

The Transformation of Mortgage Finance and the Industrial Roots of the Mortgage Meltdown*

Adam Goldstein

and

Neil Fligstein

Department of Sociology

University of California

Berkeley, Ca. 94720

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Abstract

The 2007-2009 financial crisis was centered on the mortgage industry. This paper develops a distinctly sociological explanation of that crisis based on Fligstein's (1996) "markets as politics" approach, White's (2002) view of production markets, and the sociology of finance. We use archival and secondary sources to show that the industry became dominated by an "industrial" conception of control whereby financial firms vertically integrated in order to capture profits in all phases of the mortgage industry. The results of multivariate regression analyses show that the "industrial" model drove the deterioration in the quality of securities that firms issued and significantly contributed to the eventual failure of the firms that pursued the strategy. We show that large banks which were more involved in the industrial production of U.S. mortgage securities also experienced greater investment losses. The findings challenge existing conventional accounts of the crisis and provide important theoretical linkages to the sociology of finance.

Introduction

It is generally agreed that the cause of the financial crisis in mid-2007 that produced a worldwide recession was the sudden downturn in the nonconventional (which includes subprime, Alt-A, and Home Equity Loans) mortgage backed securities market in the U.S. (Aalbers, 2009; Ashcroft and Schuermann 2008; Demyanyk and van Hemert, 2011; Sanders, 2008; Lo, 2012). This downturn was caused by a fall in housing prices and a rise in foreclosures. This put pressure on the mortgage-backed security bond market where massive numbers of bonds based on nonconventional mortgages were suddenly vulnerable to default (MacKenzie, 2011). Starting with the collapse of Lehman Brothers in September 2008, the entire financial sector rapidly destabilized (Swedberg, 2010). Holders of those bonds had to raise large amounts of money to cover the loans they had taken to buy the bonds, thereby creating a liquidity crisis that reverberated globally (Brunnermeier, 2009; Gorton, 2010; Gorton and Metrick, 2010; Fligstein and Habinek, 2014).

There is less agreement and less clarity about exactly how the mortgage backed security bond market developed to produce the crisis. Andrew Lo, a financial economist, concludes in a recent review of 21 academic and journalistic accounts of the crisis that “No single narrative emerges from this broad and often contradictory collection of interpretations, but the sheer variety of conclusions is informative, and underscores the desperate need for the economics profession to establish a single set of facts from which more accurate inferences and narratives can be constructed (2012, p. 1).” For their part, economic sociologists have provided analyses that have focused on the structural and institutional conditions for the meltdown, such as banking deregulation (Campbell, 2010), the structure of confidence in the financial markets (Carruthers,

2010) and the broader financialization of the economy (Krippner, 2010). Others have considered the role of financial instruments (MacKenzie, 2011), credit rating agencies (Rona-Tas and Hiss 2010), or provided useful descriptive accounts of some of the key events (Swedberg, 2010).

This paper works to produce a meso-level sociological account of what happened by establishing a set of key facts about what the banks were doing, why they came to be doing this, and how their tactics locked them into not being able to respond once the housing price bubble began to break in 2006. These “facts” require using sociological theories about market formation as well as insights from the sociology of finance. We do not claim to produce a definitive account of all facets of the crisis, but we do claim to answer one of the most critical questions: why did the banks take on so much risk in the form of mortgage backed securities (hereafter MBS) and why were they so slow to escape those risks once it became clear that the mortgages underlying the bonds were so vulnerable in 2006-07?

The main explanation for what happened in the economics literature is a story of market failure. Actors in all parts of the mortgage industry had perverse incentives to take on riskier mortgages because they could pass the risk off to another party (Jacobides, 2005). Mortgage originators passed bad loans to mortgage security issuers who packaged them into risky securities and promptly sold them off to unsuspecting investors. Because they did not intend to hold onto the mortgages or the financial products produced from those mortgages, they did not care if the borrowers were likely to default (Ashcroft and Schuermann, 2008; Purnanandam, 2011; Immergluck, 2009; see Mayer, Pence, and Shurland, 2009 for a literature review).

Economic sociologists have also developed a closely parallel variant of this argument in which they locate the sources of the crisis in the marketization of a financial system characterized by fragmented markets where banks were relatively small and were participants in only one market.

(Davis 2009; Mizruchi 2010). This approach is consistent with the perverse incentives argument as it postulates that this fragmentation promoted opportunistic behavior.

A growing body of empirical data has cast doubt on the idea that the crisis was caused by banks passing risks onto other parties. Most of the producers of MBS and collateralized debt obligations (hereafter, CDO) ended up holding large investments in these securities (Acharya and Richardson 2009; Acharya, Schnabl, and Suarez, 2013; Gorton, 2010; Erel, Nadauld, and Stulz 2014). As a result of these extensive holdings, most of the large financial firms who originated and securitized mortgages ended up in bankruptcy, merger, or being bailed out. Fligstein and Goldstein (2010) show that by 2007, there were a small number of large financial firms mass-producing MBS products in vertically-integrated pipelines whereby firms originated mortgages, securitized them, sold them off to investors, and were investors themselves in these products. These findings raise the key empirical puzzle for our paper: if the structure of the MBS production market was becoming more integrated rather than fragmented, and if the same firms that were producing the risky MBS were also holding it as investments, how do we understand the relationship between the organization of the market and the destabilizing forces which ultimately undid it?¹

The answer to this question lies in understanding the logic of the vertically integrated structure which banks came to embrace for making money at all phases of the mortgage securitization process. Drawing on White's (2002) notion of markets as role structures and

¹ Even as the industry was becoming more integrated, we do not mean to suggest that perverse transactional incentives were entirely absent from the structure of the markets. Indeed, there is ample evidence that some customers of these securities were being taken advantage of. One prominent and illustrative case of this occurred at Goldman Sachs, which used its privileged information about the underlying riskiness of a particular CDO to bet against them on the investment end while continuing to profit from their production (Lewis, 2010). Individual trading groups at several other MBS/CDO producers, including Goldman Sachs and Morgan Stanley, also either tried to short the subprime market or sold instruments which they knew to be toxic. Such duplicitous behavior is consistent with a perverse incentives account.

Fligstein's (1996) "markets as politics" approach, we locate the development of mortgage securitization markets within the context of what can be called an industrial conception of control. Conceptions of control refer to overarching dominant logics of organization and behavior, which shape the tactics firms use to make money (Fligstein 1996). In this case, financial firms came to understand that they could make money by positioning themselves in all parts of the securitization process. We call this an industrial conception of control because it is predicated on banks' securing a supply of raw mortgages in order to guarantee themselves fees at all parts of the process. Internalization of this whole value chain within large firms, and resulting high-throughput scale economies, represented a kind of industrialization where the goal was to mass produce financial instruments.²

Using both secondary and archival sources, we document the growth of this cultural conception in mortgage finance. Countrywide Financial pioneered this model in the 1990s and they made such large profits that most of the largest investment banks, commercial banks, and mortgage lenders aggressively followed suit. After 2001, the demand for MBS amongst investors increased dramatically as interest rates declined and investors were seeking safe investments with high returns. During the 2001-2003 period, vertically integrated banks produced record profits by reaping fees at all parts of the process and making investments in these securities. Beginning in 2004, the market for the mortgages that made up these securities began to dry up. Most of the new mortgages that had been made into securities were re-financings of old

² While the idea of an industrial model and vertical integration may strike some readers as odd for financial products, we think that what happened quite closely parallels the way that vertical integration worked in some industries historically. For example, vertically integration in the oil industry began mainly as an effort to control the supply of oil. But by the mid-20th century, oil companies were using oil as feed for many kinds of products, some where they would sell petrochemicals to others as well as use them for their own downstream industries (Williamson, 1983).

mortgages. By 2004, most people who could refinance had already done so. This created a crisis for banks who had invested so much in their industrial pipelines. It pushed them to look for new sources of mortgages. The solution to their problem was a huge expansion in originating and securitizing nonconventional mortgages including subprime mortgages. These mortgages proved to be more valuable as inputs into MBS because they often had higher interest rates which brought higher returns when they were packaged into MBS. But, they also ultimately proved to be more risky as these mortgagees were more likely to default.

The higher interest rates paid out by these MBS meant that the demand for MBS and CDO products remained strong from 2004-2006. In many cases, the bonds that were created were rated AAA making them attractive as investments. Firms' forward integration into underwriting CDO (which were re-securitizations of existing subprime MBS) allowed banks to package the most difficult to sell tranches of MBS to serve this market. It also reinforced the demand for more of the highest-risk, high-interest raw mortgages to use as inputs. In direct contrast to the perverse incentives account, this view suggests that the disconnection between lending and diligence was driven not by the incentive to pass the risk on to someone else, but instead by the logic of vertical integration. Without mortgages, banks could not feed their pipelines, create financial products, sell them, or leverage and hold them as investments.

The large holdings of MBS and CDO that financial institutions held as the market for these products began to turn down in 2007 were not just the result of investment strategies. Banks made markets in the sale of these products. In order to do so, they needed to originate mortgages, securitize them, and then hold onto inventory that they would ultimately sell. Banks had to operate as market makers in these securities which meant that they sometimes had to buy and sell securities that would then pile up in inventories. In order to convince customers that the

securities they were selling were safe, banks would hold onto securities arguing to their customers that they liked the products so much, they held them for their own accounts. They found themselves with some tranches of MBS, particularly what are called “super senior” MBS, that they could never sell and these often remained on their books. As the market for all securities slowed in 2007, financial institutions had unsold inventories of mortgage products. Both investments and inventories were often funded using short term asset backed commercial paper (Acharya, et. al. 2013). So, as the amount of MBS and CDO holdings piled up and their underlying value became more suspect because of the rise in foreclosure rates, banks were poised to have problems continuing to borrow money to support their holdings and inventories.³

We present multivariate regression analyses to test these arguments about how the vertical integration of banks led to their being vulnerable when the housing market turned down. As the quality of the mortgages being packaged declined, banks who the industrial model had had to continue to produce securities in order to profit from their investments in origination and securitization. When the crisis began in 2007, banks found it difficult to sell these securities as their value became uncertain. As a result of the high foreclosure rates on lower quality mortgages, banks that were vertically integrated experienced higher rates of deterioration in the quality of their MBS/CDO holdings. We also show that investment losses on MBS and CDO assets in the aftermath of the crash were significantly greater for firms who were more integrated in the production of MBS assets than those who were less involved in the production-side of the

³ It is difficult at the bank level to untangle the degree to which each of these factors contributed to the overall holdings of MBS and CDO on the eve of the crisis. Banks were not required to break out in their accounting statements into whether or not holdings were investments or inventories. We know that when firms were making lots of profits from 2001-2006, these holdings increased dramatically. But we also know that from 2007 until mid-2008, holdings increased as well implying that inventories were piling up. We also do not know initial ratings of tranches that were being held and therefore cannot separate out “super senior” tranches from other tranches.

market. Finally, because banks pursued the industrial conception and issued worse securities and had large losses on those instruments they were holding, they were more likely to go bankrupt.

Donald MacKenzie (2011) has proposed that the financial crisis was caused at least in part by the particular technical assumptions embedded in evaluations of the complex products known as collateralized debt obligations of asset-backed securities (hereafter ABS-CDO). ABS-CDO represent re-securitizations of existing asset-backed securities of which MBS tranches were one form. Mackenzie argues that evaluations of the riskiness of these products became detached from their underlying financial assets (i.e. mortgages). MacKenzie shows how this facilitated the production of products that were high-yield because they were composed of low-rated subprime MBS tranches, but nonetheless attained AAA bond ratings that made them appear to be safe investments (MacKenzie, 2011: 1011).

MacKenzie's account, which focuses on the instruments, is informative but incomplete. The question MacKenzie does not answer is why banks suddenly became interested in using mortgage backed securities as raw material for CDO. It turns out that while demand remained strong for "AAA" rated products, the lower rated tranches of subprime MBS were often harder to sell. By converting these low rated tranches into CDO, banks were able to transform them from bonds that were not investment grade to bonds that were.

He also raises but does not pursue the question of what the effect was of combining these separate businesses on the way that banks operated. Our account is that the advent of ABS-CDO reinforced and solidified the industrial production model firms were already using. Investment banks, like Bear Stearns, Merrill Lynch, and Lehman Brothers, began to realize that in order to capture enough of the CDO business, they would need more raw mortgages to package.

Commercial banks like Bank of America and Citibank saw the opportunity to move into ABS-CDO as a chance to find further downstream revenues from their lower rated tranches of subprime MBS. Our findings show that MBS producers who integrated forward into CDO production exhibited significant subsequent declines in the quality of their subprime MBS issues. The effect of CDO in causing the crisis derived not only from the fact that buyers misperceived their riskiness, but in the way that firms' increasing deployment of these products pushed them to seek out the riskiest mortgages as raw material for these products.

