

**Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.**

Liquidity Crises in the Mortgage Market

**You Suk Kim, Steven M. Laufer, Karen Pence, Richard Stanton,
and Nancy Wallace**

2018-016

Please cite this paper as:

Kim, You Suk, Steven M. Laufer, Karen Pence, Richard Stanton, and Nancy Wallace (2018). "Liquidity Crises in the Mortgage Market," Finance and Economics Discussion Series 2018-016. Washington: Board of Governors of the Federal Reserve System, <https://doi.org/10.17016/FEDS.2018.016r1>.

NOTE: Staff working papers in the Finance and Economics Discussion Series (FEDS) are preliminary materials circulated to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the research staff or the Board of Governors. References in publications to the Finance and Economics Discussion Series (other than acknowledgement) should be cleared with the author(s) to protect the tentative character of these papers.

Liquidity Crises in the Mortgage Market*

You Suk Kim[†] Steven M. Laufer[‡] Karen Pence[§] Richard Stanton[¶]
Nancy Wallace^{||}

May 31, 2018

Abstract

Non-banks originated about half of all mortgages in 2016, and 75% of mortgages insured by the FHA or VA. Both shares are much higher than those observed at any point in the 2000s. We describe in this paper how non-bank mortgage companies are vulnerable to liquidity pressures in both their loan origination and servicing activities, and we document that this sector in aggregate appears to have minimal resources to bring to bear in a stress scenario. We show how the same liquidity issues unfolded during the financial crisis, leading to the failure of many non-bank companies, requests for government assistance, and harm to consumers. The high share of non-bank lenders in FHA and VA lending suggests that the government has significant exposure to the vulnerabilities of non-bank lenders, but this issue has received very little attention in the housing-reform debate.

*This paper was prepared for the Brookings Papers on Economic Activity (BPEA) and presented at the Spring 2018 BPEA Conference. We thank the editors, Janice Eberly and James Stock; the discussants, Arvind Krishnamurthy and Susan Wachter; and conference participants for helpful comments and guidance. We are grateful for financial support from the Fisher Center for Real Estate and Urban Economics. We thank Patrick Greenfield, Peter Hansen, Paulo Issler, Becca Jorgensen, Christopher Lako, and Scott Okrent for excellent research assistance. David Rappoport and Rob Sarama alerted us to mortgage-warehouse information in the Y-14 data and graciously shared code and advice. We are also grateful to Christian Cabanilla, Sam Earl, Shane Sherlund, and Chris Shelton for helpful comments, and to many professionals in the U.S. government and mortgage market who generously helped us understand these markets. The views expressed in this paper are ours alone and not necessarily those of the Board of Governors of the Federal Reserve System or its staff.

[†]Federal Reserve Board. Email: you.kim@frb.gov.

[‡]Federal Reserve Board. Email: steven.m.laufer@frb.gov.

[§]Federal Reserve Board. Email: karen.pence@frb.gov.

[¶]Haas School of Business, U.C. Berkeley. Email: stanton@haas.berkeley.edu.

^{||}Haas School of Business, U.C. Berkeley. Email: wallace@haas.berkeley.edu.

Contents

1	Introduction	1
2	Background on non-banks, the GSEs, and Ginnie Mae	3
2.1	Non-banks in the U.S. residential-mortgage market	3
2.2	The GSEs and Ginnie Mae	4
3	Factors driving growth in non-bank lending/servicing	6
3.1	Historical evolution of the non-bank mortgage sector	6
3.2	Recent factors facilitating the rise of the non-bank sector	8
4	Warehouse lines of credit	10
4.1	Vulnerabilities of warehouse funding	15
4.1.1	Pipeline-aging risk	15
4.1.2	Mark-to-market margin calls	15
4.1.3	Roll-over risk	16
4.1.4	Covenant violations	16
4.1.5	Changes in warehouse-lender risk appetite	17
4.2	Warehouse lending during the financial crisis	18
4.2.1	Post-crisis requests for government assistance of warehouse lending	20
4.3	Warehouse lending in the mid-2010s: evidence from Y-14 data	20
4.4	Pipeline-aging risk under the GSE conservatorship	26
5	Servicing advances and delinquent-loan costs	28
5.1	Background on servicing advances and servicing expenses	29
5.1.1	Fannie Mae and Freddie Mac	29
5.1.2	Private-label mortgage-backed securities	30
5.1.3	Ginnie Mae	30
5.1.4	Servicing compensation	32
5.2	Funding of servicing advances	33
5.3	Servicing-advance liquidity during the financial crisis	35
5.4	Servicing-advance liquidity today	37
6	Vulnerabilities of non-banks to macroeconomic shocks	38
6.1	Refinance mortgages and vulnerability to interest rates	39
6.2	Credit quality and vulnerability to house-price declines	41
7	Resources available to weather shocks	45
8	Consequences of a non-bank mortgage-company failure	48
8.1	Effects on consumers	48
8.2	Effects on the U.S. government	49
8.3	Effects on banks and other creditors	50
9	Regulation and housing-finance reform	51
9.1	Non-bank regulation	51
9.2	Housing-finance reform	54

10 Conclusions	55
References	57
A Data	64
A.1 Survey of Consumer Finances	64
A.2 Home Mortgage Disclosure Act	65
A.3 Mortgage Bankers Association Performance Report	65
A.4 Y-14 data	66
B The economics of vertically disintegrated markets	68
C Structured Investment Vehicles (SIVs) pre-crisis	70

1 Introduction

Most narratives of the housing- and mortgage-market crash in the late 2000s attribute it to house-price declines, weak underwriting, and other factors that caused credit losses in the mortgage system. The Financial Crisis Inquiry Report, for example, notes “it was the collapse of the housing bubble—fueled by low interest rates, easy and available credit, scant regulation, and toxic mortgages—that was the spark that...led to a full-blown crisis” (Financial Crisis Inquiry Commission, 2011, p. xvi). In the aftermath of the crisis, regulators implemented a wide array of reforms intended to improve underwriting practices and outlaw toxic mortgages.

Much less understood, and largely absent from the standard narratives, is the role played by liquidity crises in the non-bank mortgage sector. While important post-crisis research did focus on pre-crisis liquidity problems in short-term debt-financing markets,¹ the literature has been largely silent on the liquidity issues that we focus on in this paper: the dependence of non-bank mortgage companies on credit to finance both their mortgage originations and the costs of mortgages in default. These vulnerabilities in the mortgage market were also not the focus of regulatory attention in the aftermath of the crisis.

Of particular importance, these liquidity vulnerabilities are still present in 2018, and arguably the potential for liquidity issues associated with mortgage servicing is even greater than pre-financial crisis. These liquidity issues have become more pressing because the non-bank sector is a larger part of the market than it was pre-crisis, especially for loans with credit guarantees from the Federal Housing Administration (FHA) or Department of Veterans Affairs (VA) that are securitized in pools with guarantees by Ginnie Mae. As noted in 2015 by Ted Tozer, President of Ginnie Mae from 2010 to 2017, there is now considerable stress on Ginnie Mae operations from their non-bank counterparties:²

“... Today almost two thirds of Ginnie Mae guaranteed securities are issued by independent mortgage banks. And independent mortgage bankers are using some of the most sophisticated financial engineering that this industry has ever seen. We are also seeing greater dependence on credit lines, securitization involving multiple players, and more frequent trading of servicing rights and all of these things have created a new and challenging environment for Ginnie Mae... In other words, the risk is a lot higher and business models of our issuers are a

¹See, for example, Acharya, Schnabl, and Suarez (2013); Covitz, Liang, and Suarez (2013); Gorton and Metrick (2010, 2012); Dang, Gorton, and Holmström (2013); Comotto (2012); Krishnamurthy, Nagel, and Orlov (2014).

²See “Remarks by President Ted Tozer from the Ginnie Mae Summit,” 2015, <https://www.ginniemae.gov/newsroom/Pages/SpeechesDispPage.aspx?ParamID=36>.

lot more complex. Add in sharply higher annual volumes, and these risks are amplified many times over. . . . Also, we have depended on sheer luck. Luck that the economy does not fall into recession and increase mortgage delinquencies. Luck that our independent mortgage bankers remain able to access their lines of credit. And luck that nothing critical falls through the cracks. . . .”

We outline below the major liquidity vulnerabilities associated with non-banks in the mortgage market, along with the solvency issues that could trigger or compound these liquidity issues. We describe these separately, although solvency and liquidity risks are, of course, often closely linked. For example, Bear Stearns failed in 2008 when the firm was arguably still solvent, when “a sudden wholesale run impeded the investment bank from obtaining funding on both unsecured and collateralized short term financing markets” (Allen and Carletti, 2008).

Liquidity Non-bank mortgage companies finance their originations with a form of short-term credit. This credit is vulnerable to all the dynamics that derailed other short-term lending during the financial crisis, including margin spirals and counterparty runs. Put more simply: in times of strain, it is easy for the lender to tighten loan terms or withdraw credit entirely, and this tightening of credit alone can put the non-bank out of business rapidly.

Non-bank mortgage companies also need to finance the costs associated with servicing defaulted loans for extended periods of time. Obtaining this financing can be difficult in times of strain, particularly for loans in pools guaranteed by Ginnie Mae.

At the current time, most mortgages are guaranteed by the government, and this guarantee eases some of the strains that existed in the pre-crisis period. However, a government guarantee does not mean that mortgage-related assets are riskless, because the guarantee is conditional on actions by the mortgage originator or servicer that are difficult for future purchasers or lenders to observe.³ In addition, institutional details of the Ginnie Mae servicing contract make it almost impossible to pledge some of these assets as collateral for a loan.

Solvency The business model of many non-banks also exposes them to significant solvency risks. Some non-bank lenders are heavily dependent on revenue from mortgage refinancing. A rise in interest rates would significantly affect this source of revenue. In addition, non-banks are more likely to service loans with a higher probability of default. While many of these loans are guaranteed by the FHA and VA, these guarantees, as alluded to above, are

³See Krishnamurthy (2010a) for a discussion of the mechanisms underlying historical financial crises.

conditional and somewhat limited. As a result, a rise in defaults could expose servicers to costs large enough to jeopardize their solvency.

A fundamental difficulty in trying to gauge these risks is the very limited data available. Only a few non-banks are publicly traded, and the commonly used data from *Inside Mortgage Finance* are aggregated and exclude some of the largest Wall Street firms. We assemble data on non-bank mortgage institutions from a variety of sources. Most notably, we identify in confidential supervisory data the lines of credit extended by large commercial bank holding companies to non-bank mortgage institutions. These data provide a rare glimpse into a typically unobserved aspect of non-bank financing. Our data explorations, however, primarily highlight the fact that researchers—as well as many mortgage-market monitors and regulators—do not have the information needed to assess the risks of this sector.

One reason the lack of data is problematic, as we describe in the paper, is that a collapse of the non-bank mortgage sector has the potential to result in substantial costs and harm to consumers and the U.S. government. In addition to the losses that the government is explicitly on the hook for, the experience of the financial crisis suggests that the government will be pressured to backstop the sector in a time of stress, even if such a backstop is not part of the government’s mandate ex-ante. We end by observing that this aspect of mortgage-market fragility is almost entirely missing from the housing-finance reform debate.

2 Background on non-banks, the GSEs, and Ginnie Mae

2.1 Non-banks in the U.S. residential-mortgage market

The post-crisis U.S. mortgage market has two very different pieces. One part of the market — the “traditional” side — consists of highly regulated banks and other depository institutions that usually handle the three main mortgage functions — origination, funding, and servicing — themselves. They fund their mortgage originations with deposits or Federal Home Loan Bank advances, generally service their own loans, and either hold the loans in portfolio or securitize them in pools guaranteed by Ginnie Mae or the Government-Sponsored Enterprises (GSEs), Fannie Mae and Freddie Mac.

However, there is also a second part of the mortgage market—non-bank mortgage originators and servicers—which is much less discussed in the literature but represented almost half of mortgage originations in 2016, up sharply from around 20% in 2007 (Figure 1). These non-banks also represented close to half of all mortgage originations sold to the GSEs in 2016, as well as 75% of all originations sold to Ginnie Mae. The striking rise in the Ginnie Mae

non-bank share appears to have continued in 2017; data from the Urban Institute pins the non-bank share of Ginnie originations at 80% in December 2017.⁴



Figure 1: Share of all U.S. mortgages originated by non-banks from 2001 to 2016. Source: Authors’ calculations from Home Mortgage Disclosure Act (HMDA) data.

Non-banks differ from banks both in the types of mortgages that they originate and the types of borrowers that they serve. In addition to their outsized share of loans sold to Ginnie Mae, non-banks are more likely to originate mortgages to minority, lower-income, and lower credit-score borrowers. For example, in 2016, non-banks originated 53% of all mortgages, but 64% of the mortgages originated to black and Hispanic borrowers and 58% of the mortgages to borrowers living in low- or moderate-income tracts.⁵

Non-bank mortgages are a smaller share of total mortgages outstanding than of new mortgage originations. However, as shown in Figure 2, in 2016 the dollar volume of mortgages in Ginnie Mae pools issued and serviced by non-banks exceeded the corresponding volume for banks, and by the end of 2017 the non-bank share was close to 60%. As a result, non-banks are now the main counterparties for Ginnie Mae. *Inside Mortgage Finance* estimates that the non-bank share of servicing was 38% for Fannie pools and 35% for Freddie pools at the end of 2017 (January 19, 2018).

2.2 The GSEs and Ginnie Mae

Although both the GSEs and Ginnie Mae guarantee mortgage-backed securities, there are a number of essential differences. In particular, Ginnie Mae servicers are exposed to greater

⁴See Urban Institute, *Housing Finance at a Glance*, January 2018.

⁵The statistics from HMDA in this paragraph refer to purchase and refinance mortgages for single-family, owner-occupied, site-built homes.

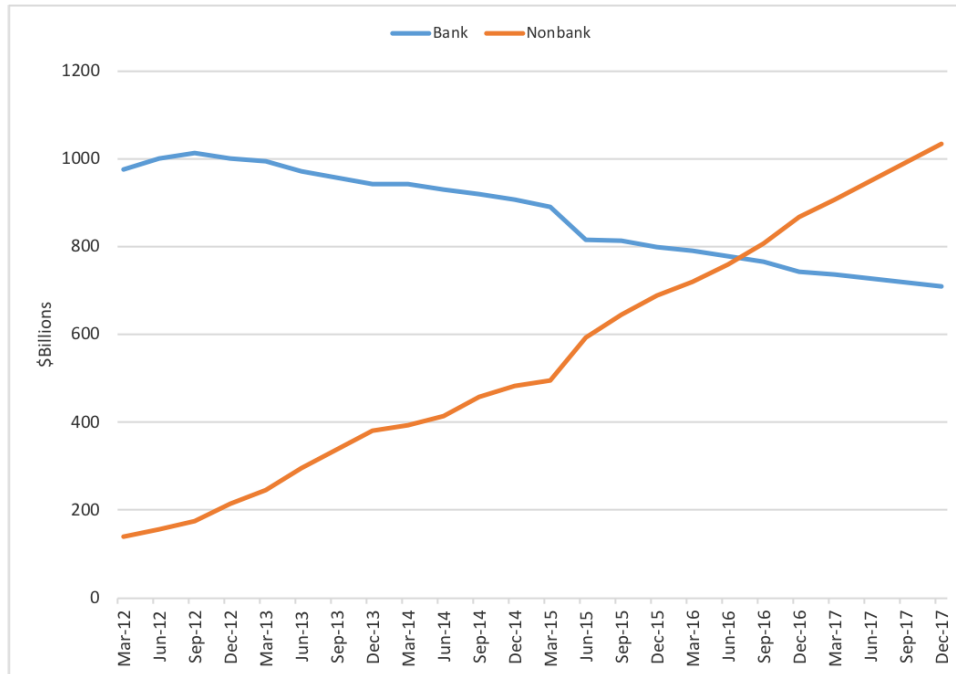


Figure 2: Outstanding balance (\$ billion) of MBS guaranteed by Ginnie Mae and serviced by non-banks. Source: Authors’ calculations from Ginnie Mae data.

liquidity strains, and a greater risk of experiencing high unreimbursed servicing costs, than GSE servicers. As we describe at the end of this section, understanding these differences is also key to assessing some housing-finance reform proposals.

Guarantee and issuance of securities Both the GSEs and Ginnie Mae provide a guarantee to their mortgage-backed securities (MBS) investors that they will receive their payments of interest and principal on time. One crucial difference between these institutions, though, is who issues the underlying securities. The GSEs purchase loans from mortgage originators and issue the securities themselves. For Ginnie Mae MBS, financial institutions originate or purchase mortgages and then issue securities through the Ginnie Mae platform.

In both cases, the loans in the securities have to meet certain underwriting standards and other requirements. The GSEs set the standards for the loans in their pools. For Ginnie Mae pools, the standards are set by the government agency that provides the insurance or guarantee on the mortgage (Federal Housing Administration, Department of Veterans Affairs, Farm Service Agency, Rural Housing Service, or Office of Public and Indian Housing).

Insurance against credit risk Another crucial difference between the GSEs and Ginnie Mae is who bears the credit risk associated with mortgage default. As shown in figure 3, for loans in GSE pools, the mortgage borrower takes the initial credit loss (in the form of

her equity in the house), followed by the private mortgage insurance (PMI) company (if the mortgage has PMI), and then the GSE. For loans in Ginnie Mae pools, the mortgage borrower is again in the first-loss position, followed by the government entity that guarantees or insures the loan. However, the Ginnie issuer/servicer — unlike in the GSE case — is expected to bear any credit losses that the government insurer does not cover. (We discuss this issue in detail in Section 5.) Ginnie Mae covers credit losses only when the corporate resources of the issuer/servicer are exhausted. The fact that servicers in the Ginnie Mae model are exposed to greater potential credit loss is important in evaluating some housing-reform proposals, as we discuss in Section 9.

The GSEs, Ginnie Mae, and government insurance agencies will not bear the full credit loss, of course, if they can show that the originator or issuer violated the guidelines of their programs. In that case, the agencies can pursue the originator or issuer to recoup some or all of its losses. If the originator or issuer is no longer in business, though, it is difficult to recoup losses. Ginnie Mae, in particular, is unlikely to recoup losses because it only steps in when the issuer/servicer has run out of resources. Its main remedy for practical purposes is to take the servicing without compensating the servicer.

3 Factors driving growth in non-bank lending/servicing

3.1 Historical evolution of the non-bank mortgage sector

The rise in the non-bank lending sector was facilitated by several developments over the past 50 years. In essence, these developments have led to the vertical disintegration of the non-bank mortgage sector; we review the economics of such markets in Appendix B.

Development of GSE and Ginnie Mae securitization infrastructure The first major change occurred in the 1970s, when the federal government introduced standardized securitization systems through the GSEs⁶ and the Government National Mortgage Association (Ginnie Mae),⁷ and allowed non-depository mortgage banks to issue and service loans under GSE and Ginnie Mae authorization criteria (see Follain and Zorn, 1990; Garrett, 1989, 1990; Jacobides, 2005; Kaul and Goodman, 2016).

⁶The Emergency Home Finance Act of 1970, Pub. L. No. 91-351, 84 Stat. 450, created Freddie Mac and authorized Fannie Mae to establish a secondary mortgage market.

⁷The Housing and Urban Development Act of 1968, Pub. L. No. 90-448, 82 Stat. 476, created Ginnie Mae.

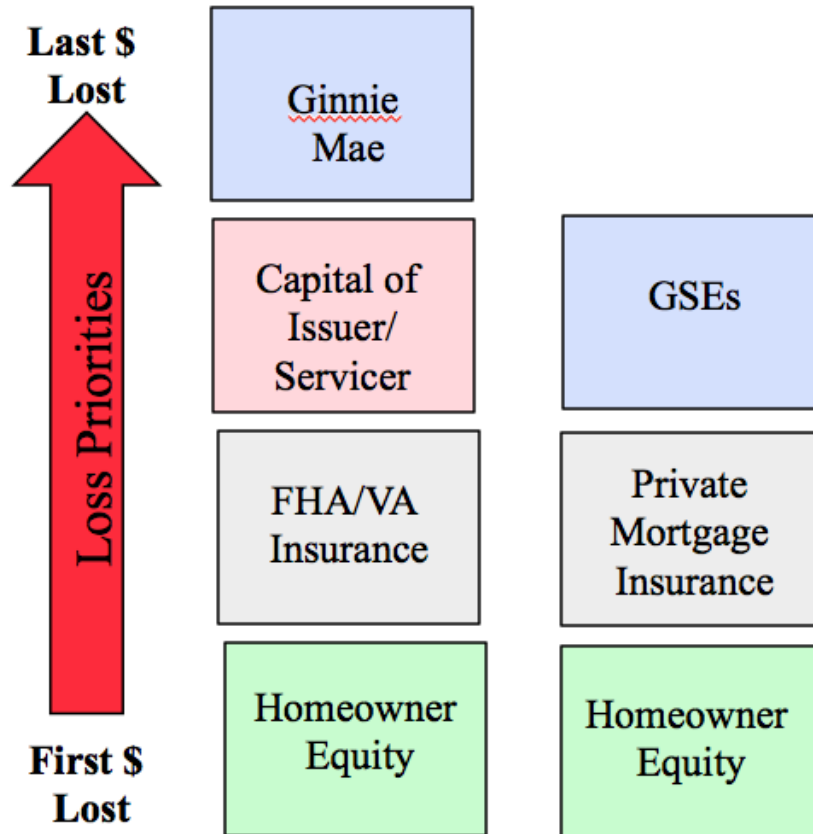


Figure 3: Difference between the credit loss position of Ginnie Mae (left set of boxes) and the GSEs (right set of boxes) when a mortgage defaults in a guaranteed pool. Adapted from Success Stories Ginnie Mae Summit, 2016, https://www.ginniemae.gov/issuers/issuer_training/Summit%20Documents/gnma_gse_differences.pdf.

