"The ins and outs of mortgage debt during the housing boom and bust"

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Abstract: From 1999 to 2013, U.S. mortgage debt doubled and then contracted sharply. Our understanding of the factors driving this volatility in the stock of debt is hampered by a lack of data on mortgage flows. Using comprehensive, individual-level panel data on consumer liabilities, I estimate detailed mortgage inflows and outflows. During the boom, inflows from real estate investors tripled, far outpacing growth from other segments such as first-time homebuyers. During the bust, although defaults and deleveraging are popular explanations for the debt decline, a collapse in inflows has been the major driver. Inflow declines across counties have been associated not just with house price declines, but also with rising unemployment and higher minority population shares. Finally, inflow declines reflect, in part, a dramatic decline in first-time homebuying. First-time homebuying fell among both high and low credit score individuals, but much more precipitously for low score individuals. Further analysis suggests that the differential decline by credit score likely reflects markedly tightened credit supply.

1. Introduction

From 1999 to 2007, household mortgage debt in the U.S. doubled in real terms to almost $11 trillion (see Figure 1) – at the time, more than all U.S. government debt (including local and state), and about 30 percent of all domestic nonfinancial sector debt.[1] After 2007 a financial crisis and recession ensued, consistent with recent research linking surges in private debt to banking crises (e.g. Reinhart and Rogoff 2011). Finally, mortgage debt declined by about $2 trillion from 2008-2013, a (proportionally) larger and longer-running decline than any experienced since at least 1945.[2] In sum, the period from 1999 to 2013 has been a volatile one for U.S. mortgage debt and the economy more broadly.

These swings in the stock of debt are well known from standard data sources, but there is virtually no data on the underlying flows, resulting in a limited understanding of the reasons for the recent volatility, and hindering the ability of policy makers and prudential regulators to know whether and how to react to fluctuations in aggregate credit growth. This paper aims to help fill this gap by developing novel measures of mortgage flows from comprehensive, individual-level panel data on consumer liabilities. At the highest level, mortgage inflows come from consumers who accumulate mortgage debt over a short period, and outflows come from consumers who reduce such debt. More importantly, I also disaggregate these broad inflows and outflows into key subcomponents according to several borrower characteristics (e.g. credit score) and activities (first-time homebuying, default, etc.)

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[1] Figure 1 is based on the credit record data used in this paper; other debt amounts based are based on the Federal Reserve's Financial Accounts of the United States, also known as the Flow of Funds. Appendix Figure 1 provides a comparison of aggregate mortgage debt calculated from the credit record data and aggregate mortgage debt from the Flow of Funds. According to these data, mortgage debt has, on average, made up about two-thirds of all household debt.

[2] The Flow of Funds provides data on total household mortgage debt back to 1945; the natural log of this series in real terms is plotted in Appendix Figure 2.

During the housing boom, a number of factors could have contributed to the buildup of mortgage debt such as equity extraction (e.g. Greenspan and Kennedy 2008; Mian and Sufi 2011; Bhutta and Keys 2013), increased purchases of second homes and investment properties (e.g. Haughwaut et al. 2011), and increased first-time homebuying by more marginal borrowers due to a credit expansion that may have been partially government induced (e.g. Mian and Sufi 2009; Agarwal et al. 2012).

Similarly, multiple reasons have been hypothesized to explain the sharp contraction in total mortgage debt during the bust. The debt decline is sometimes characterized as evidence of "deleveraging," a term that implies a process of households unwinding debt built up prior to the crisis, perhaps because plummeting house prices pushed leverage ratios well above levels that households or lenders target (e.g. Dynan 2012; Eggertson and Krugman 2012). A more common and popular explanation for the debt decline is the rise in mortgage defaults. For example, *The Economist* (2012) writes, "It's not that American households have been more frugal or disciplined. Household debt has fallen largely thanks to defaults, particularly on mortgages."

