

# Bank Aggregator Exit, Credit Supply, and Borrower Outcomes in the Mortgage Industry

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(FIRST DRAFT)

## **Abstract**

We study the effects of exit by bank aggregators in the mortgage market – firms who purchase and pool loans originated by other entities, providing significant liquidity and connecting smaller originators to secondary markets. Bank of America and JP Morgan Chase were large aggregators until 2012 and 2014, respectively, when they abruptly exited. Variation in these banks' local market shares provides plausibly exogenous exposure to aggregator exit. Comparing areas with high and low exposure in a difference-in-differences design, we find that exit by Bank of America and Chase caused significant entry by nonbank firms into the aggregator space, increased the amount of short-term funding that exiting banks provided to nonbank originators, and increased the probability that nonbank originators became MBS issuers. The resulting changes to the industrial organization of the mortgage industry increased mortgage interest rates, increased lending to borrowers with low credit scores, increased prepayment rates, and decreased the probability that distressed borrowers received loss mitigation.

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# 1 Introduction

The financial intermediation chain that produces mortgages in the United States has multiple distinct roles. Originators interact directly with consumers to underwrite and supply mortgages. In the short term, banks finance their own originations with internal funds and provide warehouse lines of credit to nonbanks to fund their originations. Long-term funding ultimately comes from either bank balance sheets or (more commonly) from secondary markets through mortgage-backed securitization (MBS). Although some originators access secondary markets directly, others sell their loans to "aggregators" who then securitize the mortgages. Aggregators provide significant interim liquidity for originations, connect originators to long-term funding from secondary markets, and affect the quality of loan servicing through their choice of servicer (Stanton et al. 2014; Stanton et al. 2018). Financial institutions' incentives to assume these roles depend on economies of scale and scope, internal and external sources of funding, and regulatory burdens, among other factors. As these factors shift, the industrial organization (IO) of the market can change dramatically.

This paper studies how exit by bank aggregators in the early 2010s affected the role of nonbanks in the IO of the mortgage sector, credit supply, and borrower outcomes. The literature has documented an increase in nonbanks' share in origination and servicing and given various reasons for this dramatic shift (Buchak et al., 2018; Kim et al., 2018), focusing primarily on differences in regulatory regimes and ability to harness technological innovation. However, prior studies have not investigated the different roles played by banks and nonbanks along the supply chain, or provided *causal* estimates on how the shift to nonbanks affected credit supply and borrower outcomes. Our contribution addresses this gap.

Our findings suggest that nonbanks are imperfect substitutes for banks as aggregators. Bank aggregators lower the cost of financial intermediation, likely because of their scale economies, cheaper and vertically integrated short-term funding, and greater ability to time MBS issuance to take advantage of market conditions. Bank aggregators also have greater incentive than nonbanks to safeguard their reputations, for example to preserve their ability to cross-selling non-mortgage products to their customers. Reputational risk affects an aggregator's willingness to fund loans to borrowers with low credit scores, and its incentive to provide borrowers with high quality servicing.

Our empirical strategy leverages the abrupt pullback of two very large bank aggregators—Bank of America (BOA) and JP Morgan Chase (Chase)—from the mortgage aggregation business in 2012 and 2014, respectively. BOA pulled back from both "conventional" mortgages eligible for sale to Fannie Mae and Freddie Mac and mortgages insured by the Federal Housing Administration (FHA), whereas Chase pulled back only from the FHA market. The pullbacks were motivated by the large costs associated with defaulted mortgages. In the

FHA market, those costs took the form of the U.S. government’s prosecutions under the False Claims Act (FCA) to recoup the FHA’s losses on defaulted mortgages.

We design a difference-in-differences (DID) estimate around this exit shock, described in Section 3. The identification strategy contrasts areas where Chase and BOA had large and small FHA market shares, and looks before and after their respective exits. Our primary specification resembles a shift-share design, with exit exposure measured by the (continuous) pre-exit market shares. We also consider a discrete DID based on above-median and below-median exposure. Both specifications produce very similar results. With this empirical strategy, we estimate the effects of exit by bank aggregators on nonbank entry, funding relationships, consumer interest rates, and outcomes measuring borrower composition and the quality of loans.

We first examine how the BOA and Chase’s exit as aggregators affected the IO of the mortgage market. We find that nonbank firms stepped into the void left by BOA and Chase. In particular, nonbanks became a larger share of the entities that sold loans to Fannie Mae or Freddie Mac or issued MBS guaranteed by Ginnie Mae, which we refer to as being an ”Agency counterparty.” A little more than 40% of BOA pre-exit market share was replaced by nonbanks, and Chase’s exit led a similar increase. Evaluated at the average pre-exit market shares, BOA’s (Chase’s) exit led to a 15 pp (4 pp) increase in the share that nonbanks represented of Agency counterparties.

Next, we examine how nonbanks increased their Agency-counterparty share. We find that nearly half stemmed from an increase in the extent to which nonbanks purchased loans from other originators—in other words, some nonbanks replicated BOA and Chase’s aggregator role. The rest of the increase was driven by nonbanks that lent directly to borrowers growing in size enough to become Agency counterparties themselves.

However, we also provide evidence that nonbanks were only imperfect substitutes for bank aggregators. Although securitization provides long-term financing for originations, nonbanks still rely on banks for short-term liquidity to purchase originations from correspondent lenders or fund their own originations prior to securitization. We find that almost all the increase in nonbank share is at least partly funded by short-term liquidity from banks that significantly pulled back from the FHA market, including BOA and Chase. This result suggests that large banks still provided liquidity to the mortgage market even after their exit, but now only indirectly through nonbanks. Unlike nonbanks, bank aggregators were able to source short-term financing from their own deposits as vertically integrated entities, or could access advances from the Federal Home Loan Banks. These funding sources available to banks are typically less costly than the external funding that a nonbank can obtain from a third-party bank.

In subsequent parts of the paper, we examine how the significant change in the IO of the mortgage market affected credit supply and borrower outcomes. Although nonbanks replaced some of the roles that BOA and Chase played, nonbanks may have a higher cost of funding than vertically integrated banks and face different incentives. We focus on how these differences between banks and nonbanks may result in changes in credit supply and borrower outcomes.

We analyze the effects of the aggregators' exit on several loan-level outcomes, starting with mortgage interest rates. We find that Chase and BOA's exit increased consumer loan prices. Controlling for a rich set of borrower and loan level characteristics, interest rates on home-purchase loans increased more than 4 basis points in areas with above-median relative to below-median exposure to Chase's exit. BOA's exit had qualitatively similar effects in both FHA and conventional lending. In fact, the exit shocks had comparable relative effects on prices after accounting for differences in levels of interest rates and magnitudes of the banks' pre-exit shares. Evaluated at the mean exposure, each exit caused a 1-2% relative increase in prices in affected markets. These results suggest that exit by bank aggregators increased the costs of financial intermediation, and rising intermediation costs were passed through to consumers in higher prices.

We also find that exit by the bank aggregators expanded the credit box, shifting the composition of credit supply toward lower credit quality borrowers. In the loan-level analysis, BOA's exit from FHA lending reduced the average credit score on FHA loan originations by 1 point for every 10% of pre-exit market share, more than a 3 point reduction in average scores at the mean exposure. The average credit score of FHA originations decreased 1.6 points in areas with above-median relative to below-median exposure to Chase's exit. These effects are driven almost entirely by increased lending to borrowers with very low credit scores, below 640 points. We find no significant evidence of increased loan originations among higher credit quality borrowers. We attribute the increase in originations among lower credit score borrowers in part to nonbanks' greater willingness, relative to banks, to take on the financial and reputational risks associated with loan default. Moreover, banks could have other non-mortgage lending opportunities with higher returns on capital than lending to low-score mortgage borrowers (Gissler et al., 2020).

