine. Boston Reserve Bank President Eric Rosengren insisted otherwise at the September 16 meeting: "The failure of a major investment bank, the forced merger of another, the largest thrift and insurer teetering, and the failure of Freddie and Fannie are likely to have a significant impact on the real economy" (FOMC 2008e: 30). Yet the extent of his alarm placed Rosengren in a distinct minority. Federal Reserve Governor Donald Kohn, himself one of the more growth-focused participants during the lead-up to September, better captured the Committee's central tendency with his projection that "Activity is more likely to stagnate than to decline" (FOMC 2008e: 58).

Of course, all of this would change in a matter of days. By early October, the FOMC was coordinating a joint interest rate cut with the world's major central banks. By the next regularly scheduled meeting, on October 28-29, Janet Yellen was arguing that "we are in the midst of a serious global meltdown" (FOMC 2008f: 68). Nonetheless, we can safely conclude that at no point prior to the last months of 2008 did the FOMC even remotely appreciate the depths or dangers of the financial crisis. Even after they came to grasp *that* housing and financial markets were intimately intertwined, they failed to recognize the *extent* of the risk that housing posed for financial markets and institutions. What is more, they failed to recognize the extent of the risk

that financial markets and institutions posed for economic growth. In short, the FOMC continued

to make sense of economic life in terms of two conceptually distinct and largely independent

spaces: the "financial" and the "real" economies.

Conclusions

Our use of topic models coupled with a more conventional form of textual analysis

demonstrates quite clearly the power of culture in shaping actors' ability to make sense of the

external world. The backgrounds of the participants, the words they use to frame their

arguments, even their measurement instruments all affect their interpretation and construction of

reality, as sociologists maintain (Bourdieu and Wacquant, 1992; Goffman, 1979; Callon, et al.,

2007; Weick, 1995). The fact that the group of experts whose job it is to make sense of the

direction of the economy were more or less blinded by their assumptions about how that reality

works, is a sobering result.

It is useful to return to our theoretical discussion. We have provided clear evidence to

support the importance of culture and sense-making in decision making. We have shown how the

background and training of actors attempting to interpret what is going on in some outside world

profoundly limit the issues they examine and cause them to miss connections between things.

Perhaps, our most important contribution to the study of culture and sense-making is

methodological. Used in conjunction, topic modeling and a close reading of texts provide a

powerful weapon with which to demonstrate the role of culture in shaping social perceptions and

actions.

Our case study of the FOMC adds evidence that under the right circumstances, professional experts can have a wide degree of autonomy in analyzing policy situations and making decisions. The FOMC is clearly on one end of a spectrum whereby professional experts can exert their authority. It engages in arcane policy making in an avowedly apolitical fashion (Brint, 1990). In this way, it resembles agencies like the International Monetary Fund (Chwieroth, 2010) more than the large-scale political projects that brought neoliberal policies to some countries but not others (Fourcade-Gourinchas and Babb, 2004). That there was little or no pushback within the FOMC or in the broader financial community about how the FOMC was analyzing the economy up to the crisis shows how dominant and legitimate the macroeconomists at the FOMC were.

What is even more surprising is that in the wake of the failure of the Federal Reserve to foresee the crisis, there has been relatively little real push for change in the way that the Federal Reserve operates. Part of this is certainly due to the fact that the Federal Reserve quickly changed its position once it was clear that the crisis had started and acted effectively to prevent another Great Depression (Blinder, 2013). If anything, the Federal Reserve's power has expanded in the wake of the crisis due to the Dodd-Frank Act, and its use of macroeconomic tools to judge the state of the economy has not changed very much at all. This reflects two facts. First, there is no articulated alternative to macroeconomics as a basis for economic forecasting. Second, economists remain firmly in control of the main levers of the Federal Reserve suggesting that even if an alternative existed, it would be highly unlikely to gain adherents in the FOMC. This shows the remarkable resilience of a professional elite who clearly failed in their

central mission, a resilience that is due to their control over the levers of power and their claim on arcane knowledge.