This paper is the first to quantify these various flows into and out of the pool of mortgage debt, allowing a precise assessment of their relative importance over time. The analysis helps provide a more complete understanding of the underlying forces pushing up household debt during the housing boom, and thus may help point to the most important sources of instability contributing to the financial crisis. For example, inflows from "investors" – those with more than one mortgaged property – are found to have grown more sharply than any other major category of inflows, while inflows from first-time homebuyers – even those with low credit scores – grew modestly.

The analysis also sheds important new light on why mortgage debt has been declining in recent years. Recent research using aggregate data has concluded that there would have been little or no contraction in household debt since 2007 were it not for mortgage defaults (Mason and Jayadev 2014). However, the flows data shows that the contraction in new credit issuance has been far greater than the expansion in defaults. By overemphasizing defaults, policy makers potentially underappreciate the scope of another problem, namely the broader health of credit markets and the lack of credit supply and/or demand.[3]

In addition to the analysis of nationwide inflows and outflows, I disaggregate mortgage inflows down to the state and county levels to study how credit growth varied geographically during both the boom and bust, and how this variation relates to local economic conditions and demographic characteristics. During the boom, growth in inflows was highly correlated with labor market improvements and the black and Hispanic share of residents, but these relationships are sharply attenuated or all together erased after conditioning on house price growth, revealing the tight link between house price appreciation and credit growth during the boom. During the bust there is also a close relationship between house price and inflow declines, but rising unemployment and areas with higher shares of Hispanic residents and of vacation homes are also strongly associated with declines in new credit. Several important implications of this analysis will be discussed.

Finally, while there has been a sharp reduction in new credit issuance in recent years, including mortgages to first-time homebuyers (more precisely, first-time borrowers), the extent

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[3] My paper builds on work by Brown et al (2011) who use the same data, and my results are broadly consistent with theirs. In particular, they emphasize that there has been a substantial drop in *net* borrowing after accounting for charge-offs. The inflow-outflow framework I build in this paper disaggregates the data more finely and helps show, for example, that paydowns and payoffs have not grown that much and that the contraction in inflows has really driven down net borrowing. Knotek and Braxton (2012) builds on an earlier version of this paper, studying total inflows for different categories of debt (housing, auto, etc.) over time.

to which tightened credit supply can be blamed, as opposed to weak demand, is impossible to disentangle with aggregate data. Using the individual-level data, I find that first-time borrowing has contracted much more sharply among low credit score individuals compared to high credit score individuals, even after accounting for possibly differential effects of unemployment shocks on lower-score individuals as well as time-varying effects specific to certain demographic groups (e.g. younger people) that might be correlated with time-varying credit score effects. In the end, I estimate that heightened credit score thresholds can explain about 40 percent of the drop in first-time homebuying in recent years relative to the early 2000s.

This aspect of the paper relates to a broader literature trying to identify the effects of credit supply shocks on the economy separately from credit demand. Some recent research has made progress using novel micro data sources (e.g. Bassett et al. 2012, Becker and Ivashina 2011, Del Giovane et al. 2011, Jimenez et al. 2012). This paper employs new micro panel data where consumers' borrowing activity at all creditors (banks and non-banks) is observed before and after the crisis, as are their credit scores – the most important measure of credit quality used in U.S. consumer credit markets.

The rest of the paper is organized as follows. In the next section I describe the credit record panel data in more detail. Section 3 defines "inflows" and "outflows" and discusses how they can be divided. The results section proceeds in three parts. The first part describes how inflows and outflows and some of the most important subcomponents have changed over time. The second part focuses on variation in the boom and bust in inflows at the state and county level. And the third part centers on the reduction in first-time mortgage borrowing, with the goal of identifying the role tightened credit standards has played. Finally, the last section concludes.

2. Consumer Credit Record Data

The data for this paper are from the Federal Reserve Bank of New York's (FRBNY) Consumer Credit Panel (CCP). The full dataset is a 5 percent, nationally representative sample of all individuals with a credit record and a valid Social Security number.[4] The CCP tracks the same individuals over time at a quarterly frequency, and the sampling approach is designed to generate the same entry and exit behavior as present in the population, with young individuals and immigrants entering the sample and deceased individuals and emigrants leaving the sample each quarter at the same rate as in the U.S. population, such that each quarterly snapshot continues to be nationally representative. [5]

The CCP provides data on individuals' debt holdings, payment history, credit scores and geographic location down to the census block, with all items refreshed quarterly as noted above.[6] Thus, the data have notable strengths in terms of size, timeliness and high frequency even while providing considerable detail on the liability side of individual balance sheets. One of the only other sources of individual panel data with balance sheet information is the Panel Study of Income Dynamics (PSID), but those data arrive with a considerable lag, have far fewer observations than the CCP, and can suffer biases due to non-response and sample attrition.