Separation of mortgage origination from mortgage funding The second major change, the separation of mortgage origination activity from mortgage funding activity, occurred as the result of the recession of 1979–81, when banks and savings and loan institutions (S&Ls) laid off their underwriting staff and then re-established long-term relationships, often with the same staff, as independent loan brokers (see Garrett, 1989, 1990; Jacobides, 2005).

Separation of mortgage servicing from mortgage funding The third major change, the separation of loan servicing from loan origination, occurred in 1991, when the Resolution Trust Corporation (RTC), a government-owned asset-management company charged with liquidating the assets of failed S&Ls, devised new legal structures that enabled the separate sale of mortgage servicing rights from loan portfolios (see Resolution Trust Corporation, 1992, 1993, 1994). By the end of 1993, the RTC had successfully sold and priced \$6.9 billion in mortgage servicing rights from the portfolios of 32 failed S&Ls (see Resolution Trust Corporation, 1994), thus launching the stand-alone non-bank mortgage-servicing industry.

3.2 Recent factors facilitating the rise of the non-bank sector

In addition, several more-recent developments have further facilitated the increase of non-banks in mortgage lending and servicing.

Attempts to recover credit losses In the aftermath of the financial crisis, the GSEs and the U.S. government pursued loan originators in order to recover some of the credit losses associated with loans collateralizing GSE and Ginnie Mae securities. By the third quarter of 2015, the GSEs had collected \$76.1 billion in connection with lender repurchases of mortgage originations (McCoy and Wachter, 2017). Lenders were required to repurchase these loans because one or more of the “representations and warranties” that they made upon sale of the loans to the GSEs turned out to be inaccurate or worse.

Meanwhile, the Department of Justice (DOJ) began litigating cases in which FHA loans were originated in a manner inconsistent with HUD’s rules. These cases often involved pursuing treble damages against originators through the False Claims Act.⁸ As of October 2016 the cumulative DOJ settlements had reached \$6.6 billion of mortgage-related False Claim Act Violations; most of these settlements were with commercial banks (see Goodman, 2017). McCoy and Wachter (2017) provides a comprehensive review of these developments.

These legal and regulatory actions appear to have weighed more heavily on banks than non-banks. The San Francisco Chronicle noted in 2015, “Banks are also still smarting from

⁸False Claims Act, 31 U.S.C. §§ 3729–3733.

the fines, settlements, and repurchase demands that grew out of the mortgage crisis. It has been a painful time for lenders, especially big banks, said Bob Walters, chief economist with Quicken Loans. ‘Independent mortgage companies don’t have the same legacy exposure.’” In addition, the structure of non-banks may make them less sensitive to such losses. Most non-banks are privately held and so face less market-disciplinary pressure than banks in response to losses. Also, most mortgage non-banks are monolines with fewer alternative business lines to protect than banks, and so have less skin in the game and a more viable option to go out of business in the face of outsized losses.

As a result of these losses, large depositories have faced a greater incentive to participate in the U.S. mortgage market by lending to non-bank originators through lines of credit, or warehouse lines, rather than directly lending to mortgage borrowers. Because warehouse lenders are not the legal lenders of record to mortgage borrowers, they are insulated from losses stemming from the GSEs’ repurchase programs and Department of Justice False Claims Act prosecutions.

Revised regulatory capital treatment of mortgage servicing rights In 2013, the federal banking regulators issued a revised capital rule for banking institutions that increased the capital requirements for exposures to mortgage servicing rights.⁹ The full implementation of the rule, including an increase in the risk weight for mortgage servicing rights, was scheduled to take effect January 1, 2018 for all banking organizations. The new requirements had the potential to have a fairly significant effect on some banks, primarily small-to-midsize banking institutions that specialize in servicing mortgages and for whom these mortgage servicing rights are large relative to their capital. In anticipation of these rules, some of these banking institutions reduced their acquisitions of mortgage servicing portfolios.

In late 2017, however, the banking regulators delayed full implementation of the new standard and also proposed simplifying these rules for banking organizations that are not subject to the capital rule’s advanced approaches. The proposal would simplify the treatment and reduce the stringency of the capital requirements for holdings of mortgage servicing rights for all but the largest and most sophisticated banking organizations.¹⁰ These proposed revised rules would probably have only a small effect on the mortgage servicing activities of small-to-mid-sized banking institutions.

IRS tax clarification that facilitates REIT involvement in mortgage servicing In 2012, the IRS issued a private-letter ruling that established that certain assets associated with

⁹See Board of Governors et al. (2016) for more detail.

¹⁰See <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20170927a.htm>.

mortgage servicing count as qualified assets for REITs.¹¹ This clarification in tax treatment appears to have contributed to the decision of some REITs to become more involved in holding and financing assets associated with mortgage servicing. New Residential Investment Corporation, for example, increased its holding of such assets from \$43 million in 2011 to \$8.4 billion in the third quarter of 2017.¹² As of the second quarter of 2017, New Residential held the servicing rights on \$353 billion in mortgages, making it the fifth largest holder of servicing rights in the U.S.¹³

Rapid non-bank technology adoption and focus on refinancing Some non-banks have been quicker than banks to adopt “fintech” and profit from refinancing mortgages. In particular, the growing use of algorithmic underwriting on the part of several large non-banks, such as Quicken, has significantly reduced the consumer-facing costs of origination. Fuster, Plosser, Schnabl, and Vickery (2018) and Buchak, Matvos, Piskorski, and Seru (2017) provide a fuller treatment of fintech’s role in the increasing presence of non-banks.

Growth of the subservicing sector The subservicing industry has boomed in recent years, thereby allowing non-banks to hold mortgage-servicing rights without having to build and maintain a servicing infrastructure. Data from *Inside Mortgage Finance* indicate that subservicers serviced \$2 trillion in mortgages in 2017:Q3 (around 20% of all mortgages outstanding), up from around \$1.2 trillion in 2014:Q3.

4 Warehouse lines of credit

Non-banks face potential liquidity pressures from both their origination and their servicing lines of business. On the origination side, the main vulnerability of non-banks is their reliance on a type of short-term funding known as warehouse lines of credit. Access to these lines is a crucial aspect of the non-bank business model. For the most part, these lines are provided by commercial banks and investment banks because warehousing requires scale, sophisticated risk management systems, access to capital markets, and personnel.¹⁴

¹¹<https://www.irs.gov/pub/irs-wd/1234006.pdf>.

¹²Source: 10-K and 10-Q filings of New Residential Investment Corporation (starting in 2013) and New-castle Investment Corporation (prior).

¹³See *Inside MBS and ABS*, “New Residential Goes Whole-Hog into MSR While Largest REIT MBS Investor Takes a Different Tack,” August 4, 2017, p. 9.

¹⁴Pre-crisis, several large Real Estate Investment Trusts were warehouse lenders. By 2008 they had nearly all failed.

Data availability Lack of data is a significant impediment to understanding warehouse lending to non-banks fully. Even establishing the aggregate size of warehouse lending is nearly impossible. Only a few non-banks are publicly traded (and are thus required to provide information on the structure of their funding facilities and the identities of their counterparties in their 10-Qs). *Inside Mortgage Finance* reports the total outstanding commitments of a sample of warehouse lenders. However, these data exclude many major market participants (*IMF* refers to them as “Wall Street repo lenders”).¹⁵

For example, as shown in Table 1, PennyMac reported in their 2017:Q3 10-Q filing that they had warehouse lines from 12 lenders.¹⁶ Of these 12, IMF only captures two (JP Morgan Chase and Wells Fargo), representing just 16% of PennyMac’s total borrowing on warehouse lines.

Name of Counterparty	Net amount of liabilities presented in the consolidated balance sheet (\$ 000)
Bank of America	938,104
Credit Suisse First Boston Mortgage Capital LLC	857,882
JPMorgan Chase & Co.	445,746
Citibank	280,127
Morgan Stanley Bank, N.A.	168,184
Daiwa Capital Markets	157,827
Deutsche Bank	114,852
Royal Bank of Canada	94,424
Wells Fargo, N.A.	51,780
Barclays Capital	50,353
BNP Paribas	46,330
Federal National Mortgage Association	1,353
Total	3,206,962

Table 1: Mortgage origination and servicing funding lines reported as derivative liabilities in the Form 10Q, September 30, 2017 for PennyMac Mortgage Investment Trust. The table presents the significant counterparty derivative liabilities sold under agreements to repurchase after considering master netting arrangements. All assets sold under these agreements to repurchase have sufficient collateral or exceed the liability amount recorded. Source: <https://www.sec.gov/Archives/edgar/data/1464423/000156459017022699/0001564590-17-022699-index.htm>.

¹⁵The 2017:Q3 warehouse rankings in the December 1, 2017 issue include data from JP Morgan Chase, Wells Fargo, Texas Capital, Comerica, Everbank, BB&T, Customers Bank, Texas Capital, First Tennessee, Santander Bank, Flagstar Bancorp, People’s United, Southwest Bank, Fidelity Bank and Stonegate/NattyMac.

¹⁶They also report a line from Fannie Mae’s “as soon as pooled plus” program, which forward-funds pools before sale to investors.

Regulators have access to some data on warehouse lending that are not generally available to researchers. One of our paper’s contributions is that we provide the first public tabulations of the warehouse lines of credit that certain large bank holding companies provide to non-banks; these tabulations are based on supervisory loan-level data collected as part of the Federal Reserve’s Comprehensive Capital Analysis and Review and are known as the Y-14 data after the reporting form number (see Appendix A for more details). These data provide a view of warehouse lending from the perspective of the banks, but these data do not include banks that are not required to file the Y-14 data collection, or non-banks that extend warehouse credit. As we describe in more detail in Section 9, Ginnie Mae and the GSEs collect data on non-banks’ warehouse lines exposure on Mortgage Bankers Financial Reporting Form 1055, and the Conference of State Bank Supervisors collects data on non-bank warehouse lines on the Nationwide Multistate Licensing System Mortgage Call Report.

Size of the warehouse lending market Although we cannot observe all warehouse lending, the portion we can observe has grown significantly in recent years as non-bank mortgage originations have increased. As of the third quarter of 2017, *Inside Mortgage Finance* reported about \$67 billion in outstanding commitments on warehouse lines, an 11.6% increase from the previous year and a rise of almost 70% from *Inside Mortgage Finance*’s estimate of \$40 billion at the end of 2012. Meanwhile, in our sample of warehouse lines recorded in the Y-14 data, the total commitment on warehouse lines of credit from large BHCs to independent mortgage companies has risen from \$17 billion at the end of 2013 to \$34 billion at the end of 2016, with the peak in the series being \$39 billion in the third quarter of 2016 (Figure 4). The figure also shows that of this \$34 billion commitment, mortgage lenders had utilized just over \$23 billion.

The number of dollars on warehouse lines at any given time implies a much higher volume of originations that flow through these lines over a period of time. *Inside Mortgage Finance* estimates that mortgage originations are funded on warehouse lines, on average, for about 15 days (November 30, 2017). Scaling up the \$23 billion in warehouse utilizations in the Y-14 data to the *Inside Mortgage Finance* benchmark suggests around \$40 billion in total warehouse outstandings at the end of 2016, which translates into about \$1 trillion in loans funded over the course of a year.¹⁷ To put this number in context, total mortgage

¹⁷To reach this estimate, we assume that the ratio that holds between Inside Mortgage Finance’s committed lines at the end of 2016 (\$62 billion) and what we observe in the Y-14 data (\$34 billion) also holds for line utilization. We also assume that the 15-day estimate of time on warehouse lines recorded in the Mortgage Bankers Performance Report corresponds to calendar days and not business days, and that the IMF total accurately represents the warehouse lines outstanding. Our estimate of total flow of mortgage originations is then $(\$23 \text{ billion}) \times (\$62 \text{ billion}/\$34 \text{ billion}) \times (365/15) = \1020 billion . It is possible that



Figure 4: Total size and usage of warehouse lines of credit at banks subject to the Federal Reserve’s Comprehensive Capital Analysis and Review (CCAR). Source: Authors’ calculations from Y-14 data.

originations in 2016 are estimated to be around \$2 trillion, indicating that around half of mortgage originations in a given year cycle through these warehouse lines.

The warehouse-lending process Figure 5 shows the two stages of the warehouse-lending process. In the initial stage shown in Subfigure (a), the mortgage borrower (1) is approved for a mortgage from the non-bank originator (2), who funds the mortgage using a draw from a line of credit provided by a warehouse lender (3). Typically, the warehouse lender will only fund around 95% of the mortgage balance, so that the non-bank originator has some “skin-in-the-game” for each loan. The collateral on the loan is the mortgage on the house, and the non-bank in turn transfers the “mortgage” to the warehouse lender to collateralize the draw on its line of credit.¹⁸ Since the passage of the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) of 2005, mortgage-collateralized warehouse lending is

this number underestimates the total flow of originations, because it is based on quarter-end utilization. Industry anecdotes suggest that some non-banks try to reduce their utilizations at the end of the quarter.

¹⁸A “mortgage” in the U.S. actually comprises two contracts: 1) a mortgage, which creates a collateral interest in property as security for the performance obligation, or a trust deed, where a third party, a “trustee”, holds the borrower’s real estate title for the lender’s benefit until the loan is repaid; 2) a promissory note, which is the loan document that accompanies the mortgage and specifies the amount of money borrowed and the terms of repayment. Thus, technically the collateral is both the mortgage and the promissory note.

eligible for accounting and legal treatment as repurchase agreements.¹⁹ As shown in Figure 5, the non-bank originator is the repo seller and the warehouse lender is the repo buyer in the origination transaction.

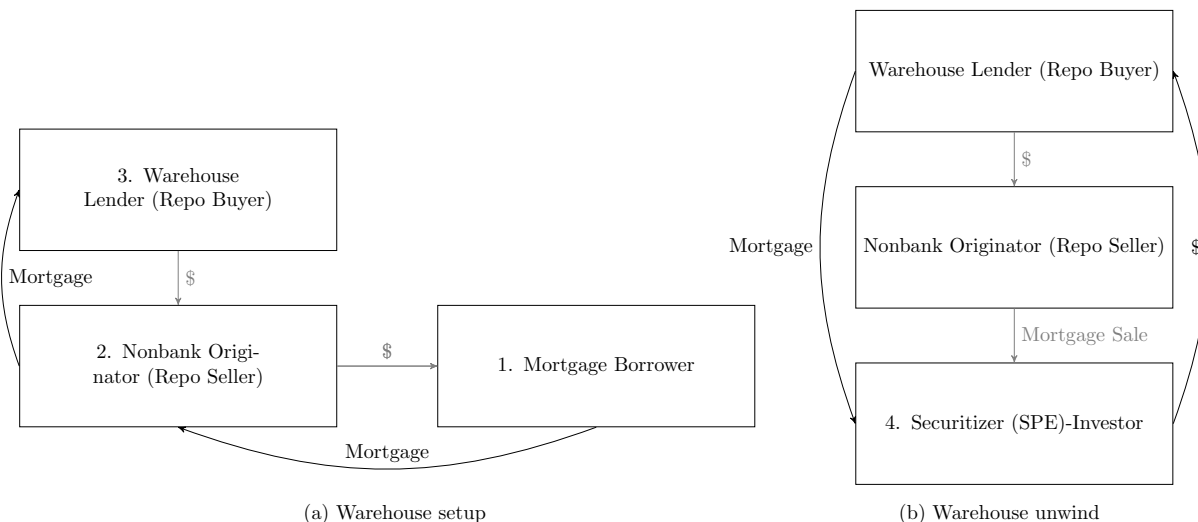


Figure 5: Schematic for the collateralized warehouse lending process for mortgage origination. Subfigure (a) presents the setup phase of warehouse funding for non-bank mortgage origination (warehouse setup), where: (1) a mortgage borrower obtains a mortgage funded by a non-bank originator (technically the repo seller); (2) the mortgage originator funds the loan through a collateralized line of credit; (3) the warehouse lender (technically the repo buyer) holds the mortgage note as collateral against the draw on the line of credit (the draw amount is valued at the loan balance minus a haircut). Subfigure (b) shows the warehouse unwind where: (4) the non-bank mortgage originator must sell the mortgage note to a securitizer-investor — in the case of the GSEs this would be a loan sale (either cash or swap for the bonds of the SPE) to a Fannie or Freddie Special Purpose Entity (SPE), and in the case of Ginnie Mae the loan sale would be part of a sale of Ginnie Mae pool of mortgages to investors. The proceeds from the loan sales flow directly to the warehouse lender, who releases the collateral, the mortgage/trust deed and promissory note, to the securitizer-investor. The warehouse lender then pays down the dollar value of the draw to the non-bank originator’s line of credit.

¹⁹The Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA), Pub. L. No. 109-8, 119 Stat. 23, was a statute that made several significant changes to the United States Bankruptcy Code. The specific changes that affected warehouse lending practices included: i) Section 101(47), which redefined the “repurchase agreement” to include mortgage-related securities, mortgage loans, and interests in mortgage related securities or mortgage loans; ii) Section 741(7), which redefined the “securities contract” to include mortgage loans and any interests in mortgage loans, including repurchase transactions; and iii) the “safe harbor” amendments in Section 555 and 559, which exempted “repurchase agreements” from automatic stay and, under Section 362(b)(7), enabled a repo buyer to recoup losses due to counterparty bankruptcy by selling the mortgage loans serving as collateral (see Bellicha, Stanton, and Wallace, 2015).

In the second stage of the warehouse lending process, shown in Subfigure (b) of Figure 5, the non-bank originator is responsible for finding a willing buyer for the mortgage. Currently, these mortgage investors are the GSEs or Ginnie Mae investors. Pre-crisis, investors in private-label mortgage securities also made up a large part of the market. Once the mortgage is sold, the proceeds from the sale are paid to the warehouse lender, who holds the mortgage as collateral. The warehouse lender then releases the mortgage/trust deed and promissory note to the mortgage investor (the pool created by the GSEs, the Ginnie Mae issuer, or the private-label securitizer). The warehouse lender then pays down the dollar value of the draw to the non-bank's line of credit.²⁰

4.1 Vulnerabilities of warehouse funding

There are five important vulnerabilities associated with the warehouse funding of non-banks: 1) margin calls due to aging risk (i.e., the time it takes the non-bank to sell the loans to a mortgage investor and repurchase the collateral), 2) mark-to-market devaluations, 3) roll-over risk, 4) covenant violations leading to cancellation of the lines, and 5) change in warehouse-lender risk appetite.

4.1.1 Pipeline-aging risk

The time it takes a non-bank to sell a warehoused loan to a securitization vehicle is a fundamental risk, because tardy loan sales are subject to additional interest charges, margin calls, and penalties. This is known as “aging risk.” Tardy loan sales can also lead to higher haircuts on future draws from the line of credit. The contracts on warehouse lines of credit may require the non-bank to take loans off the lines within a certain period of time.²¹ As described in Section 4.2, slowdowns in the securitization of mortgages in both the GSE and private-label markets contributed to the cancellation of billions of dollars of lines of credit to mortgage originators in the fourth quarter of 2006 and first two quarters of 2007, and to the failure of many originators.

4.1.2 Mark-to-market margin calls

Typically, the master repurchase agreements for warehouse lines also allow the warehouse lender to mark to market the mortgage loans held as collateral on the line. If mortgage interest rates rise sharply while the mortgage is in the warehouse facility, for example, the

²⁰See Warehouse Lending from A to Z, Part One and Two, Mortgage Banking Association Webinars by Sophie B. Schubert, Joe Lathrop, and Tom Kelly, September 17, 2013 and September 24, 2013.

²¹Credit Suisse's funding facility with PennyMac, for example, explicitly defines an aging limit of 90 days for agency mortgages. Form 8K, PennyMac Financial Services, Inc, April 28, 2017.

mortgage will fall in value. If the market value of the loans times a pre-defined “advance rate” is less than the repurchase obligations owed by the non-bank borrower, the warehouse lender is entitled to make a margin call. The margin call must usually be resolved within 24 hours, either by a cash payment or by delivering additional mortgage loans to bring the facility back into balance. In other financial markets, such “mark to market” pricing and collateral requirements have, historically, led market conditions and financing conditions to worsen at the same time, precipitating counterparty runs and margin spirals (see Bookstaber, 2007; Brunnermeier and Pedersen, 2009; Allen and Carletti, 2008; Krishnamurthy, 2010b).

4.1.3 Roll-over risk

When the term of the warehouse line expires, the non-bank must negotiate a new contract with the warehouse lender (“roll-over risk”). If market conditions have changed, the non-bank can face higher funding costs. Roll-over risk is currently significant, given that most lines have maturities of less than one year, significantly shorter than the usual pre-crisis maturities of 3–5 years.

4.1.4 Covenant violations

Warehouse lenders can adjust the terms or cancel lines if non-banks violate any of the covenants on the contract. The covenants often include requirements that the non-bank maintain certain levels of net worth and unrestricted cash and ratios of liabilities to net worth, and be profitable for at least one of the previous two consecutive fiscal quarters. Covenants may also require that loans be sold to securitization vehicles within a certain period of time, as discussed earlier.²²

During normal times, when a non-bank violates a covenant, the warehouse lender will generally waive the covenant or renegotiate the agreement.²³ During times of stress, however, the incentive of the warehouse lender is to pull the line and seize and sell the underlying collateral as quickly as possible, as warehouse lenders are allowed to do under the repo eligibility provisions afforded them under BAPCPA 2005. Amplifying these dynamics is the fact that large non-banks typically have warehouse lines of credit with multiple warehouse

²²PennyMac’s 2017 facility with Credit Suisse, for example, requires a minimum net worth of \$500 million, a minimum of \$40 million in unrestricted cash, and a maximum ratio of liabilities to net worth of less than 10:1 (see <https://www.sec.gov/Archives/edgar/data/1464423/000119312517380211/d498496d8k.htm>). As another example, PHH stated in its 2015:Q4 10K that its warehouse line covenants included a net worth minimum of \$1 billion and a ratio of liabilities top net worth less than 4.5 to 1. (see https://www.sec.gov/Archives/edgar/data/77776/000110465915015004/a14-25744_110k.htm).