It is here that we make our most important theoretical contribution. The sociology of markets and the sociology of finance are subfields that have tended to have distinct research programs. By locating the problem of the construction of financial instruments, their innovation, and their deployment with how such instruments are embedded in firms' strategies to make money in markets, we offer a more satisfying account of what happened. From this perspective, our story and MacKenzie's story are complementary and inform one another. MacKenzie's account focuses on the integration of the financial instruments that evolved separately in the mortgage and corporate banking sectors and became intertwined as banks realized that high-risk mortgages made excellent material for lucrative financial products. We show that this integration had a long history that began with the shift from a market for mortgages whereby banks lent money and held onto mortgages, to a market for mortgage securities, and finally to markets for all types of financial instruments based on those securities. Depending on where one cuts into the process, this use of financial instruments was both a cause and an effect of the profound alteration in the identities of market actors, and the strategies and structure of banking in the U.S. from 1980 to the meltdown of 2008.

Theoretical Considerations

It is useful to begin by characterizing how we intend to combine elements of the sociology of markets and the sociology of finance. The sociology of finance has focused on the socio-technical aspects of trading and the creation and evaluation of financial models and instruments in order to arrive at accounts of how these markets have evolved (Knorr-Cetina, 2004). There are two important critiques in this literature of the sociology of markets. First, some of the literature is interested in how the financial products, technologies, and practices themselves create markets by embodying economic principles (MacKenzie and Millo, 2003; Buena and Stark, 2005; Callon, 1998; Preda, 2007). The critique of production approaches is that they fail to consider how the actual structuring of the market results from the economic ideas embedded in market technologies.

Knorr Cetina and her co-authors (Knorr Cetina and Bruegger, 2002; Knorr Cetina, 2004; Knorr Cetina and Preda, 2007) have provided a second more general critique of a production-oriented approach to markets. They suggest that a production perspective, like that embedded in White's version of the sociology of markets (2002) or Fligstein's "markets as politics" approach (1996; 2001) confounds how the market works with the social structuring of the firms in a market. They argue that the limitations of a production perspective are particularly acute in financial markets, which are dependent not just on new forms of financial products, but also on electronic technology and a whole web of market devices that make firms less relevant to understanding what is going on. Their view is that financial markets are more organized around the flow of financial transactions and the processes that create and sustain that flow than production approaches, which, by focusing on the relationships between firms, fail to grasp the essential features of those markets.

While there is merit to both of these critiques, there is also the possibility that production and sociology of finance arguments might actually be combined to produce a more satisfying analysis of the way that financial products and the firms that create, sell, and trade them operate to produce complex markets. To do so requires thinking about the co-evolving relationship between the socio-technical aspects of financial products and more institutional dimensions of market development. It also requires that we consider the role of production in structuring financial markets.

We propose a recursive dynamic between financial technologies and financial firms' strategies and structures. From this perspective, the creation of new and ever more esoteric financial products that are driven by models, equations, and new forms of classification (Callon 1998; Mackenzie and Millo 2003) deeply affect the relationships between financial firms who are looking for market opportunities or worried about staying profitable and surviving the crises in their main product lines (Fligstein 2001). Put another way, White's argument (2002) that firms watch one another in product markets and decide where to place themselves in a role structure implies that firms have to figure out how financial products fit into what they are doing and position themselves in their competition with other players.

In the case of financial markets, the internal organization of banks and other financial entities are certainly being changed by the new opportunities presented to them by the creation and diffusion of new products. But, their use of such products fits the banks' larger narrative about who they are as firms and what kinds of products they produce. It establishes who their peers and competitors are and works to reorganize the role structures of their markets. But those existing structures also affect financial innovation. It is within the larger context of the challenges facing how financial firms make money that the innovation make sense. Firms

searching for new sources of profit or trying to figure out how to survive crises in their main markets turn to existing financial products to create new innovations to stabilize their positions. In our case, for example, the inability to sell lower rated tranches of subprime MBS was solved by using the CDO technology to turn these tranches into more saleable products.

We use the “markets as politics” approach as a way to think about the rise of new markets and changes in the governing conception of control of existing markets (Fligstein, 1996; 2001). We use several ideas from the “markets as politics” approach.” New markets emerge when a new conception of control provides a way of how to think about how to organize that market. New markets frequently appear as the result of either a crisis in an old market or the possibility for a whole new kind of product usually related to those in nearby markets. In the case of the market for mortgages, we consider how the crises in the main markets of savings and loans and commercial banks created new opportunities to change the way that mortgages were purchased and financed providing the impetus for the emergence of the market for mortgage backed securities. This stimulated the growth of a whole range of financial products that are well documented by MacKenzie (2011).

Many features of markets reflect how firms deal with their competitive struggles. For instance, Fligstein (1996) highlights how vertical integration is a generic strategy which industrial firms pursue in order to control supplies and thereby stabilize their production. We will show that vertical integration became quite important in the evolution of the market for mortgage securitization. Financial firms realized that having mortgages was necessary in order to produce the more esoteric products downstream such as MBS and CDO, which were based on mortgage backed securities. Without mortgages as the raw material for these products, the production of new financial products was impossible.

In order to understand our argument that there was a co-evolution of the instruments and financial institutions, it is useful to present an overview of how the structure of the industry and the mortgage products changed over time. The market by which Americans bought mortgages underwent two large transformations that affected who the players were, how they competed, and which financial products were invented and elaborated. In 1980, savings and loan banks whose main product was the conventional mortgage, dominated the mortgage industry.⁴ The MBS was invented during the late 1960s by economists who worked for the government (Quinn, 2008). This is in line with the idea that the economics profession played a role in producing new financial products. But, because of the dominance of the savings and loan banks and difficulties selling MBS to investors, the market never took off (Lewis, 1990).

It took the crisis of the savings and loan industry's model in the 1980s to provide the opportunity for the MBS market to flower. The market for mortgage securitization was primarily organized by the government sponsored enterprises, known by their acronyms, Fannie Mae, Freddie Mac, and the government owned issuer, Ginnie Mae. The government sponsored enterprises used MBS to re-organize how Americans got mortgages for their homes. Equally important was the role of the bond selling industry, particularly Lewis Ranieri at Solomon Brothers, who figured out how to make the bonds attractive to investors (Lewis, 1990). The industry that emerged contained a fragmented set of interrelated markets dominated by different kinds of financial firms who specialized in each market.

⁴ We note that that the 30 year fixed rate mortgage that required a 20% down payment was itself a financial innovation the helped expand the housing market in America.

The second transformation began in the mid-1990s and witnessed the emergence of the industrial conception of control where the largest financial firms participated in all phases of the market including the production of CDO. This industrial conception emerged for complex reasons across different kinds of financial institutions. Commercial banks and some of the remaining savings and loan banks began to move into the investment banking business in order to take advantage of the fees associated with the production of MBS as well as taking the opportunity to hold these products as lucrative investments. Investment banks discovered that to secure their position in the production of mortgage securities, they needed to guarantee themselves a supply of mortgages and they began to purchase mortgage originators.

The creation of the MBS-CDO was endogenous to this process. Financial institutions used tranches of subprime mortgages that they could not sell to manufacture highly rated derivatives. As banks integrated, the boundaries between what were previously savings and loans banks, commercial banks, mortgage banks, and investment banks eroded as many banks were operating in multiple segments. Over a 30 year period, both the financial instruments and the structure of the industry and identities of the players shift dramatically. This brief account illustrates how the structuring of the firms and the creation and use of the products was an interdependent process. We now turn to explicating this process in more detail.

The Structure of the Mortgage Securitization Market

A mortgage backed security is a bond backed by a set of mortgages that entitles the bondholder to part of the monthly payments made by the mortgage borrowers. Like other bonds, MBS are rated by credit rating agencies to indicate to buyers their relative riskiness. Figure 1 provides a diagram illustrating the basic role structure of securitization deals. The emergence of

this complex transactional structure has been documented in a number of places (Quinn, 2008; Barmat, 1990; Jacobides, 2005; Green and Wachter, 2005; Ranieri, 1996; Kendall, 1996).

Borrowers purchasing homes take loans from lenders, also known as originators. These originators could be local banks, commercial banks, or specialized mortgage brokers. The originators sell the loans to issuers, or to wholesalers who would bundle loans together to then sell to issuers. The MBS issuers' role is to serve as an intermediary between mortgage originators and investors, creating the financial instruments out of individual mortgages. The underwriter manages the deal, funds the securitization, and sells the bonds. Mortgagees make monthly payments to servicers, who distribute the payments to bondholders.

(Figure 1 about here)

In the 1980s and 1990s, the structure depicted in Figure 1 can be thought of as series of production markets that were linked by the moving of mortgages and MBS across firms that specialized in each of the markets. The core issuers who organized the securitization market were the government sponsored enterprises (hereafter, GSE)--Fannie Mae, Freddie Mac, and the government-owned mortgage insurer, Ginnie Mae.

It is important to discuss the various types of mortgage security products and how they map onto the social and regulatory boundaries of the production market. MBS are distinguished by the underlying mortgages which compose them, such as conventional/conforming, Alt-A, B/C ("subprime"), or home equity loans. The differences between these types relate to both characteristics of the mortgage and the borrower, as well as the regulatory rules governing MBS production. The most important distinction is that only conventional mortgages ("prime") were eligible for inclusion in the mortgage pools of the GSE-issued bonds. To qualify for a prime or conventional mortgage, a person needed 20% down and a credit score of 660 or above.

Conventional mortgages have a fixed interest rate and had 30 year terms. Borrowers who lacked these qualifications but were willing to pay a higher interest rate and/or higher fees could qualify for various types of nonconventional mortgages. That fact that the GSE's were generally barred from issuing MBS backed by non-conforming loans created a market segmentation whereby GSEs dominated issuance in the prime market, while securitization of nonconventional loans was conducted almost solely by private firms.⁵ The MBS issued by the GSE were known as agency backed MBS and distinguished from non-agency MBS. The vast majority of MBS produced from the 1970s until 2003 were agency backed.

MBS deals were divided into risk-stratified securities called "tranches" starting in the mid-1980s (Ranieri, 1992). While backed by common pools of mortgages, the various tranches provide different risk profiles. Riskier tranches of a bond pay a higher rate of return but are the first to default in the event of losses. In the early 2000s, another more complex type of instrument called a CDO started to become popular. A mortgage CDO (often called ABS-CDO) is a derivative, or re-securitization, of existing MBS tranches. Packagers would take the lower rated tranches subprime MBS bonds (called "mezzanine tranches" in the industry jargon) and

⁵ We will use the term nonconventional to describe all of these types of loans and reserve the term subprime for a particular type of nonconventional mortgage (which are also called B/C). Subprime MBS refers specifically to securitizations of B/C mortgage pools. Here are the conditions that could qualify a mortgagee as subprime: two or more loan delinquencies in the last 12 months; one or more 60 day loan delinquencies in the last 24 months; judgment, foreclosure, or repossession in the prior 24 months; bankruptcy in the past 5 years; a FICO score less than 660; and debt service to income ratio of 40% or greater. If one's credit was a bit better, one could qualify for an intermediate "Alt-A" mortgage, often without any proof of income. Jumbo mortgages refer to mortgages which failed to conform to GSE standards because they were too large. Jumbo loans were typically for luxury homes or in homes in high-cost markets. Home equity loans (HEL) refer to loans that borrow against the equity value of one's home.

package them together into a new bond, which theoretically contains a more diversified set of assets. The top tranche of that bond would be the least likely to fail and it was graded AAA. While the complexity of pricing a CDO can be very difficult due to the disparate income streams from which it is constituted, at root it is simply a claim on mortgage backed security tranches, which are in turn claims on income from mortgage payments made by home buyers. See Mackenzie (2011) for a thorough discussion of these bonds.

The Transformation of Mortgage Finance and the Rise of an Industrial Conception of Control

While the roots of mortgage securitization extend back to the late 1960s (Quinn 2008), it began to dominate the mortgage finance system in the mid-1980s. Before then, most Americans got mortgages by borrowing from savings and loans or commercial banks. These firms would form a long-term relationship with the borrower. In the 1970s and 1980s, the savings and loan banks experienced a crisis in their basic business model (Barth, 1991). The industry began to collapse and the securitization model filled the void they left behind. The percent of all mortgages that became securitized increased from 15% in 1981 to 49% in 1987 (Jaffee and Rosen, 1991:120).