Two other attributes of the data facilitate the analysis in this paper. First, they cover the vast majority of mortgages – regardless of lien status, and regardless of whether the loan is held

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[4] There is also a supplementary dataset comprised of every individual living at the same address in a given quarter as members of the primary 5 percent sample. These supplementary data are not utilized in this paper. Also, I only use subsamples of the data ranging from 5-15 percent depending on the type of analysis; sample sizes are provided in the table and figure notes.

[5] For more information on the CCP, see Lee and van der Klaauw (2010). It is important to note that all individuals in the data are anonymous: names, street addresses and social security numbers have been suppressed by Equifax. Individuals are distinguished and can be linked over time through a unique, anonymous consumer identification number assigned by Equifax.

[6] Credit scores for each individual are based on the Equifax 3.0 model, which is similar conceptually and numerically to the FICO score. The Equifax score ranges from 280 to 850, with higher scores associated with a lower expected likelihood of default.

in a bank's portfolio, sold to a government-sponsored enterprise (e.g. Fannie Mae and Freddie

Mac) or sold into a private-label security – in a consistent way over a fairly long period of time.

Second, because the dataset follows individuals rather than mortgages, total mortgage debt of an

individual can be tracked over time even if, for instance, someone refinances out of one

mortgage and into another.

That said, the CCP data have some limitations. For one, lenders provide only a few

details about each mortgage, such as the outstanding balance and whether it is open- or closed-

ended. Other information, including the occupancy status (owner-occupied or not) and the

location of the property securing the mortgage, are generally not reported. Occupancy status

would help in identifying borrowers who have mortgages on investment properties. Instead,

such borrowers must be inferred based on the number and size of the mortgages they have on

record, as will be discussed in more detail later.

Also, there is little information beyond standard credit record data on each individual.

Thus there are very few demographic variables and no individual-level information on

employment, income or assets. One of the few demographic variables available is year of birth.

In addition, as noted the data provide location information down to the census block, and one can

ascribe average characteristics of a neighborhood, such as average neighborhood income, to the

individuals living in those neighborhoods.[7] One caveat is that the reported location for each

individual is based on their mailing address on file, which may not always be someone's actual

residential address. It could instead be a PO Box, an office building, or the address of a relative,

for example. The fraction of consumers with a mailing address that reflects where they actually

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[7] Census blocks are smallest geographic unit used by the Census Bureau. They are a subset of census tracts, which typically have a population of 1,200-8,000. Neighborhood income and other census demographic data used in this paper are at the census tract level from the 2000 Census; income is not available at the block level.

live is not known, but the data at least indicate that in any given quarter about 90 percent of consumers with a mortgage have a street address, rather than a PO Box address or an address in a high-rise or office building.

The location variable can also help identify moves from one house to another as instances when census block changes from one quarter to the next. Given the caveat about the location variable discussed above, and the possibility that consumers may be slow to inform creditors of address changes, estimates of mobility from the CCP could be understated. That said, the analysis that follows will use, to some extent, the available information on address changes.