Our case study expands the purview of the literature on economists and their performativity in markets. The demonstration that economic policymakers create "market devices"—or more plainly, use economic tools—to engage in sense-making is a useful addition to the literature (Hirschman and Berman, 2014). Such devices help policymakers decide what to do by giving them tools to evaluate uncertain environments. They also provide them with justifications for action and help them manage the expectations of communities like the financial markets. The idea of a "market device" is a sub category of a broader notion that people borrow cultural tools all of the time to guide them in their interactions. So, for example, the use of network analysis, invented by anthropologists and sociologists in the 1960s and 1970s, has been taken over by corporations to create social networks in order to sell products. This is clearly a case of using cultural tools invented for one purpose and turning them into a marketing tool.

Our paper also provides an ironic twist to the problem of the performativity of economics. The performativity literature seeks to show how economists using economic models make markets in their own image. In our case, the economic training and the models they deployed to make sense of the economy matter precisely because they *inhibited* economists' abilities to understand and act upon a set of markets whose objective workings were quite clearly independent of their sense perceptions. The mortgage market, the financial markets, and the connections between them were not a product of macroeconomic models. On the contrary, these models constantly led the FOMC to underestimate the size of the problem caused by the housing

decline and to completely miss the connections between the housing bubble and a potential

banking crisis. The result was a major failure of economic forecasting on the part of the major

economic forecaster of the American state.

 This makes us wonder what it would have taken to formulate a more accurate analysis of

the economy. First, the people in the room would have had to have other forms of expertise. But

in order for these people to be in the room, the whole structure of the Federal Reserve System

would have to change. Whom the Federal Reserve recruits and promotes and what kinds of

evidence would count as truth would have to be greatly altered. Even if such people were

present, it is clear that the format of the discussion and the group processes in the room would

have made it difficult for such a different perspective to have gotten a hearing. One could

imagine that a dissenting voice would soon be isolated and treated as an outsider whose views

were interesting but not to be taken seriously. Unless there was quite a bit more balance in the

discussion in terms of the number of people with different views and expertise, it is difficult to

see how the outcome would have changed.

 Even then, one might ask whether such a diversity of viewpoints would have really made

a difference. While participants with different points of view might have seen this particular

crisis more clearly, they would be blind to other facets of reality (Zuckerman, 2010). Moreover,

would a different point of view have prevailed or would it just have caused more confusion and

conflict? Still, had there been more voices, the FOMC might have intervened earlier and with

greater effect, thereby preventing the meltdown not just of the American economy, but the world

economy as well.

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Table 1: Voting Members of the Federal Open Market Committee, 2000-2008

Name	FOMC Position	Year(s)	Previous Sector	Career Central Banker?	Advanced Degree(s)	Dissertation Branch of Economics
Bernanke, Ben	Governor, Chairman	2002-2005, 2006-2008	Academic & Public	No	Economics PhD	Macroeconomics
Bies, Susan	Governor	2001-2007	Academic, Public & Private	No	Economics PhD	Macroeconomics
Broaddus, J. Alfred	Reserve Bank President	2000, 2003	Public	Yes	Economics PhD	Macroeconomics/ Microeconomics
Duke, Elizabeth	Governor	2008	Private	No	MBA	-----
Evans, Charles	Reserve Bank President	2007	Public	Yes	Economics PhD	Macroeconomics
Ferguson, Roger	Governor	2000-2006	Private	No	Economics PhD, JD	Industrial Organization
Fisher, Richard	Reserve Bank President	2005, 2008	Public + Private	No	MBA	-----
Geithner, Timothy	Vice Chairman	2003-2008	Public	No	Economics MA	-----
Gramlich, Edward	Governor	2000-2005	Academic + Public	No	Economics PhD	Macroeconomics
Greenspan,	Chairman	2000-	Public +	No	Economics PhD	Macroeconomics