Securitization vertically disintegrated the mortgage market, replacing the integrated savings and loan bank “originate to hold” model with the “originate to distribute” model pictured in Figure 1. The GSE came to be at the center of the American mortgage system. They bought mortgages from originators and wholesalers and hired issuers and underwriters to create MBS and then sell them to investors, who included commercial banks, insurance companies, and pension funds. During this period it was possible for mortgage loans to pass through as many as

five different kinds of financial institutions (originators, wholesalers, underwriters, government sponsored enterprises, and servicers) before settling into investors' portfolios. These markets were horizontally unconcentrated. The main concentrated entities were the government-sponsored enterprises and the large investment banks who acted as underwriters (Fligstein and Goldstein 2010).

Astute readers will note that the fragmented structure of the “originate to distribute” model is exactly how the “perverse incentives” perspective imagined the way the market looked in 2007. But, this structure as it emerged in the early 1990s was not the final form that mortgage securitization would assume. The largest financial firms did not remain specialists in one part of the mortgage market but saw advantage to spreading themselves across all segments of the market. Banking firm conglomeration, the erosion of regulatory boundaries, and an increasing orientation towards generating fees as a source of growth during the latter half of the 1990s formed the building blocks of what would coalesce into a vertically-integrated industrial model of MBS production.

Commercial banks had historically sought out stable relationships with their customers, both households and industrial corporations. But Davis and Mizruchi (1999: 219-220) show that from 1970-1990 commercial banks lost their core lending markets to other financial entities. Corporations raised money directly from financial markets. Consumers turned from savings accounts to money market funds and mutual funds. So-called nonbank banks like GE Capital made “industrial” loans while the financial arms of the automobile companies, like GMAC took over the auto loan business. Specialized mortgage originators like Countrywide Financial absorbed market share in the mortgage market. Dick Kovacevich, CEO of Norwest, a large

regional commercial bank said in response to his perception of the crisis: “The banking industry is dead, and we ought to just bury it” (James and Houston, 1996: 8).

In order to survive, commercial banks embraced a shift from a conception of their business where they tried to build long term relationships with their customers to a fee-based view of their business where revenues came primarily from charging fees for every transaction with customers. Mortgage securitization is a lucrative fee based business. Fees are charged to arrange the loan to a home buyer, selling that mortgage to a wholesaler or issuer, turning the loans into MBS, underwriting the MBS deal, selling the MBS to investors, and servicing the underlying mortgages in the MBS packages.

Commercial banks were not just satisfied to enter the mortgage origination and servicing businesses. They also wanted to enter more lucrative businesses such as investment banking, securities trading, and insurance. From the mid-1980s, the commercial banks pushed to undermine and circumvent the legal strictures that kept them out of these lucrative businesses (Barth, et. al., 2000). They were supported in this effort by the Federal Reserve (Hendrickson, 2001). Throughout the 1980s and 1990s, the regulatory boundaries between various financial product and service markets were blurring as loopholes and new regulations permitted banks more freedom to pursue new markets. The repeal of the Glass Steagall Act in 1999, with passage of the Gramm-Leach-Bliley Act, signaled the final end to the regulatory segmentation of the financial system.

By 1999, bank mergers had created large financial conglomerates that no longer saw themselves as lending institutions but as diversified financial services firms (Hendrickson, 2001; Barth, et. al., 2000). Kaufman (2009: 100) shows that between 1990 and 2000, the 10 largest

financial institutions increased their share of industry assets from 10% to 50%. DeYoung and Rice (2003) document this shift across the population of commercial banks. They show that income from fee related activities increases from 24% in 1980 to 31% in 1990, to 35% in 1995, and 48% in 2003. The largest sources of this fee generation in 2003 were securitization, servicing mortgage and credit card loans, and investment banking (DeYoung and Rice, 2003: 42). This shows that commercial banks were moving away from traditional lending as the main source of revenue even before the repeal of the Glass Steagall Act.

This increased attention to fee generation through securitization and servicing was accompanied by a huge compositional shift in commercial banks' assets toward real estate debt, mostly in the form of GSE-backed MBS. Real estate related investments accounted for 32% of commercial banks' assets in 1986, increasing to 54% of assets in 2003. By 1999, Bank of America, Citibank, Wells Fargo, and J.P. Morgan Chase, had all shifted their businesses substantially from a customer based model to a fee based model centered on real estate. They would originate mortgages, sell them to the GSE, and then borrow money to buy and hold MBS as investments. They were not the only banks to embrace this model. Countrywide Financial and Washington Mutual Bank (a savings and loans bank) both rapidly entered into all parts of the mortgage business during the 1990s. Amongst investment banks, Bear Stearns entered the mortgage origination business by setting up lender and servicer EMC in the early 1990s. Lehman Brothers was also an early mover into the mortgage banking business, acquiring originators in 1999 and 2003 (Currie, 2007). Industrial product lenders GMAC and GE Capital also both moved into the business of originating mortgages and, eventually, even underwriting MBS issues (Inside Mortgage Finance, 2009).

One measure of the industrialization of the mortgage securitization is the degree to which all raw mortgages were being securitized. In the world of the early 1990s, when smaller and regional banks still dominated the various parts of the mortgage market, there were still a substantial number of mortgages held directly in bank portfolios. Figure 2 presents data on the rate of mortgage securitization for prime and nonconventional loans from 1995 until 2007. Nonconventional loans are securitized at a relatively low rate of 25% in 1995. The rate increases over the period to almost 90% by 2007. A similar pattern can be observed for prime or conforming loans (although this starts at a higher level due to the relative advancement of the GSE-controlled market by the 1990s).

(Figure 2 about here)

The MBS and CDO industry 2001-2008

The central role of the GSE in the mortgage market began to change after 2001. The GSE could not issue MBS for nonconventional mortgages and the increasing growth of that market prompted more firms to begin issuing and underwriting their own “private label” MBS. This was the final push that completed the vertical integration of mortgage securitization and the evolving industrial conception of control.

Figure 3 presents data on the size and composition of mortgage origination volumes from 1990-2008. Beginning in 2001, the overall mortgage origination market began to take off, increasing from \$1 trillion a year in 2001 to almost \$4 trillion in 2003. The main cause of this massive expansion was the low interest rates policy of the Federal Reserve which encouraged households to refinance their mortgages and buy new houses. One can see that from 1990-2003, conventional mortgages’ share remained high, about 70%. But beginning in 2003, this changed.

By 2006, 70% of loans were nonconventional. In 2005 and 2006, the peak years of the bubble, financial firms issued \$1 trillion of nonconventional MBS in each year, up from only \$100 billion in 2001 (Inside Mortgage Finance, 2009). It is this shift in the market that brought the integration process into its final phase. In essence, because the GSE could not package MBS from nonconventional loans until 2006, a lucrative opportunity opened up for financial firms.

(Figure 3 about here)

Why did the nonconventional market take off in 2004? After a record year in 2003, the mortgage securitization industry experienced a supply crisis in 2004. Figure 3 shows the 2004 drop-off in new mortgages was severe, with monthly origination volumes *declining over 70%* from \$200 billion in August 2003 to under \$60 billion a year later. The main cause of this decline was that the 2003 refinancing boom had run its course. Of the \$3.8 trillion of new mortgages written in 2003, \$2.53 trillion, about two thirds, was attributable to refinancing as borrowers took advantage of low rates. The precipitous drop in mortgage originations posed a major source of concern for industry actors given that the dominant business model was based on high throughput. Interest rates were still relatively low and there still existed a large demand for MBS from investors. Moreover, originators had grown their operations and needed more mortgages to fill their suddenly excess capacity. As an editorial in the Mortgage Bankers Association trade newsletter wrote:

“Mortgage originators who geared up their operations to capitalize on the boom now face a dilemma. Given a saturated conforming market that is highly sensitive to interest rates, where can retail originators turn for the new business they need to support the organizations they have built?” Mortgage Banking, May 1, 2004.

Barclays Capital researcher Jeff Salmon noted in May 2004 that, “The recent dearth of supply has caught the securitization market off guard” (Asset Securitization Report, May 17,

2004). If the financial industry was to keep the mortgage securitization machine churning, firms would somehow need to find a new source of mortgages. This crisis pushed industry actors to stabilize their supply of mortgages by collectively re-orienting to using non-conforming mortgages as an alternative source of fuel for MBS/CDO. This is in line with the “markets as politics” argument that firms in a crisis will try and stabilize their environments (Fligstein, 1996). As Figure 3 shows, the banks expanded into the nonconventional segments aggressively.

Reporting on discussions at the June 2004 American Securitization Forum in Las Vegas, the trade journal *Asset Securitization Report* noted that limited mortgage supply remained the “hot topic”, but also noted the generally “harmonious agreement” amongst analysts from the major banks that the largely untapped nonconventional market segments could offer a solution to the supply crunch (*Asset Securitization Report*, p.10, June 14, 2004). An editorial in *National Mortgage News* from March 2005 also highlighted the compensatory logic driving the growth of the nonconventional markets: “The nonconventional market is booming this year. Taking up the slack (as it did last year) for the big drop off in prime lending, and keeping record numbers of people employed in the mortgage industry”.

Countrywide Financial was one of the most successful leaders of this shift, and they became a model that other firms emulated in order to profit from nonconventional lending. Their annual report boasted:

“Countrywide’s well balanced business model continues to produce strong operational results amidst a transitional environment. Compared to a year ago, the total mortgage origination market is smaller as a result of lower refinance volume. This impact has been mitigated by Countrywide’s dramatic growth in purchase funding and record volumes of adjustable rate, home equity, and nonconventional loans”. (2005)

Nonconventional mortgages turned out to be enormously profitable. Mercer Oliver Wyman, a consulting firm, calculated that nonconventional mortgages accounted for 50% of the originations in 2005 and 85% of the profits (Mortgage Servicing News, 2005).

Figure 4 considers how the non-conventional mortgage securitization business came to be an increasingly core activity for the larger financial sector. It shows the degree to which the largest 25 financial firms in the United States (in terms of total assets) were also among the top-25 firms in nonconventional mortgage securitization segments. In 1998, only 4 (24%) of the 25 largest financial firms in the country were in the top 25 of any of the segments of nonconventional MBS. By 2006, 14 of the 25 (56%) were involved in the nonconventional MBS market.

(Figure 4 about here)

In sum, the shift toward nonconventional markets was caused by both a crisis and an opportunity. The crisis was the decline of the highly saturated market for conventional mortgages after 2003. The opportunity was the realization that nonconventional MBS would generate higher returns than prime mortgages. The absence of the GSEs allowed firms to integrate and capture all the fees at every step. Moreover, the riskier nature of the mortgages allowed firms to extract greater revenue from the financial engineering these non-agency-backed MBS could be used for. The resulting bonds also paid out higher returns as they were backed by mortgages with higher interest rates attached to them.

Vertical Integration Explored

It is important to show how this vertical integration strategy was embedded within a larger industrial conception of control. Actors understood the need to be involved in all vertical segments as not simply a form of diversification to generate fees, but as a linked production

system in which each of their positions reinforces the others with the goal of maximizing throughput.

Levine (2007) concludes:

“Why have the Wall Street firms so aggressively embraced this vertical integration strategy? The answer is to protect and leverage their returns from their mortgage underwriting and securitization desks. In fact, revenues from the fixed income divisions currently represent the largest components of the revenue mix for commercial and investment banks.”

This analysis comports with the contemporaneous rationales voiced by executives of the leading players. In a 2006 interview, Jan Remis, senior managing director at Bear Stearns, explained the need for backward integration because the industrial model was viable only so long as a firm could secure a ready supply of inputs:

"Wall Street firms require a major investment to maintain a successful securitization platform in the areas of research, sales and trading. To optimize this investment requires a steady source of raw materials--mortgages--which can be packaged into securities to support the capital-markets activities" (quoted in McGarity 2006).

Anthony Tufariello, head of the Morgan Stanley's Securitized Products Group, voiced a similar logic in announcing Morgan Stanley's purchase of mortgage originator Saxon Capital:

“The addition of Saxon to Morgan Stanley's global mortgage franchise will help us to capture the full economic value inherent in this business. This acquisition facilitates our goal of achieving vertical integration in the residential mortgage business, with ownership and control of the entire value chain, from origination to capital markets execution to active risk management” (Morgan Stanley, 2006)

According to Jeff Verschleiser, then co-head of mortgage trading at Bear Stearns:

“The key point to remember is that it's not just the buying that counts. It's the integration. Simply buying a mortgage originator and having it operate in a stand-alone capacity without leveraging the infrastructure of your institution is not something I would consider vertical integration.” (quoted in Currie 2007).

Of course, this integration was never entirely complete throughout the industry. Some medium-sized mortgage originators remained independent and continued to sell mortgages to

issuers in an originate-to-distribute model. Many others integrated forward into nonconventional MBS issuance, but hired investment banks to underwrite the deals. A few underwriters like Goldman Sachs never integrated backwards into origination. Nonetheless, integration was the dominant logic. By 2006, three quarters of all subprime mortgage originations were conducted by firms who also issued MBS (Inside Mortgage Finance 2009).