Aggregators often become servicers of loans they securitize, and securitizers of FHA loans are obligated to assume servicing initially. Thus, the exit of large bank aggregators also shifted servicing to nonbanks, which could affect borrower outcomes if nonbank servicers have different incentives than bank servicers. This reasoning suggests we can use our setting to estimate the causal effects of having a loan serviced by a nonbank firm, using the bank exit shock as an instrument for assignment of borrowers to nonbank servicers. Using this IV strategy, we estimate the causal effect of nonbank servicers on two important servicing outcomes:

prepayments and loss mitigation.

We find that borrowers with nonbank servicers tend to prepay their loans earlier than those with bank servicers. Controlling for observable loan-level characteristics, having a nonbank servicer causes an 18 percentage point increase in the probability that a loan is paid off within two years of origination. This magnitude is very large, given that the unconditional probability of early prepayment within two years is around 17 percent. We attribute this result in part to the fact that nonbanks make profits almost exclusively from mortgage origination, and thus have an incentive to refinance their borrowers as often as possible, while banks make profits from cross-selling other products to their existing book of borrowers. Our finding that loans originated by nonbanks prepay faster than those originated banks has also been documented in Kim et al. (2022b) and other studies.

Finally, we also examine the causal effect of the shift to nonbank servicers on loss mitigation for distressed borrowers in the context of the CARES Act forbearance during the Covid-19 pandemic. We find that nonbanks are less likely to provide forbearance to distressed borrowers. Loans that are serviced by nonbanks, again instrumented by Chase’s exit shock, become at least 60 day past due without receiving forbearance at a probability 6 percentage points higher than loans serviced by banks. This is an economically significant impact, given the unconditional mean of the outcome variable is about 14 percent. Our causal estimate is consistent with previous findings that nonbank servicers are correlated with lower forbearance rates (Cherry et al., 2021; Kim et al., 2022a). Our results on loss mitigation suggest that borrowers with nonbank servicers receive significantly lower quality servicing, a welfare cost of the shift to nonbank aggregators caused by bank exit.

**Related literature** This paper adds to the literature studying the role of aggregators in the mortgage market. Stanton et al. (2014) is one of the first papers to point out an important role played by aggregators and documents the network structure between aggregators and retail originators. Stanton et al. (2018) develops a theoretical framework to analyze this mortgage market network. Our paper contribute to this literature in the following ways. First, our paper provides causal estimates of the effects of large bank aggregators using a quasi-experimental research design. Second, our focus is on the difference between bank and nonbank aggregators after the Great Financial Crisis, whereas these two earlier papers studied aggregators in general using the data before the Great Financial Crisis.

Our work is also related to papers, such as Buchak et al. (2018), Kim et al. (2018), Fuster et al. (2019), and Gete and Reher (2021), that study the shift from banks to nonbank or fintech lenders in the mortgage

market, reasons behind the the shift, or the consequences of the shift. Our paper contribute to this literature in multiple ways. First, whereas these papers focus on the shift to nonbank or fintech lenders among retail originators, our paper focuses on the shift from bank aggregators to nonbank aggregators and shows how the shift to nonbank aggregators affected retail originators and altered banks' role in the mortgage intermediation chain. Second, although the previous papers study how different loan characteristics are correlated with nonbank or fintech originators, we estimate the causal effects of the shift to nonbank aggregators on credit supply and borrower outcomes using difference-in-differences regressions that exploit regional variation in exposure to BOA or Chase's exit.

There are also related papers studying different roles played by banks and nonbanks in the mortgage market. Jiang (2021) studies warehouse funding relationship between banks and nonbanks, and how that funding relationship interacts with their competition between banks and nonbanks in the retail origination market. Buchak et al. (2020) show that substitution between banks and nonbanks is imperfect, because bank balance sheet capacity gives a comparative advantage over nonbanks in originating loans that are not easily securitized (e.g., non-conforming loans). Relative to these papers, we study the role of banks as aggregators and offer evidence that nonbank aggregators cannot perfectly replicate large bank aggregators even in the segment of the market for conforming loans, which can be easily securitized.

## 2 Vertical Disintegration of the Mortgage Market

In the years before and immediately after the Global Financial Crisis, large banks played several inter-related roles in the mortgage market.

- They originated some loans directly and purchased many more loans from correspondent lenders.
- They funded these originations using low-cost deposits or advances from the Federal Home Loan Banks, and extended “warehouse” lines of credit to nonbank mortgage companies (which lacked access to both funding sources) so that these firms could originate loans themselves.
- When they had accumulated sufficient mortgages, banks swapped the mortgages for an MBS guaranteed by Fannie Mae or Freddie Mac (for “conventional” loans that met these agencies' guidelines), issued MBS guaranteed by Ginnie Mae (for loans insured or guaranteed by the Federal Housing Administration, FHA, or Department of Veterans Affairs, VA), issued “private label” MBS without a government credit guarantee (for loans that were too large or otherwise did not meet the standards of the agencies), or continued to hold the loans on balance sheet.

- When the loans were sold to a securitization trust, a new asset—a mortgage servicing right (MSR)—was created, which represents the present discounted value of the servicing fee. Banks retained this asset and serviced the securitized loans along with the loans that they held in portfolio.
- As borrowers made their insurance and tax payments, banks held those funds in escrow until disbursement to the appropriate authorities. Banks also marketed other products to these borrowers.

The Global Financial Crisis and the resulting regulatory response led banks to re-assess their appetite for these business lines. One such factor was the increase in bank capital requirements, especially for MSRs. The increased capital requirements were particularly onerous for banks that had large MSR holdings relative to their equity. However, an even more significant factor appeared to be the large and somewhat unanticipated costs associated with defaulted loans. These costs included GSE “putbacks” (required repurchases of defaulted loans), legal exposure for faulty servicing and breaches of securitization representations and warranties, and in the case of FHA loans, Department of Justice prosecutions under the False Claims Act for defrauding the government. Although both banks and nonbanks were affected by these costs, the ramifications were more severe for large banks because they faced more reputational risk, had other business lines to protect, and had deeper pockets. In other words, nonbanks had a more viable option than banks to shed the costs of defaulting loans by going out of business.

Banks reduced their exposure to mortgage defaults by pulling back from mortgage origination, purchase, and servicing. Purchasing mortgages was problematic because the bank assumed the legal liabilities associated with the loan, but did not observe or control some aspects of that lender’s underwriting or interactions with the borrower. However, banks expanded their presence in warehouse lending to nonbank competitors, which allowed them to maintain a presence in mortgage lending while limiting their exposure to default costs.

The shift from a vertically integrated market in which banks originate, purchase, fund, and service loans to a “vertically disintegrated” market in which banks primarily fund nonbanks who originate and service loans should raise mortgage costs for at least three reasons. First, banks have much lower funding costs than nonbanks for the period before the securitization sale. Because their funding costs are so low, banks have the additional financial advantage that they can time MBS issuance to take advantage of favorable market conditions, whereas nonbanks need to move loans off the relatively costly warehouse funding to securitization as soon as possible. Second, banks reap more revenue from the balances in escrow accounts. Since escrow accounts must be held at insured depositories, nonbanks park these balances at banks, and banks only pass along some of the revenue that they generate from deposits. Third, banks have a broader array of products

to cross-sell to their borrowers, whereas nonbanks are generally monolines that focus only on mortgage originatio and servicing.