Alan		2006	Private			
Guynn, Jack	Reserve Bank President	2000, 2003, 2006	Public	Yes	MBA	-----
Hoenig, Thomas	Reserve Bank President	2001, 2004, 2007	Public	Yes	Economics PhD	Macroeconomics
Jordan, Jerry	Reserve Bank President	2000, 2002	Public + Private	No	Economics PhD	Financial Economics
Kelley, Edward	Governor	2000-2001	Private	No	MBA	-----
Kohn, Donald	Governor	2002-2008	Public	Yes	Economics PhD	Macroeconomics
Kroszner, Randall	Governor	2006-2008	Academic	No	Economics PhD	Macroeconomics
Lacker, Jeffrey	Reserve Bank President	2006	Academic + Public	Yes	Economics PhD	Macroeconomics
Lockhart, Dennis	Reserve Bank President	2008	Private	No	Economics MA	-----
McDonough, William	Vice Chairman	2000-2003	Public + Private	No	Economics MA	-----
McTeer, Robert	Reserve Bank President	2002	Public	Yes	Economics PhD	Macroeconomics
Meyer, Laurence	Governor	2000-2001	Academic + Private	No	Economics PhD	Macroeconomics

Minehan, Cathy	Reserve Bank President	2001, 2004, 2007	Public	Yes	MBA	-----
Mishkin, Frederic	Governor	2006-2008	Academic	No	Economics PhD	Macroeconomics
Moskow, Michael	Reserve Bank President	2001, 2003, 2005, 2007	Academic, Public + Private	No	Business/Applied Economics PhD	-----
Olson, Mark	Governor	2001-2006	Public + Private	No	None	-----
Parry, Robert	Reserve Bank President	2000, 2003	Public + Private	No	Economics PhD	Macroeconomics
Pianalto, Sandra	Reserve Bank President	2004, 2006, 2008	Public	Yes	Economics MA, MBA	-----
Plosser, Charles	Reserve Bank President	2008	Academic	No	Economics PhD, MBA	Macroeconomics
Poole, William	Reserve Bank President	2001, 2004, 2007	Academic + Public	Yes	Economics PhD, MBA	Macroeconomics
Rosengren, Eric	Reserve Bank President	2007	Public	Yes	Economics PhD	Macroeconomics
Santomero, Anthony	Reserve Bank President	2002, 2005	Academic	No	Economics PhD	Macroeconomics/ Financial Economics
Stern, Gary	Reserve Bank President	2002, 2005, 2008	Public	Yes	Economics PhD	Macroeconomics

| Warsh, Kevin | Governor | 2006-2008 | Public + Private | No | JD | ----- |
| Yellen, Janet | Reserve Bank President | 2006 | Academic + Public | No | Economics PhD | Macroeconomics |

Table 2: Words for selected topics. Hyperparameter values were alpha = 1/15 = 0.067 and eta = 0.2

Financial Markets	Productivity	Housing	Employment	Bank Liquidity	Inflation	Weakness
financial	productivity	housing	employment	april	prices	weakness
credit	growth	inflation	improvement	commodity	inflation	easing
banks	slowing	growth	productivity	pdcf	pace	sales
turmoil	nairu	core	growth	lehman	pass	stimulus
risk	labor	moderate	hiring	prices	increase	fiscal
institutions	acceleration	president	recovery	inflation	pause	inventory
cut	supply	thank	business	facility	energy	attacks
cdo	wage	section	job	system	tightening	spending
losses	tight	language	ten	tslf	core	cut
loans	tightening	residential	gap	options	costs	tech
market	inflation	alternative	disinflation	june	compensation	consumer
mortgage	treasury	bit	tax	headline	higher	investment
downside	demand	home	expansion	institutions	oil	november
deterioration	year	energy	output	repo	measures	economy
liquidity	prices	forecast	dollar	voluntary	neutral	sector
swap	tech	trend	pickup	primary	statement	recession
commercial	stock	comfortable	equipment	stress	contained	manufacturing
agencies	increase	data	july	stigma	language	recovery
auction	earnings	past	accommodative	dis	remove	argentina
october	trend	public	june	stearns	accommodative	september
capital	workers	poole	spending	dealers	data	industry
lending	rise	slightly	strong	reserve	china	travel
asset	euro	predominant	positive	party	path	auto
stress	higher	think	recommendation	solvency	move	weakening
insurance	unemployment	ceo	labor	exigent	rise	decline
modal	technology	prices	strength	sec	markup	basis
sheet	deepening	labor	data	march	graphs	economic
exposure	pressures	spillover	fiscal	oil	expectations	stock
crunch	oil	subprime	inventory	financial	pressures	downside
spreads	national	uncertainty	recent	merrill	solid	holiday

Table 2: Top words for selected topics (continued).