CDO and the Completion of Vertical Integration

The demand for MBS throughout this period was quite high. Indeed, one of the reasons the pivot towards the nonconventional markets was so swift was that firms faced a continuing demand for MBS products that were highly rated and paid relatively high rates of return. This demand was so high that banks began to produce a new set of products in large quantities at the same time: MBS-CDO. The proliferation of these instruments represents an important intersection between the socio-technical processes of financial innovation and the organizational processes of production. ABS-CDO represent a different technology that is more complex than the MBS that were issued (MacKenzie 2011).

In spite of the good market for MBS tranches, financial firms found that many bond buyers wanted to hold higher rated instruments. This left them with lower rated MBS tranches that they could not sell. CDO allowed financial firms to bundle otherwise unsalable BBB-rated “mezzanine” MBS into highly rated securities. They did so by producing tranches that allowed purchasers to buy the level of risk that the underlying bonds would default (MacKenzie, 2011). ABS-CDO production absorbed 92% of the 13,300 BBB rated MBS tranches produced in 2004 and 100% in 2005 (Cordell, et. al. 2012). In contrast, less than 10% of the AAA rated subprime MBS was ever recycled into ABS-CDO (Park 2013). The construction of CDO represented the

final phase of vertical integration that used the most unsalable raw materials, BBB rated nonconventional MBS tranches, and turned them into salable products.

ABS-CDO products received high ratings partially because of the way they were put together, but also by the way that ratings were constructed. MacKenzie (2011) shows that rising real estate prices and liberal assumptions about default correlations between different housing markets were used to create the ratings models that continued to view these instruments as low risk and high yielding. AAA ratings for nonconventional ABS-CDO made them one of the most attractive investments around in terms of alleged risk and return (see Carruthers and Stinchcombe (1999) for a thoughtful discussion of the role ratings agencies play in producing confidence in financial markets).

Investment banks were the leaders in the new CDO products. By 2005 Lehman Brothers was self-originating almost two-thirds of the mortgages contained in its \$133 billion of MBS/CDO issues (Currie 2007: 24). Meanwhile, the larger commercial bank holding companies who already had nonconventional mortgage origination operations as part of their large retail businesses sought to integrate forward into MBS underwriting and CDO production in order to capture fee revenue (Levine 2007).

Figure 5 presents data on the extent of vertical integration in subprime (B/C) production by tabulating the number of vertical market segments of the 25 financial firms who were amongst the largest participants in any of these segments. The four vertical segment categories included here are origination, MBS issuance, underwriting, and mortgage servicing. In 2002, only 25% of these firms which had large market share in any nonconventional production segment participated in three or four vertical segments in that market. But by 2006, this had risen

to 45%. In 2002, nearly 40% of these firms participated in only one segment of the market and by 2006, this had fallen to less than 20%.

(Figure 5 about here)

The Blurring of the Boundaries between Producers and Investors

The mass-production strategy eroded the basic distinction between producer and investor as financial firms began retaining a significant portion of their own product. As noted earlier, in the 1990s, banks frequently held onto agency backed MBS. Acharya and Richardson (2009) offer data showing that banks themselves – not outside investors – came to be the primary investors in ABS-CDO tranches after 2004. Fligstein and Goldstein (2010) show that investment banks increase their holdings from \$35 billion to \$175 billion from 2002-02007 and commercial banks increased their holdings from \$650 billion to \$1.1 trillion. Contrary to the theory of securitization as a way to distribute risks, the plurality of MBS/CDO assets became concentrated within the very same firms that were producing them. Acharya et al. (2013) term this “securitization without risk transfer.”

To understand why producers would retain their own products as investments, it is important to understand the varying investor demand for different tranches of ABS-CDO. Investors around the world were drawn to the high-yielding, highly-rated senior AAA tranches. But like subprime MBS, ABS-CDO also generated its own difficult-to-sell byproducts. This came in two different forms. First there were the lower-rated equity and mezzanine tranches, which amounted to approximately 20%-25% of the typical ABS-CDO deal. Few investors other than some hedge funds were interested in these tranches. Forensic accounts show that few of these were ever sold to outside investors (Park 2013). Instead, producers retained them by recycling them into their own third-order “CDO-squared” deals which were either sold off to

investors or held on the bank's account. As the Financial Crisis Investigation Committee concluded, "Merrill and other investment banks simply created demand for CDOs by manufacturing new ones to sell the harder-to-sell portions of the old ones" (2011, p.203).

The second byproduct of ABS-CDO production was larger quantity of so-called "super-senior" tranches. While ostensibly very safe, super-senior tranches were of little interest to outside investors because they yielded low returns. In order to hasten the completion of deals, expediency demanded that producers simply keep the "super-senior" tranches. Banks could generate profits from these bonds. They paid out at a higher rate of return than LIBOR and the AAA ratings meant that under the Basel capital regulations, banks could hold enormous quantities of super-senior ABS-CDO with little or no regulatory capital charges (Acharya and Richardson, 2009). By the summer of 2007, UBS's net exposure to retained super-senior was estimated to be \$50 billion, Citigroup's \$43 billion, Merrill Lynch's \$32 billion, and Morgan Stanley's \$11 billion (Triana 2011).⁶

In sum, the mortgage finance field came to be governed by a distinctly industrial model of vertically integrated mass-production. In the face of the expanding nonconventional mortgage market, all types of banking firms sought to position themselves across all segments of those markets. They would originate mortgages, act as issuers and underwriters for bonds based on those mortgages, create esoteric financial derivatives from MBS, find customers for those bonds at home and around the world, and profit by holding some MBS and/or CDO bonds as leveraged investments in their own portfolios. They also had "super senior" CDO bonds as a byproduct of their activities. Figure 6 presents the ideal-typical industrial model employed by the majority of

⁶ As mentioned earlier, it is difficult if not impossible to separate out the degree to which the holdings of banks on the eve of the crisis were investments, inventory to be sold, or super senior tranches that could not be sold. Banks did not have to publicly break down their investments into sufficient detail to figure this out.

the 25 largest financial firms in the U.S. on the eve of the market crash. The model did not resemble the “originate-to-distribute” strategy implied by the perverse incentives approach. Instead, there is ample evidence that financial firms embraced vertically integrated MBS/CDO production, and in many cases ended up retaining significant investments in the very instruments they had produced.

(Figure 6 about here)

The Industrial Model and the Meltdown: Three Hypotheses

Our basic argument is that when foreclosures of subprime mortgages began to rise in 2006, the financial firms that were the most vulnerable to the downturn were those that had vertically integrated. Banks who were integrated had grown the subprime market, had issued some of the most risky mortgages, and were producing MBS and CDO based on those mortgages. As the market for those securities began to dry up in 2007, they held billions of dollars of securities that were difficult to value. In spite of the market slowdown, they found it difficult to change their course of direction and stop purchasing mortgages to produce securities. Their profits were entirely based on the flow of mortgages which produced revenue at each phase of the process. Moreover, employees were compensated based on how much was produced at each part of the process. They were funding these securities using short term borrowings mostly from the asset backed commercial paper market (Acharya, et. al., 2013; Gorton, 2010). In this section, we construct some hypotheses about the implications of these actions for the poor performance of these banks in the crisis.

It has been well known that as the housing price bubble entered its final phase, loan underwriting standards were declining and low-documentation loans were increasing. Both of these were later associated with heightened defaults (Mayer, Pence, and Sherlund 2009;

Demyanyk and Van Hamert, 2011). Subprime mortgages that were securitized after 2006 defaulted at elevated rates compared to similar unsecuritized mortgages, suggesting that the ability to securitize mortgages promoted lax screening (Keys, et. al., 2010). At the end, issuers produced MBS and CDO tranches that tended to perform significantly worse relative to their initial ratings, reflecting the lower quality of the loans used to produce them (Cordell, et. al. 2012).

There are two alternative hypotheses about the relationship between the organization of MBS/CDO production markets and the race to the bottom that produced ever-lower quality securities composed of the riskiest mortgages. The perverse incentives theory suggests that misaligned incentives encouraged insufficiently diligent and/or fraudulent practices at each stage of the securitization process. This implies that less integrated issuers should issue MBS that turn out to be of lower quality relative to its initial rating since it is exposed to more lax monitoring and adverse selection throughout the production process (Immergluck 2008; Purnanandam 2011). Conversely, such a transaction-cost perspective would view vertical integration as a strategy to obviate the hazards of market transactions by internalizing them within hierarchies, thereby facilitating better quality control (Williamson 1983).

In contrast, our account implies that banks' integration strategies were never about reducing risk or enhancing monitoring capabilities, but were intended to capture the maximum quantity of mortgages to feed through their pipelines. The continuing need for high-yield loans helps make sense of evidence that banks were slackening underwriting standards and marketing deceptively affordable products to consumers.

At the hearings of the Joint Economic Committee of Congress (2007), Kurt Eggert, a law professor testified:

“I think we’ve had a presentation of the secondary market as mere passive, you know, purchasers of loans, that it’s really the originators who decide the loan. But if you talk to people on the origination side, they’ll tell you the complete opposite. They’ll say, you know, our underwriting criteria are set by the secondary market. They tell us what kind of loans they want to buy. They tell us what underwriting criteria to use.”

William Dallas, CEO of bankrupt mortgage owner Ownit, which was partially owned by Merrill Lynch, told the New York Times:

“Merrill Lynch told me we should offer more low-documentation loans in which the borrower’s income is not verified. They wanted these loans because they could make more money off of them. They told me that if we did not provide these loans, we would forego profits.” (New York Times, November 7, 2008).

Securing ever worse loans was driven by integrated producers’ need to keep feeding their pipelines with as many risky mortgages as possible. Forward integration into CDO production exacerbated this problem by heightening demand for the very riskiest mortgages. The empirical implication of this argument is that both forward integration into CDO production and backward integration into origination both undermined the quality of the MBS that was produced. This brings us to the following hypothesis:

Hypothesis 1: The more vertical production segments in which an issuer of nonconventional MBS operated, the worse the (ex-post) quality of the subprime MBS issued by that firm.

This need to keep supplying mortgages in order to produce MBS/CDO helps us to account for the seemingly anomalous fact that MBS/CDO producers remained deeply involved in loan origination even as signs of the mortgage market's mounting crisis began to accumulate. In 2006, housing prices started to decline, delinquency rates rose steeply, and several home builders went out of business. Discussion of a housing price bubble became increasingly prevalent in the business press as the bubble grew (Zuckerman 2010). Nonetheless the investment banks continued to expand aggressively in nonconventional MBS production through early 2007. During late 2006 and early 2007, Bear Stearns, Merrill Lynch, and Morgan Stanley

acquired additional nonconventional originators.

The trade group, the American Securitization Forum summarized what was going on in early 2007:

“In the past, predicting what investment banks would do at this stage of the housing cycle used to be simple. Having ramped up the business while the going was good, they would then shutter it at the first sign of trouble. That’s what happened with the mortgage conduit business in the 1980s, and again in the early 1990s. This time, it’s different. Wall Street seems to have thrown out its old and trusty playbook. Instead of pulling back in 2006, several major firms went on a spending spree. That might sound strange to some. Buying at the start of downturn surely risks overpaying for an asset whose business is in decline. So why do it? Well, despite the gloomy outlook, competition is not letting up. First, clients [of investment banks] have been setting up capital-markets desks to securitize their own loans in their own version of vertical integration. Countrywide is the most renowned for doing this, but others from SunTrust to IndyMac have taken the plunge, and still others are following. Second, more players are trying to buy loans that are still for sale. That’s especially true of the mortgage market, where vertical integration has been most rampant. “In 2000 we’d have maybe five or six groups bidding on a loan sale,” says Commaroto. “Now there are 20 or more. [...] The more bidders, the higher prices can go, and that, of course, can undermine the economics of a securitization. It also means a desk has more chance of not getting enough loans in a timely manner.”

In this way, widespread adoption of the vertically-integrated model propelled itself forward in a path-dependent fashion: securitizers wanted to keep their pipelines flowing. But to do so they had to pursue further integration in order to secure an ever-diminishing supply of available mortgages and avoid being cut out of the value chain by their competitors, who were also integrated.⁷

But vertical integration reduced organizational flexibility and rendered firms less responsive to signs of impending trouble. Organizations are typically inert because their forms and practices rest on sticky cognitive, structural, and resource commitments (Hannan and

⁷ One could interpret firms’ continuing production of MBS after housing peak as part of a strategic endgame, in which each producer realized the end was near, but sought to profit from selling MBS as long as possible before exiting at the last moment (Zuckerman 2010). However, expanding origination capacity through acquisitions and further vertical integration does not appear consistent with a “quick-exit” strategy. To the extent that firms became more organizationally enmeshed, they became less capable of exiting rapidly.