### **3 The False Claims Act and Bank Pullback from FHA lending**

When originators or aggregators submit loans for FHA insurance, they perform multiple quality assurance functions on behalf of the FHA and certify that the loans meet program standards. Starting in 2011, the Department of Justice filed lawsuits under the False Claims Act (FCA) alleging that certain lenders had certified loans that did not meet the guidelines and thereby defrauded the government. The FCA allows for large financial penalties, including triple damages for the government’s loss from the fraud as well as civil penalties. The lawsuits resulted in 16 lenders paying around \$5.5 billion in damages from 2012-17.

The FCA prosecutions were not something most FHA lenders likely anticipated before the GFC. The Department of Justice had not used its FCA authority as expansively previously, in part because its powers were more limited before legislative changes in 2009 and 2010. Lenders also perceived the prosecutions as unfair and arbitrary as well as costly. The Mortgage Bankers Association wrote in a 2020 letter that “the Federal Housing Administration (FHA) and Department of Justice over pursued lenders for minor errors on defaulted FHA insured loans that had no causal relationship to the reason for default.” Jamie Dimon, Chase CEO, noted in a 2016 shareholder letter that “FCA settlements wiped out a decade of FHA profitability.”

The FCA lawsuits were likely a factor in BOA’s depature for correspondent lending in 2012 and were explicitly a factor in Chase’s exit from the FHA market in 2014. Bank of America inherited a large aggregator business as part of its 2008 acquisition of Countrywide Financial and was one of the largest aggregators of FHA mortgages in 2010. On October 4, 2011, BOA announced that it would shut down its aggregation activities at the end of the year as part of its effort to right-size its balance sheet and rebuild capital after it suffered enormous losses from the Countrywide acquisition. At the same time, BOA was negotiating an FCA settlement with the Department of Justice for legacy FHA loans originated by Countrywide. In early February 2012, HUD announced that BOA would pay \$500 million to settle the first of what turned out to be two major FCA settlements.

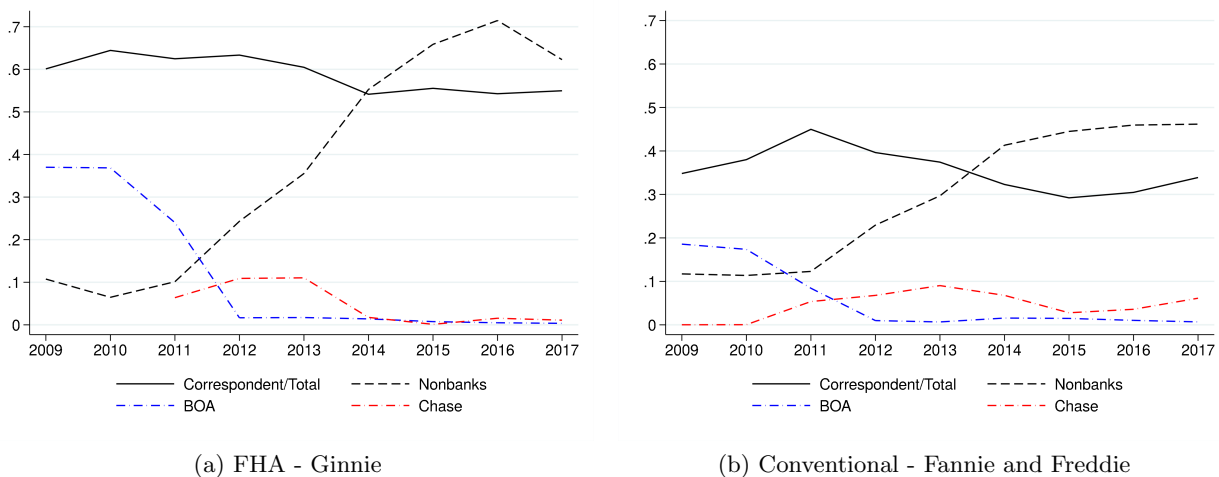
Chase exited the FHA market two years later, after it settled an FCA lawsuit with the Department of Justice on February 5, 2014 for \$614 million. In 2013, Chase was the [th] largest FHA aggregator, with [y percent] market share. Chase’s CEO, Jamie Dimon, announced the bank’s pullback from the FHA market in a July 2014 conference call with investors: “Until they come up with a safe harbor or something, we are



going to be very, very cautious in that line of business... The real question for me is should we be in the FHA business at all.”

Figure 1 shows the dramatic decline in BOA’s (blue dashed line) and Chase’s (red dashed line) mortgage activity during this period.

Figure 1: Evolution of National Market Structure for Securitized Home Purchase Mortgages

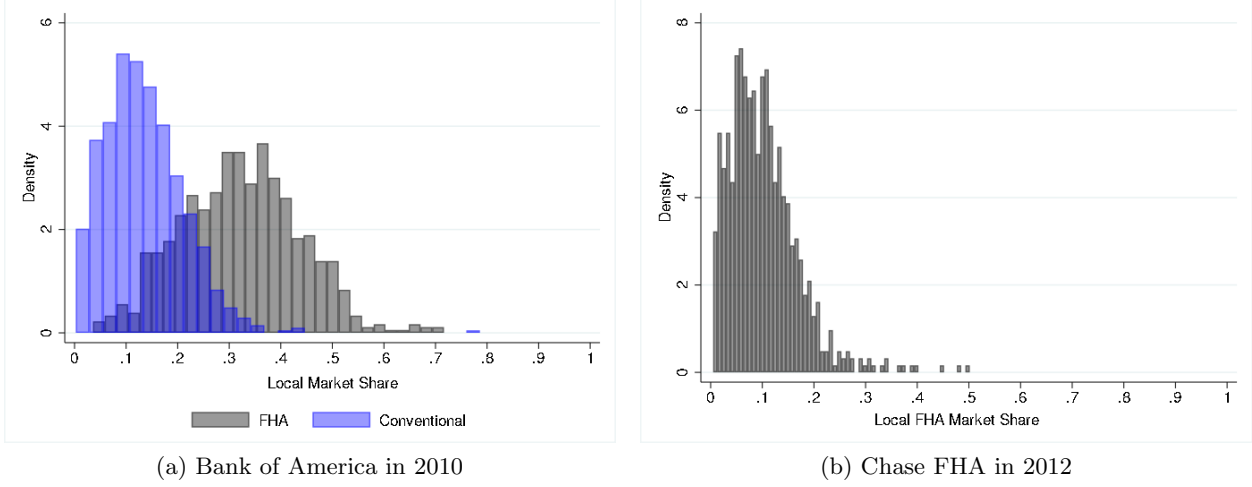


## 4 Identification and Estimation

Our identification strategy leverages market-level variation in the impact of BOA and Chase’s national exit shock. BOA and Chase were significant FHA and conventional mortgage aggregators on a national scale. However, their local market shares of correspondent lending just prior to their exit had significant geographic variation. Figure 2 plots cross-sectional densities for pre-exit (2010 BOA, 2012 Chase) markets shares across localities and shows that BOA’s market share ranged from zero to 80 percent in 2010, and Chase’s market share ranged from y to z percent in 2013. As the banks withdrew outright as correspondent lenders, some local mortgage markets experienced the exit of a dominant aggregator while other areas experienced insignificant changes in market structure.