Energy	Housing Bubble	Minutes	Charts & Data	Policy Response	Portfolio	Objectives	Macroeconomics
Hurricane	bubble	minutes	Panel	Target	acf	objective	interest
Katrina	rent	Release	Model	Reserve	rps	Goal	rate
Gasoline	housing	statement	Us	Zero	study	numerical	gdp
Oil	land	committee	Line	Bound	ginnie	explicit	year
Gulf	mortgage	public	Chart	Program	securities	narrative	inflation
Energy	home	communication	Economy	Sheet	portfolio	inflation	unemploym
Gas	thank	draft	Black	Funds	treasury	mandate	one
August	overvalued	language	Rule	December	dissent	range	expectations
Rebuilding	ratio	think	Right	Federal	outright	target	point
Refinery	arms	formulaic	Middle	Rate	mae	stability	may
September	properties	vote	Red	Facility	government	communication	forecast
Storm	afford	expediting	Present	quantitative	asset	Dual	also
intervention	ofheo	members	Bottom	Deflation	lombard	congress	now
disruptions	percentile	announcement	depreciation	Quantity	gnmas	diversity	percent
Orleans	value	editing	simulations	Ceiling	collateral	Adopt	growth
Crude	ltv	nineteen	Dollar	Size	freddie	Public	economy
uncertainty	exhibit	discussion	Exhibit	Monetary	sovereign	achieve	term
Supply	hedge	meeting	Taylor	Banks	interim	horizon	policy
Damage	misalignme	decision	Show	Excess	discount	section	risk
Impact	loans	words	adjustment	Purchases	window	specific	like
Heating	shown	view	Foreign	Interest	issue	regime	well
Barrel	index	process	productivity	Treasury	system	Cpi	continue
reconstruction	miami	issue	Rate	Tools	disclose	definition	last
Winter	gse	backwards	Frb	Securities	operations	benefits	much
devastating	nonmarket	Give	Top	Guarantee	contingency	central	even
Filed	constant	Blackout	Ratio	communication	repo	transparency	can
Coast	lenders	Say	Profits	Regime	tally	committee	see
Effect	family	Use	Variables	Policy	authorized	Run	seems
Gallon	upper	Information	coefficients	Money	diversified	Think	real
Natural	misallocation	Agree	Exchange	nonstandard	auction	anchored	months