²³See, for example, the waiver granted to Walter in 2017, <https://www.sec.gov/Archives/edgar/data/1040719/000119312517200563/d394793d8k.htm>.

lenders, and the lending contracts tend to have cross-default clauses such that a default on one line triggers an automatic default on the non-bank's other credit obligations. If these lenders sense that the failure of the non-bank is imminent, each has the incentive to minimize its losses by canceling the line and seizing its collateral before its competitors. This race to seize assets can further erode the viability of the non-bank as an ongoing entity, and if the warehouse lender sells the mortgages after it seizes them, those sales can weigh on mortgage valuations. Liquidity can quickly dry up as non-performance by one counterparty contractually triggers non-performance by other counterparties, leading to cascading losses of capital access in times of market stress.

The rapidity with which covenants can bind is exemplified by the final month of operation of New Century Financial Corporation, which was the largest non-bank mortgage lender in 2006. In a summary of facts, Kevin J. Carey, the U.S. bankruptcy judge, notes that²⁴

“On March 2, 2007, NCFC announced that it was unable to file its annual report on Form 10-K for the year ended December 31, 2006 by March 1, 2007, without unreasonable effort and expense... The announcements caused a variety of issues with the repurchase counterparties to the Debtors Master Repurchase Agreements, including margin calls, restricting and ultimately terminating funding for loans originated by the Debtors. . . This exacerbated the Debtor's liquidity situation and, by March 5, 2007, the Debtors were able to fund only a portion of their loan originations. The Debtors' inability to originate loans and the exercise of remedies by the Repurchase counterparties left the Debtors in a severe liquidity crisis. On April 2, 2007, the Debtors (other than Access Lending) filed chapter 11 bankruptcy cases. . .”

4.1.5 Changes in warehouse-lender risk appetite

Many banks that provide warehouse funding also originate, hold, and service mortgages themselves. This arrangement can increase the attractiveness of warehouse lending: in the event that the bank takes possession of the mortgages that collateralize the lines, it has an existing infrastructure for those mortgages. However, if a bank wants to reduce its overall exposure to mortgage-related risks, it may find it more desirable to cut back on the services that it provides to other mortgage institutions—such as warehouse lending—than to reduce its own operations.

Some of the scenarios that might cause a bank to reassess its mortgage exposure are macroeconomic, such as decreases in house prices or increases in interest rates that reduce the

²⁴See <https://www.davispolk.com/files/uploads/Insolvency/NewCenturyBankruptcy.pdf>.

profitability of mortgage lending. Other scenarios involve unexpected changes in government policy that likewise could affect profitability or increase the risks of mortgage lending. For example, in 2009 the House of Representatives approved legislation that would allow mortgage “cramdown,” which would give bankruptcy judges hearing Chapter 13 petitions the latitude to split the mortgage balance for underwater loans into a secured portion equal to the value of the house and an unsecured portion equal to the excess of the mortgage balance beyond the house value.²⁵ The unsecured portion, like credit cards and other such debts, would probably be discharged for pennies on the dollar. This provision in the legislation did not pass the Senate, in part due to concerns that lenders would react by restricting access to credit in the future (see Swagel, 2009; Goodman and Levitin, 2014). Likewise, as discussed earlier in this paper, in the aftermath of the financial crisis the GSEs and the Department of Justice pursued putback requests and False Claims Act prosecutions, respectively, much more aggressively than they had before the crisis; this shift and the ensuing large costs were not expected by lenders.

4.2 Warehouse lending during the financial crisis

In 2006, the top 40 mortgage originators accounted for about 97% of the \$2.98 trillion total mortgage originations in the U.S., and 28 of those institutions, representing 59% of total mortgage origination, used at least one warehouse line of credit to fund their originations.²⁶ Many of these non-banks and some depository mortgage originators also had off-balance-sheet entities called Structured Investment Vehicles (SIV). SIVs were typically organized as unconsolidated entities within the parent originator’s corporate holding company. They functioned as an additional warehouse lender (repo buyer) to the parent originator and the SIV’s collateralized lending activity to the parent (the repo seller) was funded by selling asset-backed commercial paper (ABCP). In addition to the collateral and fees from the warehouse lending to the parent, the credit quality of the ABCP was further protected through credit enhancements from pre-funded reserves and subordination notes as well as liquidity supports from commercial banks with at least Aaa credit ratings (see Acharya et al., 2013; Pozsar, Adrian, Ashcraft, and Boesky, 2012; Covitz et al., 2013).

The two largest non-banks in 2006 were New Century Financial Corporation and American Home Mortgage Corporation. New Century issued \$59.8 billion in new originations

²⁵Helping Families Save Their Homes Act of 2009, H.R. 1106, 111th Cong. (as passed by House, Mar. 5, 2009).

²⁶See *Inside Mortgage Finance* February 2, 2007; Stanton, Walden, and Wallace (2014); Bellicha et al. (2015).

using \$14.35 billion from nine warehouse facilities²⁷ and a \$2 billion line from its SIV, Van Karman Funding Trust.²⁸ American Home Mortgage originated \$58.9 billion of new loans funded via a \$2.49 billion line from its SIV, Broadhollow Funding, LLC,²⁹ and \$9.25 billion from eight warehouse facilities.³⁰

These sources of warehouse credit began to dry up rapidly in the run-up to the financial crisis as the slowdown in the securitization markets made it difficult for the non-banks to move loan originations off the warehouse lines and the premiums paid for subprime warehoused loans evaporated. In 2006:Q4 there were 90 warehouse lenders in the U.S. with about \$200 billion of outstanding committed warehouse lines; however, by 2008:Q2 there were only 40 warehouse lenders with outstanding committed lines of \$20–25 billion, a decline exceeding 85%.³¹ By March of 2009, there were only 10 warehouse lenders in the U.S. In addition, runs on SIVs led to the collapse of this form of warehouse funding by the end of 2007 (Figure 7), and it has not returned as a funding source post-crisis (see Acharya et al., 2013; Pozsar et al., 2012; Covitz et al., 2013).

The collapse of the short-term funding structure of non-banks and some depositories such as Countrywide led to rapid losses in liquidity and lending activity. Origination volumes by the non-banks, which hovered around \$800–900 billion a year from 2003 to 2006, plummeted to \$280 billion in 2008 (see Figure 6). Many of these firms experienced bankruptcies and closures similar to that of New Century. As shown in Table 11 in Appendix C, of the 19 non-banks and depositories who funded their originations using both warehouse lines and SIVs in the pre-crisis period, only two, Nationstar Mortgage and Suntrust, survived until 2017. The rest (representing about 45% of 2006 mortgage originations) were closed down, went bankrupt, or were involved in FDIC supervised sales. Altogether, the total number

²⁷As of December 31, 2005, the warehouse lenders were: Bank of America, N.A. (\$3B); Barclays Bank, PLC (\$1B); Bear Stearns Mortgage Capital (\$800M); Citigroup Global Markets Realty Corporation (\$1.2B); Credit Suisse First Boston Capital, LLC (\$1.5B); Deutsche Bank (\$1B); IXIS Real Estate Capital, Inc. (\$850M); Mortgage Stanley Mortgage Capital, Inc. (\$3B); UBS Real Estate securities Inc. (\$2B) (see <http://www.sec.gov/Archives/edgar/data/1287286/000089256906000258/0000892569-06-000258-index.htm>).

²⁸See Moody Investor Services for quarterly reports on Van Karman.

²⁹The total credit available from Broadhollow Funding, LLC was \$3.25 billion as reported in quarterly reports on Broadhollow Funding LLC from Moody's Investor Services.

³⁰As of March 30, 2006, American Home Mortgage had warehouse facilities of \$2.5 billion with UBS Real Estate Securities Inc., \$2.0 billion with Bear Stearns, \$1.0 billion with Barclays Bank PLC, \$1.0 billion bank syndicated facility led by Bank of America, N.A., \$750 million with Morgan Stanley Bank, \$150 million with J.P. Morgan Chase, \$450 million facility with IXIS Real Estate Capital, Inc., and a \$1.4 billion syndicated facility led by Calyon New York Branch (see <https://www.sec.gov/Archives/edgar/data/1256536/000091412106001369/am728775-10q.txt>).

³¹See National Mortgage News, October 20, 2008.

of mortgage companies (both independent and affiliated with banks) fell in half—a drop of nearly 1,000 companies—between 2006 and 2012.³²

4.2.1 Post-crisis requests for government assistance of warehouse lending

The sharp contraction in warehouse lending led non-bank mortgage originators to lobby the federal government intensively for help. Letters sent by the Mortgage Bankers’ Association to Treasury Secretary Paulson, Treasury Secretary Geithner, Federal Reserve Chairman Bernanke, and federal bank regulators in late 2008 and early 2009 outlined the gravity of the situation and proposed a variety of policy responses, including a federal guarantee of warehouse lines and a reduction in bank risk-based capital ratings for warehouse lines.³³ In September 2009, the U.S. House of Representatives passed a bill that included a sense of Congress that “the Secretary of the Treasury, the Secretary of Housing and Urban Development, and the Director of the Federal Housing Finance Agency should use their existing authority under the Emergency Stabilization Act of 2008, the Housing Economic Recovery Act of 2008 and other statutory and regulatory authorities to provide financial support and assistance to facilitate increased warehouse credit capacity by qualified warehouse lenders. . . .”³⁴ The types of support suggested in the bill included direct loans, guarantees, credit enhancements, and other incentives. The bill never emerged from the Senate Banking Committee and so was not enacted. In late 2009 and early 2010, however, both Fannie Mae and Freddie Mac introduced programs that facilitated the flow of warehouse credit to independent mortgage banks. Fannie Mae’s program was originally intended to support about \$1 billion in warehouse lines in 2010.³⁵

This history suggests that in periods of acute stress, the federal government is likely to be called upon to backstop the non-bank origination funding flow, even though the government is not paid ex-ante for providing this insurance function.

4.3 Warehouse lending in the mid-2010s: evidence from Y-14 data

As previously discussed, even aggregated data on warehouse lending are hard to come by, and loan-level data are even more scarce. In this paper, we explore the current warehouse

³²See Bhutta and Canner (2013).

³³See, for example, https://web.archive.org/web/20101007080352/http://mbaa.org/files/AU/2009/MBALettertoGeithner_WarehouseLending_2-5-2009.pdf.

³⁴21st Century FHA Housing Act of 2009, H.R. 3146, 111th Cong. (as passed by House, Sept. 15, 2009). <https://www.congress.gov/bill/111th-congress/house-bill/3146>

³⁵See <https://www.wsj.com/articles/SB125486796534968995> and <https://www.reuters.com/article/fanniemaewarehouselending/fannie-mae-launches-1-bln-warehouse-lending-plan-idUSN2214885920100222> for early news reports on the programs.

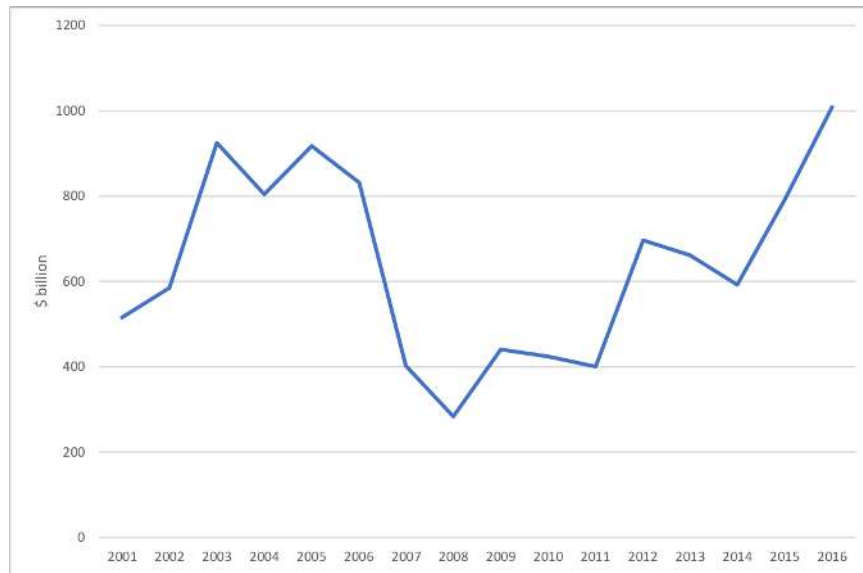


Figure 6: Non-bank mortgage originations (in \$ billions) from 2001 to 2016. Source: Authors' calculations from HMDA data.

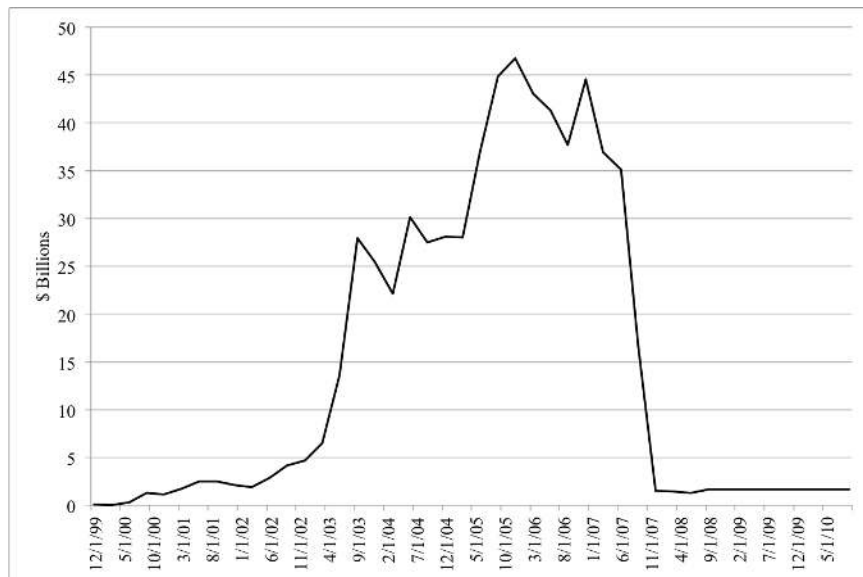


Figure 7: Pre-crisis outstanding committed mortgage warehouse balances in billions of dollars of the off-balance-sheet U.S. Structured Investment Vehicles funded by extendable asset-backed commercial paper and collateralized by mortgage loans held in warehouse prior to securitization. Source: Authors' calculations from quarterly SIV statements reported to Moody's Investor Services.

lending situation using the Y-14 supervisory data, which include 5,065 quarterly observations on 663 warehouse lines of credit extended to 287 non-banks by 14 warehouse lenders from 2013 to 2016.³⁶

As shown in Table 2, committed exposures on each line are relatively small, ranging from \$8.7 million at the 10th percentile of the distribution to \$200 million at the 90th percentile. Almost all (93%) of lines are utilized. Of the lines that are utilized, the median utilization rate is 76%; 32% of lines are utilized at 100%, meaning that they have no spare capacity. 15% of the lines are “demand loans,” meaning that the warehouse lender can call them at any time. Of the lines with a scheduled maturity, most of them are 364 days or less; the tenth percentile, median, and 90th percentile of the maturities are 362, 365, and 1,820 days, respectively.³⁷ Most (77%) of the lines are tied to LIBOR. Interest rates range from 1.45% at the tenth percentile, to 2.73% at the median, to 3.65% at the 90th percentile. About 40% of the lines are guaranteed, typically (for nonpublic companies) by personal guarantees from their major shareholders.³⁸ About 75% of lines are secured by collateral in addition to the mortgage originations; this collateral can take the form of cash or other marketable securities, blanket liens, or other assets.

Large banks extend credit other than warehouse lines to non-banks; in total, we estimate that large banks extended \$47 billion in credit to non-banks in 2016:Q4. A bit more than 60% of these credit facilities were identified by the banks as being for warehouse purposes, with another 13% for working capital, 5% for general corporate purposes, and 20% for other reasons.

Banks assign an internally generated credit rating to each of their credit facilities. Looking at all credit facilities extended to non-banks, only about 5% of the facilities were rated AA or A by the bank lender, with an additional 28% rated triple-B. Of the remaining two-thirds with high-yield ratings, the majority have double-B ratings, but about 15% of all warehouse lines are rated single-B or lower by their warehouse lenders.

As a preview of our results later in this section, we also tabulate the share of non-banks that have a credit facility (warehouse line or other type) with multiple commercial banks in our sample. In any given quarter, about three-quarters of the non-banks in our sample

³⁶Although the Federal Reserve began to collect Y-14 data in 2011, we do not use data from 2011 or 2012 because of data quality issues in the early years of the data collection.

³⁷We infer the maturity of the loan by comparing the origination date and the renewal date. It is possible that some Y-14 reporters do not update the renewal date in their data submissions and so warehouse lines that appear to have multi-year maturities are in fact the 364-day facilities that are standard in this industry.

³⁸“Guaranty requirements vary, but most warehouse lenders require major shareholders of non-public companies to guaranty obligations.” Stoner and Calandra, “Warehouse Lending 2017,” presentation, available at <http://media.straffordpub.com/products/warehouse-lines-of-credit-drafting-mortgage-loan-purchase-agreements-custodial-agreements-reps-and-warranties-2017-05-11/presentation.pdf>.

have only one credit facility with a large bank in our data, whereas 16% have credit facilities with two banks and 9% have facilities with three or more banks. In a financial crisis, as we noted earlier, the presence of multiple warehouse lenders gives each lender an incentive to seize its collateral before its competitors. Our data suggest this interconnectedness still exists, although we only observe a portion of it because our data include perhaps half of the total warehouse lines outstanding. Finally, throughout our sample, the credit lines were performing well: the share that are past due is essentially zero.

Interconnectedness of warehouse lending We next explore the characteristics of the non-banks that pose the greatest interconnectedness risk. In Table 3, we classify non-banks by the number of banks in our data that extended warehouse lines to them (as opposed to all credit facilities, as Table 2). To obtain more information on the non-bank characteristics, we merged measures of each non-bank’s total mortgage originations and the share of its originations that were guaranteed by the FHA or the VA from the Home Mortgage Disclosure Act data. For those non-banks that are Ginnie Mae seller-servicers, we merged data from Ginnie Mae on total originations into Ginnie pools, total portfolio serviced for Ginnie Mae, and the delinquency rate on that servicing portfolio. Appendix A provides more information on these merges.

Larger non-banks, as measured by loan originations, have warehouse lines of credit with more banks. Non-banks in our data with only one warehouse line originate, on average, about \$621 million in mortgages each quarter. In comparison, institutions with warehouse lines with two lenders originate about \$2.5 billion in mortgages each quarter, and institutions with three or more warehouse lenders originate \$9.4 billion a quarter. The share of these originations that are insured by the FHA or VA does not vary significantly by number of warehouse originations. Meanwhile, non-banks with more warehouse relationships also have larger portfolios of loans serviced for Ginnie Mae, although the delinquency rates on those portfolios does not vary significantly by the number of warehouse relationships.

Turning to the characteristics of the warehouse lines, non-banks with more warehouse relationships pay lower interest rates on their lines than non-banks with fewer relationships. Non-bank credit facilities are also a bit more likely to be rated investment-grade if the non-bank has multiple relationships, are less likely to be required to post a personal guarantee, have a bit higher utilization rates, and are a bit more likely to be demand loans.

We next estimate regressions that explore the extent to which the interest rates charged on warehouse lines reflect the underlying risks. We use interest rates instead of interest rate spreads because we have incomplete information on the interest-rate indexes for the lines. We add fixed-effects for each quarter-end to the regressions to adjust for fluctuations over

Panel A: Statistics calculated over warehouse lines	
Committed Exposure (\$Mil.)	
10th percentile	8.70
Median	45.13
90th percentile	200.00
Share of lines that are utilized	0.93
Of lines that are utilized:	
Median utilization rate	0.76
Share of lines that are utilized at 100%	0.32
Share that are demand loans	0.15
Maturity of line (days) (calculated only for non-demand loans)	
10th percentile	362
Median	365
90th percentile	1,820
Share with an interest rate tied to LIBOR	0.77
Interest Rate (%) (calculated only for utilized lines)	
10th percentile	1.45
Median	2.73
90th percentile	3.65
Share with a guarantee	0.41
Share of additional collateral types:	
Cash or marketable securities	0.09
Blanket Lien	0.13
Other types	0.49
No other security	0.29
Panel B: Statistics calculated over all credit lines	
Share of credit line types:	
Mortgage Warehousing	0.62
Working Capital	0.13
General Corporate Purpose	0.05
Others	0.20
Share with a credit rating of	
AA or A	0.04
BBB	0.28
BB	0.52
B	0.14
C or D	0.01
NA	0.01
Share of nonbank-quarter pairs with a credit line with	
1 bank	0.76
2 banks	0.16
3 or more banks	0.09
Share past-due	0.00
N. Obs.	7,594

Table 2: Selected characteristics of bank loans extended to non-bank mortgage companies. Source: Authors' calculations from Y-14 data.