This variation suggests a difference-in-differences (DID) identification strategy to estimate the effects of aggregator exit. Comparing otherwise similar local markets and loans, the effects of BOA and Chase’s exit are identified off differences over time in lending outcomes between areas with high and low pre-exit market shares. Our baseline specification resembles a shift-share design, measuring exposure by the (continuous) pre-exit market share of the exiting bank. We also estimate a discrete DID by comparing markets with

Figure 2: Geographic Variation in Exposure to Aggregator Exit Shock



above-median to below-median exit exposure.

We implement this strategy in a regression framework using a rich set of controls for observable loan-level and market-year-level factors. We estimate separate regressions for each exit event. Formally we estimate two types of specifications, (1a) and (1b), depending on whether the outcome  $y$  is measured at the market level or at the loan level.

$$y_{mt} = \sum_t \alpha_t S_m + x_{mt} \gamma + \xi_m + \xi_{g(m)t} + \epsilon_{mt} \quad (1a)$$

$$y_{imt} = \sum_t \beta_t S_m + x_{imt} \gamma + \xi_m + \xi_{g(i,m)t} + \epsilon_{imt} \quad (1b)$$

The DID estimates are the coefficients  $\alpha$  and  $\beta$ . The treatment exposure measure is the pre-exit local market share  $S_m$ , measured in 2010 for BOA and 2012 for Chase. We estimate year specific DIDs  $\alpha_t$  and  $\beta_t$ , as above, with reference coefficients being the year before exit (2011 and 2013 for BOA and Chase, respectively). We also estimate specifications that pool pre-periods and post-periods, yielding a single DIDs estimate.

Markets  $m$  are tuples defined by loan type (FHA or Conventional), loan purpose (home purchase or refinance), and local area (county, 3-digit zip code, or state). Individual loans are notated  $i \in m$ . Time  $t$  is measured in years. Control variables are given by the vectors  $x$ . Each regression includes market fixed effects  $\xi_m$ , and fixed effects  $\xi_{gt}$  that define DIDs control groups for each loan  $i$  and/or market  $m$ , so that identification comes off variation over time between markets within treatment/control sets  $g()$ . The DID

groups control for the changes in the GSE and FHA maximum loan limits, which we describe later in this section.

## 4.1 Data

We estimate our regressions with rich (near population) loan-level data from four sources: data collected under the Home Mortgage Disclosure Act (HMDA) for 2009-2017, eMBS (Mortgage Backed Securities Online) for 2013-2017, FHA administrative data for 2009-2015, and GSE data for 2009-2017. The HMDA data for this period provide excellent lender identifiers and geographic information, but very limited information on interest rates, borrower credit quality, and servicing outcomes. The eMBS, FHA, and GSE datasets have rich information on prices and credit quality but very limited lender information. We use the HMDA data to measure geographic market shares for each loan product, and to assess market structure, around the exits of the major banks. We merge these HMDA-derived exposure measures for Chase and BOA exit into the eMBS, FHA, and GSE datasets using the most granular geographic information available on each dataset.

## 4.2 Control Groups and Threats to Identification

As noted earlier, the mortgage market experienced significant shocks and changes during the 2010-15 period besides the FCA prosecutions and BOA and Chase exits. These events could affect borrower demand for FHA and conventional mortgages and the relative appetite of banks and nonbanks for originating these loans. If these changes are correlated with our identifying variation, then we might be inappropriately attributing mortgage market outcomes to BOA and Chase's exit when other factors were the cause.

The change that presents the most direct challenge to our identification is the decrease in the GSE loan limit in October 2011 and the FHA loan limit on January 1, 2014, which coincide with the BOA and Chase exits. The maximum loan size eligible for FHA insurance or for sale to the GSEs varies by MSA and county. In 2008, the Economic Stimulus Act increased the maximum limit for FHA and GSE loans dramatically from \$362,790 to \$729,750. Various pieces of legislation kept it at that level until October 2011, when the GSE limit fell to \$625,000. The FHA loan limit stayed at the higher level until January 1, 2014, when it also fell to \$625,000. The unusual situation of the FHA loan limit exceeding the GSE loan limit meant that FHA loans were attractive for a couple years to some borrowers who would typically have chosen other products.

Because the loan limit varies by county, this change poses a threat to our identification strategy if these loan limits changed in counties where BOA or Chase had large market shares in 2011 or 2013. To address this issue, our baseline specification groups together markets subjected to similar changes in FHA and GSE

conforming loan limits over the estimation period.

Other mortgage market developments during this period affected the relative appetite of banks and nonbanks for participating in the mortgage market, but since these developments occurred at the national level they should not threaten our identification. For example, in July 2013, the Federal Reserve and other U.S. banking regulators finalized a rule to implement Basel III capital rules in the United States. The phase-in period for large banking organizations began in January 2014. Several mortgage-market rules made by the Consumer Financial Protection, such as the Ability to Repay rule, also took effect in January 2014. Throughout this period, the GSEs pursued lenders for loan putbacks.

### 4.3 Sample Selection

We focus on (product,purpose,location) markets with at least 250 loans the year before the associated exit event. This cut avoids over-representing variation from very small markets. For loan-level regressions (1b), we restrict analysis to loans with observable interest rates and a full set of observable underwriting characteristics (credit scores, loan-to-value ratio, etc). These sample restrictions affect a small fraction of loans, and ensure the composition of loans is fixed across outcomes.

## 5 Effects on the Industrial Organization of the Mortgage Market

We first examine how the exit of BOA and Chase affected the industrial organization of the mortgage market, focusing on entry by nonbanks into different roles in the intermediation chain.

### 5.1 Entry by Nonbank as Agency Counterparty

Prior their exit, BOA and Chase were large Agency counterparties. They packaged originations (mostly purchased from correspondent lenders) and sold them to Fannie Mae or Freddie Mac (receiving cash or an MBS in return) or issued MBS guaranteed by Ginnie Mae. We examine how the two banks' exit affected the nonbank share of Agency counterparties.