3. Estimating inflows and outflows

As described earlier, I use the CCP data to estimate mortgage "inflows" and "outflows". Over a given window of time (τ), inflows come from consumers who increase their mortgage debt balance, and outflows come from those who decrease their mortgage debt:

$$inflows_\tau = \sum_i^N \Delta balance_{i\tau} 1(\Delta balance_{i\tau} > 0)$$

$$outflows_\tau = \sum_i^N \Delta balance_{i\tau} 1(\Delta balance_{i\tau} \leq 0)$$

The sum of inflows and outflows equals the change in outstanding debt during that window:

$$\Delta stock_\tau = inflows_\tau + outflows_\tau$$

Researchers can obtain the left-hand-side of this identity ($\Delta stock$) from publically available data such as the Federal Reserve's "Flow of Funds" and the FRBNY's Quarterly Summary of the

CCP, but not the right-hand-side items (*inflows* and *outflows*).[8] From 2001-2007, household

mortgage debt increased at an above-average pace, and, after the financial crisis, contracted by

more than at any other time in the post-war era.[9] When debt deviates sharply from trend growth,

it could stem from abnormal inflows (new lending) or unusual outflows (e.g. a lot of defaults).

Measuring inflows and outflows and analyzing how they change over time can help us better

understand the sources of volatility in debt growth during the housing boom and bust.

It is important to note that the construction of *inflows* and *outflows* in this paper is based

on the net change in an individual's mortgage balance over a two-year period and thus avoids

counting mortgage transactions that have little actual impact on an individual's indebtedness

towards inflows and outflows. Specifically, Δ*balance* can be rewritten as:

$$\Delta balance_{i\tau} = originations_{i\tau} + draws_{i\tau} - repayments_{i\tau} - defaults_{i\tau}$$

where *draws* refers to new borrowing on a home equity line of credit (HELOC). Thus, Δ*balance*

captures new originations to the extent that they exceed repayments and defaults during a given

period. In a typical refinance transaction, a consumer's balance stays roughly the same because

the new loan pays off the old one and so refinances, in general, will not contribute substantively

to *inflows* or *outflows*. However, someone who, for example, does a "cash-out" refinance (that

is, the principal amount of the new loan exceeds that of the old loan), or gets a new loan to

purchase their first home or second home, will contribute significantly to *inflows*.

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[8] The "Flow of Funds" data, now known as the Financial Accounts of the United States, can be accessed at
http://www.federalreserve.gov/releases/z1/current/. The FRBNY's quarterly report and summary data can be
accessed at http://www.newyorkfed.org/microeconomics/hhdc.html#.
[9] See Appendix Figure 2, which shows (log) real household mortgage debt since 1945.

The unique individual-level details available in the CCP allow me to further divide *inflows* and *outflows*. At the broadest level, I classify individuals into four mutually exclusive groups – two inflow groups and two outflow groups. On the inflow side are:

- *Entrants* – This group is composed of people who went from a zero to positive mortgage balance over a two-year period. It not only includes first-time homebuyers, but also includes those who may have had a mortgage sometime in the past and return to owning from renting, or own a house free and clear and decide to borrow against the equity.

- *Increasers* – This group includes those who increase their total mortgage balance over a two-year period, for instance by doing a cash-out refinance, borrowing more on a HELOC, or by taking on another mortgage to buy another property.

On the outflows side are:

- *Exiters* – This group is comprised of those who went from a positive to zero total mortgage balance, for example by paying off their mortgages or by having them canceled after a default. [10]

- *Decreasers* – These are individuals who decreased their total mortgage balance over the two year period, but did not completely erase such debt. This group includes, among others, those who do nothing but simply pay down their mortgages through scheduled payments, or downsize to a smaller home and mortgage.

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[10] In some cases a zero balance may be reported in one quarter, q, but a positive balance is reported in $q-1$ and $q+1$. This can happen, for example, when a borrower refinances, and the new mortgage is reported by the new lender with a lag (i.e. the old mortgage is paid off in q, but the new mortgage does not show up on record until $q+1$ or even later, potentially). If the balance in q is zero and positive in $q-1$ and $q+1$, I set the balance in q equal to the balance in $q+1$. The main impact of this adjustment is to help offset the effect of the refinance boom in second half of 2003 on exit and entry; in other words the adjustment somewhat reduces exits in 2001-03 and entries in 2003-05.