	By number of Y14 bank lenders (calculated for warehouse lines only)		
	(1) One lender	(2) Two lenders	(3) Three or more lenders
HMDA originations (\$Mil)	621 (3,214)	2,574 (7,918)	9,444 (21,612)
Of HMDA originations:			
Share of FHA loans	0.26 (0.18)	0.22 (0.16)	0.22 (0.14)
Share of VA loans	0.10 (0.12)	0.10 (0.15)	0.11 (0.15)
New origination for GNMA pools (\$Mil)	416 (823)	815 (1,620)	1,141 (2,153)
Total portfolio serviced for Ginnie Mae (\$Mil)	3,503 (7,550)	8,230 (17,185)	11,148 (19,992)
Delinquency rate of loan portfolio serviced for Ginnie Mae	0.02 (0.02)	0.02 (0.02)	0.03 (0.03)
Avg. interest rate of lines (%)	2.83 (1.03)	2.41 (0.80)	2.18 (0.64)
Share with a credit rating of:			
AA or A	0.03 (0.18)	0.05 (0.17)	0.06 (0.18)
BBB	0.29 (0.45)	0.34 (0.40)	0.27 (0.31)
BB	0.49 (0.50)	0.48 (0.43)	0.52 (0.38)
B	0.16 (0.36)	0.13 (0.30)	0.15 (0.29)
C or D	0.02 (0.13)	0.00 (0.03)	0.00 (0.00)
NA	0.01 (0.10)	0.00 (0.03)	0.00 (0.00)
Share with a guarantee	0.49 (0.50)	0.39 (0.45)	0.26 (0.37)
Utilization rate	0.67 (0.32)	0.66 (0.28)	0.75 (0.23)
Share that are demand loans	0.14 (0.35)	0.16 (0.32)	0.23 (0.32)
Total Committed (\$Mil)	58 (88)	175 (230)	366 (354)
Originations to Committed Amount	12.91 (29.93)	12.64 (28.09)	23.77 (48.50)
Median maturity (days)	368	675	365
N. Nonbanks	387	119	58
N. Obs.	2,332	694	379

Table 3: Selected characteristics of non-banks by number of warehouse lenders. Source: Authors' calculations from Y-14, HMDA, and Ginnie Mae data.

time in the base rates. The regressions also include fixed-effects for each warehouse lender in order to control for any pricing factors idiosyncratic to each lender.

As shown in table 4, interest rates increase with the lender’s internal rating of the riskiness of the credit line. Lines with a double-B rating have rates about 14 basis points higher than lines with double-A or single-A ratings, and lines with a single-B rating have rates about 22 basis points higher. Loans with a guarantee bear higher rates even though the guarantee should provide the warehouse lender with more protection; perhaps the presence of the guarantee indicates that these loans are more risky in other ways that we do not capture in our data.

Non-banks that have relationships with multiple warehouse lenders have lower rates on their lines than non-banks with one warehouse line. Larger non-banks, as measured by their mortgage originations, also have lower interest rates on their lines. As indicated in the earlier table, non-bank size is correlated with the number of lines, so it is noteworthy that the number of lines is negatively associated with interest rates even conditioning on lender size. The result suggests that warehouse lenders do not internalize the possibility of a “run” dynamic or other interconnectedness concerns in their pricing.

We next examine whether the loan pricing varies with the characteristics of the mortgages that collateralize the line. In particular, we examine whether loan pricing varies with the share of originations that are insured by the FHA or VA. As we describe in Section 5.1.3, if these loans default, servicers are exposed to potentially large unreimbursed servicing costs; the servicing rights associated with these loans are also less valuable. If warehouse lenders are concerned about the possibility that they might need to seize and hold the mortgages collateralizing their lines, interest rates should be higher for warehouse lines collateralized with more of these loans. Indeed, both shares are associated with higher rates on the warehouse line, and the VA share is statistically significant at the 1% level. Of course, there are other interpretations of this coefficient, such as if lenders who originate a lot of VA-insured loans are riskier in other dimensions.

4.4 Pipeline-aging risk under the GSE conservatorship

As described in section 4.2, a key component of the collapse in warehouse lending during the financial crisis was the slowdown of speeds in the private-label securitization market. Today the mortgage securitization market consists almost entirely of securities with GSE or Ginnie Mae guarantees. This portion of the securitization market, unlike the PLS market, worked fairly smoothly during the financial crisis, although in March 2007, before the GSEs entered

		Dependent variable: Interest rate of a credit line (%)
Credit rating of:		
BBB		0.000896 (0.02)
BB		0.142*** (2.69)
B		0.218*** (3.25)
C or D		0.173 (0.33)
NA		0 (.)
Demand loan		0.0714 (1.57)
With a guarantee		0.0754* (1.76)
Number of banks with facilities with:		
= 2		-0.0837** (-2.23)
≥ 3		-0.103** (-2.24)
HMDA originations quartile:		
(25%, 50%]		-0.196*** (-3.88)
(50%, 75%]		-0.327*** (-5.46)
(75%, 100%]		-0.367*** (-5.35)
Share of FHA Loans		0.126 (1.16)
Share of VA loans		0.289*** (2.91)
N. Obs.		3,362

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Factors associated with interest rates on warehouse lines of credit. Source: Authors' calculations from Y-14 and HMDA data.

conservatorship, the average GSE pipeline time to securitization increased from about 30 days to 60 days (Stanton and Wallace, 2016).

More recently, various technological and process enhancements to the loan pooling and securitization process have shortened further the amount of time that mortgages are funded on warehouse lines, and the GSEs have continued to refine their “gestation repo” programs,³⁹ which allow non-banks to pay off their warehouse line as soon as pool approval rather than at sale.⁴⁰ *Inside Mortgage Finance* reports that the average time that loans stay in the lines as collateral has fallen to only 14–15 days from 18–20 days four years ago (see *Inside Mortgage Finance*, November 30, 2017). As long as this situation continues, the “aging risk” that contributed to the collapse of warehouse lending in the PLS market during the financial crisis appears less likely.

However, this fact points to a potential vulnerability for housing-finance reform: any changes that undermine the market’s confidence that these fast and reliable speeds will continue has the potential to be de-stabilizing. The government’s implicit liquidity provision in these securitization markets is one of the linchpins that allows the non-bank mortgage sector to stay in business.

5 Servicing advances and delinquent-loan costs

As mortgage servicers, non-banks face both liquidity and solvency concerns. The crux of the liquidity issue in mortgage servicing is that servicers of mortgages in securitized pools are required to continue making payments to investors, tax authorities, and insurers when mortgage borrowers skip their payments. Servicers are eventually reimbursed for these “servicing advances,” but they need to finance the advances in the interim. The crux of the solvency issue is that servicers can incur large costs servicing delinquent loans, especially those that wind up in foreclosure.

The issue is especially acute for Ginnie Mae servicers. These servicers need to advance more types of payments for much longer than GSE servicers. As noted by Ginnie Mae Executive Vice President Michael Bright, “Liquidity is the ability to make good on principal and interest payments to Ginnie bondholders. . . liquidity is key, 100 percent.”⁴¹ Ginnie Mae

³⁹A pool is said to be “in gestation” awaiting delivery to the takeout investor upon security issuance. Gestation warehouse lending from banks and investment banks has long existed to expedite sales for Ginnie Mae issuance.

⁴⁰The programs include the “As soon as pooled plus: Loan-level Funding for Whole Loans or MBS” program of Fannie Mae (see https://www.fanniemae.com/content/fact_sheet/early-funding-options-overview.pdf) and the “Early Execution Program” of Freddie Mac, which allows for funding 45 days before the settlement date of the pool (see http://www.freddie.mac.com/singlefamily/early_funding.html).

⁴¹See *Inside MBS & ABS*, April 6, 2018.

servicers, unlike GSE servicers, may also be required to absorb large costs because the FHA and VA insurance does not cover all expenses associated with delinquent loans. Finally, private-market financing collateralized by Ginnie Mae advances is essentially impossible to obtain, so servicers need to fund the advances with cash from current operations, unsecured loans, or credit lines collateralized by other assets, such as mortgage servicing rights.

During and after the financial crisis, servicers of private-label RMBS faced liquidity issues. A financing market existed for the advances, but credit terms had tightened considerably. The Federal Reserve’s Term Asset-Backed Securities Loan Facility (TALF) helped alleviate these strains. A similar policy response would not be effective today, because the private market does not consider Ginnie Mae advances as eligible collateral for financing.

5.1 Background on servicing advances and servicing expenses

The amount of exposure that servicers have to servicing advances and costs associated with delinquent loans varies by the type of servicing contract, with servicers for Fannie Mae and Freddie Mac having relatively low exposure, servicers of private-label mortgage securities having a fair amount of exposure, and servicers for Ginnie Mae having substantial exposure. We summarize these provisions below, describing for each market the concerns around liquidity and the sources of unreimbursed expenses associated with delinquent loans.

5.1.1 Fannie Mae and Freddie Mac

Liquidity Servicers of pools guaranteed by the GSEs are required to advance principal and interest until the borrower is 120 days delinquent on the loan (Fannie Mae, 2017, section A1-3-07). Servicers continue paying the property taxes, insurance premiums, and foreclosure expenses associated with delinquent loans after that point, but servicers can submit reimbursement requests for these expenses “as soon as possible” after incurring an expense (Fannie Mae, 2017, section E-5-01) or, in some cases, after the completion of the foreclosure. The GSEs take possession of the property after the foreclosure sale, so the servicer is not responsible for any property costs after that point.

Costs of delinquent loans For delinquent loans, the two major costs are the lost servicing fee and the costs of financing advances. The servicer takes its fee from the borrower’s monthly payment, so if the borrower stops making payments, the servicer does not get paid. The servicer also does not get reimbursed for the costs associated with financing servicing advances, although these costs are relatively small since the servicer is only on the hook for

tax-and-insurance advances for extended periods. Servicers are also liable for costs associated with the foreclosure process and any incurred expenses in excess of GSE guidelines.

5.1.2 Private-label mortgage-backed securities

Liquidity Servicers of private-label mortgage-backed securities are required to “advance monthly principal and interest payments as well as property taxes, insurance, and maintenance costs for delinquent borrowers” until the delinquency is resolved (Moody’s Investor Service, 2017). Servicers can stop making advances for principal and interest once they deem that they will not be able to recover them, although they are obligated to continue advancing other funds. Although new issuance of these pools remains very low, nearly \$800 billion of these securities were still outstanding at the end of 2017, primarily representing legacy securities originated before the financial crisis.⁴²

Costs of delinquent loans PLS servicers – unlike GSE servicers – eventually get reimbursed for their forgone servicing fees from the proceeds from the foreclosure sale or other resolution to the default. Like the GSE servicers, however, they are not reimbursed for the costs that they incur financing the advances (Cordell, Dynan, Lehnert, Liang, and Mauskopf, 2009).

5.1.3 Ginnie Mae

Liquidity Servicers of pools guaranteed by Ginnie Mae are obligated to continue making payments to investors, property insurers, and tax authorities for the life of the loan “without regard to whether they will be able to recover those payments from liquidation proceeds, insurance proceeds, or late payments” (Ginnie Mae, 2017, Chapter 15). Servicers have the option to stop the advances by purchasing loans out of the pool (for the value of the loan’s remaining principal balance, minus any advanced principal payments) once the mortgages reach 90 days delinquency, but it may not be cost-effective for some non-banks to hold the mortgages that are bought out of the pool.

The servicer is likely to recover much of the advances eventually from the FHA, VA, or other government mortgage insurance, or from other resolutions to the mortgage delinquency, but there can be substantial delays between when the servicer incurs the expense and when it gets reimbursed. In the FHA case, for example, roughly 40 months pass on average from the first missed mortgage payment until the point when the servicer is eligible to file a claim

⁴²Securities Industry and Financial Markets Association, “U.S. Mortgage-Related Issuance and Outstanding,” <https://www.sifma.org/resources/research/us-mortgage-related-issuance-and-outstanding/>.

with FHA.⁴³ Unlike PLS servicers, Ginnie Mae servicers must keep advancing funds even if it anticipates that it will not recover them.⁴⁴

Costs of delinquent loans Ginnie Mae servicers, like GSE servicers, do not receive the servicing fee for delinquent loans. However, for FHA-insured loans, servicers are allowed to include “debenture interest” in their insurance claim. Currently, this interest is roughly equivalent to the unpaid mortgage balance times the rate on the constant-maturity ten-year Treasury on the day that the borrower defaulted. However, servicers lose the right to claim much of this interest if they miss certain deadlines in the default servicing process, even if the deadline is missed for only one day. Kaul, Goodman, McCargo, and Hill (2018) document that the servicers in their sample lost part of this interest 43% of the time in 2015 and 2016, and that this forgone interest averaged around \$5,000.

Servicers of FHA-insured loans also are out-of-pocket for the first two months of interest associated with a borrower delinquency, and are exposed to potentially large property repair costs. Many of the property repair costs stem from the fact that the FHA, unlike the GSEs or VA, requires the servicer to bring the property up to saleable condition after the foreclosure sale before it is conveyed to the FHA. The FHA does not reimburse some property-preservation costs at all; for others, its allowance is below servicers’ actual costs. Repair costs associated with natural disasters can be particularly expensive for servicers.⁴⁵ These repair costs can be large: the data in Kaul et al. (2018) indicate that average property preservation losses are around \$4,000 for the 53 percent of foreclosures that follow the more expensive “conveyance” route. Those same data also indicate that other losses associated with foreclosures, such as legal costs, average around \$3,500 for all types of foreclosures.

As an indicator of the size of these losses, the average annual gross revenue that a servicer earns from a performing loan is around \$575. The average revenue after adjusting for operating costs is around \$350, but this estimate assumes a low overall default rate on the portfolio (2.76%).⁴⁶

⁴³Department of Housing and Urban Development (2018), Table 4, sum of months spent in delinquency, foreclosure, and deed transfer.

⁴⁴“The Issuer must use its own resources to cover shortfalls in amounts due to security holders or to Ginnie Mae resulting from insufficient collections on the mortgage collateral” (Ginnie Mae, 2017, Chapter 4).

⁴⁵FHA does not reimburse servicers with the costs associated with repairing property damage caused by “fire, flood, earthquake, tornado, boiler explosion (for condominiums) or Mortgagee Neglect,” where Mortgagee Neglect is defined as anything the servicer should have done to keep the property in saleable condition between the foreclosure sale and the conveyance of the property to FHA (Department of Housing and Urban Development, 2016, Section IV.A.2.a.ii.(A.)(1.), p. 835)

⁴⁶Gross revenue calculation assumes a loan balance of \$177,000 and a servicing fee of 32.5 basis points. Net revenue calculation assumes net operating income of 19.9 basis points. These are the averages for servicers who concentrate in government-guaranteed loans in the 2017:Q3 Mortgage Bankers Performance Report data, Tables P2 and P3.

Unlike servicers of FHA loans, servicers of VA-insured loans are, in principle, reimbursed for almost all advanced funds and incurred expenses, including taxes, insurance, interest on the unpaid principal balances and other advances, property preservation expenses, and foreclosure costs such as attorney’s fees. VA reimburses the servicer for these expenses plus the credit loss on the mortgage (the difference between the unpaid mortgage balance and the sales price of the foreclosed property). However, the total VA reimbursement is capped, generally speaking, at 25% of the original mortgage balance.⁴⁷ Incurring costs in excess of this guaranty amount is not difficult, especially if house prices decline by a non-trivial amount. Cordell et al. (2009), for example, note that legal fees, sales commissions, and maintenance expenses alone can total more than 10% of the loan balance.

To gauge the greater expense associated with servicing delinquent loans, and especially FHA or VA loans, we turn to data from the Y-14 mortgage servicing rights schedule. Large bank holding companies record their costs for servicing loans, broken out by type of servicing contract (Fannie Mae/Freddie Mac, FHA, VA) and by the delinquency status of the loans. The data are available for seven banks that serviced about \$700 billion in mortgages in total in 2016.

For each bank, we calculate cost of servicing a delinquent loan or a loan in foreclosure relative to a performing loan. The typical bank, as measured by the median of this measure, spends 10 to 12 times as much servicing a delinquent loan as a performing loan; this ratio does not vary much by whether the loan is serviced for Fannie Mae, Freddie Mac, FHA or VA. However, for loans in foreclosure, the costs differ significantly by type of servicing contract. For loans serviced under a Fannie or Freddie contract, the typical bank spends 17 times as much servicing a loan in foreclosure as a performing loan. For loans serviced for FHA or VA, the typical bank spends about 50 times as much servicing a loan in foreclosure as a performing loan. In a separate dataset of servicing expenses incurred by both bank and non-bank servicers, Kaul et al. (2018) similarly find that the costs of servicing loans that are seriously delinquent or in foreclosure are three times as high for FHA loans than GSE loans.

5.1.4 Servicing compensation

Although Ginnie Mae servicers take on more risk than Fannie and Freddie servicers, they do not necessarily receive greater servicing compensation. The minimum servicing fee is 25 basis points of the unpaid principal balance for Fannie Mae and Freddie Mac securitizations, and 19 basis points for Ginnie Mae securitizations.⁴⁸ Since the mortgages in Fannie and Freddie

⁴⁷See Department of Veterans Affairs (2018), Chapter 14, for details.

⁴⁸The Ginnie Mae II program calls for a minimum servicing fee of 19 basis points, with a range up to a maximum of 69 basis points. It is our understanding that Ginnie Mae servicers often retain on a weighted

pools are typically larger than those in Ginnie Mae pools, the gap in dollars of servicing revenue per mortgage is even larger.

The less-advantageous terms of the Ginnie Mae servicing contract raises the question of why servicers enter this business. The answer appears to be that under prevailing market conditions, originating mortgages can be more profitable for Ginnie Mae pools than Fannie or Freddie pools, especially when coupled with the ease of entry associated with the FHA and VA streamlined refinance programs (see Section 6). Some Ginnie Mae pools trade at better prices than GSE pools, and so originators realize more gain-on-sale income. In the third quarter of 2017, for example, non-banks who had more than 50% of their originations headed for Ginnie Mae pools earned 254 basis points on average in gain-on-sale income, compared with 196 basis points for those with less than 50% of originations destined for Ginnie Mae pools.⁴⁹ The price of originating the more profitable FHA and VA mortgages is accepting the servicing contract. Further, these non-banks have less skin in the game and may be more willing to take on these risks, realizing profits in good times and knowing they have the option to go out of business if delinquency rates rise.

5.2 Funding of servicing advances

Servicers need to finance the advances associated with delinquent loans until they are repaid from the mortgage insurance, foreclosure proceeds, or other sources. Originally, this financing was provided primarily by commercial banks as a complement to the warehouse funding that they provided to their clients. In 2003, large non-bank servicers started using securitization to fund the servicing advances associated with their private-label RMBS (Ramakrishnan, 2013). The agreements governing the servicing of private-label RMBS establish that the servicer is repaid first (before the bond holders) from the proceeds from the foreclosure or other resolution to the defaulted mortgage. Because of this first claim on the foreclosure proceeds, servicing-advance ABS are typically rated triple-A by the rating agencies, and carry favorable financing terms. In one deal that priced in 2012, for example, the yields on

average 30 to 35 basis points on an overall portfolio basis for the Ginnie Mae II business, which covers the majority of the single-family Ginnie Mae MBS production. The much smaller and older Ginnie Mae I program requires 44 basis points in servicing fee be retained, with no range. Issuers that want to capitalize their upfront cash will retain as low a servicing fee as possible in the interest of securitization into the highest MBS pass-through coupon.

⁴⁹Mortgage Bankers Association Performance Report, Table K2

these ABS were 1 to 2%.⁵⁰ Securitization terms typically will fund as much as 95% of the value for the types of advances that get repaid the fastest.

Even with the advent of securitization, though, large banks play a crucial role in the functioning of the servicing-advance market. The reason is that part of a non-bank's servicing-advance funding needs are predictable, and part fluctuate considerably, even within a given month. The securitization trust issues term notes with a fixed principal to finance the predictable part of the advances, and variable funding notes (VFNs) with fluctuating principal to finance the more variable part of the servicing advances. The term notes are generally purchased by capital-markets investors such as asset managers, pension funds, insurance companies, or hedge funds. The VFNs are often funded by bank-sponsored asset-backed commercial paper conduits, or sometimes by banks directly. Banks also may allow non-banks to finance servicing advances as part of the warehouse lines of credit primarily used for funding loan originations, or banks may arrange other types of financing.

One issue with servicing advances associated with the GSEs and Ginnie Mae is that these institutions retain the right to terminate, sell, or transfer the servicing in the event of servicer underperformance. This right allows these entities to follow through on their guarantee of timely payment of principal and interest to investors. However, this right also implies that these entities, rather than the servicer, have the first claim on the servicing advances. Private creditors are reluctant to finance servicing advances if they are unsure as to whether their loan to the non-bank is truly collateralized.

Fannie Mae and Freddie Mac deal with this issue through an “acknowledgment agreement” with the servicer and the private creditor. That agreement establishes that if Fannie Mae or Freddie Mac terminates, sells, or transfers the servicing, the original servicer will be reimbursed for any servicing advances made before the transfer of servicing (Fannie Mae, 2017, section A2-7-02). As a result, servicers for Fannie and Freddie are generally able to obtain financing for their advances, although their need for such funding, as discussed in Section 5.1, is much lower than for PLS or Ginnie Mae servicers. Some large non-bank servicers fund these advances with securitization, using structures and terms similar to the servicing-advance securitizations used for private-label RMBS.⁵¹

⁵⁰ Servicing advance ABS are almost always privately placed, and so it is difficult to get information on pricing. In October 2012, Home Loan Servicing Solutions “priced a Triple A rated 0.99-year average life tranche at 1.35% yield, while it paid a yield of 2% for another 2.99-year Triple A rated tranche” (Ramakrishnan, 2013).

⁵¹ Ramakrishnan (2013) noted that a triple-A, 2.04-year average-life note issued in 2013 from a Nationstar servicing advance ABS trust backed by Freddie Mac receivables paid a yield of 1%. See <https://www.nationalmortgagenews.com/news/ditech-securitization-funds-300m-of-agency-servicer-advances> for coverage of other ABS collateralized by Fannie Mae and Freddie Mac servicing advances.

Ginnie Mae, in contrast, has no acknowledgment agreement that covers servicing advances, and in the event that Ginnie Mae terminates or transfers the servicing, the servicer will not be reimbursed for the outlays that it has made.⁵² “If Ginnie Mae declares a default and extinguishment under the applicable Guaranty Agreement, the Issuer forfeits and waives any and all rights to reimbursement or recovery of any advances and expenditures made by the Issuer, all such rights of the Issuer are extinguished and Ginnie Mae becomes the absolute owner of such rights, subject only to the unsatisfied rights of the security holders.”⁵³ In the event of servicing transfer, the new servicer receives the proceeds from the servicing advances, even though it did not originally outlay the funds. As a result, Ginnie Mae servicers can only obtain unsecured financing, such as unsecured corporate bonds, to cover their advances. The rates on this financing are high, especially since many of the non-banks have high-yield credit ratings.