Freeman 1984; Scott 1995). Structural inertia is especially acute for vertically-integrated firms because of their investments in all phases of a business. As a result, managers are more likely to remain wedded to flawed strategies when they involve sunk costs (Staw, 1997; Ghemawat, 1991). So, for example, at J.P. Morgan, which adopted a relatively cautious MBS strategy and was a laggard in terms of vertical integration, Gillian Tett documents strong reluctance amongst top executives to “shut the spigots” of the nascent mortgage pipeline they had worked so hard to build once subprime defaults began to rise (2008, p.123-4).

Firms that were integrated across more stages of the production process also contain more sub-units with heterogeneous interests. For instance, in 2006, managers within Lehman Brothers’ securitized products division advocated sharply curtailing nonconventional mortgage originations as they found themselves accruing unsold inventories of MBS. These managers claim that their efforts were rebuffed by managers in the mortgage capital division, which had a clear interest in continuing to maximize origination (United States Bankruptcy Court 2010, p.86).

This argument suggests that the mass-production model induced organizational lock-in through both structural and cognitive mechanisms: Even in the face of declining housing prices and rising mortgage default rates, the industrial strategy had oriented actors toward continued mortgage origination and production of securities. Moreover, the integrated organizational structures they had adopted rendered them more inert. This leads us to our second hypothesis:

Hypothesis 3: Among firms involved in the MBS production market, those that were more vertically integrated are more likely to have failed after the market turned down in 2007.

A second hypothesis relates to financial losses suffered by banks in the wake of the crisis. Globally, accounting write-downs on MBS and mortgage-based CDO among large financial firms totaled more than \$315 billion from mid-2007 to mid-2009 (Bloomberg 2010).

Conventional accounts inspired by the “perverse incentives” theory emphasize that producers of MBS/CDO sold dubious assets to outside investors, especially during the endgame of 2007.⁸ This theory implies that financial firms who were not directly involved in production of U.S. MBS would experience greater relative losses because they were less savvy to the complex intricacies of MBS/CDOs and more dependent on the flawed, overinflated credit ratings. Meanwhile, more integrated producers would experience lesser investment losses because they had informational advantages about the riskiness of the instruments.

There are multiple mechanisms by which the industrial conception of the MBS/CDO producers would experience greater losses. First, banks were amongst the largest buyers of their own products for investment purposes. Second, more integrated producers would have been exposed to a greater quantity of MBS/CDO simply because they had accumulated more “super-senior” tranches as a result of their greater production volumes. Third, integrated producers were caught holding inventories of MBS/CDO they had intended to sell, as well as component pieces in various stages of the production process. It could take up to six months for a newly originated mortgage to become a fractional income stream in ABS-CDO.⁹

By early 2006, many industry actors were openly questioning the sustainability of the housing bubble and deriding the quality of recent MBS/CDO issues (Zuckerman 2010). Doubts intensified at the same time that the emergence of new market devices like CDS, and the

⁸ One prominent case of this occurred at Goldman Sachs, which shorted subprime ABS-CDOs (bet against them) even while continuing to profit from their production (Lewis, 2010). Numerous lawsuits have alleged similarly duplicitous (albeit more isolated) behavior at other MBS/CDO producers.

⁹ It is difficult at the bank level to untangle the degree to which each of these factors contributed to the overall holdings of MBS and CDO on the eve of the crisis. Banks were not required to break out in their accounting statements into whether or not holdings were investments or inventories. We know that when firms were making lots of profits from 2001-2006, these holdings increased dramatically. But we also know that from 2007 until mid-2008, holdings increased as well implying that inventories were piling up.

subprime ABX index all made it possible to short (bet against) MBS/CDO in various ways. Actors within producing banks were best-positioned to perceive the dubious quality of their investment holdings (after all, they had produced these instruments!). Yet very few of the firms producing MBS/CDOs made any systematic attempts to sell their investments until it was too late (Mackenzie 2011; Lewis, 2010).

There were several factors at play. First, some executives believed that hedges in the form of credit default swaps amounted to insurance on default risk. Second, as we have already mentioned, banks were reluctant to give up on their mortgage pipelines because of their commitment to making money at each phase of the process. An example of this dynamic can be found in the contrasting outcomes of two well-known cases where bearish traders sought to convince executives to shed investment against the overinflated market.

In 2006, Deutsche Bank's top CDO trader, Greg Lippmann, became convinced that the subprime MBS and ABS-CDO markets were bound for a spectacular collapse. Lippmann took his case to top executives, proposing a firm-wide effort to unwind Deutsche Bank's MBS/CDO holdings and then short the market. Lippmann's arguments fell on deaf ears, and Deutsche Bank ultimately took \$4.5 billion in losses on its MBS/CDO investments (U.S. Senate 2011; Lewis 2010; Zuckerman 2010). Lippmann's inability to convince his superiors is less surprising when one considers that the bank's residential mortgage securitization unit was simultaneously in the final stages of completing a \$430 million acquisition of the subprime originator MortgageIT, along with its 27 offices and 2100 employees. This was Deutsche Bank's second originator acquisition of the year. Thus Lippmann's proposed investment strategy was operating at complete cross-purposes with the firm's strategic commitment to keep stocking its warehouse of subprime MBS in accordance with the industrial model.

Around the same time, three traders at Goldman Sachs spurred a similar initiative. Unlike Lippmann, they succeeded in convincing top executives that Goldman should systematically shed its super-senior investments (at a loss) and then short the market. Unlike Deutsche Bank, Goldman Sachs had not embraced the industrial model. Although it was the fourth largest underwriter of mortgage-related ABS-CDOs, it had not created an integrated pipeline like most of its competitors. Currie (2007) notes the “conspicuous absence” of Goldman from the rush to acquire non-prime originators in 2005 and 2006.

This leads us to our final hypothesis:

H3: Banking firms that were more integrated in nonconventional production experienced greater subsequent losses on MBS/CDO investments.

Data and Methods

We use three different datasets to test our hypotheses. The data set in this analysis is comprised of annual firm-level data on for the top 25 subprime (B/C MBS) issuers, which comes from Inside Mortgage Finance (2009). This data is matched to data on the subsequent ratings history of B/C MBS securities issued by these firms, which was reported by Bloomberg (2009). The unit of analysis is the firm-year. We make no attempt to account for censoring since the top 25 issuers account for over 90% of the market throughout this period.

We assess the effect of vertical integration on subprime MBS quality by modeling the average magnitude of *ex post* credit downgrades for each firm's MBS tranches which were issued from 2002 through 2007, and which were backed by pools of subprime (“B/C”) mortgages. Ex-post credit downgrades are a commonly used measure to capture the underlying quality of bonds (Benmelech and Dlugosz 2009; Barnett-Hart 2009). The basic argument is that the revealed quality of the bonds will come out as the revised credit rating reflects the actual default rates of the underlying mortgages. Beginning in mid-2007, the credit ratings agencies began

downgrading MBS and CDO en masse. This measure is calculated by summing the difference (in full letter-grades) between the credit rating at time of issuance and as of May 31, 2009 for each subprime tranche issued by a given firm, and then dividing by the number of subprime tranches issued by the firm that year. Greater values denote more severe overrating, i.e. lower quality relative to the original rating.

We estimate a fixed effects panel model for the analysis. The two main independent variables of interest are backward integration by issuers into origination, and forward integration by originators into CDO issuance. We measure these using a dummy variable indicating whether the subprime issuer was also a top-25 firm in subprime origination or a top-10 producer of mortgage-related ABS-CDO. The “perverse incentives” perspective predicts a negative association between integration and downgrade magnitude, while the “markets as politics” thesis predicts a positive association.

The model includes controls for competitive pressures as measured by changes in each issuers' market share, and growth as measured by the rate of change in its volume of B/C MBS issuance. Firms may face pressures to cut corners at various stages of the securitization process as their share of the increasingly competitive market diminishes. They may also be more likely to sacrifice quality as they pursue a strategy of rapid growth in the subprime market. Evidence suggests vertical integration occurred as part of a larger growth strategy, but it is important to understand the effects of integration on bond quality independently of the increasing issuance volume with which it may also be associated.

We include national-level variables on the overall size of the prime and subprime mortgage markets in order to index the overall growth of the mortgage bubble and to capture any effects of shifts in overall mortgage supply. The quality of MBS bonds packaged in a given year

may be partly a function of the scarcity of subprime mortgages and alternative mortgage markets in the preceding year if scarcity spurs firms to become more desperate in seeking out any mortgages they can find. Finally, the model includes an indicator for whether the issuing firm had been involved in the prime origination market during the preceding year in order to control for the possibility that backwardly integrating subprime issuers experienced declines in bond quality simply because they had no prior experience or capabilities in origination. All covariates are lagged one year to preclude reverse causation.

Our second data analysis uses data from Inside Mortgage Finance (2009) as well. The data sample for the failure analysis includes firms that were a top-20 player in any subprime (B/C) business segment (mortgage origination, MBS issuance, MBS underwriting, or mortgage servicing) during 2006 or 2007. This produces an N of 31 firms, of which 20 had failed by July 2009. We use a cross-sectional logit regression to test whether the firm's level of integration in subprime MBS production (measured by number of segments in which it participated circa 2007) heightened the likelihood of subsequent failure.

Vertical integration is measured by counting the number of vertical segments in which each firm participated, which ranges from one to four. We define firm failures to include distressed merger or takeovers, bankruptcy, or nationalization between July 2007 and July 2009. In all these cases the firm either ceases to exist or undergoes a substantial shift in ownership. Firms that survive through government bailouts or by changing their regulatory status are treated as surviving.

One potential problem with our definition of failure in this case is that many firms who survived only did so through the "exogenous" intervention of government bailouts. We note, however, that this approach is effectively conservative in regards to testing our hypothesis of a

positive relationship between vertical integration and firm death. For instance Citigroup, the firm which took the largest losses of all on MBS and which was widely considered the most likely to fail in the absence of the TARP funds, was also one of the most vertically integrated.

The effective firm-level unit of analysis is the parent financial firm. The death of a mortgage or securitization subsidiary is not treated as a death unless the financial parent firm dies as well. The one exception is in cases where the ultimate parent is primarily a non-financial firm. For instance, although General Motors entered bankruptcy in 2009, we do not code its surviving mortgage subsidiary, GMAC, as failing since the parent firm's failure was not directly related to the MBS meltdown. This coding decision is again conservative in regards to our hypothesis insofar as the surviving GMAC mortgage unit was fully vertically integrated.

The failure model includes controls for firm size and diversification. We include dummy variables for a) whether the firm is a subprime specialist, and b) whether the firm is one of the 30 largest financial firms in the US market, as measured by the Compustat total assets figure. Larger, and more diversified firms may have been less dependent on the subprime mortgage-related business, and they may have had more resources to weather a crisis in that market compared to subprime specialists. Larger firms were also more likely to be deemed "too big to fail" and thereby benefit from government bailouts.¹⁰

The third hypothesis is tested using a data sample that differs considerably from the two others because the aim is to analyze investment losses not only within the population of non-

¹⁰ Note that the small sample size (N=31) severely limits the number of covariates we can reasonably include in the logit model. We experimented with additional controls to measure the *depth* of a firm's involvement in each subprime MBS production segment. Those (unreported) models also show that *integration across production segments* has a significant positive, independent association with failure likelihood. We also sought data on firms' leverage ratios, but we could only acquire this data for twenty-four of the thirty-one firms since private companies are not required to report this information.

conventional MBS producers, but across a broader population of banking, investment, and securities firms from around the world. This dataset includes publicly-traded banking, investment, and securities broker firms with assets over \$10 billion that were included in the Compustat North America and Compustat Global databases. It does not include insurance companies. This amounts to a total of 163 firms from 22 countries. Although the sample does not purport to be representative of all MBS investors (several significant classes of investors such as hedge funds, pension funds, and sovereign wealth funds are not included), it does cover the vast majority of large, publicly-traded banking and securities firms that were at the center of the crisis. This sample is useful for comparing investment outcomes for producers and non-producers insofar as the units of analysis are broadly equivalent entities, all of whom were at risk for investing in MBS/CDO.

