Mortgage Brokers, Technology, and Credit Supply: Evidence from MERS*

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Abstract

We examine the effects of the Mortgage Electronic Registration System, or MERS, on mortgage origination volumes and foreclosure rates prior to the Great Recession. MERS was introduced in the late 1990s and significantly reduced the cost and time associated with secondary loan sales. Using novel data from the Massachusetts Registry of Deeds, we show that the introduction of MERS led to an expansion in credit supply that was primarily fueled by non-bank lenders originating loans to low-income borrowers. We also find that foreclosure rates were higher on these loans. Our paper provides one explanation for why credit supply increased prior to the 2008 financial crisis, and why supply increases were larger in low-income areas.

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1 Introduction

Why did the supply of residential mortgage credit expand so dramatically in the early 2000s? Starting with Mian and Sufi (2009), a large literature has documented that credit supply increased prior to the 2008 financial crisis, which in turn affected numerous variables such as house price appreciation, mortgage defaults, and the real economy. However, the origins of this increase in credit supply remain relatively unexplored. For example, why did credit supply increase so dramatically in the early 2000s instead of at some other point in time? Why was much of the increase in credit supply fueled by non-bank lenders such as mortgage brokers and mortgage bankers (see, e.g., Berndt, Hollifield, and Sandas (2016))? Finally, why were so many new loans originated to lower-income borrowers who were often of questionable credit quality (see, e.g., Keys, Mukherjee, Seru, and Vig (2010))? To date, there is no single, consistent answer to these questions.

In this paper, we argue that financial innovation played a significant role in boosting credit supply prior to the 2008 financial crisis. In particular, we focus on the introduction of the Mortgage Electronic Registration System (MERS) in the late 1990s.[1] In simple terms, MERS allows a financial institution to sell a mortgage without having to legally update the mortgage's owner of record, thereby significantly reducing the time and costs associated with secondary loan sales. As such, the introduction of MERS represented a major innovation in the secondary market for mortgages. In fact, according to Ketcham (2012), more than two-thirds of all home loans in the United States were registered through MERS by the end of 2007, less than a decade after its introduction.[2] However, despite the enormous importance of MERS for the mortgage market, there are currently no papers studying the effects of MERS on credit supply or the unintended consequences that the introduction of MERS may have imparted on mortgage borrowers prior to and during the most recent financial crisis.

Our central argument is that, by reducing the time and costs associated with selling

[1] MERS is a registered trademark of MERSCORP Holdings, Inc.

[2] Ketchum, Christopher (2012), "Stop Payment! A Homeowners' Revolt Against the Banks." *Harper's Magazine*, January 2012. Accessed at https://harpers.org/archive/2012/01/stop-payment-a-homeowners-revolt-against-the-banks/.

mortgages, MERS may have indirectly helped to fuel the boom in residential mortgage credit supply prior to the 2008 financial crisis. Our argument has three primary components. First, while all originators would stand to benefit from the introduction of MERS, the largest benefits should accrue to the institutions with the highest probability of selling loans: namely, non-bank lenders such as mortgage brokers or mortgage banks.[3] Second, by significantly reducing transaction costs, MERS allowed non-bank lenders to expand origination volumes.[4] Finally, the "marginal" new loan originations in this setting would likely involve borrowers with poor credit scores, since borrowers with prime credit scores had no trouble obtaining credit even in the absence of MERS.[5] Importantly, this argument predicts higher origination volumes *particularly by non-bank lenders, particularly for low credit-quality borrowers* following the introduction of MERS. Despite a wealth of evidence on the role of subprime mortgages in the financial crisis (see, e.g., Ashcraft and Schuermann (2008), Mian and Sufi (2009), Demyanyk and Hemert (2011), Purnanandam (2011), and Dell'Ariccia, Igan, and Laeven (2012)), we are aware of no other papers that attempt to show why non-bank lenders in particular were responsible for the rise in mortgage originations to low credit-quality borrowers prior to the crisis.

Consistent with our hypotheses, we find that both the number of mortgages and the dollar volume of lending activity increase following an institution's adoption of MERS. These effects are entirely concentrated within non-bank lenders and are stronger in areas populated by lower-income borrowers. The economic magnitudes of these effects are large: according to our estimates, the incremental increase in origination volumes associated with MERS is about $1.5 million per census tract per lending institution per year, or approximately seven new loans. We also find that foreclosure rates are higher for mortgages originated by MERS-active non-bank lenders than for bank-originated loans or loans originated by institutions that are not MERS members. Importantly, the incremental increases in credit supply appear to be

[3]Non-bank lenders such as mortgage brokers or mortgage bankers do not originate loans they intend to hold on their balance sheet; all loans are originated with the intent to (eventually) sell them.

[4]In particular, by lowering the marginal cost of origination, MERS may have allowed financially-constrained lenders to fund additional originations.

[5]See, e.g., Bhutta and Keys (2016) and Akey, Heimer, and Lewellen (2017).

targeted within areas populated by lower-income borrowers. Hence, while the introduction of MERS represented a significant financial innovation for the mortgage industry, its unintended consequences may have led to the origination of a significant quantity of low-quality loans prior to the 2007-2009 financial crisis.

To test our hypotheses, we obtain a novel dataset from the Massachusetts Registry of Deeds containing all land records filed with county clerks in six Massachusetts counties from 1990-2018. These land records indicate, for each loan, (1) the names of the original mortgage lenders, (2) whether the loan was registered with MERS at any point along the ownership chain, (3) the names of any subsequent owners of the mortgage, and (4) whether foreclosure proceedings were ever completed on the property.[6] We then hand-match the names of lenders in our dataset with various databases from the Federal Financial Institution Examination Council (FFIEC) and HMDA to obtain data on each institution's history and entity type (i.e. mortgage broker, commercial bank, bank subsidiary, bank affiliate, or other). As such, our dataset provides a comprehensive picture of the secondary market for purchased mortgage loans within the state of Massachusetts. We also supplement our dataset with additional nationwide mortgage application and origination data from HMDA and verify that all of our main results hold across the U.S. mortgage market as a whole.

Our main hypothesis is that MERS led to a reduction in the time and cost associated with the sale of loans on the secondary market. This hypothesis suggests that MERS should cause an outward shift in the supply curves of member institutions, which, holding demand constant, should correspond with higher quantities and lower mortgage rates after an institution becomes a MERS member.[7]

Our empirical design combines the bilateral nature of the MERS system (i.e. in a MERS-

[6]One caveat of our data is that, because MERS alleviates the need to register ownership changes with the county clerk, once a loan is registered with MERS, we do not know whether the loan was subsequently purchased or the identity of any future purchasers.

[7]Most non-bank lenders are small and likely face funding constraints that limit the number of loans they can originate at a given point in time. If MERS helps institutions to alleviate such funding constraints, then an institution joining MERS would also expect its supply curve to flatten. Since non-bank lenders are more likely to face financial constraints than banks, we would thus expect supply curves to shift outwards for both banks and non-banks following the introduction of MERS, but for supply curves to flatten more for non-banks than for banks after an institution joins MERS.

registered transaction, the buyer and seller of a loan must both belong to MERS) with stringent fixed effects. In particular, our primary tests compare loan origination volumes, foreclosure rates, and other outcome variables for MERS-active lenders relative to non-MERS active lenders in the periods before and after *another transaction partner* joins MERS. That is, suppose mortgage broker A (existing MERS member) and mortgage broker B (not a MERS member) both operate in a census tract, and both brokers sell loans to bank C. Our tests compare changes in origination volumes at broker A with changes in origination volumes at broker B after *bank C* joins MERS. In this way, any changes in origination volumes are not a function of the brokers themselves joining MERS, but are rather a function of one of their business partners joining MERS. In support of this assumption, we verify that parallel trends exist for MERS-active and non-MERS active lenders in the period before a mutual trading partner joins MERS.

We include a rich set of fixed effects to absorb any time-varying demand effects in order to isolate the supply effect specifically resulting from the MERS technology. In particular, our main regressions include zip code $\times$ year, purchaser $\times$ year, and buyer $\times$ seller (i.e. relationship) fixed effects. Zip code $\times$ year fixed effects absorb any time-varying shocks to the demand for mortgages within a specific zip code. Purchaser $\times$ year fixed effects absorb any time-varying shocks to the demand for purchased mortgages by a given institution (say, because investor demand for mortgages or mortgage backed securities has increased). Collectively, these fixed effects help to rule out alternative hypotheses associated with increases in the demand for mortgages by consumers or increased in the demand for purchased mortgages by investors (see, e.g, Barberis, Greenwood, Jin, and Shleifer (2018)). Since different institutions adopted MERS at different times, our setting also benefits from staggered treatment adoption within very narrowly-defined geographic areas, making it unlikely that a common economic shock is responsible for driving our results.

One possible concern with our identification is that there could be time-varying demand from the institution who purchases mortgages and becomes a MERS member (bank C in our example), for mortgages originated by MERS lenders (such as broker A), for reasons

other than the fact that the lender is a MERS member. To address this concern, we verify that there are no differences in the relationships between MERS and non-MERS lenders and the purchaser in the period before the purchaser becomes a MERS member. These parallel trends help to alleviate concerns that there are systematic differences between MERS members and non-MERS members that might drive differences in mortgage origination after a common trading partner becomes a member. Another possible concern is that rather than capturing an overall increase in credit supply within a census tract, we could be capturing lending substitution between MERS members and non-members. We address this concern in a number of ways, including by aggregating our main results to the census tract level and verifying that tract-level origination volumes increase after lenders active in that tract join MERS. We also perform a number of other robustness tests (including a placebo test) to verify that our results are capturing an increase in credit supply and possess external validity beyond the state of Massachusetts.