5.3 Servicing-advance liquidity during the financial crisis

Servicing advances are more difficult to finance during economic downturns. Mortgage delinquencies, and the associated need for servicing advances, generally rise when house prices fall and unemployment rises; servicing costs rise, and profitability falls. Meanwhile, financing conditions usually tighten during economic downturns. This combination means that servicer-advance financing is more expensive, and sometimes not available at all, at the same time that the need for it is greatest.

This dynamic can be seen during and after the 2007–08 financial crisis. At that time, the private-label RMBS market was enormous—\$2.7 trillion—and the Ginnie Mae market was both small—\$400 billion— and primarily serviced by banks. The liquidity issues, therefore, manifested in the experiences of companies such as Ocwen Financial Corporation, one of the largest subprime mortgage servicers at that time.⁵⁴ In 2004, servicing advances and cash each represented about a third of Ocwen’s assets (Figure 8). In 2006, advances began to increase as a share of assets, rising to 45% in 2006, 59% in 2009, and a whopping 79% in 2011. Cash, meanwhile, contracted, reaching a low of 3% of assets in 2011.

As Ocwen noted in 2009, “An increase in advances outstanding relative to the change in the size of the servicing portfolio can result in substantial strain on our financial resources. This occurs because excess growth of advances increases financing costs with no offsetting

⁵²Ginnie Mae, like Fannie Mae and Freddie Mac, has an acknowledgment agreement that covers mortgage servicing rights.

⁵³Ginnie Mae MBS Guide, Chapter 5, p. 5-4.

⁵⁴In its 2008 10-K, Ocwen describes itself as “one of the largest servicers of subprime mortgage loans.” (https://www.sec.gov/Archives/edgar/data/873860/000101905609000308/ocn_10k08.htm). We focus on the experience of Ocwen because it is publicly traded and so data are available.

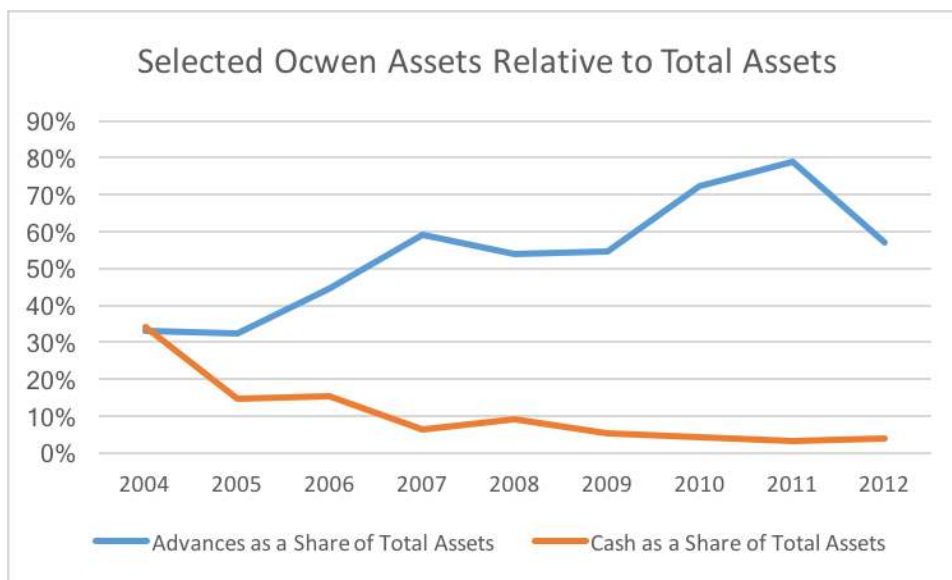


Figure 8: Selected assets of Ocwen Financial Corporation relative to total assets. Source: Authors’ calculations from Ocwen 10-K filings retrieved via the U.S. Securities and Exchange Commission’s EDGAR system.

increase in revenue, thus reducing profitability. If we are unable to fund additional advances, we could breach the requirements of our servicing contracts. Such developments could result in our losing our servicing rights, which would have a substantial negative impact on our financial condition and results of operations and could trigger cross-defaults under our various credit agreements.” At the same time that Ocwen’s advances were increasing, strains in the financial markets were hindering its ability to finance these advances; it noted “The current challenges facing the financial markets have made it difficult to renew or increase advance financing under terms as favorable as those of our current facilities.”⁵⁵

In a hearing before the House Subcommittee on Housing and Community Opportunity, William Erbey, the Chairman and Chief Executive Officer of Ocwen, stated “the large commercial banks who have traditionally provided this financing have all but withdrawn from the market” (Committee on Financial Services, 2009). The large banks withdrew, in part, because they were struggling to digest the servicing advances generated by their own affiliates. He also noted that the situation was difficult enough that a consortium of non-bank mortgage servicers (the Independent Mortgage Servicers Coalition) had made “various proposals to the Federal Reserve, Treasury and FHFA to provide up to \$8 billion in a short-term

⁵⁵See Desmond (2009) for an account of similar liquidity troubles at Carrington Mortgage Services.

financing facility and/or a related guarantee to independent loan servicers who, combined, service in excess of \$600 billion in mortgages (over four million homes).”⁵⁶

Concerns were also raised that the servicers’ financing difficulties would give them an incentive to foreclosure quickly on delinquent homeowners or give them modifications that were not in the best interests of the consumer or MBS investor, since these resolutions to mortgage distress would allow servicers to recoup their advances faster.⁵⁷ In part as a response to these concerns, the Federal Reserve Board included servicing-advance ABS as an eligible asset class for its Term Asset-Backed Securities Loan Facility (TALF), noting that “accepting ABS backed by mortgage servicing advances should improve the servicers’ ability to work with homeowners to prevent avoidable foreclosures.”⁵⁸ The inclusion of servicing-advance ABS as a TALF-eligible asset class contributed to a decrease in interest rates on these securities and helped provide servicers with longer-maturity funding.⁵⁹ For example, “the interest-rate spread on the TALF-financed [servicing advance] ABS issued in August [2009] was 75 basis points below the spread on the ABS issued in June [2009].”⁶⁰ Ocwen stated in its 2010 10-K that “Our prospects for advance financing have improved due to the inclusion of servicer advances in TALF” (p. 42) and that “Our recent TALF issuances. . . increased the maturity for 42% of our advance financing needs at fixed interest rates” (p. 41). Five servicing-advance ABS with balances totaling \$1.7 billion were ultimately financed with TALF loans.

5.4 Servicing-advance liquidity today

Today Ginnie Mae MBS outstanding are quite large and primarily serviced by non-banks, whereas the private-label market continues to run off (Figure 9). Financing the advances associated with Ginnie Mae MBS is not a strain currently because delinquency rates are low and servicers are generating sufficient cash from their operations. Likewise the low delinquency rates mean that the costs associated with servicing delinquent loans are low.

The situation seems likely to be considerably less sanguine in a different macroeconomic environment. In the aftermath of the hurricanes in August and September 2017, for example, concerns were raised that advances associated with the consumer forbearance that the GSEs and Ginnie Mae granted to borrowers with hurricane-damaged homes would be a problem for

⁵⁶The five members of the Independent Mortgage Servicers Coalition (IMSC) were American Home Mortgage Servicing, Carrington Mortgage Services, GMAC Mortgage, Nationstar Mortgage, and Ocwen Loan Servicing.

⁵⁷See Aiello (2018) for evidence that this dynamic occurred and was economically significant.

⁵⁸<https://www.federalreserve.gov/monetarypolicy/20090319a.htm>.

⁵⁹See Campbell, Covitz, Nelson, and Pence (2011) for a broader discussion of TALF’s effectiveness.

⁶⁰<https://images.forbes.com/media/pdfs/2009/08/Bernanke-letter.pdf>.

“thinly capitalized” non-banks.⁶¹ As noted in Section 5.1.3, natural disasters are particularly costly for FHA-insured loans, because servicers must repair the associated property damage out of pocket. Most non-banks turned out to be sufficiently geographically diversified to withstand this strain.

More broadly, the worrying aspect of the situation now is that the current size of the Ginnie Mae market and the concentration of Ginnie Mae servicing in the hands of non-banks is a combination that has never been tested. The Ginnie Mae market was much smaller, and primarily in the hands of banks, in the financial crisis and aftermath. A sustained rise in defaults on FHA and VA loans now could lead to large advances that non-banks would be unable to finance, as well as costs that they would be unable to absorb.

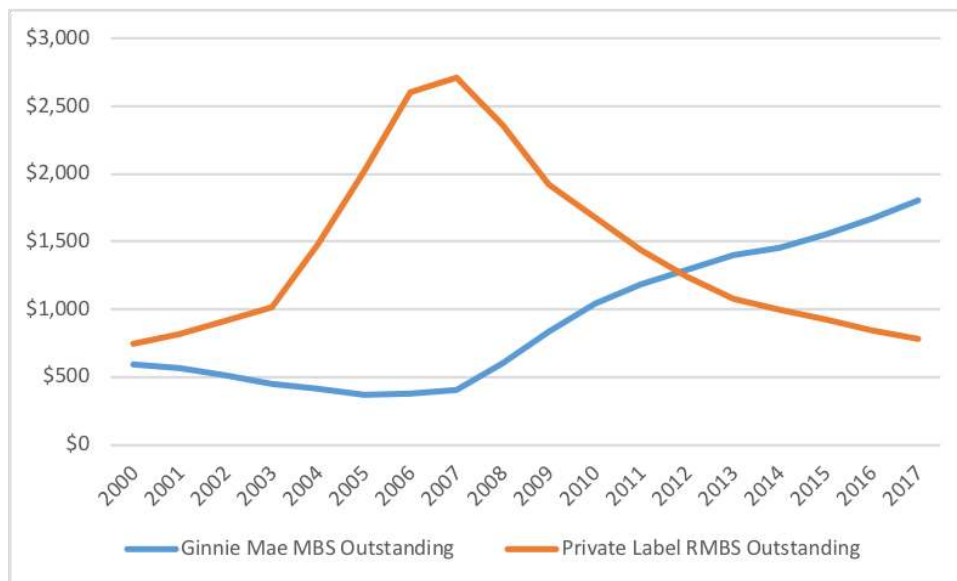


Figure 9: Outstanding MBS volumes (in \$ billion). Source: Securities Industry and Financial Markets Association, U.S. Mortgage-Related Issuance and Outstanding.

6 Vulnerabilities of non-banks to macroeconomic shocks

The liquidity vulnerabilities associated with non-banks could be triggered or amplified by solvency issues. These solvency issues, in turn, might stem from the two major macroeconomic shocks that typically affect mortgage markets: interest rates and house prices. These shocks would probably have a disproportionate effect on non-banks because of their business models.

⁶¹See *Inside MBS and ABS*, September 8, 2017, “Hurricane Damage: Despite Moratoriums on Default Loan Processing, MBS Issuers Must Keep Making Payments.”

These potential hits to their profitability, described in more detail below, can also affect their liquidity through two channels. First, warehouse lenders can pull or reprice lines of credit if non-banks violate the profitability covenants on the lines. Second, a decline in house prices and a corresponding rise in mortgage defaults will increase the servicing advances that a non-bank needs to finance as well as the unreimbursed costs that they will need to absorb.

6.1 Refinance mortgages and vulnerability to interest rates

Many non-banks have focused their business on originating refinance mortgages, which could make them more vulnerable to increases in interest rates, as the demand for refinance mortgages is highly interest-rate dependent. Although the 2016 HMDA data indicate that overall, just 48% of non-bank mortgage originations were to refinance existing mortgages (the same fraction as among bank-originated mortgages) this industry average masks the significant dependence of some large lenders on refinances. In particular, for each of the three largest non-bank mortgage lenders, refinances accounted for more than 70% of their 2016 originations. In addition, another four of the 25 largest non-bank mortgage lenders relied on refinances for more than 90% of their total originations in 2016.

The larger focus of non-bank lenders on refinance mortgages is particularly strong in the Ginnie Mae market, where 41% of all non-bank originations in 2016 were for refinances compared with 30% for banks. Traditionally, the lower income, credit-constrained borrowers that are more prevalent in the FHA market have been less likely to refinance their mortgages, and this has led these borrowers to become locked into high coupon mortgages and unable to take advantage of rate decreases and thus lower interest payments on their mortgages.⁶²

However, the FHA and VA have introduced streamlined programs that allow lenders to refinance mortgages at a relatively low cost, and as a result several large non-bank lenders appear to have heavily focused their activities on refinancing borrowers in Ginnie Mae pools. HMDA data indicate that for four of the 25 non-banks who originated the most FHA or VA loans in 2016, refinances made up more than 70% of their total origination volume. The relative ease of refinancing through the VA program, in particular, appears to have induced some lenders to aggressively solicit borrowers for refinances that may not have been in the borrowers' best interest (see Consumer Financial Protection Bureau, 2016; Rexrode, 2017).

One manifestation of the more active refinancing by non-banks is that non-bank originated mortgages prepay more quickly than bank originated mortgages. Figure 10 presents

⁶²Deng and Gabriel (2006) found in the pre-crisis period that mortgage-backed securities created from borrower pools with higher proportions of more-credit-constrained borrowers tended to prepay more slowly and these slower prepayment speeds more than offset the higher default rates. As a result, these bonds had higher durations and tended to trade at a premium, suggesting that lower-credit-quality borrowers were subsidizing higher returns to MBS bond holders.

the relative conditional prepayment rates (CPRs) for bank and non-bank Ginnie Mae securities (based on all pools, as calculated by Recursion, Co.).⁶³ The CPR is the percentage of the principal of the mortgage pool that is paid ahead of schedule, typically because some of the underlying mortgages are refinanced. As shown in the figure, during times of elevated refinancing activity, such as in the first half of 2015 and mid-2016, the non-bank CPRs are considerably higher than the bank CPRs. In 2017, bank and non-bank CPRs both hovered around 15%. However, some non-banks, as shown in Figure 11, have CPRs significantly higher than these industry-wide numbers, partly reflecting the elevated refinancing in the VA program. The CPRs of Freedom Mortgage, for example, spiked well above 40% in both 2015 and 2016. Ginnie Mae, as part of its investigation with the Department of Veterans Affairs, notified a small number of lenders in February 2018 that they might lose access to some Ginnie Mae programs if their elevated prepayment speeds did not come more in line with the rest of the market.⁶⁴

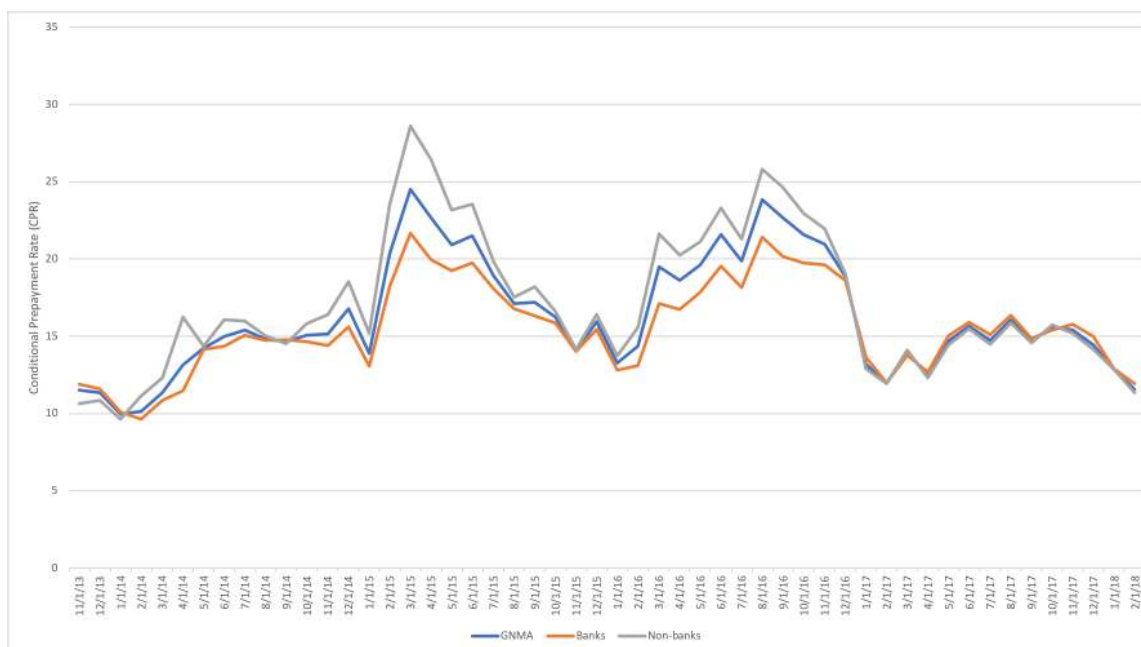


Figure 10: Conditional prepayment rates (CPRs) of bank and non-bank Ginnie Mae securities. Source: Recursion, Co.

In the event of a sustained rise in long-term interest rates, refinancing activity and the associated revenue will drop, and this drop will affect the solvency of some non-banks particularly hard. For some of these non-banks, their mortgage servicing rights—which typically rise in value when interest rates increase—will offset some of the loss in refinancing revenue.

⁶³We thank Li Chang for generously providing these data.

⁶⁴See <https://www.ginniemae.gov/newsroom/Pages/PressReleaseDispPage.aspx?ParamID=129>.

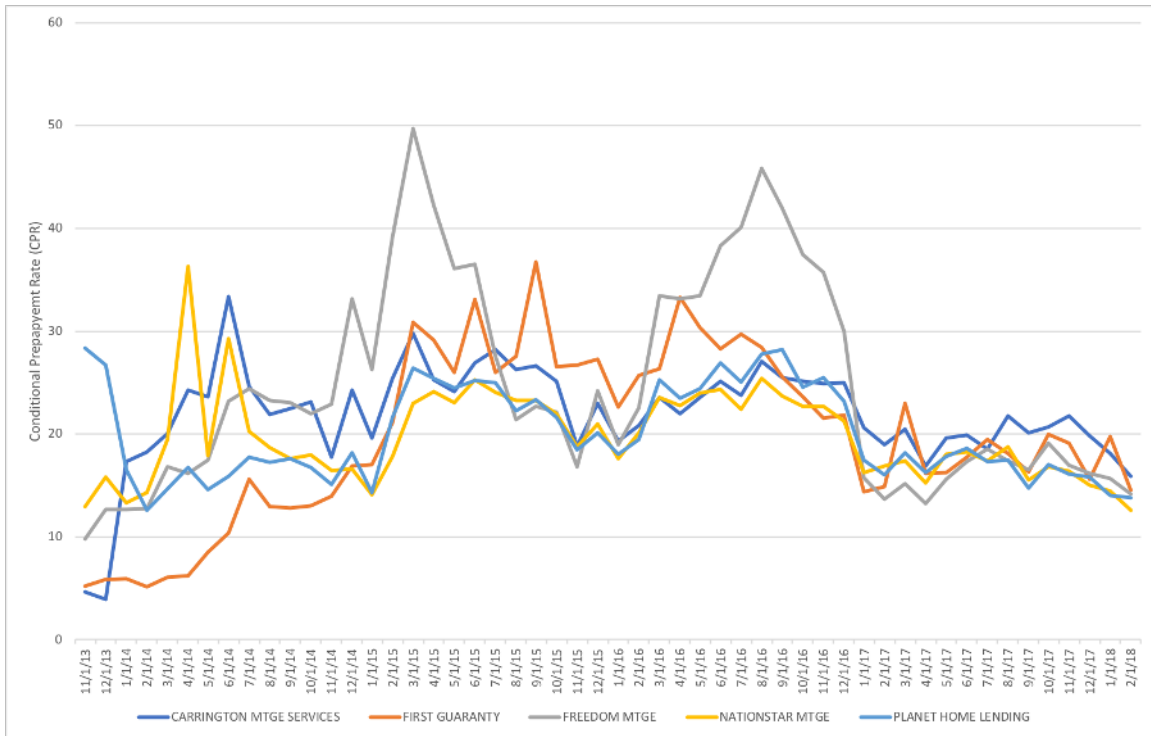


Figure 11: Conditional prepayment rates (CPRs) for the five non-bank counterparties to Ginnie Mae with the highest CPRs. Source: Recursion, Co.

However, this effect will be muted for the non-banks that have sold some of their servicing revenue to other institutions.

6.2 Credit quality and vulnerability to house-price declines

Available evidence also suggests that mortgages originated by non-banks are of lower credit quality than those originated by banks, which means that the non-bank servicers would be more vulnerable to rises in delinquencies triggered by a fall in house prices.

First, as described earlier, a larger fraction of non-bank originations are FHA or VA mortgages, which tend to be riskier than other types of loans. In the third quarter of 2017, the serious delinquency rates on FHA and VA mortgages on single family homes were about 4% and 2% respectively, compared with just under 1% for loans in GSE pools (see Urban Institute, *Housing Finance at a Glance*, December 2017). Delinquency rates on FHA and VA mortgages that are originated and serviced by non-banks are higher still. Based on issuer-level delinquency rates provided by Ginnie Mae, we estimate that on average, 3.6% of mortgages in Ginnie pools with non-bank issuer/servicers were two months or more

delinquent in the fourth quarter of 2017, compared with 1.8% of mortgages in pools with bank issuer/servicers.⁶⁵

These differences in delinquency rates reflect the risk characteristics of the underlying mortgages. Household survey data from the 2016 Survey of Consumer Finances indicate that borrowers with mortgages from non-banks have higher loan-to-value ratios and higher debt-service-to-income (DTI) ratios than borrowers with mortgages from banks within both the FHA/VA mortgage category and the non-FHA/VA mortgage category (Table 5). Non-bank borrowers are more likely to have lower credit scores, as proxied by the share of these borrowers who report being turned down for credit, or not applying for credit because of a fear of being turned down, in the last year. Non-bank borrowers are also more likely to be from financially vulnerable groups: they have less income and wealth than their bank counterparts, are less likely to have college degrees, and are more likely to be minorities. Finally, the growth and the churn within the non-bank sector are evident from the lower loan ages, and from the higher share of non-bank borrowers who report that their current servicer is not the same institution as their mortgage originator.