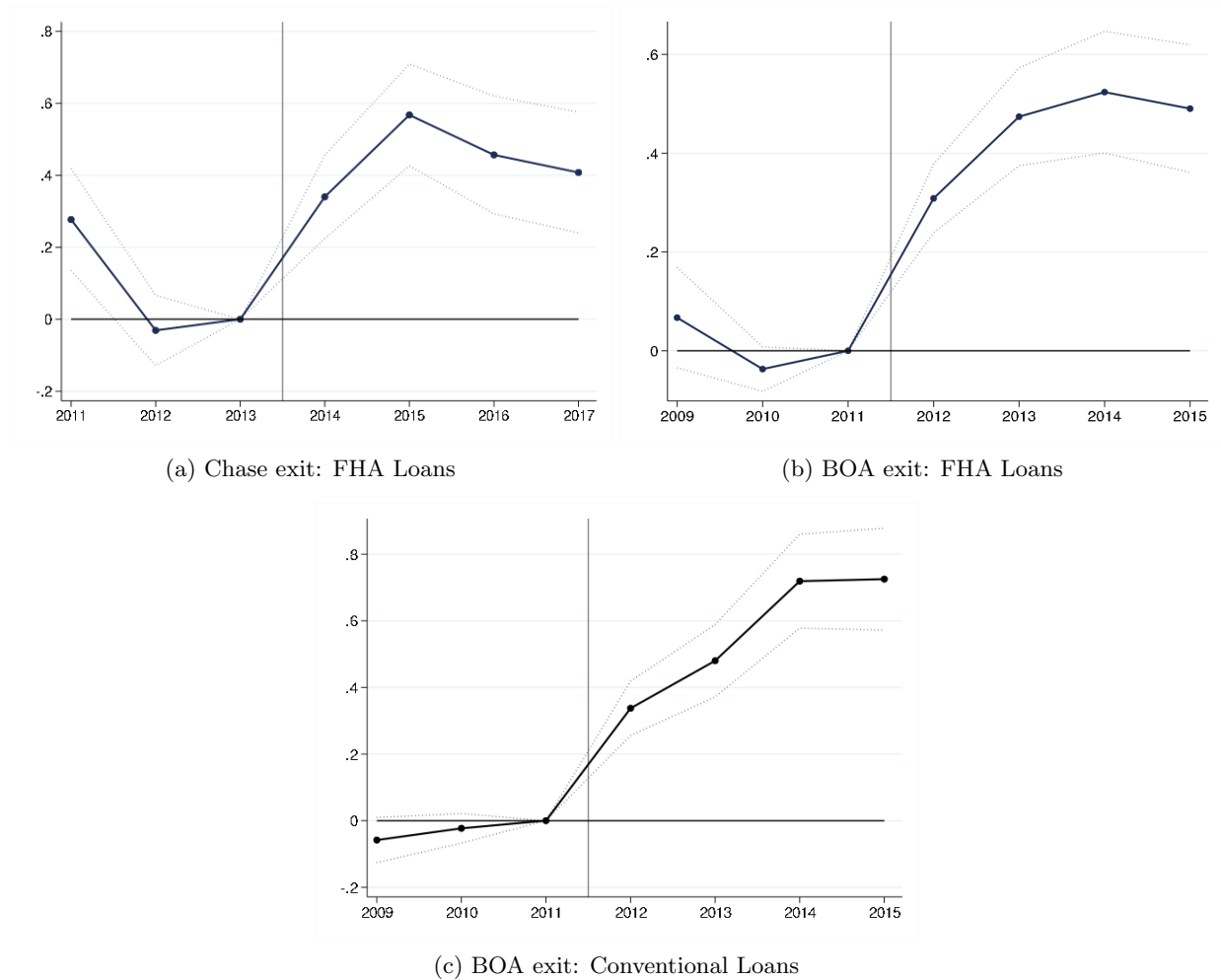
Figure 3 presents our estimates of equation (1a) for nonbanks' share as agency counterparties. Our estimates indicate a bank/nonbank replacement rate of around 40–50%. Figure 3(a) show that every one percentage point of Chase's pre-exit market share for FHA loans was replaced by 0.4 pp of nonbank market share in the same product and local area, on average. At the mean pre-exit share (10%), the estimate implies that Chase's exit contributed to a 4 pp increase in nonbanks' share of FHA lending from 2014-2017.

We find largely similar effects of BOA exit on nonbank market shares for FHA loans (Figure 3(b)). Every 1 percentage point of decline in BOA FHA market share was replaced by roughly 0.5 pp of nonbank market share in the same product and local area. BOA's pre-exit market share in the FHA market in 2010 was 37% on average, meaning that BOA's exit from the FHA market led to a 18 pp increase in nonbank shares as counterparties of delivering FHA loans into Ginnie Mae MBS.

The replacement rate for GSE loans after BOA exit (Figure 3(c)) is slightly higher at around 60%. Given BOA's pre-exit market share in the GSE market at around 15% in 2010, BOA's exit from the GSE market led to about a 7 pp increase in nonbank shares as GSE counterparties delivering new originations.

In sum, these results show that BOA and Chase's exit led to a significant increase in the market share of nonbank as counterparties to agencies that deliver new originations to agency MBS.

Figure 3: Effects of Bank Exit (1% pre-exit share) on Market Share of Nonbanks as Agency Counterparties



Note: Estimates and standard errors from equation (1a) for the effects of a 1% decline in exiting-bank market share. Standard errors clustered at the market level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

## 5.2 Entry by Different Nonbank Types

Both BOA and Chase were dominant aggregators prior to their exit. They heavily relied on the correspondent channel to source loans to deliver into agency MBS. Especially, most of the FHA loans the two banks packaged into Ginnie Mae MBS were purchased from correspondent lenders, and the two banks rarely lent directly to FHA borrowers. A natural question is whether their nonbank replacements employed a similar strategy. In this section, we examine the effects of BOA and Chase's exit on the share of FHA loans purchased or originated by nonbank counterparties.

Table 1 presents the estimates. (Note: the estimates under columns (1) and (4) correspond to the estimates in Figures 3(a) and 3(b), which do not distinguish nonbank shares depending on how they source loans.) We find that after the two banks' exit, nearly half of the increase in the overall nonbank share was driven by the rise of nonbank aggregators, as shown in columns (2) and (4). These nonbank aggregators employ a similar strategy to BOA and Chase's strategies, purchasing new originations from retail originators and packaging them into MBS. For example, PennyMac Loan Services, which is one of the largest nonbank aggregators in the FHA market, almost exclusively relies on correspondent lenders for loans it securitizes into Ginnie Mae MBS. How much nonbank aggregators replaced the exiting bank's aggregator role varies across the two different exit events. Nonbank aggregators account for nearly 80% (50%) of the increase in the nonbank share resulting from Chase's exit (BOA's exit).

Columns (3) and (6) suggest that nonbank aggregators do not entirely account for the increase of nonbank counterparty share. The exit of the two banks also resulted in nonbank counterparties that directly lend to borrowers. For example, Rocket (formerly Quicken) Loans almost exclusively relies on the retail or broker channel for loans it securitizes into Ginnie Mae MBS. Such nonbanks accounted for a little more than a half of the increase in the nonbank share resulting from BOA's exit.

Table 1: Effects on share of loans purchased or originated by nonbank counterparties (NC)

	Chase's exit			BOA's exit		
	(1) Purchased or originated by NC	(2) Purchased by NC	(3) Originated by NC	(4) Purchased or originated by NC	(5) Purchased by NC	(6) Originated by NC
Post=1 × Pre-exit Market Share	0.427*** (0.081)	0.341*** (0.065)	0.087 (0.056)	0.409*** (0.041)	0.193*** (0.024)	0.216*** (0.034)
County x Loan Purpose FE	Y	Y	Y	Y	Y	Y
Year x Loan Purpose FE	Y	Y	Y	Y	Y	Y
Other Controls	Y	Y	Y	Y	Y	Y
N. Obs.	5,908	5,908	5,908	5,908	5,908	5,908
Adj. $R^2$	0.95	0.84	0.94	0.93	0.78	0.91

Note: Estimates and standard errors from equation (1a) for the effects of a 1% decline in exiting-bank market share. Standard errors clustered at the market level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

### 5.3 Responses by Retail Originators to Bank Aggregators' Exit

We now turn our attention to how retail originators responded to BOA and Chase's exit. Some are exclusively correspondent lenders, who sell all of their originations to aggregators. These firms are not Agency counterparties. Other retail originators are counterparties. They source loans to securitize into agency MBS through lending directly to borrowers (sometimes via brokers), although they could also purchase loans from

correspondent lenders at the same time.

For this analysis, we estimate a different regression, which exploits how much retail originators relied on BOA or Chase prior to their exit. Formally we estimate the following regression:

$$y_{jpt} = \sum_t \beta_t S_{jp} + \xi_{jp} + \xi_{pt} + \epsilon_{jpt} \quad (2)$$

The outcome variable  $y_{jt}$  is measured at the level of lender ( $j$ ), loan purpose type ( $p$ ), and year ( $t$ ). The main treatment variable is  $S_{jp}$ . This variable measures the share of loans originated by lender  $j$  that are sold to BOA in 2010 for BOA's exit and to Chase in 2012 for Chase's exit. We calculate this share separately for purchase loans and refinance loans.