The dependent variable of interest is firms' cumulative investment losses on MBS/CDO during the crisis period from Q2-2007 through Q3-2009. Investment losses on MBS assets are measured using accounting data on "write downs" which were acquired from Bloomberg's WDIC database. Bloomberg collected information from financial statements, announcements, and financial news sources in order to track firms' cumulative write-downs as a result of the crisis. For the present analysis we include only write-downs on assets which were directly tied to mortgages. This includes the Bloomberg categories RMBS, SUB, CDO, and "other mortgage related assets". Our measure purposely excludes losses on loan portfolios, investments in other firms, and other non-mortgage-related investments. The rationale for this is to separate direct losses from MBS-related investments from the broader liquidity crisis which they spawned.¹¹

¹¹ One further issue is censoring on the dependent variable. The Bloomberg WDIC database reports losses only for

The dependent variable is measured as the natural logarithm of one plus total mortgage-related write-downs over the period Q1.2007-Q4.2009. We take the log in order to compensate for the skewed distribution of losses. Using a scaled ratio measure of (non-logged) write-downs-to-assets yields very similar results. The main explanatory variable of interest is the number of vertical segments of the non-conventional MBS/CDO production chain in which the firm was a major player during 2005 or 2006 (top 20 for MBS segments, top 15 for ABS-CDO). Note that this integration measure ranges from 0-5 (rather than 1-5) because the data sample includes MBS/CDO investors that were not involved in any MBS production segment.

We control for firm size using the logarithm of total assets since larger firms will tend to experience greater absolute losses. Size also proxies for a host of other firm characteristics which may have contributed to losses on MBS. For instance, larger, less nimble firms may have been less capable of reacting quickly once the market began to unravel and liquidity dried up. Including firm size also helps guard against spurious correlation due to risk-taking incentives associated with the “too big to fail” hypothesis.

We include a dummy indicator for whether the firm is foreign- or U.S.-based (foreign subsidiaries are treated as foreign) since geographic proximity to the U.S. market may affect both the degree of involvement in the mortgage industry as well as investment losses. Approximately 56% of the firms in the sample are from outside the United States. Only 10% of the foreign firms in the sample were major players in U.S. MBS production. We also include a cross-product

firms with total cumulative asset write-downs in excess of \$100 million. Firms included in the Compustat database but omitted from the Bloomberg database are coded as having zero write-downs. This means that some censored cases reported as zeros may have small non-zero losses. Since the study sample is confined to large firms with assets in excess of \$10 billion, censoring should have little substantive impact (Erkens, Hung and Matos 2011). In all of the censored cases, actual losses necessarily represent less than 1% of total firm assets.

interaction term between log assets and foreign/domestic, as the effect of size may differ for foreign banks. Finally, we report a separate specification that includes a measure of the firm's total ABS-CDO production volume since 2002. Firms with greater ABS-CDO production volume will tend to accumulate more super-senior debt, independently of their degree of integration.

Results

Table 1 presents the fixed-effects estimates of the average magnitude of credit downgrades for subprime MBS issued by a given firm in a given year. Turning first to the control variables, the results provide some marginally significant evidence that firms diluted quality in response to competitive pressures. Each 1% drop in an issuer's market share was associated on average with a .14 letter grade increase in overrating during the following year. Coefficients for the total size of prime and subprime origination sectors show that diminishing quality in the subprime MBS sector tracked the expansion of the market and the decline of the prime sector. This is significant because it shows that the average riskiness of subprime MBS increased even as the aggregate availability of subprime mortgages expanded. More important for our argument, the results show that the *ex post* quality of issuers' subprime MBS declined after they integrated backwards by entering the origination business: Overrating of a firm's securities increased on average by a full letter grade after the firm began issuing bonds composed of self-originated mortgage pools.

(Table 1 about here)

Models 3 and 4 show that firms' forward integration into ABS-CDO issuance also fed back to undermine the quality of their subprime MBS. After integrating forward into ABS-CDO

production, firms issued subprime MBS that was subjected to a full additional letter grade of downgrades on average. This is consistent with the idea that satisfying the input demands from their ABS-CDO desks pushed banks to cut more corners in the production of MBS. We note that the effects of forward- and backward-integration appear to be additive insofar as each attains independently of the other.

Taken together, these results suggest that the spread of the vertically-integrated production model helped propel the downward slide in subprime MBS quality that occurred after 2003. This supports Hypothesis 1, and it runs counter to the predictions of the perverse incentives perspective. It also contrasts with standard economic perspectives on vertical integration as a strategy to enhance monitoring in situations where market transactions are characterized by moral hazard. In this case, issuers' internalization of the value chain had the opposite effect. Integrated firms diminished quality in order to feed the maximum quantity of raw mortgages through their pipelines.

The results reported in Table 1 concern the relationship between organizational structure and the subsequent performance of *subprime MBS*. One might object, however, that *ABS-CDO* performance – *not MBS* performance – is the more relevant outcome metric since *ABS-CDO* increasingly represented the final product that was sold to investors and kept on firms' books after 2004 (MacKenzie 2011). To assess whether a negative effect of vertically-integrated production also holds for *ABS-CDO* securities, we triangulated between our data on organizational structure and the results of a recent study of *CDO* performance by Cordell et al. (2012). They use a proprietary dataset from *Intex* to examine the effect of *CDO* dealer identity on loss rates among the population of 727 *ABS-CDO* deals underwritten by the 17 largest *CDO* producers from 2000-2007. Their unique data allows them to model deal-level loss rates ([actual

write-downs + expected write-downs] / principal value), conditional on the observable characteristics of the securities. These characteristics, which would be observable to investors, include deal attributes, tranche attributes, composition of the underlying asset collateral, and year of issuance. They then estimate firm-fixed effects and rank the 17 major ABS-CDO dealers according to the degree to which their securities tended to under- or over-perform comparable securities issued by other firms in the same year. The amount of firm-level variation is significant: adjusted average loss rates on ABS-CDO underwritten by the worst performer (Morgan Stanley) were 17% higher than those underwritten by the best performer (Dresdner) (2012, table 14).

We examine the relationship between ABS-CDO performance and organizational structure by coding for whether each ABS-CDO dealer had a backwardly-integrated MBS pipeline (defined as being a major player in both nonconventional mortgage origination and MBS issuance) at the height of the ABS-CDO market in 2006. By this metric, 10 of the 17 largest ABS-CDO producers were fully integrated in subprime MBS production circa 2006. Table 2 shows the relationship between integration and ABS-CDO quality: Of the five firms who issued the worst-performing ABS-CDOs on average, all but one of them (UBS) had adopted the integrated mass-production structure. Conversely, among the five issuers whose CDO instruments performed best relative to their observable characteristics, only one (JPMorgan) had an integrated subprime mortgage pipeline. Across all seventeen dealers, the biserial correlation coefficient between the firm fixed-effects reported by Cordell et al., and our dichotomous backward integration measure is $\rho = .60$ (S.E. = .22).

This result provides an additional point of evidence in support of Hypothesis 1. Not only did backwardly- and forwardly integrated MBS issuers generate worse performing MBS, but

backwardly-integrated CDO issuers also tended to issue worse-performing ABS-CDOs.¹² More broadly, the pattern for ABS-CDO performance also lends support to our theorized relationship between financial innovation and productive organization. While the technical assumptions embedded in ABS-CDO made them dangerous in general (Mackenzie 2011), they became especially dangerous when harnessed into the industrial production structure.

(Table 2 here)

Hypothesis 2 proposes that those firms which were more vertically integrated would be more likely to fail in the aftermath of the meltdown. Table 3 presents results of logit estimations testing this hypothesis. The coefficient estimates indicate that firms which were more fully integrated across nonconventional securitization markets (origination, issuance, underwriting, servicing) as of July 2007 were significantly more likely to fail thereafter. For each additional vertical segment across which the firm was integrated, the estimated ratio of the odds of dying (versus the odds of surviving) increases by a factor of 4.8. This association is substantively sizeable and statistically significant despite the small number of observations (n=31).

(Table 3 here)

The results in Table 3 provide further evidence that the industrialization of

¹² This does not entirely disprove the perverse incentives account because it does not address the nexus between producers and investors: underperformance could reflect a dynamic whereby some integrated firms sought to use their asymmetric knowledge about the instruments in order to purposely sell lemons to unwitting investors. If such opportunism were the driving force behind CDO performance variation, then we would expect that those firms' which issued the worst-performing products on would have experienced lesser investment losses themselves (compared to those firms which produced better-performing products). We assessed this possibility by examining the association between the quality of a producer's ABS-CDO products and the firms' own investment losses on MBS/ABS-CDO (relative to firm size). We did not find any evidence of a significant relationship. If anything, the lowest-quality producers tended to experience slightly greater investment losses (results available).

nonconventional securitization was as key to the market's demise as its growth. The more fully that firms pursued the vertical integration strategy, the more likely they were to fail. Ancillary analyses also show that the effect of integration attains independently of the size of the firm's stake in each of its mortgage-related businesses. In other words, it is not simply that firms with larger stakes in nonconventional markets were more susceptible when the market collapsed, but *integration across* these markets mattered independently.

Hypothesis 3 predicted that the more vertical production segments in which a banking firm was involved, the greater its subsequent investment losses on MBS-related assets. Table 4 shows the regression results for this analysis. The estimates lend strong support to hypothesis 3. The sign on the production segments variable is positive and the magnitude is quite substantial: across the two specifications, a one unit increase in the number of vertical production segments is associated with taking between 115%-140% greater subsequent write-downs on MBS-related assets.

(Table 4 here)

Note that the addition of the ABS-CDO production volume measure in the second column of table 4 attenuates the estimate for vertical integration somewhat. This is consistent with the idea that more integrated producers experienced greater losses in part because they had simply accumulated more super-senior byproduct. Yet the fact that the estimate remains so sizeable (115%) suggests that the spillover effect of the industrial production on investment losses was not solely an artifact of total volume produced. This is consistent with our argument that the industrial model also made firms more vulnerable to losses as a result of organizational lock-in.

The results in table 4 are also robust to several alternative specifications. Given the zero-inflated distribution of the production segments variable, we experimented with treating it as an ordinal rather than interval measure. Consistent with the above result, this approach shows that intercept estimates increase roughly linearly across the range of production segments. This implies that the positive association between integration and subsequent investment losses does not simply reflect differential outcomes for producers and non-producers (zeros versus non-zeros), but that increasing *degrees of integration* on the production side are associated with more substantial investment losses.¹³

Discussion and Conclusion

We began this paper by asking a focused question about the recent financial crisis: why did the banks take on so much risk in the form of mortgage backed securities and why were they so unable to escape those risks once it became clear that the mortgages underlying the bonds were so vulnerable? Our paper provides a clear and coherent answer to that question. The conception of control that came to dominate the largest financial firms in the U.S. produced an industrial model of vertical integration that brought them to mass-produce MBS and CDO in order to make money off of all phases of the securitization process. The “industrial” model was enormously profitable as long as house prices went up and the supply of mortgages was sufficient to feed the pipeline.

After 2003, saturation in the conventional mortgage market meant that financial firms ended up substituting riskier nonconventional mortgages to feed their securitization machines.

¹³ One caveat to bear in mind is that the investment loss analysis is confined to large banking and securities firms. Some other types of non-producer investors such as hedge funds may have experienced comparatively greater losses.

The average quality of subprime issuers' securities declined significantly after they integrated backwards into subprime origination and after they integrated forward into repackaging of MBS into ABS-CDO. Most of these firms did not exit the production market even as house prices began to turn down because their core business model depended on interdependent revenue streams at all phases of the process. The industrial model is consistent with what we have shown: the issuance of securities that were of lower and lower quality, high losses on the securities that they held, and for many of these banks, organizational "death". Our empirical findings provide evidence that the "perverse incentives" explanation of the crisis is wrong. By viewing these markets as production markets, we shed light on a set of organizational processes that have been almost entirely overlooked in the literature on the financial crisis.

Our findings imply that industrial model plays an important role in explaining why so many firms unraveled despite the fact that many traders within these firms recognized the vulnerability of their investment holdings (Zuckerman 2010). One obvious avenue for future research is to unpack the intraorganizational mechanisms underlying these organizational failures. There are several plausible stories for why managers responded so slowly to the crisis. One is that as the banks themselves became more organizationally complex and positioned in more market segments, very few actors had a panoramic understanding of what was going on in different parts of the firm. Few top executives fully grasped how their banks were making money and the riskiness of investments that were piling up at various trading desks and off-balance sheet entities.

Another story involves compensation incentives. Almost everyone's compensation was tied to how much they produced in the short-term. This generated a bias toward "doing deals" (Ho 2009). Traders like Greg Lippman, who recognized the vulnerability of MBS/CDO

investment holdings, were unable to overcome the strong producer bias that had been institutionalized elsewhere throughout the organization. Finally, many actors may have bought into their own sales pitches about the power of financial engineering to tame risk. Mathematical risk models operated as powerful sense-making devices to justify chosen courses of action even in the face of countervailing signals.