Bank and non-bank underwriting differences also appear in GSE and Ginnie Mae securitized loans. As shown in Table 6, the DTI ratios are slightly higher for non-bank originators among both GSE and Ginnie Mae loans. Median FICO scores are also lower for non-bank mortgages, by 5 points among GSE mortgages and by 25 points among Ginnie Mae mortgages. Furthermore, annual changes in both DTI ratios and median FICO scores suggest that the credit quality of Ginnie Mae mortgages being originated by non-banks is declining more quickly than for bank originated mortgages. In particular, non-bank DTIs have increased by 3.7% year-over-year, faster than the rate of increase for bank DTIs, and the downward trend in FICO scores is nearly twice as high for Ginnie Mae non-bank versus bank originators. (In contrast, the changes in DTI ratios and FICO scores for GSE loans have been similar among bank and non-bank originated mortgages.)

In recent years, the comparatively low credit quality of non-bank-originated loans has not created significant problems for lenders or servicers, as overall mortgage default rates have been low.⁶⁶ However, due to the lower credit quality of loans being originated by non-banks, a rise in defaults would probably hit non-bank lenders and servicers particularly hard, as happened in the years leading up to the financial crisis.

⁶⁵Averages are weighted by the outstanding pool balance. These delinquency rates are lower than those for FHA- and VA-insured loans overall because servicers have the option to buy delinquent loans out of the pools.

⁶⁶As of 2017:Q3, just under 1% of the GSE single family loan portfolio was seriously delinquent, compared with 3 1/2% in 2012. Similarly, serious delinquency rates on FHA loans were under 4%, compared with 9% in 2012 (see Urban Institute, 2017).

Selected Characteristics of Mortgage Borrowers
By FHA/VA Status and Type of Lender
2016 Survey of Consumer Finances

Characteristic	FHA/VA Mortgages		Not FHA/VA Mortgages	
	NonBank	Bank	NonBank	Bank
Share of All Mortgages	15%	18%	29%	38%
Household income				
Median	\$75,948	\$78,986	\$83,036	\$93,228***
10th percentile	\$24,303	\$30,379*	\$26,706	\$31,311***
Net Worth				
Median	\$93,626	\$137,906***	\$214,850***	\$278,844***
10th percentile	\$6,701	\$21,627**	\$17,500*	\$46,890***
% LTV > 90%	19%	12%***	13%**	6%***
% LTV > 95%	13%	6%***	9%**	3%***
Total debt-service-to-income ratio (median)	0.24	0.23	0.23*	0.23***
Total debt-service-to-income ratio (90th percentile)	0.51	0.47	0.49	0.47***
Turned down for credit in last 12 months	25%	22%	14%***	14%***
Did not apply for credit: afraid of being turned down	12%	11%	9%	4%***
% with Bachelor's degree	32%	39%*	46%***	52%***
% non-white	43%	39%	28%***	20%***
Average loan age (yrs)	5.1	6.2***	5.7*	5.9**
% servicer change since origination	58%	39%***	51%**	37%***
N	351	279	679	1,098

Note. The values for each measure are statistically significant different from those for borrowers who obtain FHA or VA mortgages from nonbanks at the *** 1%, ** 5%, or * 10% level. Standard errors are adjusted to incorporate imputation uncertainty and are bootstrapped with 999 replications to incorporate the SCF sample design. Estimates are weighted.

Table 5: Characteristics of borrowers with FHA/VA and non-FHA/VA mortgages, broken down by whether their lender is a bank or non-bank. Source: Authors' calculations from the Survey of Consumer Finances.

The servicing-advance strains associated with a rise in defaults on FHA and VA mortgages would affect some parts of the U.S. more significantly than others. Figure 12 shows the share of all mortgages in 2016 that were originated by non-banks and insured by the FHA or VA in counties that are part of metropolitan statistical areas (MSA).⁶⁷ This share is higher in the southern and southwestern parts of the U.S., and in particular in parts of Georgia, North Carolina, Texas, Virginia, California, and Arizona.⁶⁸ Servicers with heavy concentrations in these areas may be more vulnerable to servicing-advance strains.

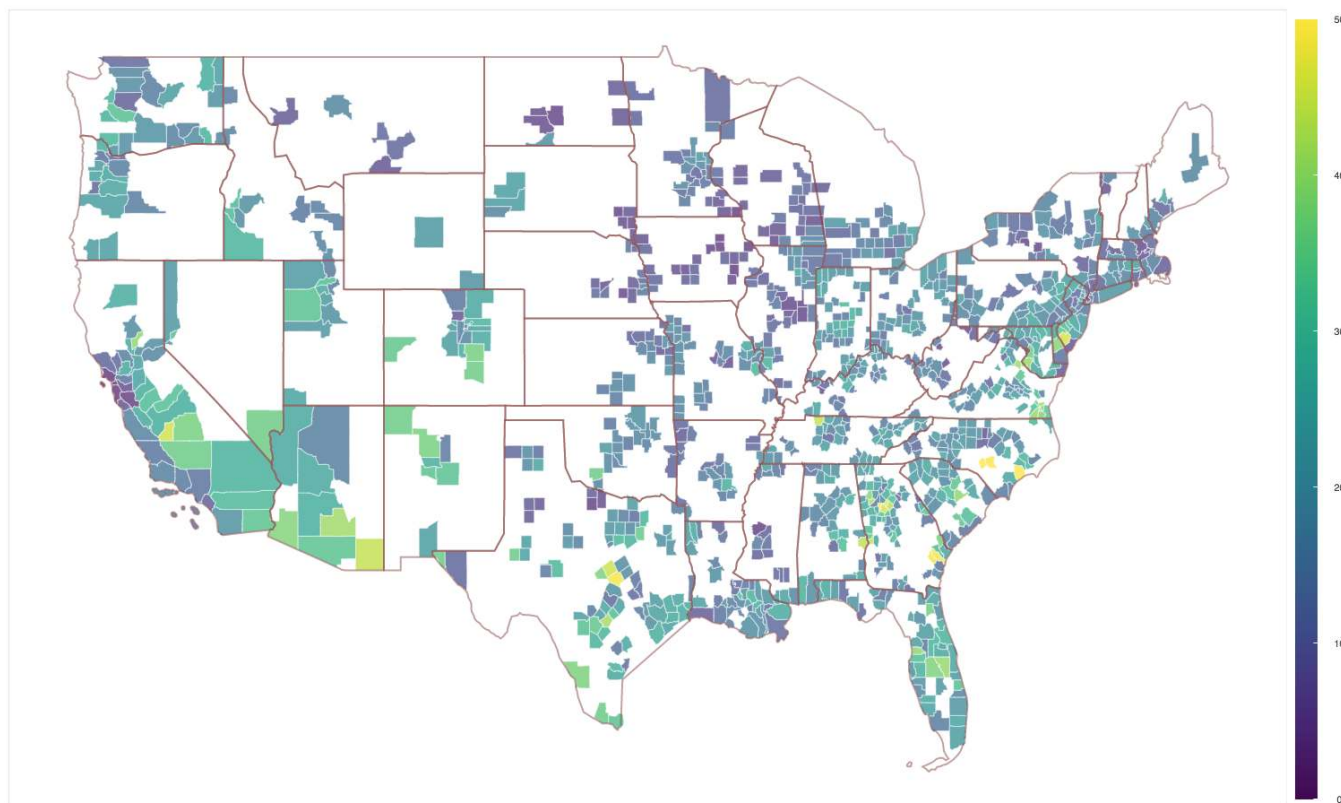


Figure 12: FHA or VA loans originated by non-banks as a proportion of all loans by county, 2016. Source: Authors' calculations from HMDA data.

⁶⁷The HMDA data are more representative for counties in MSAs.

⁶⁸The counties or independent cities, according to our estimates, in which 40 or more percent of 2016 mortgage originations were non-bank FHA or VA loans were Hoke, NC; Clayton, GA; Onslow, NC; Cumberland, NC; Bell, TX; Liberty, GA; Long, GA; Rockdale, GA; Cumberland, NJ; Henry, GA; Kings, CA; Coryell, TX; Montgomery, TN; Cochise, AZ; Russell, AL; Newton, GA; Douglas, GA; Guadalupe, TX; Stafford, VA; Pinal, AZ; Hampton, VA; Portsmouth, VA; Charles, MD; Suffolk, VA; and Osceola, FL.

7 Resources available to weather shocks

In the event of an adverse shock, non-banks have limited resources to draw upon. Table 7 shows selected assets and liabilities of non-banks, expressed as a share of the totals, as of the third quarter of 2017. The shares are based on simple averages of the reports of 268 independent mortgage companies.

Seventy percent of the non-bank assets are mortgages held for sale, i.e., mortgages on their way to a securitization vehicle. These mortgages serve as collateral for the warehouse lines of credit that fund them, and so are not available to the non-bank to absorb other shocks. About 10% of non-bank assets are mortgage servicing rights, which historically were the main unencumbered asset for non-banks. In recent years, though, non-banks have devised increasingly complex ways to use these MSRs as collateral for various forms of financing. MSRs are also liable to lose value or become illiquid in an economic downturn. For example, in the fourth quarter of 2008, the reported book values of MSRs held by banks fell by 33%, from \$76 billion to \$51 billion, even though the volume of one-to-four family residential mortgages serviced for others increased during that quarter.⁶⁹ Meanwhile, cash represented just 6% of assets.

Non-banks have a limited ability to raise debt to fund additional expenses. Most of their eligible assets are already tied up collateralizing secured lending facilities. Most of the publicly traded non-banks have high-yield credit ratings, which makes raising funds in unsecured bond markets expensive.⁷⁰ Finally, non-banks do not have access to the liquidity backstops available to a bank, such as the Federal Reserve System or the Federal Home Loan Bank System.⁷¹

In addition, as described in Section 4.1.3, non-banks are susceptible to increases in interest rates when their credit facilities mature. In the third quarter of 2017, 83% of their debt was lines of credit, typically with maturities just under a year, and 5% was other short-term debt. The bank lenders can also, in many cases, raise the rates on the lines before the renewal date if the non-bank violates one of the covenants of the credit agreement (which is likely to happen during times of stress).

Servicers with a high concentration of Ginnie Mae servicing appear to have fewer resources to meet liquidity strains than other servicers, even though their servicing-advance requirements make them more vulnerable to such strains. Table 8 reproduces some liquidity

⁶⁹Board of Governors of the Federal Reserve System et al. (2016), p. 21.

⁷⁰In late 2017, Moody's senior unsecured ratings of major publicly traded non-banks were Ocwen, Caa2; Walter, Ca; Nationstar, B2; Freedom Mortgage Corporation, B2; PHH, B1; PennyMac Mortgage Investment Trust, B2; Quicken, Ba1.

⁷¹A couple of mortgage REITs have access to the FHLB through captive insurance subsidiaries through 2019 (Light, 2016).

	Originator type	Median	Annual % Change	
Debt Service to Income Ratio (percent)	GSE	Non-bank	36	5.9
		Bank	35	6.0
	Ginnie Mae	Non-bank	42	3.7
		Bank	40.25	2.5
Loan to Value Ratio (percent)	GSE	Non-bank	80	0.0
		Bank	80	0.0
	Ginnie Mae	Non-bank	96.5	0.0
		Bank	96.5	0.0
FICO Score	GSE	Non-bank	748	-0.06
		Bank	753	-0.06
	Ginnie Mae	Non-bank	675	-1.3
		Bank	700	-0.06

Table 6: GSE and GNMA Borrower Underwriting Characteristics for Bank and Non-banks, September 2017. Source: eMBS.com, Urban Institute (2017).

Selected Items, Balance Sheets of Independent Mortgage Companies	
<u>Selected assets</u>	<u>% of total assets</u>
Mortgages held for sale	70%
Mortgages held for investment	1%
Mortgage servicing rights	11%
Mortgage advances	1%
Unrestricted cash and cash equivalents	6%
<u>Selected liabilities</u>	<u>% of total liabilities</u>
Lines of credit	83%
Other short-term debt	5%
Long-term debt	5%
<u>Memo</u>	
Number of independent mortgage company respondents	268

Table 7: The share that selected assets and liabilities represent of total assets and liabilities for independent mortgage companies as of 2017:Q3. Source: Authors' calculations from Mortgage Bankers Performance Report data, 2017:Q3.

measures published by the Mortgage Bankers Association for 2017:Q3. Servicers are sorted by whether servicing for Ginnie Mae represents less (“majority GSE”) or more (“majority Ginnie Mae”) than 50% of their servicing. As shown in the first memo line of the table, servicing for Ginnie Mae represents 6% of servicing for majority-GSE servicers, and 70% for majority-Ginnie Mae servicers. The statistics provide median measures estimated for 144 majority-GSE servicers and 51 majority-Ginnie servicers.

	Majority GSE% Q3 2017	Majority Ginnie Mae% Q3 2017
LIQUIDITY METRICS (Median)		
Unrestricted cash and cash equivalents/ Monthly recurring operating expenses (ratio, representing number of months)	2.6	2.3
Liquidity/Tangible net worth (%)	31	26
FHA liquidity metric/Agency servicing UPB (bps)	66	39
MEMO		
% Government owned servicing (#)	6.4	70
Number of companies reporting	144	51

Table 8: Various liquidity measures for independent mortgage companies as of 2017:Q3. Source: Authors’ calculations from Mortgage Bankers Performance Report data, 2017:Q3.

The first measure, median unrestricted cash relative to recurring operating expenses, is 2.6 months for majority-GSE servicers and 2.3 months for majority-Ginnie servicers. The second measure, median liquidity relative to tangible net worth, is 31% for majority-GSE servicers and 26% for majority-Ginnie servicers. The biggest gap between the two types of servicers appears in the FHA liquidity metric relative to agency servicing unpaid principal balance. The median of this measure is 66 basis points for majority-GSE servicers and 39 basis points for majority-Ginnie servicers.

It is difficult to assess the liquidity position of non-bank servicers from these statistics because we do not have threshold values for these measures for stressed scenarios and because the statistics obscure considerable heterogeneity across firms. Moody’s, however, publishes assessments of the liquidity positions of the non-bank mortgage finance companies that it rates. One of its key measures is secured debt relative to gross tangible assets.⁷² Moody’s notes, “High reliance on secured debt reduces a finance company’s financial flexibility because it encumbers assets, making them unavailable to be used as a liquidity source should an unexpected need arise.”⁷³ A company with a deep-junk rating of Ca or worse will have a value of 60% or more. Of the ten non-bank mortgage companies that Moody’s assessed in

⁷²Gross tangible assets exclude credit loss reserves.

⁷³Moody’s Investors Service, “Rating Methodology: Finance Companies,” October 2015.

June 2017, eight had values on this liquidity measure consistent with a Ca rating; a couple of these eight companies had secured debt in the range of 80 to 90% of their gross tangible assets.⁷⁴

8 Consequences of a non-bank mortgage-company failure

In the event of a failure of a non-bank mortgage company, there are three main types of parties who would have exposure: (1) consumers; (2) the U.S. government and, by extension, taxpayers; (3) banks and other creditors. their creditors.

8.1 Effects on consumers

A large-scale failure of non-banks has the potential to lead to a significant contraction in mortgage origination capacity. As noted in Section 6.2, non-banks disproportionately serve borrowers with lower credit scores, higher loan-to-value ratios, and higher debt-to-income ratios; they also disproportionately serve lower-income and minority borrowers. If non-bank failure resulted in a reduction in mortgage origination capacity, it is not clear that other financial institutions would extend credit on the same terms to these borrowers, or perhaps even extend credit at all. This contraction in mortgage credit availability has the potential to be a significant drag on house prices.⁷⁵

On the servicing side, as discussed in Section 5.3, a financially stressed servicer has an incentive to pursue resolutions to delinquent loans that minimize the non-banks' servicing advances rather than alternatives that might be more beneficial for borrowers or investors. In the event of an outright and disorderly servicer failure, there is potential for harm to a broader group of borrowers. For example, borrowers might not be properly credited for their payments to mortgage lenders, tax authorities, and insurance companies; mortgage modifications might get stalled. After years of scrutiny by federal and state regulators in the aftermath of the financial crisis, most servicing operations are in better shape than pre-crisis, and so these worries are somewhat less acute. Nonetheless, a disorderly servicing transfer may still be confusing or stressful for borrowers.

⁷⁴Moody's Investors Service, "Mortgage Finance Companies: Profitability Will Stay Modest as Rates Increase and Originations Decline," June 15, 2017.

⁷⁵See Anenberg, Hizmo, Kung, and Molloy (2017) for one study that establishes the significant effect of credit availability on house prices.

8.2 Effects on the U.S. government

The losses to the U.S. government would stem from two main sources. First, in the aftermath of the financial crisis, Fannie Mae, Freddie Mac, and the U.S. Department of Justice (on behalf of FHA) pursued originators through put-backs and enforcement actions for losses associated with poor loan underwriting. Because mortgages in GSE and Ginnie Mae pools at that time were primarily originated by banks that survived the financial crisis, the government was able to recoup billions in losses. In contrast, if a stressed situation unfolded today, some non-banks might not have the resources to survive, and their remaining assets—such as the mortgages collateralizing the warehouse lines—would transfer to the lender with the lien on the collateral and would not be available to the government as recourse for poor underwriting.

Second, the GSEs and Ginnie Mae may incur losses after absorbing the servicing portfolio of a failing servicer. A servicer in financial distress is also a servicer that is more likely to take shortcuts in some of its operations, and remedying those deficiencies can be costly. The GSEs or Ginnie Mae might have difficulty finding a new organization to take over the servicing, especially if that servicing has little value. Ginnie Mae does not have clear authority to pay a servicer to take a portfolio in a situation in which a rapid transfer is in the interest of borrowers. The contraction in servicing capacity in recent years has exacerbated this issue. In 2008, for example, 77% of independent mortgage companies serviced their own loans; by 2017:Q3, the share was 43%.⁷⁶

Ginnie Mae would also be responsible for absorbing the portion of the credit loss on delinquent loans that was not covered by the FHA or VA insurance or the corporate resources of the servicer before its failure. If the servicing still has value, these credit losses may not be large, since Ginnie Mae receives the servicing rights for free and can sell them for cash. However, operationally Ginnie Mae might struggle if it had to handle several servicer failures at the same time.

As an outsized example of the costs involved, in 2010, Ginnie Mae increased its reserve for losses by \$720 million, in large part due to the expected losses associated with its acquisition of the servicing portfolio of the non-bank, Taylor, Bean, and Whitaker.⁷⁷ Those losses were forecasted to arise from the portion of the credit losses that were not covered by the FHA, VA, USDA, or PIH credit insurance on the loan, and from the costs of servicing and liquidating

⁷⁶Source: Mortgage Bankers Performance Report.

⁷⁷Taylor, Bean, and Whitaker (TBW) at that point was the fifth-largest issuer of Ginnie Mae securities. See Note H in Ginnie Mae's fiscal-year 2010 financial statements, available at https://www.ginniemae.gov/about_us/what_we_do/Financial_Statements/annual_financials10.pdf, for more details on Ginnie Mae's losses.

the portfolios. The extensive fraud involved in the TBW failure, however, may make it a poor example for generalization.

8.3 Effects on banks and other creditors

The banks that lend to non-banks seem to have fairly small exposure to a non-bank failure. The bank warehouse lines of credit are collateralized by loan originations, and as detailed in Section 4.3, contain multiple additional protections for creditors including personal guarantees, collateral in addition to the loan originations, and provisions that allow for the changing of the pricing on, or the cancellation of, the warehouse line in the event that the non-bank violates any of its covenants. The warehouse lines also tend to be quite small relative to the total capital of the bank. To illustrate this point, Table 9 shows selected percentiles of total warehouse commitments to non-bank mortgage companies relative to assets and relative to equity for the 12 banks in our bank holding company sample that reported extending at least one warehouse line of credit. Warehouse line commitments represent less than 1% of assets for the three percentiles shown. Commitments are larger relative to equity, but even at the 75th percentile are only 5.6% of equity. Many of the non-banks' other creditors (such as the investors in servicing-advance ABS) are also secured by assets such as servicing advances or mortgage servicing rights.

	25th percentile	Median	75th percentile
Committed warehouse lines relative to assets	0.05%	0.42%	0.67%
Committed warehouse lines relative to equity	0.46%	3.29%	5.60%

Table 9: Selected percentiles of the distribution of warehouse line commitments relative to bank holding company assets and equity. Source: Authors' calculations from Y-14 data.

A more significant effect on banks may stem from the fact that some banks have exited the servicing business and outsourced their servicing operations to non-banks. Citigroup, for example, announced in 2017 that it was disbanding its mortgage-servicing department and hiring a non-bank subservicer to service its remaining portfolio of bank-held mortgage loans (Gray, 2017). If the subservicer were to fail, Citi might have difficulty finding another servicer to pick up the portfolio, and would not have the capacity to service the loans itself.

9 Regulation and housing-finance reform

9.1 Non-bank regulation

The sharp rise in non-bank involvement in residential mortgage lending and servicing has important implications for safety and soundness oversight in U.S. mortgage markets. When regulated financial institutions dominated the GSE and Ginnie Mae issuer base, a significant portion of originator risk-management oversight was carried out by bank regulators such as the Federal Deposit Insurance Corporation, the Federal Reserve System, the Office of the Comptroller of the Currency, and the National Credit Union Association.