Our paper makes four primary contributions to the literature. First, a large literature has examined the supply of mortgage credit in the run up to the financial crisis. For example, Mian and Sufi (2009) investigate the cause of the sharp rise in house prices and subsequent spike in mortgage default rates in the run up to the financial crisis and show that a rapid expansion in the supply of mortgages driven by disintermediation explains a large fraction of house price appreciation and subsequent mortgage defaults.Mian and Sufi (2011) further show that households responded to the rising value of their home equity by taking on significantly more debt, highlighting the potential feedback loop that arose from an initial increase in credit supply, to house prices, to further increases in credit supply and later defaults. While these papers carefully document that an increase in credit supply had a causal effect on house price appreciation, further increases in credit supply, and subsequent mortgage defaults, no existing literature has yet been able to identify any factors that specifically contributed to the increase in mortgage credit during this time. We contribute to this literature by pinpointing one such factor – a new technology, MERS – that particularly benefited constrained lenders and contributed to the documented shift to non-bank origi-

nated mortgages. Our paper also provides additional evidence supporting the credit supply view of the financial crisis which asserts that the financial sector played an active role in the boom and bust (as opposed to the passive view expressed in, i.e. Foote, Gerardi, and Willen (2012) and Adelino, Schoar, and Severino (2016)).

Second, our paper adds to the growing literature on the "plumbing" of the mortgage market and the mortgage securitization process. Hunt, Stanton, and Wallace (2012) are the first to study MERS, focusing on the risk that insolvency of the organization that runs the system would have on the mortgages registered within the system. Hunt, Stanton, and Wallace (2012) highlight the legal ambiguities surrounding MERS, and are the first to point out the pervasive use of MERS within the modern mortgage market. Stanton, Walden, and Wallace (2014) provide detailed documentation and analysis of the industrial organization of the US residential mortgage market and highlight the interrelationships among originators, funding sources and entities that securitize loans. Our paper complements these studies by specifically analyzing the effects of MERS on mortgage supply.

Our paper is also related to a literature that documents the impact that secondary mortgage sales (including securitization) had on the mortgage market more generally. For example, Keys, Mukherjee, Seru, and Vig (2010) provide causal evidence that the more likely a mortgage is to be sold after origination, the more likely screening is to be lax and the more likely the loan is to default. Piskorski, Seru, and Vig (2010) show that the foreclosure rate on securitized loans is higher than portfolio-owned delinquent loans and Agarwal, Amromin, Ben-David, Chomsisengphet, and Evanoff (2011) show that securitization reduces the likelihood of loan renegotiation. These findings are particularly relevant in our setting as we identify a technology that specifically benefited institutions that originate and sell mortgages. We find that origination for these types of institutions increased after the adoption of MERS, which has important consequences for the quality of screening overall rate of default and foreclosure in the run up to the financial crisis.

Finally, our results contribute to the literature on FinTech (Buchak, Matvos, Piskorski, and Seru, 2018; Fuster, Plosser, Schnabl, and Vickery, 2018) and the efficiency of innovations

within the finance industry (Philippon, 2015; Bai, Philippon, and Savov, 2016) by showing that even a very successful financial innovation like MERS may be associated with unintended consequences that can have an important impact on the short-run and long-run health of the financial sector.

2 Institutional Background

The Mortgage Electronic Registration System (MERS) is a privately-owned organization which was developed by Fannie Mae and Freddie Mac, incorporated in 1997, and subsequently sold to a small consortium of large mortgage market participants.[8] MERS was created in response to concerns that the burdens associated with registering mortgage transactions with local land record offices was impeding the sale of mortgages on the secondary market (Cocheo, 1996).

Since the early days of property ownership in the United States, each county has maintained records documenting all changes in property ownership, including mortgages. Changes in ownership are indexed through the names of grantors (the seller) and grantees (the buyer). For example, each time a mortgage transfers from one party to another, the legal owner of record is updated through the filing of an "assignment document" in the county land records.[9] The assignment document lists the grantor (the seller of the mortgage) and the grantee (the purchaser of the mortgage). Hence, by examining the history of assignment documents for a given mortgage (or a given property), owners, bankers, and other interested participants can investigate and determine the person or entity who actually has claim to the title of the property. The smooth functioning of the mortgage market fundamentally relies on having accurate information regarding a mortgage's title. For example, incorrect title information can impact the validity of foreclosures and can affect the clarity of who actually owns mortgage

[8]Source: https://www.mersinc.org/about

[9]The term mortgage colloquially refers to two distinct documents: a promissory note and a security instrument. The promissory note creates the debt obligation whereas the security instrument links the property or the collateral to the note. In this setting we refer to a mortgage as the security instrument. The security instrument is vital in determining which entity or person has legal claim to the property itself.

liens at a given point in time.

As securitization activity rapidly increased during the 1990s, county recording offices became overwhelmed with the sheer number of assignments that were required to be filed to facilitate the creation of mortgage backed securities, which often involved multiple sales of a given mortgage.[10] Furthermore, the process of tracking and validating the claim to title of the property became arduous as volumes increased, and a typical assignment validation for an average pool size could take up to six months to complete. By one industry estimate, it could cost as much as $250,000 to clean up assignment problems relating to a single block of 2,500 loans highlighting also the monetary costs involved in the assignment validation process. The overarching goal of MERS was (and is) to make the secondary market for mortgages as efficient as possible by removing these costly, time-consuming impediments to the mortgage sale process.

In particular, MERS offers two primary benefits to its members. First, MERS eliminates the costs associated with filing assignment documents with county clerks.[11] By registering the mortgage in the name of MERS, lenders can sell or transfer loans to another MERS member without needing to update the legal ownership of the mortgage. Hence, with the use of MERS, no assignment need be filed after origination and both the direct dollar costs and costs associated with time to file assignments are eliminated.

MERS can also significantly reduce the amount of time needed to complete the assignment validation process. Assignment validation is accomplished by conducting a mortgage/assignment chain audit prior to preparing a new assignment. Not all loans require this process: self-originated and MERS-originated mortgage loans will generally have no prior assignment chains and need little validation.[12] This non-requirement for assignment

[10]Often the loan originator sells the loan to an aggregator, which in turn sells it to a sponsor, which pools the loan with other loans, and in turn sells them to a depositor, which in turn sells them to a trust or a trustee to be held for the benefit of the trust. The trust then issues securities. See, e.g., Levitin (2013) for more detail on the legal requirements of residential mortgage securitization and the ABA Section of Litigation Annual Conference 2013 for more legal anecdotes.

[11]Typical direct costs are assignment filing costs, which amount to roughly $30 per loan.

[12]See the white paper "Understanding Current Assignment Verification Practices" by Nationwide Title Clearing (http://info.nwtc.com/wp-understanding-current-assign-thank-you-page)for more details on how assignment validation requirements have changed post financial crisis, and mortgageorb.com for anecdotal

validation of MERS loans may be because the MERS database is a private database, whereas land records data is public, hence assignment validation of MERS mortgages is practically not possible.

It is more likely that the primary benefits of MERS accrues to entities involved in the securitization process through time savings – allowing relatively constrained entities to originate and sell mortgages more quickly hence freeing up limited funds for more origination. Indeed we estimate a reduction of roughly 20% in time taken between the origination of loans and freeing up of funds to make the next loan through not having to file assignments, and not having to complete the assignment validation process.

3 Data

3.1 Massachusetts Registry of Deeds Data

We obtain data from the Massachusetts land records from 1990 - 2018 in bulk format from the Registry of Deeds Division of the Secretary of the Commonwealth of Massachusetts. This data, which is also available to the public at http://masslandrecords.com, contains every property-related document filed with county clerks in each of the state's 14 counties.

3.1.1 Mortgage and Assignment Documents

For each property transaction, at least two documents are typically filed with the county clerk: a deed and a mortgage. We focus on the mortgage document, which records the address of the property, the names of the buyers of the property (the mortgage grantors), the institutions providing the funding for the purchase (the mortgage grantees) and the total consideration paid by the buyers to the sellers. Importantly, the mortgage document also lists MERS as a mortgage grantee alongside the lender if the lender is a MERS member. We are aware of no other public data sources that allow us to track MERS activity. If the original mortgage lender decides to sell the loan to another institution, they are generally

evidence on assignment validation

required to file another document called an "assignment". Among other data items, the assignment document states the names of the prior lenders (the assignment grantors) and the names of the new lenders (the assignment grantees). Hence, if Lewellen Bank originated a mortgage and subsequently sold it to Williams Bank, Lewellen Bank would be listed as the mortgage grantee and the assignment grantor, while Williams Bank would be listed as the assignment grantee. We link each assignment document with its corresponding mortgage through a linking file provided by the Registry of Deeds, and only keep those assignment documents where the seller of the loan (i.e. the grantor from the assignment document) is the same institution that originated the mortgage (i.e. the grantee from the mortgage document).[13]

A key benefit of MERS is that if a loan is sold from one MERS member to another MERS member, and if the original lender listed MERS as a mortgage grantee, then no assignment document needs to be filed with the county clerk when a loan is sold because MERS remains the legal grantee to the mortgage even after the loan is sold. All ownership changes are then tracked within the private MERS system. In this way, MERS works much in the same way that the Depository Trust Company (DTC) works for securities trades. Hence, in cases where MERS is assigned as a grantee on the mortgage, there is no assignment document filed even if the loan was subsequently sold.