Abbreviations defined: cdo=credit debt obligation, frb=federal reserve board, arms=adjustable rate mortgages, pdcf=primary dealer credit facility, tslf=term security lending facility, dis=depository institutions, cf=credit facility, ofheo=office of housing enterprise oversight, rps=repos, cpi=consumer price index, gdp=gross domestic product, ltv=loan to value ratio, gse=government sponsored enterprises, acf=asset credit facility, ceo=collateralized equity obligation, nairu= non-accelerating inflation rate of unemployment
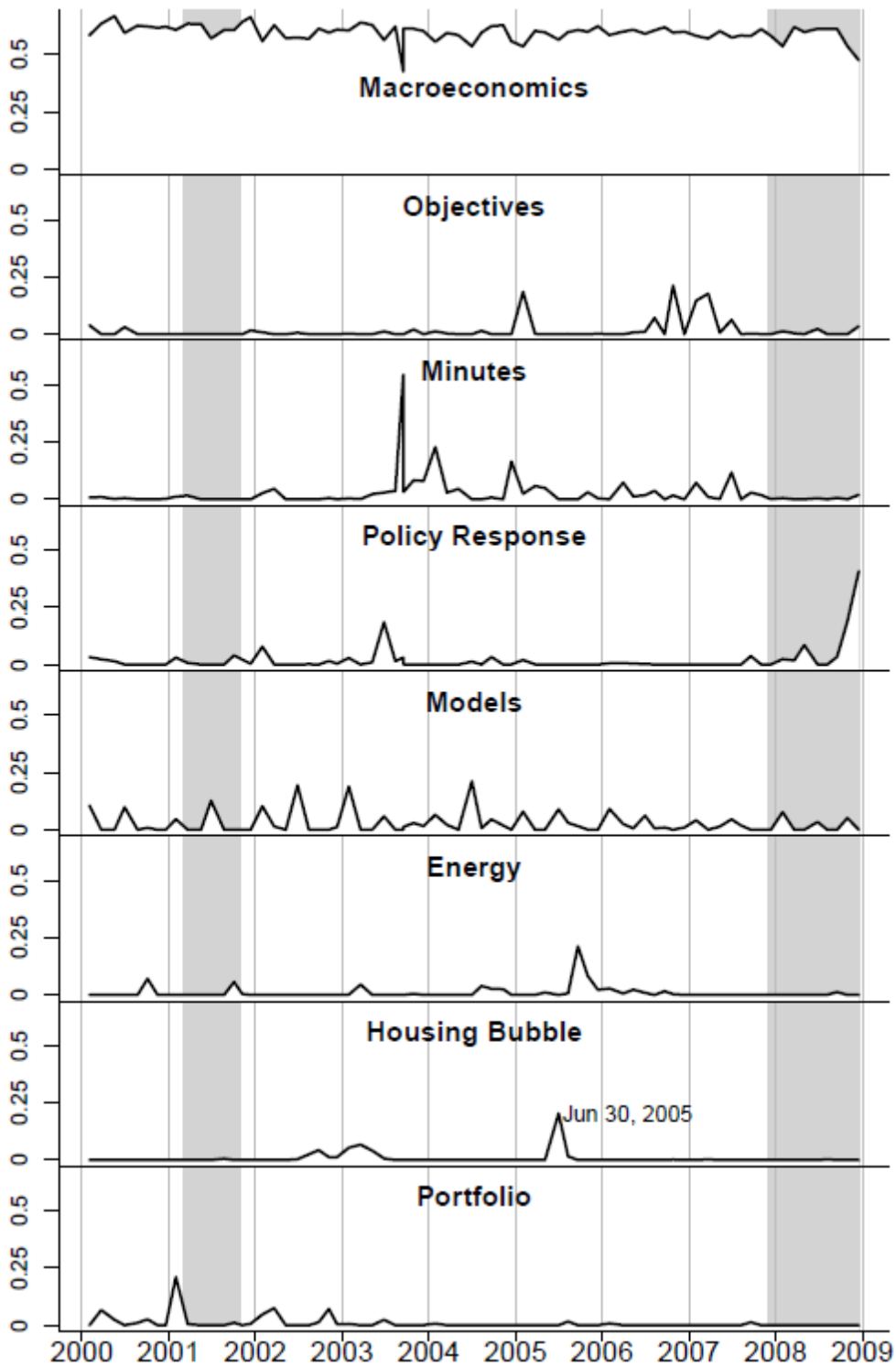
Figure 1: Topic Proportions over time. . The height of each line represents the proportion of words in a given transcript assigned to that topic. Grey bars indicate periods of recession.
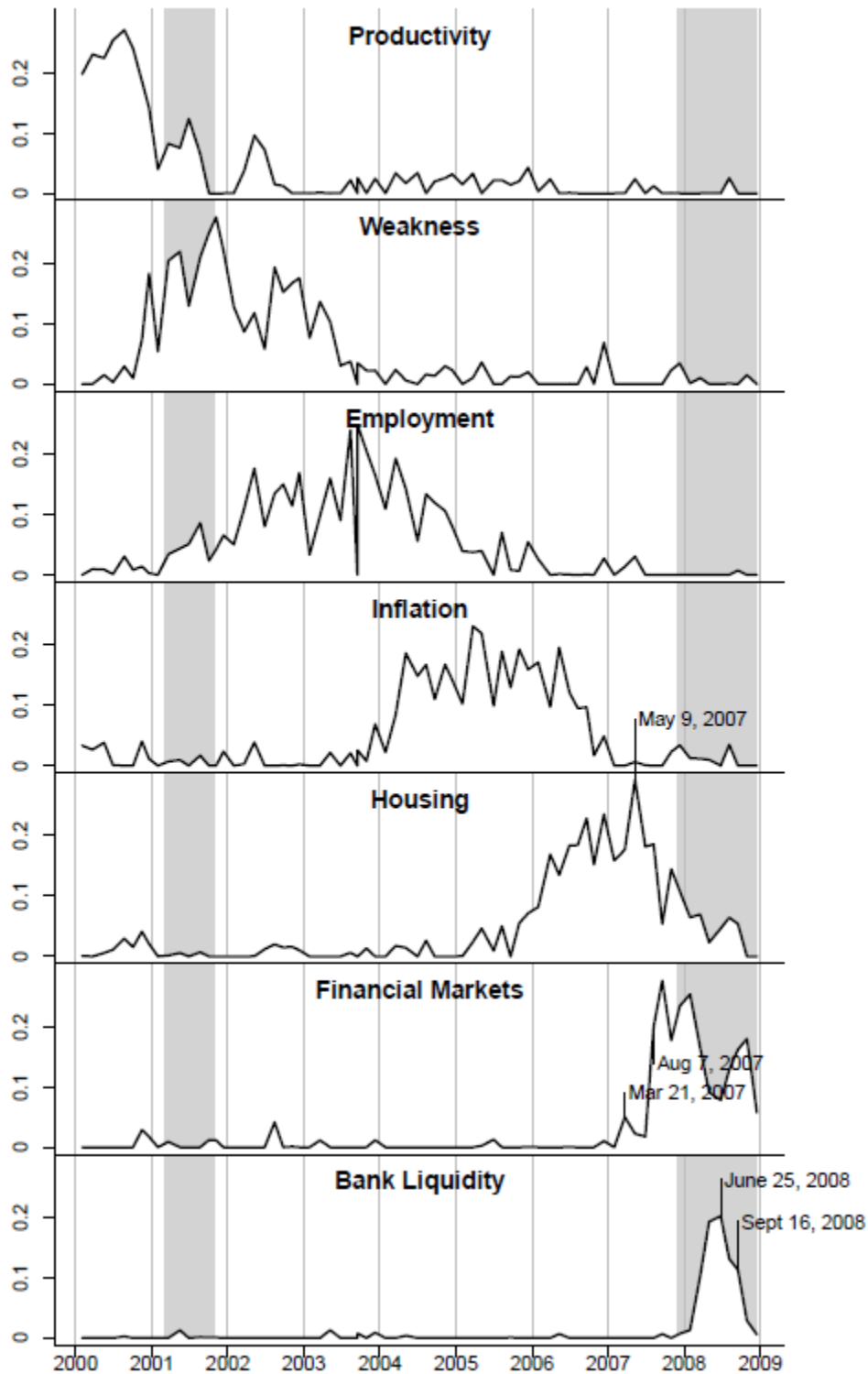
Figure 2: Topic proportions over time. The height of each line represents the proportion of words in a given transcript assigned to that topic. Grey bars indicate periods of recession.