Table 2 presents the estimates for the three outcome variables. Columns (1) and (3) show that the share of loans retail originators sell to nonbank aggregators increased as a result of the exit events. After Chase's (BOA's) exit, retail originators replaced about 26% (12%) of every loan sold to Chase (BOA) prior to its exit with nonbank aggregators. This result is consistent with the results in earlier sections. Despite the increased share of originations sold to nonbank aggregators, the exit events decreased the share of originations sold to any aggregator including bank aggregators, as shown in columns (2) and (4). Consistent with earlier sections, BOA's exit led to a particularly large decline in the share of loans sold to any aggregators, with about a replacement rate of 45%. This result indicates that more retail originators package more of their own originations into MBS. Indeed, the exit events caused some retail originators to become counterparties to Ginnie Mae as Ginnie Mae issuers, as shown in columns (3) and (6).

In sum, our finding suggests that the originators who used to sell to BOA and Chase responded to the exit of these aggregators in two ways. Some originators found other aggregators, in particular nonbank ones. These originators still received long-term funding for their originations from aggregators, but from different ones. Other originators switched their business model to become Ginnie Mae counterparties and fund their originations in the long term by securitizing the loans themselves into MBS.



Table 2: Effects on retail originators

	Chase's exit			BOA's exit		
	(1)	(2)	(3)	(4)	(5)	(6)
	Share of loans sold to nonbank aggregator	Share of loans sold to any aggregator	Ginnie Mae issuer	Share of loans sold to nonbank aggregator	Share of loans sold to any aggregator	Ginnie Mae issuer
Post=1 × Pre-exit Market Share	0.264*** (0.041)	-0.158* (0.084)	0.431*** (0.096)	0.124*** (0.038)	-0.445*** (0.076)	0.327*** (0.060)
Lender x Loan purpose FE	Y	Y	Y	Y	Y	Y
Loan purpose x Year FE	Y	Y	Y	Y	Y	Y
N. Obs.	20,354	20,354	20,354	21,414	21,414	21,414
Adj. $R^2$	0.61	0.87	0.78	0.51	0.83	0.73

Note: Estimates and standard errors from equation (2) for the effects of a 1% decline in exiting-bank market share. Standard errors clustered at the lender level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

#### 5.4 Shift in Bank's Role: Warehouse Funding Relationships

Although banks exited the aggregator space, they can assume other roles in the intermediation chain. For example, they still provide liquidity to credit markets as (upstream) warehouse lenders. Although nonbank counterparties obtain long-term financing for originations from securitization, they also need short-term financing to purchase new originations from correspondent lenders or to directly lend to borrowers before securitization sales. Because nonbanks do not have access liquidity sources typically available to banks, such as deposits and advance from the Federal Home Loan Banks, they typically obtain the short-term financing through warehouse lines of credits from commercial banks or investment banks. Nonbanks borrow warehouse lines against new originations in the pipeline prior to securitization (Kim et al., 2018; Jiang, 2021).

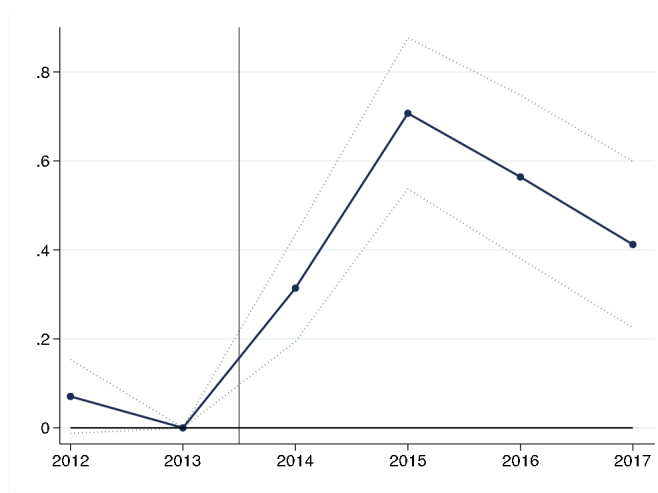
In this section, we examine whether exiting bank aggregators still supply warehouse funds to nonbanks who entered their vacated role. For this analysis, we matched nonbank firms in the HMDA data with information on their funding relationship with banks from Mortgage Call Reports (MCR) collected by the Conference of State Bank Supervisors (CSBS). The MCR data only start in 2012, which precludes analysis of BOA's exit and slightly limits the pre-treatment period for Chase's exit.

The outcome variable we consider is the FHA origination market share of nonbank Agency counterparties that have at least one warehouse credit facility from the five largest banks that significantly pulled back from the FHA market ("exiting banks"), including Chase and BOA.<sup>1</sup> Figure 4 show that Chase's exit led to entry by nonbank Agency counterparties funded at least in part by the exiting banks. The point estimates for this outcome variable are similar to those for entry by nonbank Agency counterparties reported in Figure

<sup>1</sup>Our CSBS data use agreement only allows us to show aggregated results. However, estimates with alternative outcome variables are qualitatively similar.

3(a). This result suggests that almost all nonbank Agency counterparty entrants were funded in part by the exiting banks. In other words, the exiting banks facilitated nonbanks' entry by providing short-term financing, although these exiting banks pulled back from their aggregator role.

Figure 4: Share of Originations by Nonbank Counterparties Funded by Exiting Banks



Note: Estimates and standard errors from equation (1a) for the effects of a 1% decline in Chase's market share. The sample for this analysis begins in 2012 because of the data limitation of the MCR data. Standard errors clustered at the market level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

## 5.5 Discussion

The results presented so far show that BOA and Chase's exit from their aggregator role has made a large impact on the industrial organization of the mortgage market. Nonbanks were able to substitute for bank aggregators in some aspects. In particular, nonbanks began to be more directly involved in interacting with agencies. Nonbank counterparties' share of originations delivered to agency MBS has increased significantly. Some nonbank counterparties increased their share by purchasing more originations by correspondent lenders, as bank aggregators did. Other nonbank counterparties relied more on directly lending to borrowers, and some nonbank lenders decided to become agency counterparties after bank aggregators' exit.

However, our results also suggest that nonbanks were only imperfect substitutes for bank aggregators. Although securitization provides long-term financing for originations, nonbanks still rely on banks for short-term liquidity for originations unlike bank aggregators. Consequently, banks still provided liquidity to the mortgage market even after their exit, but now only indirectly through nonbanks. In contrast, bank aggregators were able to source short-term financing from their own deposits as vertically integrated entities.

Alternatively, they could also access to advances from the Federal Home Loan Banks. These liquidity sources available to banks are typically less costly than external funding from a third-party bank.

In addition, there are also other differences between banks and nonbanks highlighted earlier in Section 2. As a result, these differences were likely to have affected credit supply and mortgage borrowers as nonbanks began to play a much larger role after bank aggregators' exit. We examine the effects on credit supply and mortgage borrowers in following sections.

## 6 Effects on Mortgage Originations

### 6.1 Mortgage Interest Rates

Exit by Chase and BOA significantly increased mortgage interest rates for each affected product. Table 3 presents our estimates of the loan-level specification (1b) for interest rates, with effects measured in basis points per unit of exiting market share.

Evaluating the effect of Chase's exit at its mean FHA share (12.8%) reveals that aggregator exit increased FHA interests rates by about 5 basis points, on average in treated markets. The effects of BOA exit in Table 3 are overall similar to Chase's exit. BOA's withdraw from FHA lending had slightly muted effects on interest rates compared to Chase's exit, while BOA's withdraw from conventional lending had slightly amplified effects on interest rates per unit of exiting market share. The three exit shocks had comparable relative effects on prices after accounting for differences in the banks' pre-exit shares. Evaluated at the mean just prior to exit, each represents a 1-2% relative increase in prices.