The Registry of Deeds also contains foreclosure documents, which are filed when the property is foreclosed upon. We are able to link foreclosure documents to mortgage documents via the linking file.

3.1.2 Dataset Construction

Our primary dataset is a loan level panel spanning the sample period 1990-2018. For each mortgage document filed, we record the property address, purchase date, mortgage amount,

[13]There are many other instances where an assignment would be filed even if a mortgage is not sold. For example, if one bank acquires another bank and decides to sell part of its acquired loan portfolio, assignments will be filed but the assignment grantor will be the acquiring bank and the mortgage grantee will be the acquired bank. We focus on mortgages that are sold immediately after origination and identify those as mortgages for which the mortgage grantee is the same as the assignment grantor and the mortgage date and assignment date are close.

lender name, and borrower name (that is, grantee and grantor information). We match mortgage documents to assignment documents through the linking file and flag a mortgage if it was subsequently assigned. If the loan was assigned, we also record the assignment date and the buyer and seller of the loan (we require the seller of the loan to match the lender on the mortgage). The data on assignments is combined with data from the mortgage so that each mortgage (and optionally, assignment) corresponds to one row in our final dataset. Matching mortgage documents to assignment documents allows us to identify relationships between lenders and who they sell mortgages to after origination. We also link foreclosure documents to mortgage documents via the linking file and create a flag if the property was foreclosed, including the date of foreclosure.

For each unique grantee or grantor in our dataset, we then manually determine whether the entity is an individual or institution. We discard the names of all individuals and trusts that appear to be controlled by individuals. All information in land records is input by hand, and hence there are various ways of spelling or abbreviating institution names. To ensure that each lender is coded accurately in our dataset, we conduct a fuzzy matching exercise supplemented by manual verification to ensure that, for example, JP Morgan Chase, J.P. MorganChase, J P M Chase, and JPMCahse are all matched to the same institution. In total, our sample contains roughly 50,000 unique institution names corresponding to approximately 6,000 unique institutions operating in the state of Massachusetts between 1990 and 2018.

We then manually match each institution to the Home Mortgage Disclosure Act (HMDA) dataset by name and obtain the institution's lender code, which can either be 0 (commercial banks), 1 (subsidiaries of banks), 2 (subsidiaries of bank holding companies), 3 (non-bank lenders), or 5 (affiliates of banks). We define a dummy variable, *Non-Bank*, that equals one if the institution has a HMDA lender code of 3 and equals zero otherwise. We manually look up institutions that do not have a HMDA match via Google searches to identify whether they are a lending institution and if so, what type.[14]

We also hand-collect data such as RSSD ID numbers and M&A activity for each de-

[14]Lenders originating less than $25m per year are not required to provide HMDA disclosures. Hence, this manual step ensures that our dataset is representative of all lenders, even very small ones.

pository institution from the National Information Center.[15] Our final dataset consists of approximately 1.6 million mortgages originated between 1990 and 2018.

We identify a mortgage as being a MERS mortgage if the Mortgage Electronic Registration System (or some variant of this spelling) is listed as a mortgage grantee.

We infer the date that each institution joined MERS as the first date for which that lender appears alongside MERS as a mortgage grantee. For example, if Williams Bank and MERS are both listed as mortgage grantees on July 1, 2004, and MERS never appeared as a mortgage grantee on Williams Bank's previous mortgages, then we would infer that Williams Bank became a MERS member in July 2004 and define the MERS Start year as 2004.

We are hence able to identify MERS start dates for both lenders and mortgage purchasers (provided that a purchaser is also a lender). For the purposes of our difference-in-differences regressions, the event year is the year in which a *mortgage purchaser* becomes a MERS member. For example, if MERS first appears alongside Williams Bank as an assignment grantee (i.e. a purchaser) in 2004, then the "pre-event period" would be recorded as 2003, while the "post-event period" would be recorded as 2005.

We identify relationships between mortgage originators and mortgage purchases through the mortgage/assignment document link and define our treated group of lenders as all lenders that had a relationship with Williams Bank in 2003 (identified as all lenders for which that lender is the mortgage grantee and Williams Bank is the assignment grantee in 2003) that were already MERS members in 2003. The control group is then defined as all lenders that had a relationship with Williams Bank in 2003 that were not MERS members in either 2003, 2004, or 2005. To construct out final panel for our baseline tests, we identify all loans by treatment and control lenders in the pre-event and post-event period for each event, and then aggregate our loan-level data by lender, year, and census tract.

The motivation to construct our panel in this way is that a lender cannot make use of the MERS system unless the institution it is selling to is also a MERS member. Hence, our panel allows us to identify the differential lending effects within a specific year and census

[15]Specifically, we use the National Information Center's "institution search" web page available at https://www.ffiec.gov/nicpubweb/nicweb/searchform.aspx.

tract of a MERS member relative to a non-MERS member when an institution they *both* have a relationship with becomes a MERS member. We are also able to include a rich set of fixed effects that enable us to isolate the effect of MERS membership on lending and run various robustness tests to ensure that other factors are not driving our results.

In some of our tests, we also construct the variable *MERS Active* at the census tract level. We define a census tract as being MERS-active if more than 20% of mortgage originations in that tract in a given year list MERS as a grantee on the mortgage. The median number of mortgages per census tract per year is 72, while the median number of mortgages per institution per census tract per year is approximately 17. Hence, we select a threshold of 17/72 $\approx$ 20% to define a census tract as MERS-active because this corresponds to approximately one institution within a median census tract becoming fully MERS-active.

Our final dataset contains data from six of the 14 counties in Massachusetts: Berkshire, Franklin, Hampshire, Middlesex, Suffolk, and Worcester counties. Collectively, these counties account for more than 52% of the state's population and contain four of the five largest cities in the state (Boston, Worcester, Lowell, and Cambridge). The six counties in our final sample are also spread out across the entire state. We exclude data from the other eight Massachusetts counties because the data from these counties are either incomplete or are not available in a research-friendly electronic format.

One concern is that the six counties we include in our sample may not be representative of either Massachusetts or the U.S. as a whole during our sample period. To assuage these concerns, we compare real GDP growth, employment growth, and house price appreciation in the six counties we study versus Massachusetts and the U.S. as a whole, both before and during our sample period. In untabulated results, we find that the six counties in our sample are similar to the excluded counties in terms of demographics, home ownership, home values, and economic trends. We also supplement our main tests with tests utilizing the HMDA database, which has national coverage. We are able to match HMDA data to our Massachusetts data by manually matching lender names from the land records with lender names in HMDA, which we then linked to each institution's numeric HMDA identifier.

3.2 Summary Statistics

Panel A of Table 1 shows the average of the fraction of mortgages and lenders in each census tract/Year that are MERS mortgages or MERS lenders respectively. The table shows that MERS membership grew extremely fast following the introduction of MERS in the late 1990's. By 2001, roughly 20% of all mortgages were registered with MERS, and roughly 12% of all lenders were utilizing the MERS system. By the end of 2007, over 50% of all mortgages were registered with MERS and nearly half of all lenders were MERS members.

Panel B of Table 1 provides summary statistics on the number of mortgages assigned to MERS during our sample period. The table shows that approximately 379,000 (or around 23%) of the mortgages originated during our sample period listed MERS as a grantee. However, most of the loans listing MERS as a grantee (more than 248,000) were originated by non-banks rather than banks, bank subsidiaries, or bank affiliates (collectively referred to as "banks"). Indeed, more than 55% of all loans originated by non-banks listed MERS as a grantee, whereas only 11% of loans originated by banks listed MERS as a grantee. Hence, most of the "MERS loans" during our sample period were originated by non-banks. In fact, a randomly drawn loan from a non-bank was *five times* more likely to be a MERS loan than a randomly drawn loan from a bank.

Panel A of Table 2 provides summary statistics on many of our key variables of interest. On average, lenders originate 122 mortgages with a face value of approximately $47 million within a census tract within a given year for the census tracts in our sample. The average foreclosure rate on these mortgages is 1.2%.

Panel B of Table 2 examines similar statistics for loans originated by non-banks versus banks. On average, non-banks originate 35 loans worth about $8 million per census tract per year and banks originate 81 loans worth approximately $27 million per census tract per year within the census tracts in our sample. The average foreclosure rate for loans made in these census tracts is significantly higher for non-banks (2.1%) than for banks (0.9%). Panel B also examines statistics specifically for MERS lenders. MERS lenders on average originate 49 loans worth about $13 million per census tract per year, and the foreclosure

rate for MERS loans is similar to that for non-banks at 2.1%.