These broad groupings are a starting point. I further subdivide *inflows* and *outflows* into several other categories of interest. For example, one way I disaggregate *entrant inflows* is into "first-time borrowers" (a proxy for first-time homebuyers) and "return borrowers", and then further by credit score. Additionally, *increaser inflows* can be disaggregated into those inflows from "investors" (borrowers with multiple mortgaged properties) and "non-investors," and *exiter outflows* can be disaggregated by mortgage default status. The main article presents several key disaggregations of *inflows* and *outflows*, while the online Appendix provides several other and more detailed breakdowns.

National aggregate inflows and outflows can also be disaggregated geographically (e.g. by state) according to the residential location of borrowers. As discussed in the previous section, the CCP provides – with some caveats – the location of consumers down to the census block level. I tabulate inflows and outflows at the state and county level to see how they vary across the country, and then examine how changes in inflows during the housing boom and bust relate to measures of local labor market conditions, house prices, and demographics.

4. Results [11]

4.1. Inflows and outflows from 1999 to 2013

Figure 2A shows dollar inflows and outflows (adjusted to 2013:Q3 dollars) from the four groups over seven consecutive two-year periods beginning 1999:Q3 and ending 2013:Q3. The four bars in a given period sum to the change in outstanding debt for that period. Thus, during

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[11] Appendix Tables 1a through 1d provides all of the inflow and outflow numbers discussed in the main text as well as additional detailed breakdowns by various categories such as credit score, income and age of the borrower, number of mortgaged properties, and by default status. The tables also provide the number of borrowers associated with the inflows and outflows, and provide estimates in both real and nominal terms.

the period just before the onset of the Great Recession – the end of 2005:Q3 through 2007:Q3 – combined entrant and increaser inflows totaled $3.45 trillion, outweighing combined outflows of $1.67 trillion, for a net increase in mortgage outstandings of nearly $1.8 trillion. In contrast, during the 2009-11 period, when inflows were at their lowest and outflows peaked, combined inflows were only $1.3 trillion while combined outflows were $2.34 trillion, yielding the decline in outstandings of just over $1 trillion.

Figure 2A thus shows that inflows contracted by about $2.1 trillion from 2005-07 to 2009-11 while outflows expanded by about $670 billion. This is one key finding of the paper: the drop in inflows has played a much more significant role in the decline of aggregate mortgage debt than the expansion of outflows, which includes defaults. Even if outflows had held steady at $1.7 trillion, outstanding debt would have declined in the 2009-11 period because inflows were just $1.3 trillion.

Inflows in 2009-11 and 2011-13, particularly entrant inflows, were significantly lower than even at the very beginning of the decade – well before the peak of the housing market. Importantly, Figure 2B indicates that the *number* of entrants and increasers has also declined markedly relative to before the recession, implying that drop in dollar inflows is not simply a function of declining home values and smaller mortgage loan amounts.

Plotted as a share of initial outstanding mortgage debt, the importance of inflows relative to outflows for explaining the decline in mortgage debt is even sharper. Figure 3 shows that total outflows have been relatively steady at 20-25 percent of the stock of mortgage debt, while inflows plummeted from 40 percent or more in the first four periods to about 12 percent in 2009-11. This finding is at odds with the emphasis on defaults and "deleveraging," which would suggest that growth in outflows should be more pronounced.

4.2. Inflows and outflows in more detail

Figure 4 presents inflows and outflows disaggregated more finely into six and four

mutually exclusive groups, respectively (Appendix Tables 1a and 1b provide all of the numbers

discussed in this section as well as additional and more detailed disaggregations). With respect

to inflows (the top panel), entrant inflows are subdivided by whether the entrant is a "first-time"

borrower or not – a proxy for being a first-time homebuyer or not – and then further by credit

score. First-time borrowers are identified in the data as entrants with no record of ever having

had a mortgage prior to the period of entry.[12] Increaser inflows are divided into those by

"investors," defined as individuals inferred to have at least two mortgaged properties at the end

of a period, and by all other increasers.[13]

During the housing expansion (the first four periods), Figure 4 indicates that a key driver

of rising mortgage debt were inflows from increasers. Inflows from investors in particular

expanded most sharply, increasing over three-fold from $250 billion in 1999-01 to almost $900

billion in 2005-07. Additionally, (as provided in the Appendix) the majority of investor inflows

come from "new" investors – individuals going from one mortgaged property at the start of a

period to two or more by the end of the period, but the growth in inflows from existing investors

(increasers starting a period with at least two mortgaged properties) outstripped that of new

investors (350 percent versus 220 percent). These results coincide closely with those of

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[12] More specifically, the age of their oldest reported mortgage is less than 24 months as of the end of the period. Note that this variable reflects any mortgage in persons credit history, even if it was earlier than 1999 (the first year of the CCP).