Some caveats are in order. We have not claimed to offer a general explanation that accounts for all facets of the financial crisis. Instead, we have tried to show how the strategies, structures, and products of financial firms shaped the evolution of the mortgage finance sector, and how the crisis emerged from this industrial configuration. Much work needs to be done to flesh out and synthesize other aspects of this development. We have barely mentioned the role of regulators, deregulation, and government in facilitating the processes we discuss. We have also not considered the role of the credit rating agencies in enabling the rapid expansion of nonconventional MBS and CDO (see Rona-Tas and Hiss 2010). We have not discussed the array of financial products including credit default swaps which were used as insurance by some financial firms to offset their investment in nonconventional MBS and CDO. We have also not emphasized the role of the asset backed commercial paper market that allowed banks to fund their origination, securitization, and investment activities (Gorton, 2010; Acharya, et. al., 2013)

Our findings have both empirical and theoretical implications for the economic sociology of financial markets. First, our results challenge received understandings about historical trajectories and organizational logics within financial capitalism. Scholars have tended to conceive of the rise of a finance-dominated economy as marking a sharp break with the Fordist mass-production logics of the 20th century (Davis 2009). During the 1980s and 1990s, financial markets and investment banks were instrumental in forcing corporations to de-diversify and

adopt flexible specialization models (Davis 2009; Ho 2009). It is ironic that the financial sector, which was so integral to the disintegration of production in the “real economy”, should come to embrace key facets of industrial Fordism. These include large firms competing across multiple market segments, mass production as a central strategy, and vertical integration as the cognate organizational structure.

Second, our analysis uses the important case of mortgage securitization to open new lines of engagement between the sociology of markets and the sociology of finance. We advance this agenda by showing how financial markets can be usefully conceived in terms of firms positioning themselves within production chains (White 2002; Fligstein 1996). We show the coevolution of socio-technical and organizational aspects of markets. Our results show that new kinds of financial knowledge, models, and instruments reshaped existing markets and the behavior of firms. But, financial firms, their conceptions of their main businesses, and their crises and opportunities structure the deployment of financial innovations as well.

So, for example, the invention of mortgage securitization eventually changed the way Americans got mortgages. But, it was over 20 years from the issuance of the first MBS by Ginnie Mae in 1970 to its dominance as a way to finance mortgages in the 1990s. It took the collapse of the savings and loan industry, the innovation of the investment banking business to figure out how to sell the securities, and the efforts of the GSE to actually set up the markets that organized mortgage originators, issuers, underwriters, servicers, and investors. Without these large changes in the identities of the banks and the reconstruction of the market for mortgages by the GSE, mortgage securitization would have remained an interesting idea that was never implemented.

As a result of the creation of the markets that organized mortgage securitization, financial innovation around mortgages became the central business of most of the largest financial institutions in the U.S. from the 1990s on. As banks realized they could profit at all points in the chain of production of MBS, the barriers between types of banks disappeared and what remained was the vertically integrated bank that produced mortgages for sale and investment. It was the industrial conception of control which grew the market for nonconventional mortgages as banks found themselves in need of a new supply of mortgages in order to keep their securitization businesses running in 2003-04. The borrowing of CDO from industrial bonds markets was the result of banks realizing that the financial instruments they were using for one purpose could be applied to entirely new purpose. The use of CDO technology solved their problem of what to do with lower rated nonconventional MBS tranches that they were not able to sell thereby allowing them to profit once again on the mortgages they had originated.

We suspect that the erosion of regulatory boundaries between different types of financial market activities since the 1990s has wrought all sorts of complex interconnections between different types of action across multiple arenas of finance. In this context, scholars should be especially wary of separating financial modeling, investment, and trading as a separate realm of study from firms, industry structures, and production activities. Our intervention points to the need for further efforts to develop a more integrative theoretical framework for the economic sociology of 21st century financial markets.

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Figure 1: The role structure of the mortgage securitization industry circa 1990

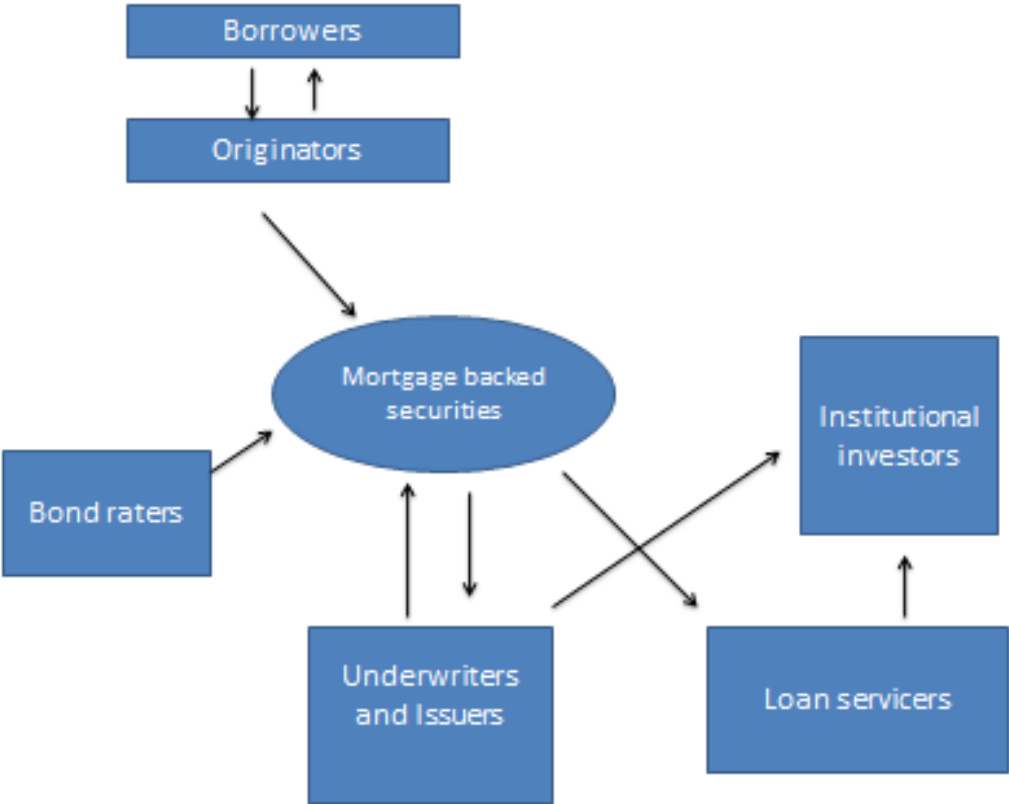


Figure 2: Percentage of all originated mortgages that were securitized (Source: Inside Mortgage Finance, 2009)

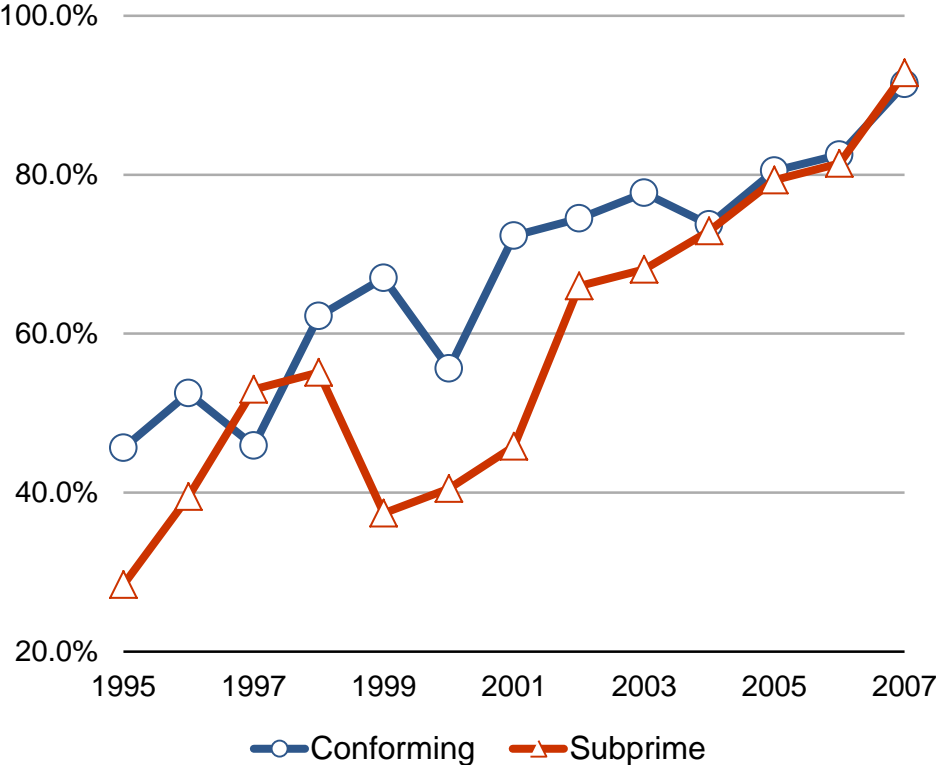
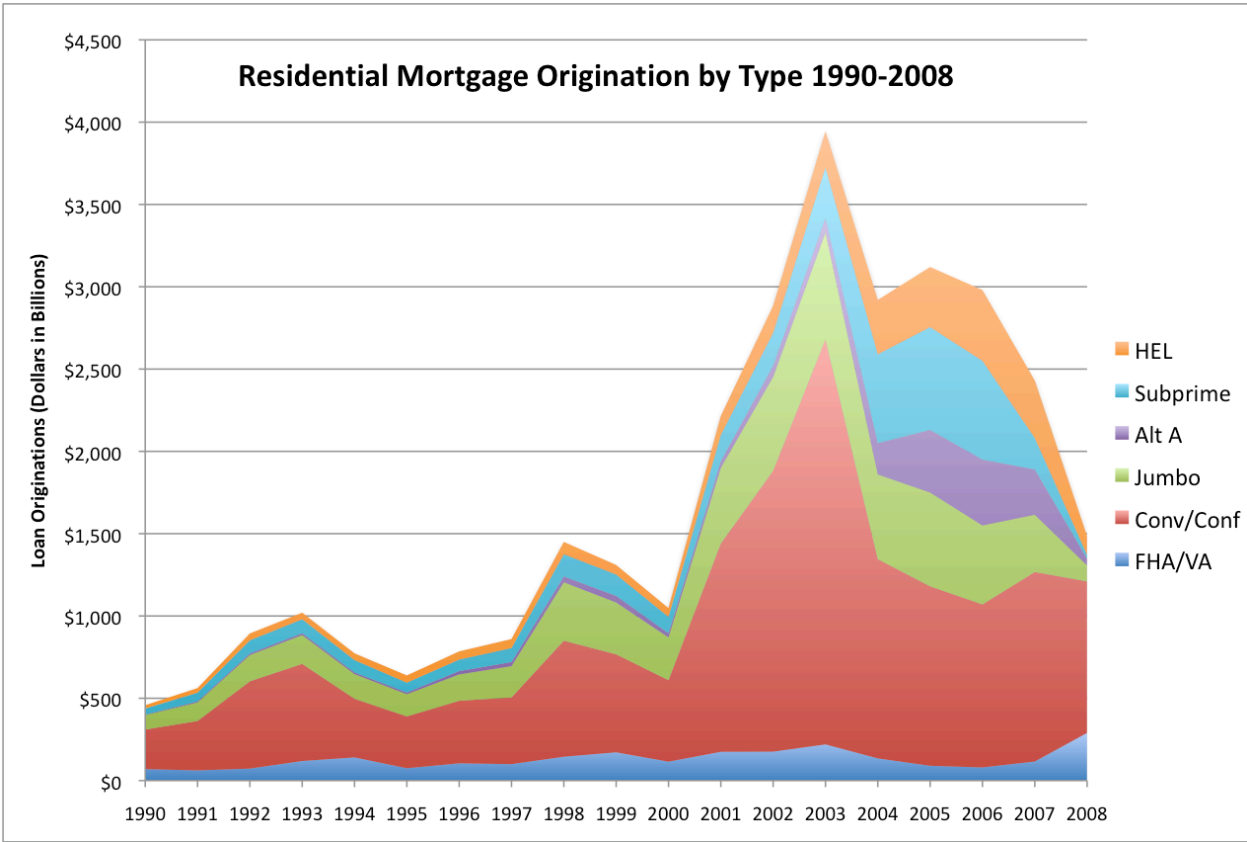
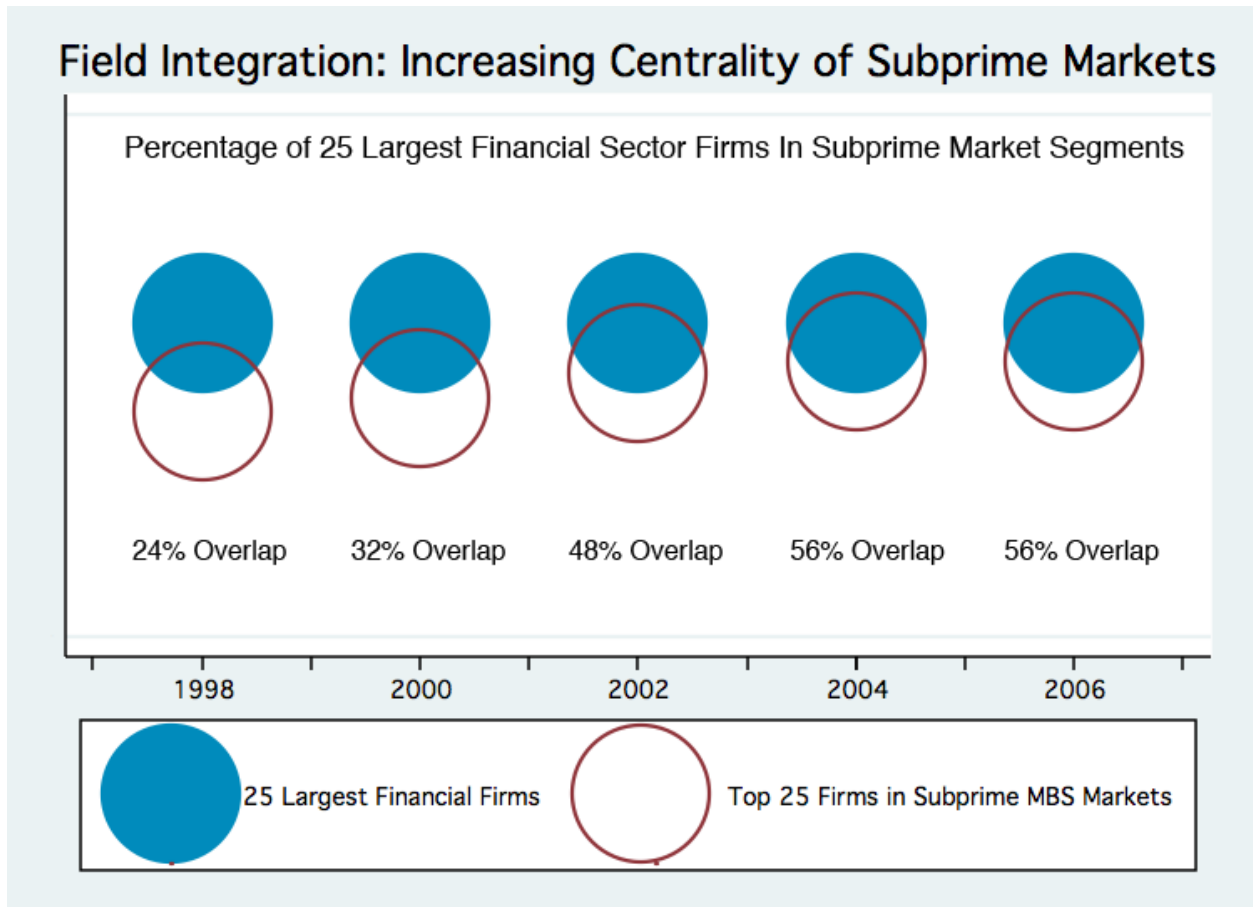