Appendix A

In order to assess whether or not topics appear constantly, randomly, or as waves, we use an autocorrelation analysis. High autocorrelations (close to 1) indicate that consecutive observations have similar values, relative to the variation in other observations. Autocorrelation values close to zero indicate that consecutive observations are no more related than nonconsecutive observations. This means that both constant proportioned topics and separate spiked topics should have autocorrelations close to zero (Lafferty and Blei, 2005).

Figure 1 shows the autocorrelations for each topic ordered from top to bottom by the number of appearances. To determine whether values are high or low, bootstrapped confidence intervals were generated by re-computing autocorrelations for random temporal re-orderings of documents. The *Macroeconomics* topic has a correlation close to zero and highest appearance frequency, confirming that it has a largely constant proportion. As expected, the insignificant autocorrelations of the other four topics related to the purpose of the FOMC (*Portfolio*, *Objectives*) and meeting related business (*Minutes*, *Models*) show that they tend to be discussed intermittently. Eight topics (*Inflation*, *Weakness*, *Employment*, *Housing*, *Productivity*, *Financial Markets, Bank Liquidity, Policy Response*) have extremely high correlations, consistent with our characterization of them as topics that vary temporally. In the case of *Policy Response*, this takes the form of adding new facilities to deal with economic developments. The lower autocorrelations of the remaining two development topics, *Energy* and *Housing Bubble*, combined with their relative infrequency suggests they are highly transient topics. In the case of

the *Housing Bubble* topic, almost all of the references refer to a single meeting of the FOMC (see

figure 1). Similarly, the *Energy topic is about* the short-lived consequences of Hurricane Katrina

on the economy.