[13] Whether a borrower with multiple mortgages has multiple properties or just one property securing those mortgages is not explicitly observed in the data. Instead I infer investor status using information on the number, type and outstanding balance of mortgages on record. A borrower is classified as an investor if (1) he has exactly two closed-end mortgages where the smaller loan is at least one-third the size of the larger, (2) he has three or more closed-end mortgages with positive balances, or (3) he has two closed-end mortgages with positive balances and at least one home equity line of credit.

Haughwaut et al. (2011), who find that investors' share of new purchase mortgages grew sharply as the housing market peaked, and help further the case that investor activity was a much more important aspect of the housing boom than is typically appreciated (see also Chinco and Mayer 2012).

Inflows from other increasers largely reflect "equity extraction" activity – that is, increased borrowing by those with just one property and who do not move. Such inflows more than doubled from 1999-01 to 2005-07, from about $200 billion to over $470 billion. As noted earlier, a few other papers (e.g. Mian and Sufi 2011; Bhutta and Keys 2013) have studied equity extraction in isolation, showing that house prices and interest rates are important drivers of such activity, and that extraction is highly predictive of subsequent default. This paper complements earlier work by quantifying the importance of equity extraction relative to other drivers of mortgage debt growth.[14]

In contrast, and perhaps surprisingly given the widespread criticism of government initiatives to increase homeownership and improve credit availability (e.g. Rajan 2010), growth in inflows from first-time borrowers in general, and from those with low credit scores (less than 680 at the start of a period) in particular, was modest during the housing expansion relative to increaser inflows. Indeed, although theoretically possible, most empirical research on the effects of government initiatives such as the Community Reinvestment Act and the Affordable Housing Goals has found limited effects, if any, on credit supply to targeted groups.[15]

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[14] It is also interesting to note that, as shown in Appendix Table 1a, increaser inflows grew most among high credit score individuals (credit score above 740), and in 2005-07 high score individuals accounted for about half of all increaser inflows. At the same time, those living in high-income neighborhoods (based on the census tract location at the end of the period) typically account for most increaser inflows, but growth in increaser inflows was somewhat stronger for those in low-income neighborhoods.

[15] See, for example, Bhutta and Canner (2009), Bhutta (2011), Bolotny (2013), Avery and Brevoort (2011) and Ghent et al. (2013). Even in Agarwal et al. (2012), it is not obvious that their estimates constitute large effects.

After the financial crisis, inflows from low-score first-time borrowers contracted more sharply than from high-score first-time borrowers, shrinking from $500 billion in 2005-07 to less than $150 billion in 2011-13, or about 70 percent – similar to the percentage decline in inflows from increasers. The sharp decline in low-score inflows relative to high-score inflows is consistent with tightened credit standards, but may also reflect differential effects of the Great Recession on low-score individuals' demand for mortgage credit. In Section 4.4, I delve deeper into this topic and try to carefully separate the role of credit supply from credit demand in explaining the recent drop in first-time homebuying.

The bottom panel of Figure 4 shows the change in outflows over time with exiter and decreaser outflows both divided into two groups. The most noticeable feature of the graph is the expansion during the housing bust of exiter outflows associated with a mortgage "default", defined as being 90 days or more behind on payments on at least one mortgage account during the period.[16] From 2005-07 to 2009-11, outflows from exiters with a mortgage default increased from about $150 billion to nearly $700 billion. [17] This increase of $550 billion accounts for most of the growth in outflows between these two periods (with almost 25 percent of this increase coming from investors). Nonetheless, as noted before, the overall expansion in outflows of about $670 billion was far less dramatic than the shrinkage in inflows of over $2 trillion.