Since each regression includes comprehensive controls for loan and borrower characteristics, the interest

Table 3: Effects of Bank Exit (1% pre-exit share) on Mortgage Interest Rates

	Chase Exit		BOA Exit	
	FHA	FHA	FHA	Conventional
Home Purchase	0.440*	0.267***	0.376***	
	(0.254)	(0.028)	(0.047)	
Refinance	0.311*	0.101***	0.461***	
	(0.173)	(0.026)	(0.051)	
Purchase or Refinance	0.393**	0.221***	0.431***	
	(0.168)	(0.024)	(0.044)	

Estimates and standard errors from (1b) for the effects of a 1% decline in exiting-bank market share, by loan purpose (rows) and by exit event and loan product (columns). Standard errors clustered at the market level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

rate results are net of effects of exit on borrower credit quality that might compositionally also impact prices. Thus comparing prices for the same products and originators supplied to similar borrowers in similar markets, the remaining effects of Chase and BOA exit on interest rates can be attributed to imperfect substitutability of banks and nonbanks as aggregators. Specifically, our results suggest that exit by bank aggregators increased the costs of financial intermediation in these markets, and rising intermediation costs were passed through to consumers in higher prices.

There are several reasons nonbanks had higher intermediation costs compared to the banks they replaced. The banks had economies of scale and broker-dealer networks that lead to advantageous secondary market opportunities for the mortgages they purchased. Banks are also vertically integrated to their funding sources, while nonbanks rely on external warehouse funding to conduct business as aggregators. Vertical disintegration from funding introduces a wedge, the warehouse lender’s markup, that increases a nonbank’s costs of aggregating downstream. Bank aggregators likely captured much of the value created by their vertical integration and secondary market opportunities, but likely also passed along some of this value to smaller originators when purchasing their loans. When nonbanks entered the aggregator space vacated by Chase and BOA, their increased costs of financial intermediation ultimately increased consumers’ prices of credit.

## 6.2 Credit Box

We present our results on borrower credit score outcomes in Tables 4-5 and in Figure 5. We highlight two results. First, in FHA lending, exit of the bank aggregators shifted the composition of credit supply to very low credit-quality borrowers. Second, in conventional lending, BOA’s exit as an aggregator increased the composition of higher credit quality borrowers without significantly affecting supply of lower quality loans.

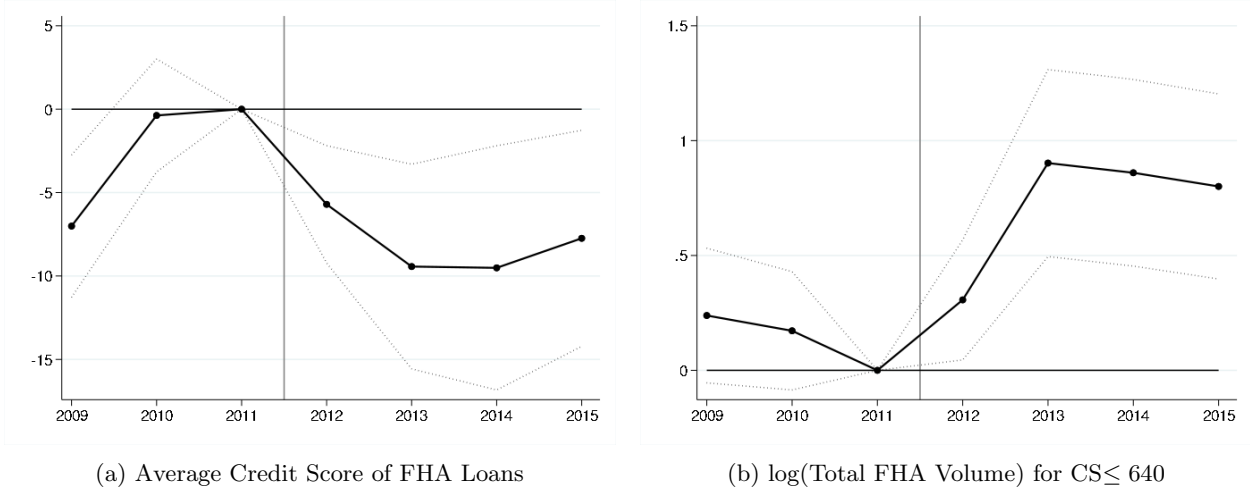
Table 4: Effects of Bank Exit (1% pre-exit share) on Borrower Credit Score

	Chase Exit		BOA Exit	
	FHA	FHA	FHA	Conventional
Home Purchase	-25.081** (10.417)	-5.065 (3.358)	-0.817 (1.764)	
Refinance	12.170 (26.533)	-12.452** (5.400)	3.261 (2.118)	
Purchase or Refinance	-5.318 (14.511)	-6.417* (3.491)	2.268 (1.761)	

Estimates and standard errors from (1b) for the effects of a 1% decline in exiting-bank market share, by loan purpose (rows) and by exit event and loan product (columns). Standard errors clustered at the market level, \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

Table 4 presents our estimates from the loan-level DID specification (1b) for borrower credit scores. We

Figure 5: Effects of BOA Exit (1% pre-exit share) on Borrower Credit Quality - Purchase Loans



Estimates and standard errors from (1b), in panel (a), and from (1a), in panel (b), for the effects of a 1% decline in exiting-bank market share. Standard errors clustered at the market level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

find that average credit scores of FHA borrowers declined after Chase's exit for home purchase loans, and after BOA's exit for both purchase and refinance loans. To illustrate magnitudes, evaluating Chase's exit effect at the mean exposure suggests that the average credit score of FHA purchase loan borrowers declined more than 3 points.

Although the banks' FHA exit increased the frequency of low credit score borrowers for FHA loans, there is no significant evidence of affects on higher credit quality borrowers. Figure 5 shows this compositional shift in action. In Figure 5(a), BOA's exit from FHA lending causes average borrower credit scores to drop about 10 points per unit of BOA's pre-exit market share. Figure 5(b) plots our estimates from the market-level specification (1a) for total credit supplied to very low credit score borrowers. FHA lending to consumers with credit scores below 640 increased significantly upon BOA's exit, in percentage terms almost 1-for-1 with their pre-exit market share.

Table 5 presents estimates from the market-level specification (1a) for total supply of credit by credit score bin and loan product, comparing above-median to below-median exit exposure markets (discrete DID). It emphasizes our second result, that in conventional lending BOA's exit as an aggregator increased the composition of higher credit quality borrowers.

There are several reasons that bank aggregator exit, and subsequent nonbank entry, might affect the the composition of borrower credit worthiness. As a first order, banks and nonbanks have different opportunity

Table 5: Effects of Bank Exit (above/below median pre-exit share) on Total Credit Volume by Credit Score

	CS $\leq$ 640		640 < CS $\leq$ 680		CS > 680	
	Purchase	Refinance	Purchase	Refinance	Purchase	Refinance
Chase's FHA Exit	0.117*	-0.004	-0.055*	-0.097	-0.055	-0.074
	(0.069)	(0.088)	(0.032)	(0.064)	(0.043)	(0.048)
BOA's FHA Exit	0.117***	0.050*	0.038**	0.017	0.043**	0.006
	(0.023)	(0.029)	(0.016)	(0.027)	(0.021)	(0.024)
BOA's Conventional Exit	0.004	0.048	0.036	0.097***	0.061***	0.139***
	(0.043)	(0.038)	(0.025)	(0.028)	(0.015)	(0.020)

Estimates and standard errors from (1a) for the effects of above-median relative to below-median exiting-bank market share, by loan purpose and credit score (columns) and by exit event and loan product (rows). Standard errors clustered at the market level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels respectively.

costs of funding mortgages, and different regulatory burdens associated with certain borrower credit risks. These incentives determine the aggregators' demands for low and high credit-quality loans. As Chase and BOA exited the aggregator space and nonbanks entered, the compositional shift in aggregator demand curves, in turn, impacted the composition of loan originations.