Figure 3:



Source: Fligstein and Goldstein (2010) and Inside Mortgage Finance (2009).

Figure 4:



Source: Compustat (2009) and Inside Mortgage Finance (2009).

Figure 5:

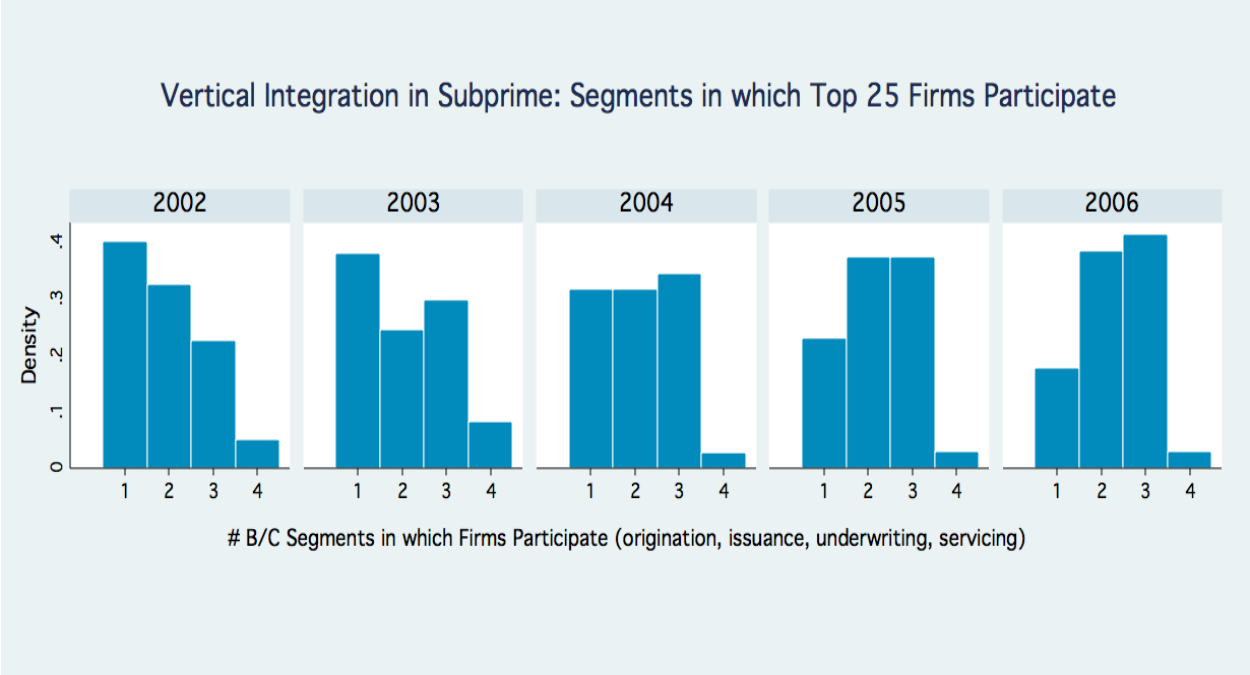


Figure 6: The Strategy of Integrated Producers

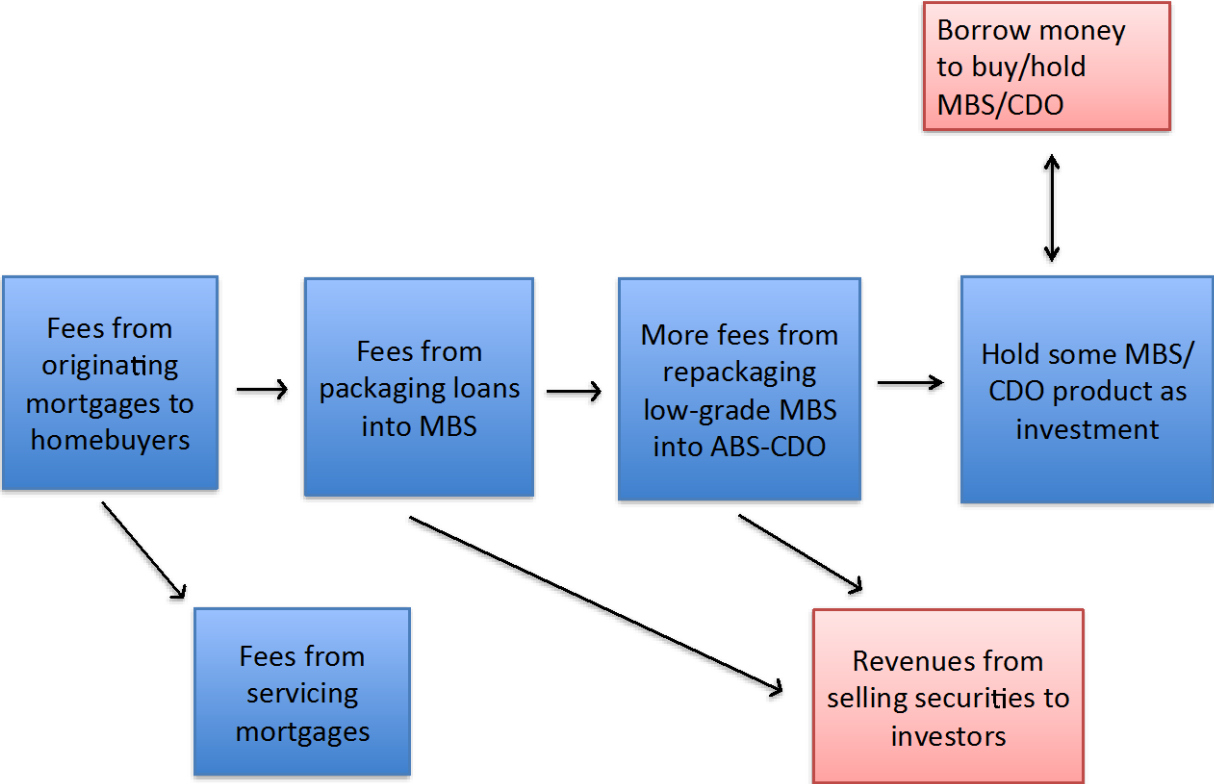


Table 1: Firm-level Fixed-effects Models of Subprime MBS Overrating: Average Magnitude of Subsequent Credit Downgrades by Issuer

Variable	1	2	3	4
B/C Issuance Market Share	-9.111 (8.479)	-13.67 (8.522)	-7.995 (8.154)	-12.86 (8.098)
[delta] B/C issuance volume	-0.0000220 (0.0000151)	-0.0000243 (0.0000148)	-0.0000219 (0.0000145)	-0.0000243* (0.0000140)
Total B/C Origination (national)	0.00348*** (0.000946)	0.00315*** (0.000934)	0.00282*** (0.000948)	0.00242** (0.000927)
Total Conventional Origination (national)	-0.000922*** (0.000262)	-0.000989*** (0.000257)	-0.00104*** (0.000256)	-0.00112*** (0.000249)
Subprime Originator (dummy)		1.004** (0.477)		1.089** (0.454)
CDO Issuer (dummy)			0.895** (0.366)	0.954*** (0.352)
Constant	4.021*** (0.591)	3.862*** (0.580)	4.094*** (0.568)	3.927*** (0.551)
Observations	91	91	91	91
Number of Unique Firms	28	28	28	28
R-squared	0.550	0.582	0.592	0.630
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Table 2: Firm Structure and Subsequent Loss Rates on ABS-CDOs Issued by Seventeen Largest ABS-CDO Issuers, 2000-2007

CDO issuers with highest average loss rate (worst performing bonds)	Integrated Subprime Pipeline 2006
BankAmerica	Yes
Bear Stearns	Yes
Citigroup	Yes
Morgan Stanley	Yes
UBS	No
CDO issuers with lowest average loss rate (best performing bonds)	Active Subprime Pipeline 2005-2006
Barclays	No
Calyon	No
Dresdner	No
JPMorgan	Yes
RBS	No

Data Sources: Column 1: Cordell et al (2012), table 14; Column 2: Inside Mortgage Data (2010).

Note: ABS-CDO issuer performance rankings are based on the value-weighted average loss rates of investment-grade (AA-AAA), mortgage-related CDOs, and are adjusted for variations in the ex-ante observable characteristics of the instruments (see Cordell et al 2012 for details).

Table 3: Predictors of likelihood of subprime (B/C) MBS producers going out of business or being taken over between 2007 and 2009.

Logistic regression estimates (expressed as odds-ratios) of failure among firms involved in subprime MBS production

Constant	.0149 (.0298)
Vertical integration in subprime (N segments)	4.808* (3.858)
Specialist in Subprime (dummy)	1.862* (.838)
Top 30 financial sector firm by assets (dummy)	-.2002 (.2832)
Observations	31

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ (two-tailed test)

Table 4: Regression estimates of effects of MBS production involvement on firms' MBS-related investment losses

	(log) write-down on MBS/CDO	
	(1)	(2)
Constant	-7.65** (2.67)	-7.09** (2.68)
Vertical Segments 2005-2006 (0-5)	1.40** (0.21)	1.15** (0.26)
Foreign Headquartered Bank (dummy)	6.06 (3.20)	5.65 (3.20)
(log) Total Assets 2006	0.78** (0.26)	0.73** (0.26)
Foreign X Total Assets	-0.48 (0.29)	-0.44 (0.29)
Volume of ABS-CDO issuance (Billions \$)		0.039 (0.024)
Observations	163	163
R-squared	0.48	0.49

Standard errors in parentheses. Two-sided test: ** p<0.01, * p<0.05