Non-banks, in contrast, are regulated for safety-and-soundness purposes by the state financial regulators. In recent years, the Conference of State Bank Supervisors (CSBS), a nationwide organization of these regulators, and the American Association of Residential Mortgage Regulators (AARMR) have developed safety-and-soundness examination procedures based on the experiences of state and federal regulators; most states have adopted some or all of these recommendations.⁷⁸ CSBS also issued a proposal for prudential standards for non-bank mortgage servicers that has not yet been finalized by CSBS.⁷⁹ These regulators have also invested heavily in collecting and aggregating regulatory financial data on non-bank mortgage servicers through the Nationwide Multistate Licensing System (NMLS); these data are gathered through a periodic report of condition and income known as the Mortgage Call Report.⁸⁰ CSBS has entered into data-sharing agreements with other regulators so that these data can be used more broadly. As with all data collection efforts for this sector, this initiative remains a work in progress: uniform data standards between state and federal regulators have not been established, and it remains a challenge for reporting forms to keep pace with the rapidly evolving mortgage servicing structures and relationships.

The GSEs and Ginnie Mae also evaluate their issuers for financial and operational soundness. We review here the requirements for non-banks since the GSEs and Ginnie Mae generally rely on the standards, reporting requirements, and processes set by bank regulators for depository institutions. Broadly speaking, these bank regulatory standards are stricter than the non-bank standards described below.

⁷⁸The examination manual is available at <https://www.csbs.org/mortgage-examination-supplements>.

⁷⁹See <https://www.csbs.org/sites/default/files/2017-11/MSR-ProposedRegulatoryPrudentialStandardsforNon-BankMortgageServicers.pdf>.

⁸⁰See <https://mortgage.nationwidelicencingsystem.org/slr/common/mcr/NMLS%20Document%20Library/Standard%20MCR%20Definitions%20FV5.pdf>

Both the GSEs and Ginnie Mae set minimum requirements for their counterparties.⁸¹ The minimum net worth requirements are \$2.5 million plus 25 basis points on the servicing unpaid principal balance (UPB) for GSE counterparties, and \$2.5 million plus 35 basis points on the issuer UPB for Ginnie Mae counterparties (see Fannie Mae, 2017; Freddie Mac, 2017; Ginnie Mae, 2017). The minimum required ratio of 6% for tangible net worth to total assets is the same for the GSEs and Ginnie Mae. The minimum liquidity requirements for non-bank GSE seller/servicers are 3.5 basis points of servicing UPB with an additional increment for nonperforming loans of 200 basis points for the amount of the nonperforming loan portfolio in excess of 6% of the total agency servicing portfolio. Ginnie Mae requires \$1 million or 10 basis points of outstanding MBS balance, whichever is greater.

The GSEs and Ginnie Mae require that non-banks submit an audited end-of-fiscal-year financial statement and unaudited statements for the remaining three quarters (see Fannie Mae, 2017; Freddie Mac, 2017; Ginnie Mae, 2017). Non-banks are also required to submit the Mortgage Bankers Financial Reporting Form (MBFRF) on a quarterly basis.⁸² The MBFRF was revised in the third quarter of 2008 to require quarterly reporting of all debt facilities, including the many variants of warehouse facilities.⁸³ In addition, the MBFRF requires non-banks to provide quarterly reports on the contractual details and covenants of their 10 largest debt facilities. Although these data have much of the information needed to evaluate non-bank safety and soundness, the data are only available to the GSEs and Ginnie Mae, as well as to the Mortgage Bankers Association for statistical purposes if the non-bank elects to share the data. These data, like the Mortgage Call Report data collected by the CSBS, might also benefit from stronger data standards and governance processes.

We list some of the limitations of this monitoring framework below; some of these points were made originally in Kaul and Goodman (2016).

1. The net worth, capital, and liquidity requirements do not account for the riskiness of the non-bank's assets, the maturity and capacity of its debt facilities, the effectiveness of its hedging strategies, or the idiosyncratic aspects of its business model. Instead, they are one-sized-fits-all minimums. In contrast, the bank regulatory framework takes many factors into account and uses risk-based assets in capital calculations.
2. The GSE liquidity surcharge of 200 basis points when delinquencies reach a certain level may be counterproductive because it requires firms to raise more funds at a time

⁸¹The Ginnie Mae requirements described here are for their single-family forward-mortgage issuer/servicers.

⁸²See https://www.fanniemae.com/content/guide_form/form-1002-mortgage-bankers-financial-reporting-form.

⁸³The form now requires an accounting of repurchased loan lines, reverse repurchase facilities, Mortgage Servicing Rights (MSRs), lines of credit, and asset-backed commercial paper facilities.

when the firms are probably already under financial stress. A better approach might be to require higher levels of liquidity throughout the business cycle.

3. Market conditions can change rapidly, particularly when interest rates swing. Quarterly financial statements provided with a lag, particularly those that are unaudited, may not provide regulators with enough information to spot issues in a timely way.
4. As non-banks become more significant counterparties to the GSEs and Ginnie Mae, and as they engage in more complicated financial engineering, the GSEs and Ginnie Mae must devote more resources to understanding and analyzing the MBFRF data. Ginnie Mae, in particular, has not had the resources for this task; we describe this in more detail below.
5. The GSE's regulator, the Federal Housing Finance Agency (FHFA), does not have formal access to the MBFRF data, or the ability to examine the GSEs' counterparties directly. This concern led the FHFA to recommend in its 2016 Report to Congress:

“FHFA’s regulated entities contract with third parties to provide critical services supporting the secondary mortgage market, including non-bank mortgage servicers for the Enterprises. While oversight of these counterparties is important to safety and soundness of FHFA’s regulated entities, it is currently exercised only through contractual provisions where possible. In contrast, other federal safety and soundness regulators have statutory authority to examine companies that provide services to depository institutions through the Bank Service Company Act. The Government Accountability Office has recommended granting FHFA the authority to examine third parties that do business with the Enterprises.”

Ginnie Mae’s lack of resources to carry out these tasks has been highlighted by its Office of the Inspector General. A recent evaluation of Ginnie Mae’s success in meeting its rapidly escalating regulatory functions (Department of Housing and Urban Development, 2017) identified numerous problems and deficiencies, including:

1. Ginnie Mae did not implement policies and procedures for its account executives in a timely manner;
2. Ginnie Mae did not develop a default strategy;
3. Ginnie Mae was not prepared for growth and its staff lacked skills;
4. Ginnie Mae had made progress on non-bank oversight. However, even this progress did not address the operational challenges that Ginnie Mae would face if default occurred;
5. Ginnie Mae may not identify problems with issuers in time to prevent default and may not be able to absorb loans without disrupting service

More broadly, Ginnie Mae has about 150 core staff to handle its nearly \$2 trillion in outstanding MBS, including the associated risk analytics.⁸⁴ These staff are supported by contractors that handle bond-administration functions and other more routine tasks. Looking at its staffing as a whole, a 2016 study cited by its inspector general noted that “contractors account for 68% of the FTEs performing Ginnie Mae core competencies, and 84% of all Ginnie Mae FTEs. . . Ginnie Mae staffing would be approximately 1,434 rather than 852 if it were staffed at a level comparable to similarly situated entities” (Department of Housing and Urban Development Office of Inspector General, 2017, p. 5).

To summarize, the prudential regulatory minimums set by the GSEs and Ginnie Mae may not be completely adequate relative to the risks posed by these firms, and the proposed state prudential minimums have not been finalized. Regulators have the option, of course, on a firm-by-firm basis to require higher levels of capital and liquidity. However, such monitoring requires access to data and staffing resources that may not be available.

9.2 Housing-finance reform

There is an active current discussion about how best to manage housing-finance reform in the wake of the financial crisis. Several proposals have been put forward, including Bright and DeMarco (2016); Mortgage Bankers Association (2017); Parrott, Ranieri, Sperling, Zandi, and Zigas (2016a,b, 2017). While all of these proposals discuss in depth the regulation of the GSEs going forward, there is much less discussion of how to mitigate the significant risks we have identified as being posed by the rapid growth of non-bank lenders and servicers. We believe that this critical issue needs to be a more important part of this discussion.

For example, Mortgage Bankers Association (2017) do not touch on the risks associated with non-banks at all. Indeed, they portray the rise of non-banks as an unalloyed positive for consumers (p. 6):

“Fortunately for consumers, the gap in funding was filled by independent mortgage bankers (IMBs), whose market share in both purchases and refinances increased from the low 20s in 2008 to nearly 48% in 2015.”

While we agree with Mortgage Bankers Association (2017) that IMBs played a crucial role in ensuring access to credit in the aftermath of the financial crisis, it is important to take account of, and plan how to manage and regulate, the additional risk these firms bring to the market.

⁸⁴The \$2 trillion number referenced here includes all outstanding MBS, not just the \$1.8 trillion in single-family MBS cited earlier in this paper.

Moreover, the risks associated with non-bank servicers that we highlight in this paper will be even more significant under some housing-finance reform proposals. For example, Bright and DeMarco (2016) proposes expanding the Ginnie Mae model. The GSEs, along with other entities licensed by FHFA, would provide credit enhancement for loans in MBS, while Ginnie Mae would wrap the MBS and guarantee the timely payment of principal and interest to investors.⁸⁵

As noted in Section 5, the need to fund servicing advances associated with delinquent loans can place large liquidity pressures on Ginnie Mae servicers. Expanding the Ginnie Mae model to a larger set of loans and lenders has the potential to expand these liquidity pressures. The authors recommend that Ginnie Mae be given more resources to ensure that servicers are able to handle this risk.⁸⁶ A follow-up piece (Kaplan, Stegman, Swagel, and Tozer (2018)) considers these liquidity issues further. Whether servicers in this expanded model are also exposed to the costs for servicing loans in default as under the current Ginnie Mae arrangement will depend on the contracts between the new credit enhancement entities and the servicers.

We believe that reform proposals need to grapple seriously with the extent to which servicers are required to advance payments for delinquent loans, and the exposure that the servicers have to unreimbursed costs associated with these loans. If either of these risks will be significant for non-bank servicers in a housing reform proposal, it seems important either to have a strong regulatory framework to ensure that servicers will have the resources to weather these risks in a stress environment, or to find a way to limit the servicers' exposure to these risks.

10 Conclusions

The non-bank mortgage sector has boomed in recent years. The combination of low interest rates, well-functioning GSE and Ginnie Mae securitization markets, and streamlined FHA and VA programs have created ample opportunities for non-banks to generate revenue by

⁸⁵The new GSEs would also be able to purchase loans from small and mid-sized lenders and issue MBS with Ginnie Mae guarantees.

⁸⁶On p. 16, "Today, however, with complex and costly loss-mitigation requirements, lengthy foreclosure timelines, and the rise of non-bank servicers that do not have access to banks' traditional funding sources (such as deposits, FHLB advances, and the Federal Reserve), the risk of an issuer liquidity crisis is something Ginnie has become more focused on." On the same page, "Ginnie, for example, has been unable to spend \$4 million on additional oversight resources requested to examine the non-bank issuers using its platform. Ginnie has been seeking, even if not as part of broader reform, the authority to spend a small fraction of the money it brings in on a process for more robust oversight and stress testing of its issuers. But because it does not control its own revenues, it cannot spend these resources, even though they are meager relative to the funds Ginnie generates for the Treasury."

refinancing mortgages. Commercial banks have been happy to supply warehouse lines of credit to non-banks at favorable rates. Delinquency rates have been low, and so non-banks have not needed to finance servicing advances.

In this paper, we ask “What happens next?” What happens if an unexpected development in the mortgage market causes lenders to lose their taste for extending credit to non-banks? What happens if delinquency rates rise and servicers have to advance substantial payments to investors—advances that, in the case of Ginnie Mae pools, the servicer will find very difficult to finance? What happens if these liquidity issues are compounded by solvency issues, such as a sharp contraction in refinancing revenue or a surge in the costs associated with mortgages in default?

We cannot provide reassuring answers to any of these questions. The typical non-bank has few resources with which to weather these shocks. Non-banks with servicing portfolios concentrated in Ginnie Mae pools are exposed to a higher risk of borrower default and higher potential losses in the event of such a default, and yet, as far as we can tell from our limited data, have even less liquidity on hand than other non-banks. Failure of these non-banks in particular would have a disproportionate effect on lower-income and minority borrowers. As one example of this disproportionate harm, we observe that loans with FHA or VA insurance represented 52% of all mortgages originated to black and Hispanic borrowers in 2016, compared with 30% of all mortgage originations in the market as a whole.⁸⁷

In the event of the failure of a non-bank, the government (through Ginnie Mae and the GSEs) will probably bear the majority of the increased credit and operational losses that will follow. In the aftermath of the financial crisis, the government shared some mortgage credit losses with the banking system through putbacks and False Claims Act prosecutions. Now, however, the banks have largely retreated from lending to borrowers with lower credit scores and instead lend to non-banks through warehouse lines of credit, which provide banks with numerous protections in the event of non-bank failure.

Although the monitoring of non-banks on the part of the GSEs, Ginnie Mae, and the state regulators has increased substantially over the past few years, the prudential regulatory minimums, available data, and staff resources still seem somewhat lacking relative to the risks. Meanwhile, researchers and analysts without access to regulatory data have almost no way to assess the risks. In addition, although various regulators are engaged in micro-prudential supervision of individual non-banks, less thought is being given, in the housing-finance reform discussions and elsewhere, to the question of whether it is wise to concentrate so much risk in a sector with such little capacity to bear it, and a history, at least during

⁸⁷Source: Authors’ calculations based on HMDA data. Sample limited to first-lien mortgages collateralized by owner-occupied site-built single-family homes.

the financial crisis, of going out of business. We write this paper with the hope of elevating this question in the national mortgage debate.

References

- Acemoglu, Daron, Asuman Ozdaglar, and Alireza Tahbaz-Salehi, 2015, Systemic risk and stability in financial networks, *American Economic Review* 105, 564–608.
- Acharya, Viral V., Philipp Schnabl, and Gustavo Suarez, 2013, Securitization without risk transfer, *Journal of Financial Economics* 107, 515–536.
- Aiello, Darren, 2018, Value destruction and aggressive foreclosures: The behavior of financially constrained mortgage servicers, Working paper, UCLA.
- Allen, Franklin, Ana Babus, and Elena Carletti, 2012, Asset commonality, debt maturity and systemic risk, *Journal of Financial Economics* 104, 519–534.
- Allen, Franklin, and Elena Carletti, 2008, The role of liquidity in financial crises, in *Maintaining Stability in a Changing Financial System: A Symposium Sponsored by the Federal Reserve Bank of Kansas City* (Federal Reserve Bank of Kansas City, Kansas City, Mo).
- Allen, Franklin, and Douglas Gale, 2000, Financial contagion, *Journal of Political Economy* 108, 1–33.
- Anenberg, Elliot, Aurel Hizmo, Edward Kung, and Raven Molloy, 2017, Measuring mortgage credit availability: A frontier estimation approach, Finance and Economics Discussion Series 2017-101, Board of Governors of the Federal Reserve System.
- Babus, Ana, 2016, The formation of financial networks, *RAND Journal of Economics* 47, 239–272.
- Bartlett, Robert, Adair Morse, Richard Stanton, and Nancy Wallace, 2018, Consumer lending discrimination in the FinTech era, Working paper, U.C. Berkeley.
- Bellicha, Aya, Richard Stanton, and Nancy Wallace, 2015, The mortgage origination pipeline and the perils of exemption from automatic stay, Working paper, U. C. Berkeley.
- Bhutta, Neil, and Glenn B. Canner, 2013, Mortgage market conditions and borrower outcomes: Evidence from the 2012 HMDA data and matched HMDA-credit record data, *Federal Reserve Bulletin* 99.

- Bhutta, Neil, Steven Laufer, and Daniel R. Ringo, 2017, Residential mortgage lending in 2016: Evidence from the Home Mortgage Disclosure Act data, *Federal Reserve Bulletin* 103, 1–27.
- Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, Office of the Comptroller of the Currency, and National Credit Union Administration, 2016, Report to the Congress on the effect of capital rules on mortgage servicing assets, <https://www.federalreserve.gov/publications/other-reports/files/effect-capital-rules-mortgage-servicing-assets-201606.pdf>.
- Bookstaber, Richard, 2007, *A Demon of Our Own Design* (John Wiley and Son, New Jersey).
- Bresnahan, Timothy F., and Jonathan D. Levin, 2013, Vertical integration and market structure, in Robert Gibbons, and John Roberts, eds., *Handbook of Organizational Economics*, chapter 21, 853–890 (Princeton University Press).
- Bright, Michael, and Ed DeMarco, 2016, Toward a new secondary mortgage market, Technical report, Milken Institute, <http://assets1b.milkeninstitute.org/assets/Publication/Viewpoint/PDF/Toward-a-New-Secondary-Mortgage-Market.pdf>.
- Brunnermeier, Marcus, and Lasse Pedersen, 2009, Market liquidity and funding liquidity, *Review of Financial Studies* 22, 2201–2238.
- Buchak, Greg, Gregor Matvos, Tomasz Piskorski, and Amit Seru, 2017, Fintech, regulatory arbitrage, and the rise of shadow banks, Working Paper 23288, NBER.
- Bucks, Brian, and Karen Pence, 2008, Do borrowers know their mortgage terms?, *Journal of Urban Economics* 64, 218–233.
- Cabrales, Antonio, Piero Gottardi, and Fernando Vega-Redondo, 2017, Risk sharing and contagion in networks, *Review of Financial Studies* 30, 3086–3127.
- Campbell, Sean, Daniel Covitz, William Nelson, and Karen Pence, 2011, Securitization markets and central banking: An evaluation of the term asset-backed securities loan facility, *Journal of Monetary Economics* 58, 518–531.
- Coase, Ronald H., 1937, The nature of the firm, *Economica* 4, 386–405.
- Committee on Financial Services, 2009, Loan modification: Are mortgage servicers assisting borrowers with unaffordable mortgages?, <https://archive.org/details/gov.gpo.fdsys.CHRG-111hhr48677>, Hearing Before the Subcommittee on Housing and Community Opportunity of the Committee on Financial Services, HR, 111th Cong. 1.

- Comotto, Richard, 2012, Haircuts and initial margins in the repo market, Working paper, European Repo Council, ICMA.
- Consumer Financial Protection Bureau, 2016, A snapshot of servicemember complaints: A review of issues related to VA mortgage refinancing.
- Cordell, Larry, Karen Dynan, Andreas Lehnert, Nellie Liang, and Eileen Mauskopf, 2009, The incentives of mortgage servicers: Myths and realities, *Uniform Commercial Code Law Journal* 41.
- Covitz, Daniel, Nellie Liang, and Gustavo A. Suarez, 2013, The evolution of a financial crisis: Collapse of the Asset-Backed Commercial Paper market, *Journal of Finance* 68, 815–848.
- Dang, Tri Vi, Gary Gorton, and Bengt Holmström, 2013, Haircuts and repo chains, Working paper, Yale University.
- Deng, Yongheng, and Stuart Gabriel, 2006, Risk-based pricing and the enhancement of mortgage credit availability among underserved and higher credit-risk populations, *Journal of Money, Credit, and Banking* 6, 1431–1460.
- Department of Housing and Urban Development, 2016, FHA single family housing policy handbook 4000.1.
- Department of Housing and Urban Development, 2017, Government National Mortgage Association, Washington, DC: Nonbank oversight.
- Department of Housing and Urban Development, 2018, FHA single family loan performance trends, https://www.hud.gov/sites/dfiles/Housing/documents/FHALPT_Jan2018.pdf.
- Department of Housing and Urban Development Office of Inspector General, 2017, Monitoring of nonbank issuers presents challenges for Ginnie Mae, https://www.hudoig.gov/sites/default/files/documents/HUD%20IG%20Topic%20Brief_GNMA%20Monitoring%20of%20Nonbank%20Issuers_Web.pdf.
- Department of Veterans Affairs, 2018, VA servicer handbook M26-4.
- Desmond, Maurna, 2009, How Dodd helped a troubled hedge fund fight for help, <https://www.forbes.com/2009/08/28/dodd-carrington-capital-business-wall-street-dodd.html#6fd0ffc52d8a>.

- Di Maggio, Marco, and Alireza Tahbaz-Salehi, 2014, Financial intermediation networks, Working paper, Columbia University.
- Elliott, Matthew, Benjamin Golub, and Matthew O. Jackson, 2014, Financial networks and contagion, *American Economic Review* 104, 3115–3153.
- Fannie Mae, 2017, Fannie Mae servicing guide: Single family, <https://www.fanniemae.com/content/guide/>.
- Financial Crisis Inquiry Commission, 2011, Financial crisis inquiry report, http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf.
- Follain, J.R., and Peter Zorn, 1990, Unbundling of residential mortgage finance, *Journal of Housing Research* 1, 117–137.
- Freddie Mac, 2017, Single-family seller/servicer guide selling segment PDF, <https://www.allregs.com/tpl/Viewform.aspx?formid=00051759&formtype=agency>.
- Fuster, Andreas, Matthew Plosser, Philipp Schnabl, and James Vickery, 2018, The role of technology in mortgage lending, Staff Report 836, Federal Reserve Bank of New York.
- Garrett, Joseph, 1989, New paradigm for lenders, *Mortgage Banking* 49, 30–37.
- Garrett, Joseph, 1990, The unbundling of an industry, *Mortgage Banking* 53, 12–21.
- Ginnie Mae, 2017, MBS guide, https://www.ginniemae.gov/issuers/program_guidelines/Pages/mbsguidelib.aspx.
- Glasserman, Paul, and H. Peyton Young, 2015, How likely is contagion in financial networks?, *Journal of Banking and Finance* 50, 383–399.
- Goodman, Joshua, and Adam J. Levitin, 2014, Bankruptcy law and the cost of credit: The impact of cramdown on mortgage interest rates, *Journal of Law and Economics* 57, 139–158.
- Goodman, Laurie, 2017, Quantifying the tightness of mortgage credit and assessing policy actions, Working paper, Urban Institute, Housing Finance Policy Center.
- Gorton, Gary, and Andrew Metrick, 2010, Haircuts, *Federal Reserve Bank of St. Louis, Review* 92.
- Gorton, Gary, and Andrew Metrick, 2012, Securitized banking and the run on repo, *Journal of Financial Economics* 104, 425–451.