As well, like in many selection markets, the tradeoffs mortgage consumers face between prices and product characteristics result in choices that separate observable risk profiles across products. Aggregators almost always service the mortgages they purchase, so BOA and Chase's exit shocks altered the characteristics of products available to consumers in affected markets. If lower credit-quality borrowers have stronger preferences for nonbank FHA servicers, and higher credit-quality borrowers have preferences for nonbank conventional loan services, then the exit shock should increase left-tail credit score demand for FHA loans and increase right-tail demand for conventional loans.

## 7 Effects on Mortgage Servicing

Aggregators purchase loans originated by retail originators and then often securitize the purchased loans into agency MBS, which are guaranteed by Fannie Mae, Freddie Mac, and Ginnie Mae. After securitization, aggregators often service the loans. In particular for securitization in the Ginnie Mae platform, securitizers are obligated to assume the servicer role after securitization.<sup>2</sup> Thus, the exit of big bank aggregators also resulted in an increase in nonbanks' share of mortgage servicing. In this section, we examine how this shift to nonbank servicers affected borrower outcomes related to servicing. We consider prepayments and loss

<sup>2</sup>Servicing right for loans in Ginnie Mae MBS could be sold to another servicer, but Ginnie Mae securitizers typically service loans they securitize.

mitigation.

## 7.1 Prepayments

Servicers can choose how aggressively refinance loans in their servicing portfolio, for example via advertising (Grundl and Kim, 2019), and thus can affect how fast borrowers refinance loans. In fact, some servicers were accused of their aggressive marketing strategies to refinance VA loans in 2017.<sup>3</sup> Although we only observe a borrower’s prepayment, a vast majority of prepayments are generally due to refinancing.

Table 6: Effects of Bank Exit (1% pre-exit share) on Early Prepayment (within 2 years)

	Chase Exit		BOA Exit	
	FHA	FHA	FHA	Conventional
Home Purchase	0.203**	0.073***	0.127***	
	(0.091)	(0.014)	(0.040)	
Refinance	0.015	0.079***	0.211***	
	(0.115)	(0.022)	(0.061)	
Purchase or Refinance	0.077	0.073***	0.190***	
	(0.084)	(0.015)	(0.050)	

Table 6 presents the effect of the exit of big bank aggregators on the probability that a borrower pays off his or her loans within two years. We control for various loan characteristics that may be correlated with refinancing incentives: interest rates on existing mortgages, loan size, credit score, LTV, and location. We consistently find that the bank bank aggregators’ exit led to an increase in an early prepayment probability. For example, Chase’s exit led to about a 2 pp increase in an early prepayment probability among purchase FHA loans.

This result suggests that nonbank servicers have different incentives than bank servicers in terms of refinancing their own borrowers. Because banks typically have multiple business lines other than mortgages, their opportunity costs of originating marginal refinance loans are likely higher than nonbanks.

## 7.2 Loss mitigation

One of important roles of servicers is to provide loss mitigation to borrowers in distress. We examine forbearance outcomes during the recent Covid-19 pandemic. In response to the pandemic, the CARES Act, which was passed in March 2020, provided forbearance for agency loans. However, borrowers had to apply for forbearance through their mortgage servicers, and Cherry et al. (2021) and Kim et al. (2022a) find evidence

<sup>3</sup>U.S. Senator Elizabeth Warren voiced concerns about such marketing practices employed by certain VA loan servicers: [LINK](#)

that some borrowers experienced significant servicer-related frictions in receiving forbearance. In particular, these papers find that forbearance take-up is correlated with whether a servicer is a nonbank. In this paper, we provide *causal* evidence on how nonbank servicers affected forbearance take-up during the pandemic, exploiting exogenous variation resulting from big bank aggregators' exit.

Similar to Kim et al. (2022a), we measure the forbearance outcome by looking at whether a borrower is ever past-due outside forbearance after the CARES act was passed. Because forbearance protected past-due borrowers from negative outcomes associated with delinquencies, any past-due borrowers would be better off obtaining forbearance. We consider two outcome variables: whether a borrower is ever at least 30 day past due outside forbearance and whether a borrower at least 60 day past due outside forbearance.

Our sample for this analysis includes loans originated in the period from 2011 and 2017 that are active as of March 2020. Then we estimate the casual effect of having a nonbank servicer on whether these loans ever became past-due outside forbearance between April 2020 and November 2020. We run a two-stage-least-square regression to measure that effect. In the first stage, we regress a dummy variable for having a nonbank servicer as of March 2020 on state-level Chase's pre-exit share interacted with the post-2013 dummy. In the second stage, we run a regression of the outcome variable on the predicted nonbank servicer share.

Table 7 presents the results by loan purpose types for the two outcome variables. Overall, nonbank servicers lead to more borrowers ever becoming past-due outside forbearance. Having a nonbank servicer increases the probability of ever being 30+ day past-due outside forbearance by 7.8 pp. This magnitude is economically large given its unconditional average at 7.5 percent. The point estimate is larger for purchase loans than for refinance loans. The effect of nonbank servicer on the probability of ever being 60+ day past-due outside forbearance is smaller but still large at 6.3 pp.

This result suggest that borrowers in distress at nonbank servicers are less likely to receive loss mitigation than bank servicers. As discussed in Kim et al. (2022a), this result is likely driven by factors, such as higher liquidity costs associated with past-due FHA loans and scale economy.



Table 7: Forbearance during the pandemic

	Ever 30+ dpd outside forb			Ever 60+ dpd outside forb		
	(1) all	(2) purchase	(3) refi	(4) all	(5) purchase	(6) refi
nonbank	0.078*** (0.025)	0.120* (0.065)	0.036** (0.016)	0.063*** (0.023)	0.109* (0.058)	0.019 (0.012)
State x Purpose FE	Y			Y		
Purpose x Year FE	Y			Y		
State FE		Y	Y		Y	Y
Year FE		Y	Y		Y	Y
State-level Controls	Y	Y	Y	Y	Y	Y
Loan-level controls	Y	Y	Y	Y	Y	Y
N. Obs.	3,939,181	2,660,785	1,278,396	3,939,181	2,660,785	1,278,396
Adj. $R^2$	0.02	0.01	0.02	0.03	-0.00	0.03

## 8 Conclusion

Exit by bank aggregators had dramatic effects in the U.S. mortgage industry. Nonbanks entered the space vacated by exiting banks, but were imperfect substitutes as aggregators. Our findings suggest that nonbank aggregators had less scale economies, were vertically disintegrated from funding sources, and had different access to secondary markets, which altogether increased the costs of financial intermediation in affected markets. The nonbank aggregators shifted the composition of credit supply toward lower credit-quality borrowers, but were also inferior quality loan servicers. As a consequence, areas impacted by the shift to nonbank aggregators saw mortgage interest rates rise, increased prepayments, and decreased received loss mitigation for distressed borrowers.

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