Figure 2 plots the time series fraction of all mortgages within the sample that have assignment documents filed at some point during their lives. Despite the fact that our sample period includes the securitization boom of the early 2000s, the figure shows that the fraction of mortgages being assigned (i.e. sold) has actually *fallen* significantly over time in the land records data. This is precisely due to the introduction of MERS: since registering a mortgage with MERS alleviates the need for the buyer and seller to file an assignment document, loans can be sold to securitization trusts (or to other lenders) without a subsequent assignment document having to be filed.

4 Results

4.1 Main results

To execute our primary tests, we aggregate our mortgage-level data at the lending institution by census tract by year level. Our primary hypothesis is that the introduction of MERS made it easier and/or less expensive for non-banks to sell loans, which in turn allowed non-banks to increase origination volumes, particularly to lower-income borrowers. However, an institution's decision to adopt MERS is likely to be non-random. In particular, it is difficult to disentangle supply-driven versus demand-driven explanations for MERS adoption and subsequent loan behavior. For example, if current or future economic conditions in a given area are expected to be particularly good, or if investor demand for (securitized) mortgages in an area is particularly strong, this area might witness increased MERS adoption and increased mortgage originations due to increases (or anticipated increases) in the demand for mortgages. In contrast, our hypothesis is that mortgage originations increase due to increases in credit supply that stem from increased MERS adoption on the part of banks and non-banks.

To overcome issues stemming from the timing of MERS adoption, we exploit the fact that when an institution joins MERS, it can only use the MERS system to sell or buy loans

from other MERS institutions. Consider two non-banks, A and B, that both operate in the same census tract. Suppose that A is a MERS member and B is not a MERS member. Suppose that both non-banks also sell loans to bank C, which is not a MERS member. Now, suppose that bank C becomes a MERS member. When bank C joins MERS, this means that non-bank A can now sell loans to bank C through MERS. However, since non-bank B is not a MERS member, non-bank B will not be able to sell loans to bank C through MERS. Hence we exploit the switching on of this relationship between bank C and non-bank A, when bank C becomes a MERS member, to measure the increase in supply of non-bank A, relative to non-bank B as a result of the use of the MERS technology.

We then saturate our regressions with zip code × year, mortgage purchaser × year, and mortgage purchaser × mortgage seller (i.e. "relationship") fixed effects. Hence, we are looking at differences in origination volume within a specific zip code across MERS-active versus non-active institutions, when a common trading partner joins MERS, after controlling for the relationships between buyers and sellers, any mortgage purchaser-specific demand shocks, and any local demand shocks that are occurring at a given point in time.

Figure 1 displays this identification strategy graphically. The specific regression we run is:

$$\begin{aligned} Ln\ Y_{ijczt} &= \alpha + \beta Post_{jt} + \gamma MERSActive_i + \delta Post_{jt} \times MERSActive_i + \\ &\quad \xi_{zt} + \phi_{jt} + \theta_{ij} + \varepsilon_{ijczt}\ , \end{aligned} \tag{1}$$

where i indexes the original mortgage lender, j indexes an institution that i has previously sold loans to that became a MERS member at time t, z indexes the zip code, and c indexes the census tract. This regression has zip code × year, buying institution × year, and "relationship" (i.e. buyer × seller) fixed effects. As such, it compares non-bank A's lending within the census tract *after bank C joins MERS*, relative to non-bank B's lending in the same census tract at the same point in time. We use a one-year window for each "event", with year -1 designated as the pre-event period and year 1 designated as the post-event

period. The "event" is defined as the year in which the purchasing institution becomes a MERS member.

The results of this test are reported in Table 3. Consistent with our hypothesis, columns (1) and (2) show that total origination volumes increase by 12% at already MERS members relative to never MERS members when an institution they both have a relationship with joins MERS. Importantly, Figure 3 also shows that parallel trends exist for the origination volumes of MERS-active and non-MERS active institutions prior to their common trading partner joining MERS. However, following the trading partner joining MERS, origination volumes increase far more rapidly at the MERS-active institution. Intuitively, since MERS requires bilateral relationships, the new member is more likely to purchase loans from the MERS member than the non-member in order to obtain the benefits of using MERS. We argue that our tests identify the difference in mortgage origination between MERS members and non-MERS members after a common trading partner becomes a member, resulting specifically from use of the MERS technology.

We also interact the variables in equation (1) with a dummy variable named *Non-Bank* that takes the value of one if an institution has a HMDA lender type of 3 ("non-bank entity"). Our central hypothesis is that following the introduction of MERS, origination volumes increased specifically for non-banks relative to other types of lenders. This is because non-banks are likely the most constrained in funds, and hence likely benefit the most from the use of MERS technology which speeds up the mortgage sale process allowing constrained institutions to originate more with the limited funds they have. Consistent with our hypothesis, columns (3) and (4) show that both origination counts and origination volumes are higher for non-bank lenders than for other lender types after a trading partner joins MERS. In fact, columns (3) and (4) show that the entire increase in lending from MERS active lenders is coming through non-banks, as the coefficients on the double interaction term is economically and statistically zero.

The estimates from Table 3 allow us to quantify the magnitude of the shift in origination volumes associated with MERS. From Table 2, each non-bank originates on average roughly

$8m in mortgages per year per census tract, which accounts for on average 35 loans equating to an average mortgage size of $227k. After the MERS relationship is switched on, mortgage origination increases by 19.4% per non-bank per census tract per year, which equates to an increase in origination of roughly $1.5m or 6.79 mortgages.[16]

We use our estimates to quantify the impact that MERS had on lenders balance sheets. Non-banks typically fund themselves with warehouse lines of credit. Warehouse lines of credit are a form of short term funding usually provided by investment and commercial banks, and mortgages are funded on warehouse lines for an average of 40 days (Kim, Lauffer, Pence, Stanton, and Wallace, 2018). Using this information, we calculate that non-banks are turning over their balance sheets approximately nine times per year (365 days per year divided by 40 days). Given total origination of roughly $8m per census tract per institution per year, this means that the average balance sheet of a non-bank in our sample is roughly $880k per census tract. Using MERS, non-banks are able to increase mortgage origination by $1.5m. If we assume that this increase in origination is made possible through a reduction in time the mortgage is held on non-banks' balance sheets, we estimate that keeping the balance sheet the same size, MERS results in a reduction in cycle time from 40 days to 33 days (a 16% reduction). Assuming a 5% cost of funding, this reduction in time held on balance sheet results in a reduction of around $200 per mortgage, or 2% of $8,500, which is the total cost of originating a mortgage according to the Mortgage Bankers Association.[17]

We next assess whether this origination expansion by non-banks is an expansion into new areas or targeted existing areas. Table 4 documents the results of an institution by year regression where the dependent variables are (log) number of census tracts a lender operates in and the median (log) income of residents in those census tracts and the pre- and post-event

[16]Aggregating the total increase in credit supply across the entire country over the entire sample period is complicated by a number of factors. For example, our results only consider quantities. Without incorporating data on loan prices and borrower price elasticities (which also likely vary across cities or regions), it is not clear what the counterfactual origination volumes would be. It is also troublesome to extrapolate data from Massachusetts nationwide, because Massachusetts may not have been a representative state during the sample period. While we will expand our sample to include nationwide data from HMDA in subsequent tests, the relationships we observe only come from Massachusetts, making it likely that we would measure any aggregate effect with significant error. We will leave this quantification for future work.

[17]Source: https://www.mba.org/mba-newslinks/2018/march/mba-newslink-tuesday-3-27-18/.

periods again correspond to the date on which a trading partner (not the institution itself) became a MERS member. Columns (1) and (2) show that when the relationship is switched on, MERS members, who can now make use of the technology adopted by their trading partner, increase the number of census tracts they operate in. However, this expansion is only occurring for non-banks, as column (1) shows the coefficient on the double interaction term is insignificant (and if anything negative). Indeed, column (2) shows that once broken out by lender type, non-banks are rapidly expanding the areas in which they are lending.

Columns (3) and (4) report the results of similar regressions where the dependent variable is now the average median income per census tract. Column (4) shows that this expansion by non-bank MERS members seems to be concentrated within lower-income areas, whereas MERS members that are banks do not seem to be similarly expanding into low-income areas. Hence, while we cannot directly observe borrowers' credit scores, our results are consistent with non-bank lenders increasing origination volumes to sub-prime borrowers. In combination, Tables 3 and 4 show that the introduction of MERS allowed non-banks to expand mortgage origination, particularly within lower-income areas.

To examine foreclosures, we next run a conditional logit regression at the mortgage level, where mortgages are grouped by census tract. Table 5 shows that foreclosures are approximately 40% less likely for loans originated by MERS-active members relative to non-members after a common trading partner joins MERS (column (1)). Consistent with our proposed channel and results in Table 3 and Table 4, column (2) confirms that foreclosure rates are in fact higher for MERS-active non-banks than for MERS-active banks when a common trading partner joins MERS. When combined with results in Table 4, the results in Table 5 are consistent with non-banks expanding credit supply to lower-quality borrowers in low-income areas, leading to an overall expansion in mortgage credit supply following the introduction of MERS.

Finally, we manually match the bank and non-bank lender names from the Massachusetts land records with lender names in the HMDA dataset. One drawback of the Massachusetts land records is that mortgage documents are only filed with county clerks if a mortgage is

ultimately originated. Since HMDA contains data on all loan applications (not just mortgages that were ultimately originated), we can use HMDA data to determine whether lenders (and particularly non-bank lenders) reduced the rates at which they denied new mortgage applications once a trading partner joined MERS, which would provide further evidence that the results documented previously are capturing a shift in supply. The HMDA dataset is also national in scope, reducing concerns about the external validity of results obtained using data from only six counties in Massachusetts.