- Gray, Alistair, 2017, Citi sells mortgage servicing arm in \$1bn deal, *Financial Times*, January 30.
- Grossman, Sanford, and Oliver Hart, 1986, The costs and benefits of ownership: A theory of vertical and lateral integration, *Journal of Political Economy* 94, 691–719.
- Hart, Oliver, 1995, *Firms, Contracts, and Financial Structure* (Oxford University Press, Oxford and New York).
- Hart, Oliver, and John Moore, 1990, Property rights and the nature of the firm, *Journal of Political Economy* 98, 1119–1158.
- Holmström, Bengt, 1999, The firm as a subeconomy, *Journal of Law, Economics, and Organization* 15, 74–102.
- Holmström, Bengt, and Paul Milgrom, 1994, The firm as an incentive system, *American Economic Review* 84, 972–991.
- Jacobides, Michael, 2005, Industry change through vertical disintegration: How and why markets emerged in mortgage banking, *Academy of Management Journal* 48, 465–498.
- Joskow, Paul L., 2005, Vertical integration, in C. Menard, and M. M. Shirley, eds., *Handbook of New Institutional Economics* (Springer, Dordrecht and New York).
- Kaplan, Eric, Michael A. Stegman, Phillip Swagel, and Theodore W. Tozer, 2018, Bringing housing finance reform over the finish line, Technical report, Milken Institute.
- Kaul, Karan, and Laurie Goodman, 2016, Nonbank servicer regulation: New capital and liquidity requirements don't offer enough loss protection, Working paper, Urban Institute, Housing Finance Policy Center.
- Kaul, Karan, Laurie Goodman, Alanna McCargo, and Todd Hill, 2018, Reforming the FHA's foreclosure and conveyance process, Working paper, Urban Institute.
- Krishnamurthy, Arvind, 2010a, Amplification mechanisms in liquidity crises, *American Economic Journal: Macroeconomics* 2, 1–30.
- Krishnamurthy, Arvind, 2010b, How debt markets have malfunctioned in the crisis, *Journal of Economic Perspectives* 24, 3–28.
- Krishnamurthy, Arvind, Stefan Nagel, and Dmitry Orlov, 2014, Sizing up repo, *The Journal of Finance* 69, 2381–2417.

Lam, Ken, and Bulbul Kaul, 2003, Analysis of housing finance issues using the American Housing Survey, <http://www.huduser.org/publications/pdf/AhsAnalysis.pdf>.

Light, Joe, 2016, Housing regulator closes loan loophole used by REITs, *Wall Street Journal*, January 12.

McCoy, Patricia A., and Susan Wachter, 2017, Representations and warranties: Why they did not stop the crisis, in Lee Anne Fennell, and Benjamin J. Keys, eds., *Evidence and Innovation in Housing Law and Policy* (Cambridge University Press, Cambridge).

Moody's Investor Service, 2017, RMBS servicer advance facilities.

Mortgage Bankers Association, 2017, GSE reform: Creating a sustainable, more vibrant secondary mortgage market, <https://www.mba.org/2017-press-releases/april/mba-offers-detailed-gse-reform-proposal>.

Parrott, Jim, Lewis Ranieri, Gene Sperling, Mark Zandi, and Barry Zigas, 2016a, A more promising road to GSE reform, <https://www.economy.com/mark-zandi/documents/2016-03-22-A-More-Promising-Road-To-GSE-Reform.pdf>.

Parrott, Jim, Lewis Ranieri, Gene Sperling, Mark Zandi, and Barry Zigas, 2016b, A more promising road to GSE reform: Governance and capital, <https://www.urban.org/sites/default/files/publication/81331/2000809-A-More-Promising-Road-to-GSE-Reform-Governance-and-Capital.pdf>.

Parrott, Jim, Lewis Ranieri, Gene Sperling, Mark Zandi, and Barry Zigas, 2017, A more promising road to GSE reform: Access and affordability, <https://www.economy.com/getlocal?q=fcea72d3-2929-4ca7-9060-f59d4db98fc2&app=eccafile>.

Pozsar, Zoltan, Tobias Adrian, Adam Ashcraft, and Hayley Boesky, 2012, Shadow banking, Staff Report 458, Federal Reserve Bank of New York.

Ramakrishnan, Shankar, 2013, Search for yield drives mortgage servicer advance ABS, <https://www.reuters.com/article/abs-mortgages/search-for-yield-drives-mortgageservicer-advance-abs-idUSL1N0BF7WH20130215>.

Resolution Trust Corporation, 1992, 1991 annual report.

Resolution Trust Corporation, 1993, 1992 annual report.

Resolution Trust Corporation, 1994, 1993 annual report.

- Rexrode, Christina, 2017, U.S. turns focus on lenders to vets, *Wall Street Journal*, September 28.
- Stanton, Richard, Johan Walden, and Nancy Wallace, 2014, The industrial organization of the U.S. residential mortgage market, *Annual Review of Financial Economics* 6, 259–288.
- Stanton, Richard, Johan Walden, and Nancy Wallace, 2017, Mortgage loan-flow networks and financial norms, *Review of Financial Studies* (forthcoming).
- Stanton, Richard, and Nancy Wallace, 2016, Warehouse lending and funding fragility in the residential-mortgage market, Working paper, U.C. Berkeley.
- Stigler, George. J., 1951, The division of labor is limited by the extent of the market, *Journal of Political Economy* 59, 185–193.
- Swagel, Phillip, 2009, The financial crisis: An inside view, *Brookings Papers on Economic Activity* Spring, 1–78.
- Urban Institute, 2017, Housing finance at a glance: A monthly chartbook (October), Technical report, Housing Finance Policy Center.
- Williamson, Oliver, 1971, The vertical integration of production: Market failure considerations, *American Economic Review* 61, 112–123.
- Williamson, Oliver, 1975, *Markets and Hierarchies: Analysis and Antitrust Implications* (Free Press, New York).
- Williamson, Oliver, 1979, Transaction-cost economics: The governance of contractual relations, *Journal of Law and Economics* 22, 233–261.
- Williamson, Oliver, 2010, Transaction cost economics: The natural progression, *American Economic Review* 100, 673–690.

A Data

A.1 Survey of Consumer Finances

The Survey of Consumer Finances (SCF) is a comprehensive survey of household income, wealth, and financial decision-making conducted every three years by the Federal Reserve Board. The most recent survey was conducted in 2016 and contains data from interviews with 6,254 households. The survey design allows us to identify households with mortgages insured by FHA or VA (and thus probably securitized in Ginnie Mae pools) as well as households with mortgages held by non-bank institutions. Three sets of questions are particularly salient:

1. Households with mortgages are asked for the name of the institution that the loan is “with.” The survey answers indicate that households respond to the question by supplying the name of the current loan servicer. Respondents are also asked to identify the type of this institution, and are prompted with the suggestions “a commercial bank, savings and loan or savings bank, a credit union, a mortgage company, a finance or loan company, or something else?” We categorize a lender as a non-bank if the respondent identifies the lender as an institution other than a bank or credit union.
2. Respondents are asked if their mortgage was originated by a different lender than the institution that currently holds it. If so, they are asked for the name and lender-type of the originating institution.
3. Households with mortgages are asked “Is it an FHA mortgage, a VA mortgage, or is it from some other program?” We use the households’ replies to code FHA and VA mortgages.

The tabulations shown in this paper are estimated on the internal version of the data, which allows for slightly more precise identification of FHA and VA loans. In the public version of the data, VA loans are combined with a handful of mentions of other types of guarantee programs, such as “first-time buyer program” or “other federal loan program.”

One potential issue with the SCF is that some borrowers may misreport their type of mortgage or type of lender. For example, in earlier waves of the survey, before the instructions were clarified in the 2007 SCF, some households appeared to report mortgages that were guaranteed by Fannie Mae or Freddie Mac as FHA mortgages.⁸⁸

More information on the Survey of Consumer Finances is available at <https://www.federalreserve.gov/econres/scfindex.htm>.

⁸⁸Bucks and Pence (2008) and Lam and Kaul (2003) note that in 2001 and 1995 SCF waves, respectively, the FHA share of mortgages appears higher than in comparable benchmarks.

A.2 Home Mortgage Disclosure Act

The Home Mortgage Disclosure Act (HMDA) was enacted by Congress in 1975 and is implemented by the Consumer Financial Protection Bureau Regulation C. The regulation covers both depository and nondepository lending institutions that (i) do business within metropolitan statistical areas and (ii) exceed minimum thresholds for assets or mortgage lending volume.⁸⁹ Under HMDA, lenders are required to disclose to the public detailed information about their home-lending activity each year including the disposition of each application for mortgage credit; the type, purpose, and characteristics of each home mortgage that lenders originate or purchase during the calendar year; the census-tract designations of the properties related to those loans; loan pricing information; personal demographic and other information about loan applicants, including their race or ethnicity and income; and information about loan sales.

The analysis in this paper uses a restricted version of the HMDA data that includes the origination date for each mortgage. Using this additional information, we restrict our calculation of statistics on loan sales to loans originated during the first three quarters of the year. This is because loan sales are recorded in the HMDA data only if the loans are originated and sold in the same calendar year, so loans originated toward the end of the year are less likely to be reported as sold (Bhutta, Laufer, and Ringo, 2017).

A.3 Mortgage Bankers Association Performance Report

Independent mortgage companies that are approved to do business with Fannie Mae, Freddie Mac, and Ginnie Mae, either as a seller or a servicer, are required to submit the Mortgage Bankers Financial Reporting Form (MBFRF), available at https://www.fanniemae.com/content/guide_form/form-1002-mortgage-bankers-financial-reporting-form, 30 days after the end of each quarter (60 days for the year-end report). The MBFRF contains comprehensive information on companies' income, balance sheets, and exposures. Companies have the option to release their data to the Mortgage Bankers Association for inclusion in aggregate statistics that are reported in the Mortgage Bankers Association Performance Report.

Larger independent mortgage companies make up a disproportionate share of the companies represented in the MBA statistics. Smaller companies typically find it more efficient to sell their originations to larger companies than to become Fannie, Freddie, or Ginnie counterparties themselves. To illustrate this point, Table 10 compares statistics on the distribution

⁸⁹See <https://www.fdic.gov/regulations/compliance/manual/5/v-9.1.pdf> for additional details on the criteria that determine which financial institutions are covered by HMDA.

of the number of loan originations among companies reporting in the MBA data and among the more representative set of non-bank mortgage lenders reporting under HMDA. As can be computed from the statistics in the table, companies with more than \$200M in loan originations in 2016 make up 89% of companies reporting in the MBA data, compared with just 56% of companies reporting under HMDA.

A: MBA

Total Lender Originations (\$)	<200M	200-400M	400-1,000M	>1,000M	Total
Number of Companies Reporting	23	22	59	108	212
Fraction of All Companies	10.8	10.4	27.8	50.9	100
Total Loans Originated (\$000s)	2,552,758	6,341,959	37,866,146	543,767,214	590,528,077
Fraction of total loans (by dollar volume)	0.4	1.1	6.4	92.1	100
Total Loans Originated (#)	12,474	31,333	159,457	2,264,134	2,467,398
Fraction of total loans (by number)	0.5	1.3	6.5	91.8	100

B: HMDA

Total Lender Originations (\$)	<200M	200-400M	400-1,000M	>1,000M	Total
Number of Companies Reporting	439	147	196	215	997
Fraction of All Companies	44.0	14.7	19.7	21.6	100
Total Loans Originated (\$000s)	33,439,508	42,392,595	122,124,072	1,164,704,235	1,362,655,732
Fraction of total loans (by dollar volume)	2.5	3.1	9.0	85.5	100
Total Loans Originated (#)	150,138	177,576	514,304	4,680,120	5,522,383
Fraction of total loans (by number)	2.7	3.2	9.3	84.8	100

Table 10: Comparison of MBA and HMDA data

A.4 Y-14 data

U.S. bank holding companies (BHCs) and intermediate holding companies with \$50 billion or more in total consolidated assets are required to file quarterly data on various asset classes, capital components, and categories of pre-provision net revenue. The Federal Reserve uses these data to assess the capital adequacy of large bank holding companies and intermediate holding companies, including in supervisory stress test models. More information on these data is available at <https://www.federalreserve.gov/apps/reportforms/reportdetail.aspx?s0oYJ+5BzDZGwnsSjRJKDwRx0b5Kb1hL>. We use data from two schedules in our paper.

The **Y-14Q H.1 corporate loan data schedule** collects loan-level detail on corporate loans and leases, including the warehouse lines of credit and other loans that BHCs extend to non-bank mortgage companies. Respondents are instructed to report corporate loans and leases that are held for sale or held for investment on the last day of the relevant quarter. Respondents are also instructed to include all corporate loans that are at the consolidated bank holding company level, and not just loans held by the banking subsidiaries. Loans with a committed balance less than \$1 million do not need to be reported.

Loans extended to non-bank mortgage lenders (also called “obligors” in the rest of this text) are not explicitly identified in the data, so we identify these non-bank obligors, as described below, by a combination of their tax ID, name, type of credit facility, and line of business. We begin by generating a list of non-bank mortgage originators from the HMDA data from 2013–2016; non-banks are those with the reporting agency listed as the U.S. Department of Housing and Urban Development. The HMDA data and the Y-14 data list the tax IDs of the relevant entities, so our first screen is whether the tax ID of an obligor in the Y-14 data matches that of a non-bank lender in HMDA. This screen identifies 418 non-bank obligors in the Y-14 data. However, these tax IDs will not match in all cases because of the corporate structure of the non-bank, so we next conducted a “fuzzy match” between the mortgage lender name in HMDA and the obligor name in the Y-14 data. We use the “matchit” command in STATA, which uses a bigram string matching algorithm. We only keep matches with match scores above 0.8 on a scale of 0 to 1. After the fuzzy match, we manually check whether the resulting matches are reasonable. This step identifies an additional 36 non-banks in the Y-14 data. Finally, we select credit lines in the Y-14 data with “credit facility purpose” equal to “mortgage warehousing.” Some of these lines are probably for commercial mortgages rather than residential mortgages. We eliminate at least some of these commercial-mortgage warehouse facilities by dropping all lines of credit that were originated by a BHC division with a name that includes “commercial.” This screen identifies a final 577 non-bank mortgage companies.

We augment the Y-14 data with data from HMDA, where available, on the number, dollar amount, and type of mortgages that each non-bank originated each quarter. We also obtain information on each non-bank’s Ginnie Mae servicing portfolio by performing a similar fuzzy match between the Y-14 obligor name and the names of Ginnie Mae’s issuers/servicers. This fuzzy match adds information from 156 Ginnie Mae issuers/servicers to our data. The HMDA and Ginnie Mae data give us some rough proxies for the assets, size, and business models of the non-bank lenders.

We also use data from the **Y-14Q Schedule I (MSR valuation schedule)** in the paper. This schedule collects information on the number and dollar value of mortgages serviced by the bank, the value of the associated mortgage servicing rights, the banks’ estimates of changes in the MSR valuations in a variety of stress scenarios, and the banks’ costs incurred in servicing mortgages. Servicing costs are broken out by type of servicing contract (Fannie Mae or Freddie Mac; FHA; VA; non-agency) and the delinquency status of the loan.

B The economics of vertically disintegrated markets

Existing theories found in the economics literature on transactions costs, contracting, industrial organization, and economic networks provide limited insight into competitive outcomes in vertically disintegrated markets in which agents can act strategically when entering into contractual agreements among themselves; are influenced by the actions of others to whom they are only indirectly connected; and make unobservable quality choices that impact outcomes, locally as well as globally. In his famous essay on the nature of the firm, Coase (1937) describes why and how economic activity divides between firms and markets. He argues that firms exist to reduce the costs of transacting through markets. Building on Coase's seminal ideas, Williamson won a Nobel prize for his development of the transaction cost theory of integration (see Williamson, 1971, 1975, 1979). A key element of this theory is that market contracts are inherently incomplete and this limitation of explicit contracts may be especially severe when complexity or uncertainty make it difficult to specify contractual safeguards, or when parties cannot walk away without incurring substantial costs. Transaction cost theory therefore argues that vertical integration can be an effective response when these features are present. A related rationale for integration is that it might mitigate potential holdups by suppliers (see Joskow, 2005; Williamson, 2010).

The property rights theories of vertical integration (see Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995) have focused on how integration changes the incentives to make specific investments and find that ownership strengthens a party's bargaining position. However, incentive theories (see Holmström and Milgrom, 1994; Holmström, 1999) have also shown that under certain conditions, asset ownership by the agent (e.g., non-integration) can be complementary to providing high-powered financial incentives.

The related literature in organizational economics has focused more directly on the determination of horizontal market structures due to firm-level costs or strategic interaction among firms (see Stigler, 1951). In addition to the trade-off between efficient horizontal scale and vertical market power, Stigler's theory adds the additional idea that formal market institutions are required to support disintegrated trade. Bresnahan and Levin (2013) also argue that transaction costs for vertically disintegrated markets usually depend on market institutions that facilitate search and matching as well as institutions that facilitate contractual and pricing arrangements. Thus, this literature appears to conclude that vertically disintegrated market structures, particularly in industries with frequent arms-length exchange, require market institutions to set standards for products and contracts, establish mechanisms for matching buyers and sellers, and disseminate supply and demand information to function well.

A more recent literature has focused on the importance of network linkages between intermediaries and financial institutions in explaining systemic risk in financial markets similar to the vertically disintegrated mortgage market (see, for example, Allen and Gale, 2000; Allen, Babus, and Carletti, 2012; Cabrales, Gottardi, and Vega-Redondo, 2017; Glasserman and Young, 2015; Acemoglu, Ozdaglar, and Tahbaz-Salehi, 2015; Elliott, Golub, and Jackson, 2014; Babus, 2016; Di Maggio and Tahbaz-Salehi, 2014). These studies show that financial networks may create resilience against shocks in a market via diversification and insurance, but may also generate contagion and systemic vulnerabilities by allowing shocks to propagate and amplify. Stanton, Walden, and Wallace (2017) develop a theoretical model of a network of intermediaries in the private label mortgage market which gives rise to heterogeneous financial norms and systemic vulnerabilities. They show, in markets of this type, that the optimal behavior of intermediaries regarding their attitude toward risk, the quality of the projects that they undertake, and the intermediaries they choose to interact with, is affected by the behavior of their counterparties. These strategic network effects influence the financial strength and systemic vulnerability of individual intermediaries, as well as aggregate market outcomes. Stanton et al. (2014) establish empirically that network effects existed in the pre-crisis vertically disintegrated U.S. private-label residential-mortgage market, and Stanton et al. (2017) find that endogenous network effects were important determinants of ex post observable systemic vulnerabilities in that market.

C Structured Investment Vehicles (SIVs) pre-crisis

SIV/ABCP Conduit Program Name	Holding Company Name	<i>Inside Mortgage Finance</i>		
		Rank 2006	Origination 2006 (\$ Billion)	Status
Mountain Funding Trust	Accredited Home Lenders	36	15.70	CH 11 2008
Broadhollow Funding, LLC	American Home Mortgage	13	58.90	CH 11 2007
Main Street Warehouse Funding Trust	Ameriquist Mortgage	16	27.80	Closed 2008
Bishop's Gate Residential Mortgage Trust	Cendant Mortgage*	18	41.26	Sold 2005
Park Granada, LLC	Countrywide	1	462.50	Sold 2008
Park Sienna, LLC	Countrywide	1		
Harwood Street Funding I, LLC	CTX Mortgage	34	13.47	Closed 2008
Harwood Street Funding II, LLC	CTX Mortgage	34		
KKR Atlantic Funding Trust	Deutsche Bank Trust Company Americas**	25	29.00	CH 11 2009
Funding, LLC (Series A)	EMC Mortgage	11	72.43	Closed 2009
Master Funding, LLC (Series B)	EMC Mortgage	11		
MINT I, LLC	GMAC Mortgage	8	74.60	CH 11 2012
Witmer Funding, LLC	GMAC Mortgage	8		
North Lake Capital Funding	Indy Mac	7	89.95	Sold 2007
Luminent Star Funding Statutory Trust I	LaSalle Bank***	18	38.31	Sold 2007
Wind Master Trust	Lehman Brothers****	38	14.00	CH 11 2008
Wind Master Trust	Lehman Brothers*****	20	34.30	Sold 2009
Strand Capital, LLC	Long Beach Mortgage*****	4	195.70	Sold WAMU
Auburn Funding, LLC	Nationstar Mortgage	NA	3.74	Sold 2006
Von Karman Funding Corp., LLC	New Century Financial	12	59.8	CH 11 2007
St. Andrew Funding Trust	New Century Financial	12		
MINT II, LLC	Residential Capital	9	96.75	CH 11 2012
Three Pillars Funding LLC	Suntrust	15	56.45	Going Concern
Ocala Funding, LLC	Taylor Bean Whitaker Mort.	30	24.80	CH 11 2011
Thornburg Mortgage Capital Resources, LLC	Thornburg Mortgage		.29	CH 11 2009
Total lenders with SIVs (\$ Billion)			1,409.46	
Total U.S. origination (\$ Billion)			2,980.00	
SIV lenders as percentage of total			47.30%	

*PHH Mortgage; **MortgageIT; ***ABN AMRO; ****BNC Mortgage; *****Aurora Loan Services; *****WAMU

Table 11: Columns one and two reports the pre-crisis universe of off-balance Structured Investment Vehicles (SIVs) that were used to fund mortgage originations by their parent holding company and were funded by Extendable Asset Backed Commercial Paper issued by their parent holding company. Columns three and four reports the 2006 values for the overall market ranking of the parent and the parent's total mortgage origination in billions of dollars. Finally, column five provides information on the status of the parent company as of 2017. Sources: Mortgage origination data were obtained from *Inside Mortgage Finance* and HMDA. SIV data were obtained from quarterly SIV statements reported to Moody's Investor Services. The status of the parent was obtained from various regulatory and corporate filings.