Table 6 contains the results of these tests. Column (1) shows that after a MERS member's trading partner joins MERS, that lender's denial rates on new mortgage applications fall by approximately 4%, which is an economically large effect. Consistent with previous tests, column (2) of Table 6 also shows that this effect is completely driven by non-bank lenders such as mortgage banks and mortgage brokers. Collectively, the results in Tables 3-6 suggest that the introduction of MERS in the late 1990s and early 2000s caused an economically significant increase in credit supply, particularly by non-bank lenders, particularly within low-income areas, and that these loans were subsequently more likely to result in foreclosure.

4.2 Robustness

4.2.1 Consumer demand shocks

Our main hypothesis is that MERS led to a reduction in the time and cost associated with the sale of loans on the secondary market. This hypothesis suggests that MERS should cause an outward shift in the supply curves of member institutions, which, holding demand fixed, should correspond with higher quantities and lower mortgage rates after an institution becomes a MERS member.

One potential concern is that, rather than capturing increases in mortgage supply due to MERS, we could simply be capturing an outward shift in the demand for residential mortgages (see, e.g, Barberis, Greenwood, Jin, and Shleifer (2018)). However, this explanation does not seem consistent with our results. First, we include granular geographic $\times$ time fixed

effects, to absorb any time varying demand for mortgages at a very local level. For consumer demand effects to be driving our results, it would have to be the case that consumers are aware of when the institution *purchasing* mortgages from their lender becomes a MERS member, and there would then have to be heterogeneous demand at that specific point in time for loans *specifically* from MERS members, *specifically* from non-banks.[18] Second, this hypothesis cannot explain increased origination volume by non-banks in lower income areas. Hence, this hypothesis seems unlikely to explain our results.

4.2.2 Common investor demand shocks

Another potential concern is that demand shocks from investors may explain our results. For example, investors may have increased their general demand for mortgage-backed securities, leading securitization trusts to respond by increasing their demand for purchased loans. This would in turn allow originators to expand their supply of mortgages to consumers. Hence, this chain of events would also cause mortgage rates to fall and mortgage origination volumes to increase. If these demand shocks are also correlated with the mortgage purchaser joining MERS, then these types of demand shocks could explain our results.

To account for these potential effects, we include purchaser $\times$ time fixed effects, which will absorb any common variation in demand for purchased loans from institutions the purchaser has a relationship with once the purchaser joins MERS. We argue that heterogeneous demand from a mortgage purchaser who adopts MERS specifically for purchased mortgages originated by MERS members is precisely what we are aiming to capture, provided that such demand heterogeneity is *not* driven by other lender characteristics that are also correlated with MERS adoption. In other words, once the purchaser adopts MERS, the purchaser can also make use of the MERS system with any lender it has a relationship with that is also a MERS member. To ensure that the use of MERS itself is driving any subsequent changes in purchase volumes, it must be the case that the purchaser is not demanding additional purchased loans from MERS lenders for reasons *other than MERS itself*. We run a number of robustness tests to

[18]This explanation is highly unlikely, as MERS membership is private, and there is no evidence that consumers were aware of MERS in large numbers until after the collapse of the housing bubble.

rule out this channel.

First, we want to ensure that MERS members (or more specifically, non-bank MERS members) do not have flatter supply curves than other types of lenders. For example, to the extent that non-MERS originators have flatter supply schedules than non-MERS originators (or MERS non-banks have flatter supply schedules than MERS banks), a demand shock from a common mortgage purchaser would result in a larger quantity increase for the MERS lenders relative to the non-MERS lenders. This could explain our finding that quantity increases are larger for MERS members relative to non-MERS members, or MERS non-banks relative to MERS banks.

However, this channel does not seem consistent with our collection of results. First, we analyze the extent of the relationship between the purchaser and the MERS active lender relative to the non-MERS active lender in the run up to the purchaser becoming a MERS member. If MERS lenders are systematically different from non-MERS lenders (say, larger lenders with flatter supply schedules), we would expect to see MERS members constituting a larger proportion of all mortgages purchased. Figure 4 documents the average percentage of all mortgages purchased from each MERS member and non-MERS member, in the 10 years prior to the purchaser becoming a MERS member. Figure 4 shows that these ex ante relationships seem to be very similar, and follow parallel trends.

We also run a series of robustness tests presented in Table 7. In Panel A, we restrict our sample to only include "small" institutions, which are defined as non-banks with less than 50 employees or banks with less than $1 billion in assets. Intuitively, small institutions are more likely to be homogeneous in nature and hence, are more likely to have similar supply schedules. Panel A of Table 7 shows that our main results continue to hold after this sample restriction. In Panel B, we restrict our sample to only include "national" purchasers that should all be subject to a common demand shock. Panel B shows that our main results again continue to hold. In Panel C, we run placebo tests where we restrict the sample to institutions that are *not* MERS members and check to see if there is any differential in lending response for large versus small institutions. We find no results, indicating that we

are not simply capturing increased lending by institutions with flatter supply schedules (as proxied for by the size of the lending institution), as opposed to capturing increased lending due to institutions' adoption of MERS.

4.2.3 National tests using HMDA data

We also manually match the bank and non-bank lenders from the Massachusetts land records with the respondent identifiers in the HMDA database. This allows us to run the same tests that we ran in Massachusetts (Table 3) using data from all over the country. Panel D of Table 7 presents the results of these tests and shows that our main results continue to hold at the national level. In other words, using relationships between mortgage originators and mortgage purchasers identified only in Massachusetts, we find that MERS lenders expand lending relative to non-MERS lenders across the United States after a purchaser that they both have a relationship with becomes a MERS member.

4.2.4 Tract-level tests

As further evidence of our proposed supply-driven channel, we aggregate our data to the institution *type* by census tract by time level. Here, we exploit within-zip code-time variation in mortgage originations across census tracts that differ in their level of institutional exposure to MERS. In particular, we define *MERS Active* as equal to one if at least 20% of mortgage originations in that census tract-year listed MERS as a grantee. Hence, at each point in time, a census tract is either MERS Active or not. We then examine the relationship between origination volumes and our MERS Active variable in a difference-in-differences regression.

More concretely, we construct a five-year window around each census tract's switch to becoming MERS Active. The first two years of the five-year period (corresponding to the two years prior to the census tract becoming MERS active) are defined as the pre-event period. The last two years of the five-year period are defined as the post-event period. For each census tract that becomes MERS active, we then define the control group as being all non-MERS active census tracts within the same zip code at the same points in time. We

saturate our regression with zip code × time fixed effects, which should account for any demand or supply shocks at the zip code level that might affect all census tracts within the zip code. As such, our empirical design allows us to compare two census tracts within the same zip code at the same point in time, where one census tract has just become MERS Active and the other census tract is not yet MERS active.

According to our main hypothesis, we should see a similar number of mortgage originations between the two census tracts prior to one census tract becoming MERS-active (i.e. parallel trends). However, we should then see a greater number and higher volume of mortgage originations in the newly-MERS active census tract relative to the non-active census tract *within the same zip code* in the two years after the first tract became MERS-active. To test this hypothesis, we run the regression:

$$\begin{aligned} Ln\ Y_{lczt} \;=\; & \alpha + \beta Post_{czt} + \gamma MERSActive_{cz} + \delta Non-Bank_{l} + \theta Post_{czt} \times MERSActive_{cz} + \\ & \lambda Post_{czt} \times Non-Bank_{l} + \psi MERSActive_{cz} \times Non-Bank_{l} + \\ & \phi Post_{czt} \times MERSActive_{cz} \times Non-Bank_{l} + \xi_{zt} + \eta_{l} + \varepsilon_{lczt}\ , \end{aligned}$$

where Y is the outcome variable of interest (number of originations, dollar volume of originations, and number of foreclosures), l equals lender type (i.e. banks versus non-banks), c indexes census tracts, z indexes zip codes, t represents time, $MERSActive$ equals 1 for the calendar years [-2, +2] surrounding the *tract's* MERS-active date and is zero otherwise, and $Post$ takes the value of 1 in the two years after a tract becomes MERS-active and is zero otherwise. Our two main coefficients of interest are the interaction term θ and the triple interaction term ϕ. A positive loading on the interaction term θ would indicate that the outcome variable increases more for newly MERS-active census tracts than for tracts that are either already MERS-active or are yet to become MERS-active. A positive value on the triple interaction term ϕ would indicate that the increase in the outcome variable following a census tract's exposure to MERS is larger for mortgage brokers serving the tract.

Table 8 presents the results of these tests. Columns (1) and (2) show that both the number of mortgages and the dollar volume of mortgages originated in a census tract expand significantly in the two years after the tract becomes MERS-active, while there is no corresponding increase in originations within non-MERS active tracts. This effect is also shown (in scaled form) in Figure 5. Column (3) of Table 8 examines foreclosures and finds the number of foreclosure increases in MERS vs. non-MERS census tracts. Furthermore, these results are stronger for non-bank lending relative to bank lending.

Collectively, the results of these aggregated tests suggest that errors with our primary specifications are unlikely to explain our main findings. These results also provide further evidence that the introduction of MERS led to an increase in the aggregate supply of mortgage credit, and that the MERS-induced increase in credit supply was largest at non-bank lenders such as mortgage banks and mortgage brokers.

5 Conclusion

This paper studies the introduction of the Mortgage Electronic Registration System (MERS) in the late 1990s and documents the contribution of MERS to the significant expansion in mortgage credit supply that occurred during the run-up to the 2007-2009 financial crisis. By removing the need for lenders to update county courthouse records every time a loan was sold, and removing the requirement to validate mortgage title chains during the securitzation process, MERS significantly reduced the time and costs associated with secondary loan sales.

We show that the introduction of MERS helped to fuel an increase in mortgage originations by non-bank mortgage lenders during the years leading up to the crisis. In particular, we hypothesize that: (1) the benefits of MERS should be the largest for non-bank lenders such as mortgage brokers, since these lenders have the highest propensity to sell loans; (2) the reductions in sales times and sales costs due to the MERS system allowed lenders (and particularly non-bank lenders) to expand origination volumes; and (3) brokers expanded origination volumes by increasing their origination activity within lower-income areas. As

such, we argue that the introduction of MERS can help to explain why non-bank lenders increased origination volumes particularly to lower-income borrowers prior to the onset of the financial crisis.

We use detailed data from the Massachusetts land records and the bilateral nature of MERS membership coupled with strict fixed effects to show three primary results. First, MERS-active institutions increased their mortgage origination volumes after a trading partner adopted MERS, relative to institutions that were not MERS members but also had relationships with the same trading partner. Second, non-bank lenders were primarily responsible for the overall increase in mortgage origination volumes. Finally, these "extra" loans made by non-bank lenders were disproportionately made to borrowers residing in lower-income areas and were subsequently more likely to be foreclosed upon. Hence, as hypothesized, our results suggest that the introduction of MERS led to an expansion in lenders' credit supply, with the bulk of the expansion coming from non-bank lenders expanding credit access to lower-income borrowers.

To our knowledge, our paper is the first in the literature to examine the effect of MERS on mortgage originations and is the first to explain why credit supply increased more dramatically at non-bank lenders prior to the onset of the crisis. Our results also contribute to the debate over the beneficiaries of the increase in credit supply prior to the 2007-2009 financial crisis. Finally, our results contribute to the literature on FinTech (Buchak, Matvos, Piskorski, and Seru, 2018; Fuster, Plosser, Schnabl, and Vickery, 2018) and the efficiency of innovations within the finance industry (Philippon, 2015; Bai, Philippon, and Savov, 2016) by showing that even a very successful financial innovation like MERS may be associated with unintended consequences that can have a important impact on the health of the housing market.

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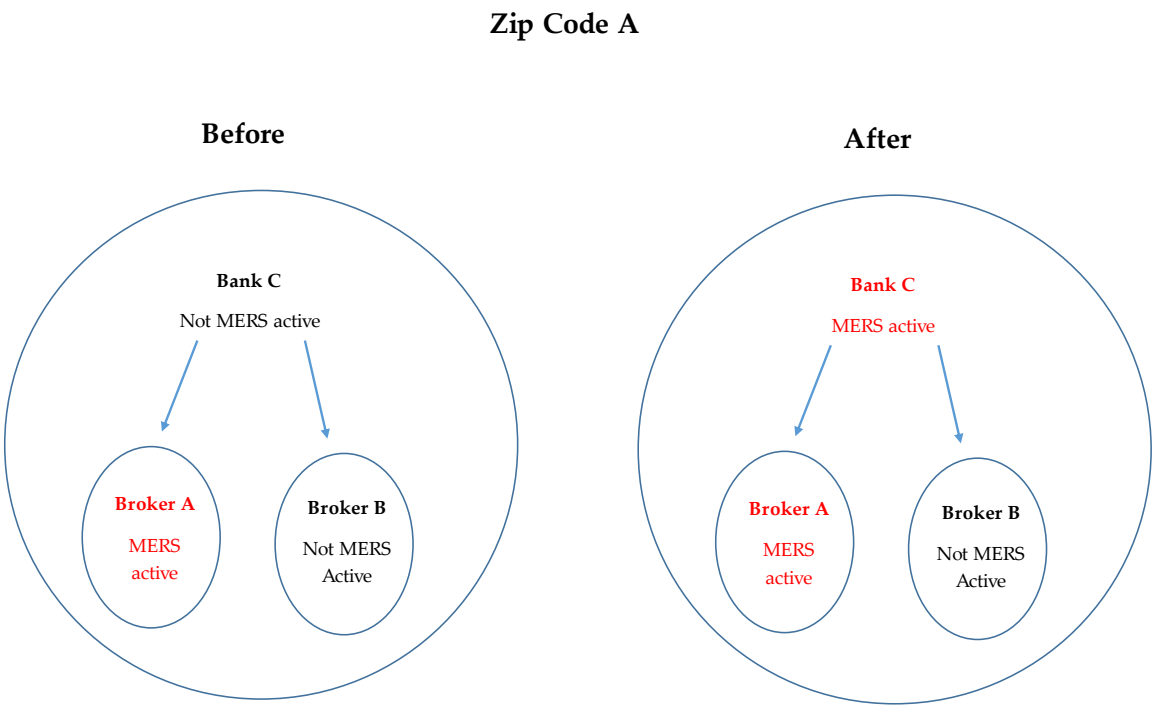

Figure 1: Description of identification strategy.

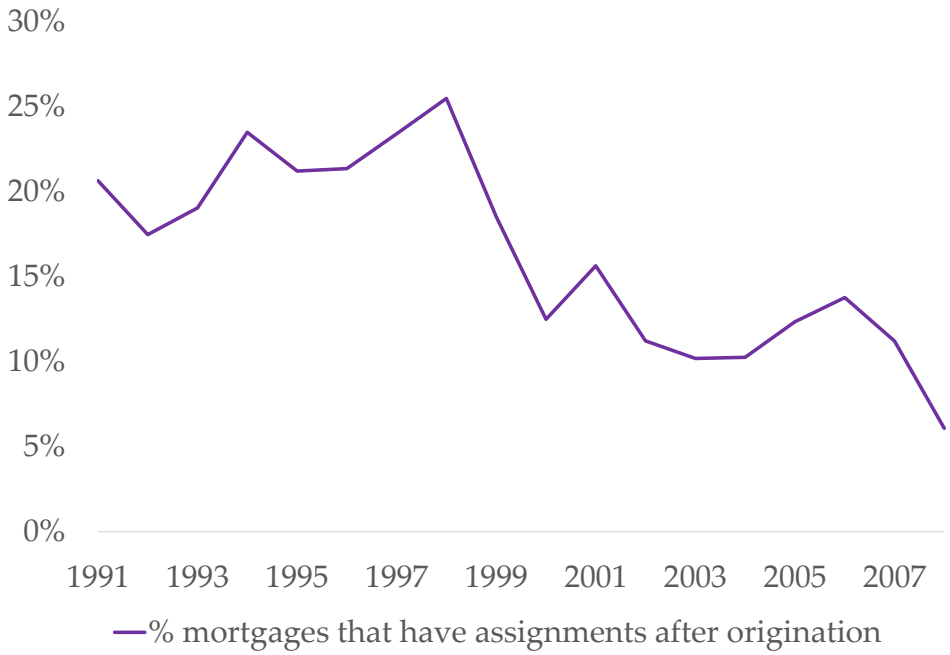

Figure 2: Fraction of mortgages with assignment documents filed immediately after origination.

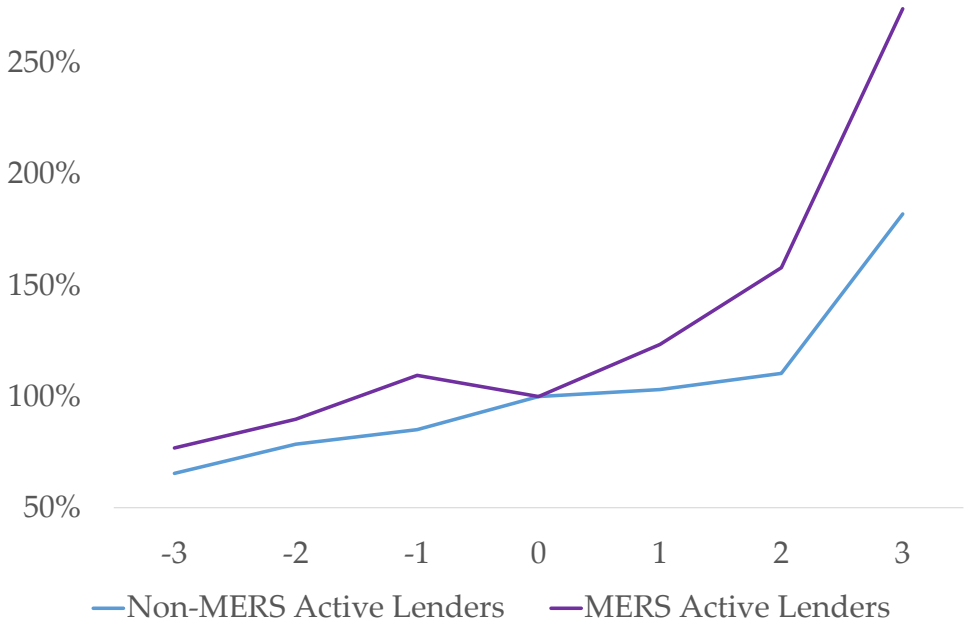

Figure 3: Average lending per census tract/year for MERS active vs non-MERS active lenders in years -3 to +3, where year 0 is the year the assignment grantee becomes a MERS member.

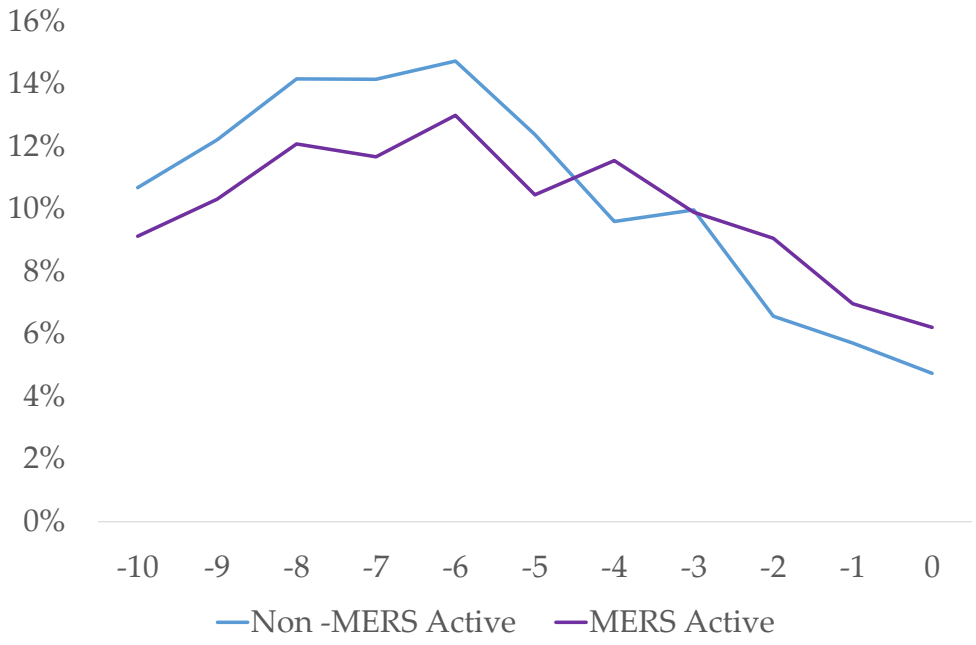

Figure 4: Percentage of all assignments for MERS Active and non-MERS active mortgage grantees in years -10 to 0 where year 0 is the year the assignment grantee becomes a MERS member.

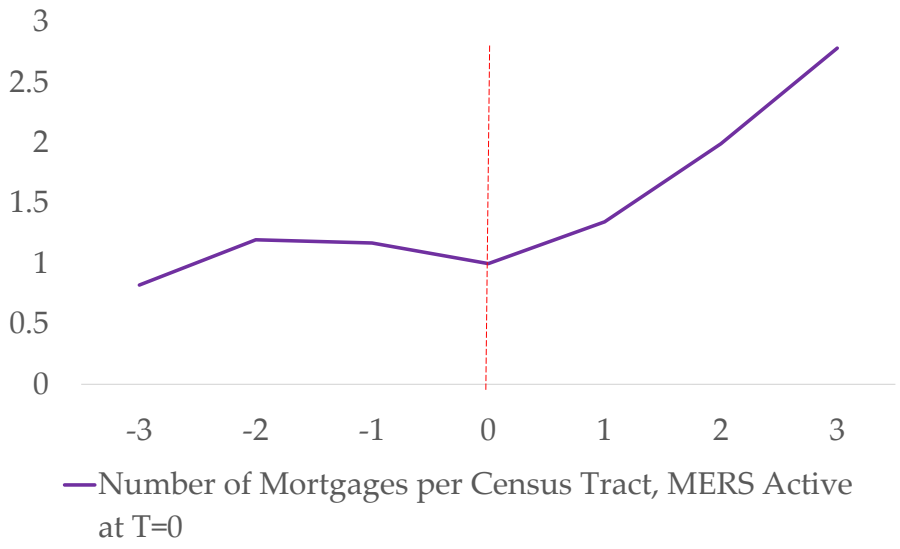

Figure 5: Number of Mortgages Per MERS Active Census Tract (scaled to equal 1 at time 0).

Table 1: **Summary Statistics: MERS Adoption**

This table contains summary statistics using data obtained from the Massachusetts Registry of Deeds. Panel A documents the proportion of all mortgages that are registered with the Mortgage Electronic Registration System (MERS) and the proportion of all lenders that are MERS active by year and averaged across census tracts. Panel B documents the total number of mortgages originated in the sample, by lender type. Bank originated mortgages are defined as mortgages originated by institutions with HMDA lender code 0, 1, 2, or 5, which are banks, subsidiaries of banks, subsidiaries of bank holding companies, and affiliates of banks respectively. Non-Bank originated mortgages are defined as mortgages originated by institutions with HMDA lender code 3, which are stand-alone institutions not related to banks either as a subsidiary or as an affiliate. HMDA lender codes are obtained through a fuzzy matching process by institution name, and a manual search of any non-matched names. The table also documents the number of mortgages by lender type and in total that are registered with the Mortgage Electronic Registration System at origination.

Panel A

Year	Census tracts	MERS-registered mortgages	MERS-active lenders
1998	551	0.0%	0.0%
1999	552	0.9%	0.4%
2000	547	6.7%	4.2%
2001	541	19.0%	12.1%
2002	556	24.6%	17.2%
2003	556	37.6%	30.2%
2004	548	39.7%	32.3%
2005	558	50.2%	40.4%
2006	547	55.7%	46.6%
2007	549	51.7%	44.4%
2008	531	43.0%	39.2%
2009	540	54.9%	50.7%
2010	547	57.0%	53.3%
2011	546	53.5%	50.2%
2012	549	58.5%	53.5%
2013	544	55.3%	50.2%
2014	547	50.3%	44.5%
2015	540	56.3%	49.9%
2016	545	58.7%	51.9%
2017	547	54.8%	47.5%
2018	548	56.4%	45.8%

Panel B

	Mortgages	MERS-registered Mortgages	% MERS
Bank Originated	1,162,762	130,738	11%
Non-Bank Originated	451,259	248,563	55%
Total	1,623,199	379,301	23%

Table 2: **Summary Statistics: Massachusetts Land Records**

This table contains summary statistics using data obtained from the Massachusetts Registry of Deeds. Panel A documents mortgage origination by census tract/year for the full sample and for census tracts identified as subprime. A subprime census tract is a census tract with a large proportion of loans in that census tract originated by subprime specialists identified by HUD. Panel B documents mortgage origination by census tract/year/lender type where non-banks are identified as institutions with a HMDA lender code of 3, or manually identified when no HMDA code exists. Banks are identified as institutions with a HMDA lender code of 0,1,2, or 5, or manually identified when no HMDA code exists.

	Panel A: Full Sample					
	Average	Min	25	50	75	Max
All Census Tracts						
No. Mortgages per Census Tract/Year	122	1	18	72	170	1555
Total Origination per Census Tract/Year	46,600,000	20,000	3,057,508	13,400,000	36,600,000	22,600,000,000
Foreclosure Rate	1.2%	0.0%	0.0%	0.0%	1.0%	50%
	Panel B: By Lender Type					
	Average	Min	25	50	75	Max
Non-Banks						
No. Mortgages per Census Tract/Year	35	1	6	18	44	567
Total Origination per Census Tract/Year	7,950,030	29,500	935,559	3,195,377	8,831,999	2,410,000,000
Foreclosure Rate	2.1%	0%	0%	0%	0%	27%
Banks						
No. Mortgages per Census Tract/Year	81	1	11	42	111	991
Total Origination per Census Tract/Year	27,100,000	20,000	1,890,415	7,531,018	21,000,000	23,100,000,000
Foreclosure Rate	0.9%	0%	0%	0%	0.39%	12%
MERS Lenders						
No. Mortgages per Census Tract/Year	49	1	8	28	72	425
Total Origination per Census Tract/Year	13,200,000	25,000	1,800,600	6,300,491	15,200,000	21,300,000,000
Foreclosure Rate	2.1%	0%	0%	0%	1.4%	22.4%

Table 3: **Credit Supply Effects of MERS**

This table contains results of an institution by year by census tract regression. The dependent variable is the log of the total number of mortgages and the log of the total dollar amount of mortgages originated per year/census tract/institution. MERS Active is a dummy variable taking a value of 1 if the mortgage grantee is MERS active, and a value of 0 if the mortgage grantee is not MERS active in the pre and post period. Post is a dummy variable taking a value of 1 for the year post the year the assignee the mortgage grantee has a relationship with becomes MERS active, and a value of 0 for the year prior to the year the assignee the mortgage grantee has a relationship with becomes MERS active. Non-Bank is a dummy variable that takes a value of 1 if the institution has a HMDA lender code 3 (i.e. is a non-bank), and a value of 0 if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank).Zip code x year, assignee x year and relationship fixed effects are included. Assignee is the institution the mortgage grantee assigns mortgages to in the pre period that subsequently becomes a MERS member in the post period. Relationship is the assignee/mortgage grantee relationship. Standard errors are clustered by county.

Dependent Variable	Log (Total Origination)	Log (No. Mortgages)	Log (Total Origination)	Log (No. Mortgages)
Post x MERS Active	0.127***	0.101**	0.000354	-0.00836
	(0.0206)	(0.0357)	(0.0150)	(0.0314)
Post x MERS Active x Non-Bank			0.194***	0.200***
			(0.0370)	(0.0349)
Post x Non-Bank			-0.175***	-0.272***
			(0.0332)	(0.0379)
Assignee x Year Fixed Effects	Y	Y	Y	Y
Relationship Fixed Effects	Y	Y	Y	Y
Zip Code x Year Fixed Effects	Y	Y	Y	Y
Observations	203,758	204,152	203,758	204,152
R-squared	0.367	0.411	0.367	0.411

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

Table 4: **Credit Supply Effects in Lower-Income Areas**

This table contains results of a lender by year regression. The dependent variable is the log of the total number of census tracts that the lender operates in a year, or the log of the average median income per census tract averaged over all census tracts the lender operates in. MERS Active is a dummy variable taking a value of 1 if the lender is MERS active, and a value of 0 if the mortgage grantee is not MERS active in the pre and post period. Post is a dummy variable taking a value of 1 for the year post the year the assignee the lender has a relationship with becomes MERS active, and a value of 0 for the year prior to the year the assignee the lender has a relationship with becomes MERS active. Non-Bank is a dummy variable that takes a value of 1 if the institution has a HMDA lender code 3 (i.e. is a non-bank), and a value of 0 if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank). Institution and year fixed effects are included. Standard errors are clustered by county.

Dependent Variable	Log (No. of Census Tracts)		Log (Median Income)	
Post x MERS Active	-0.0724	-0.438	-0.00210	0.00576
	(0.196)	(0.254)	(0.00591)	(0.00769)
Post x MERS Active x Non-Bank		0.575**		-0.0160**
		(0.216)		(0.00737)
Post x Non-Bank		-0.252		0.0117**
		(0.196)		(0.00449)
Year Fixed Effects	Y	Y	Y	Y
Lender Fixed Effects	Y	Y	Y	Y
Observations	2,236	2,236	2,236	2,236
R-squared	0.671	0.672	0.199	0.199

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

Table 5: **Foreclosures**

This table contains results of a mortgage level conditional logit regression grouped by census tract. The dependent variable - Foreclosed - is a dummy variable taking a value of 1 if the mortgage was subsequently foreclosed and a value of 0 if the mortgage was not foreclosed. MERS Active is a dummy variable taking a value of 1 if the mortgage grantee is MERS active, and a value of 0 if the mortgage grantee is not MERS active in the pre and post period. Post is a dummy variable taking a value of 1 for the year post the year the assignee the mortgage grantee has a relationship with becomes MERS active, and a value of 0 for the year prior to the year the assignee the mortgage grantee has a relationship with becomes MERS active. Non-Bank is a dummy variable that takes a value of 1 if the institution has a HMDA lender code 3 (i.e. is a non-bank), and a value of 0 if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank). Standard errors are clustered by census tract.

Dependent Variable	Foreclosed	
Post x MERS Active x Non-Bank		1.017***
		(0.272)
Post x MERS Active	-0.492***	-1.103***
	(0.117)	(0.193)
MERS Active	1.218***	1.292***
	(0.0985)	(0.172)
Post	-0.270**	-0.133
	(0.114)	(0.168)
Post x Non-Bank		-0.405*
		(0.246)
Non-Bank		0.0752
		(0.188)
MERS Active x Non-Bank		-0.101
		(0.211)
Observations	116,193	116,193

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

Table 6: **Mortgage Application Denial Rates**

This table contains results of an institution by year by census tract regression using nationwide mortgage origination data from HMDA. The dependent variable is the fraction of new mortgage applications that were denied by lenders. Non-Bank is a dummy variable that takes a value of 1 if the institution has a HMDA lender code 3 (i.e. is a non-bank), and a value of 0 if the institution has a HMDA lender code 0,1,2, or 5 (i.e. is a bank, or a subsidiary or affiliate of a bank). Census tract × year, assignee × year and relationship fixed effects are included. Assignee is the institution the mortgage grantee assigns mortgages to in the pre-event period that subsequently becomes a MERS member in the post period. Relationship refers to the relationship between the mortgage assignee (the buyer) and the mortgage grantee (the seller). All assignee and grantee variables are based solely on data from the Massachusetts land records. Standard errors are clustered by county.

Dependent Variable	Denial Fraction	
Post x MERS Active	-0.0395***	-0.0063
	(0.0044)	(0.0060)
Post x MERS Active x Non-Bank		-0.0496***
		(0.0067)
Post x Non-Bank		0.0264***
		(0.0064)
Assignee x Year Fixed Effects	Y	Y
Relationship Fixed Effects	Y	Y
Census Tract x Year Fixed Effects	Y	Y
Observations	25,936,044	25,936,044
R-squared	0.383	0.383

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

Table 7: **Robustness**

This table reports results from a series of institution by year by census tract regressions. In all panels, the dependent variable is the log of the total dollar volume of mortgages originated per year/census tract/institution. In Panel A, the sample is restricted to mortgages where the mortgage is originated by a "small" institution. An institution is defined as small if it has smaller than the median total assets (if the institution is a bank or subsidiary of a bank) or number of employees (if the institution is a non-bank). In Panel B, the sample is restricted to mortgages where the assignment grantee is a "national" institution that operates both inside and outside of New England. In Panel C, the sample is restricted to mortgages originated by non-MERS members. Large is a dummy variable taking a value of 0 for a small institution and a value of 1 for a large institution, where small is defined as above. Panel D replaces mortgage origination data from the Massachusetts land records with nationwide data on loan originations from the Home Mortgage Disclosure Act (HMDA). Despite using loan originations from HMDA, data on buyer-seller relationships and MERS membership are still sourced from the Massachusetts land record data in this panel. The variables MERS Active, Non-Bank, and Post are defined in Table 3. All panels include assignee × year and relationship fixed effects. In addition, Panels A, B, and C include zip code × year fixed effects, while Panel D includes census tract × year fixed effects. Standard errors are clustered by county.

Independent Variable	ln(Volume)	ln(No. Mortgages)	N	R-Squared
Panel A: Sample limited to "small" institutions (supply curve tests)				
Post x MERS Active	0.072***	0.081*	115,726	0.340
	(0.0167)	(0.0480)		
Post x MERS Active x Non-Bank	0.103**	0.116*	115,726	0.366
	(0.0475)	(0.0631)		
Panel B: Sample limited to "national" institutions (securitization demand tests)				
Post x MERS Active	0.135***	0.107**	187,863	0.366
	(0.0190)	(0.0349)		
Post x MERS Active x Non-Bank	0.236***	0.242***	187,863	0.366
	(0.0413)	(0.0367)		
Panel C: Large vs. small institutions (placebo tests)				
Post x Large	-0.0703	-0.0007	91,112	0.487
	(0.0597)	(0.1136)		
Post x Large x Non-Bank	-0.0703	-0.0851	91,112	0.487
	(0.0597)	(0.0835)		
Panel D: HMDA data (nationwide tests)				
Post x MERS Active	0.0588***	0.0747***	17,880,117	0.336
	(0.0112)	(0.0082)		
Post x MERS Active x Non-Bank	0.0643**	0.0985***	17,880,117	0.336
	(0.0252)	(0.0137)		

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

Table 8: **Aggregate Credit Supply Effects: Census Tract Evidence**

This table contains results of a year by census tract by lender type regression. The dependent variables are the log of the total number of mortgages, the log of the total dollar amount of mortgages and the log of the total number of mortgages foreclosed originated per year/census tract/lender type. Lender type is a dummy variable that takes a value of 1 if the institution has a HMDA lender code 3, and a value of 0 if the institution has a HMDA lender code 0,1,2, or 5. MERS Active is a dummy variable taking a value of 1 if the census tract is MERS active which is defined as having greater than 20% of all mortgages registered with the Mortgage Electronic Registration System in that year, and a value of 0 if the census tract is not MERS active defined as having 0% of all mortgages registered with the Mortgage Electronic Registration System in that year. Period is a dummy variable taking a value of 1 for the two years post the census tract becoming MERS active, and a value of 0 for the two years prior to the census tract becoming MERS active. Zip code x year and lender type fixed effects are included and standard errors are clustered by zip code.

	Log (No. Mortgages)	Log (Total Origination)	Log (No. Foreclosures)
Period x MERS Active x Broker	0.153**	0.207***	0.0993*
	(0.0719)	(0.0723)	(0.0573)
Period x MERS Active	0.339**	0.299**	-0.0508
	(0.131)	(0.132)	(0.0441)
MERS Active	-0.0511	-0.0464	0.00949
	(0.0928)	(0.107)	(0.0240)
Zip Code x Year Fixed Effects	Y	Y	Y
Lender Type Fixed Effects	Y	Y	Y
Observations	5,516	5,506	5,516
R-squared	0.741	0.637	0.765

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