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[16] This variable is measured by looking at the status of mortgage accounts in each of the eight quarters of a given period and checking for accounts that are at least 90 days past due. As shown in Appendix Table 1b, the vast majority of exiters with at least one mortgage account in default during the period were in default on all their mortgage accounts. This table also shows that only about one-third of exiters with a default actually have a *public record* of foreclosure by the end of the period in which they exited. This may reflect lags in public record data since, as the Appendix shows, most exiters with a default also have a mortgage reported from creditors as being in bankruptcy, or in "severe derogatory" status, which refers to a charge off, repossession or foreclosure.

[17] Having a 90 day plus mortgage delinquency need not necessarily lead to exit. Some borrowers may be able to catch up on payments or get a loan modification, while others may find a way to quickly get a new mortgage after default. That said, Appendix Table 2 shows that having a mortgage default is very strongly associated with exit. In any given period default increases the probability of exit by about 30 percentage points compared to a mean exit probability of about 13 percent, controlling for other factors like borrower age, mortgage balance, credit score and local economic conditions. In contrast, default on non-mortgage accounts is associated with just a five percentage point increase in the probability of exit.

Finally, the bottom panel of Figure 4 provides little indication of an acceleration in repayments not associated with mortgage default, and thus little sign of deleveraging through mortgage repayment.[18] In fact, there is a noticeable reduction in outflows from "other exiters" from 2005-07 to 2009-11 of about $200 billion, reflecting both a reduction in outflows from exiters with a non-mortgage default and those without defaults of any kind. One potential explanation might be that house price declines discouraged or undermined the ability of some people to sell their houses. However, in a regression of exit (an indicator variable) on period-specific dummy variables controlling for county-level house price declines, mortgage and non-mortgage default, as well as other borrower and debt characteristics, the coefficients on the 2007-09 and 2009-11 are negative and economically and statistically significant, suggesting that house price declines cannot explain all of the decline in such outflows.[19]

4.3. Geographic variation in the boom and bust of inflows

This section describes how the boom and bust in mortgage inflows varied geographically and how changes in inflows relate to local economic and demographic factors. To begin, Figure 5 shows that inflows declined significantly in every single state during the bust, with 40 states including D.C. experiencing declines of at least 60 log points. Further, the reduction in inflows dwarfed the expansion of outflows in every state (a few states actually had a reduction in outflows). As would be expected, Arizona, California, Florida and Nevada – the states most commonly associated with the housing boom and bust – experienced the sharpest contraction in inflows. Figure 6 shows that states with the most growth in mortgage inflows during the boom

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[18] Instead, deleveraging could be occurring in other ways; for example, instead of paying down debt, households may be reducing consumption and building up liquid assets as in Dynan (2012). In contrast, Cooper (2012) does not find evidence of a deleveraging effect on consumption.

[19] These regression results are provided in Appendix Table 2.

tended to experience the sharpest declines during the bust (the correlation is -0.52). At the same time, the contraction of inflows during the bust was, for most states, significantly larger in magnitude than inflow growth during the boom.

Table 1 provides regression results describing how the change in inflows during the boom and bust periods relate to various local economic, housing and demographic characteristics. For the boom period (columns 1-3), the outcome variable is the change in (log) inflows between 1999-01 and 2005-07, and for the bust period (columns 4-7) it is the change in (log) inflows between 2005-07 and 2009-11. The first column indicates that inflow growth during the boom was strongly related to fundamentals of employment and population growth (measured from 2000 to 2006). At the same time though, conditional on unemployment and population growth, inflows grew more swiftly in counties with a higher share of vacation homes, which could reflect speculative activity. Recall that inflows are based on borrowers' residential location, and so this finding points to higher inflows among people *living* in counties with more vacation homes, rather than outsiders buying homes in these counties as in Chinco and Mayer (2012). Residents of these counties may have been speculating increased future demand for such homes from retiring baby boomers.

The first column also indicates that, conditional on economic and population growth, inflows grew more sharply in counties with more Hispanic residents. This finding may reflect growth in subprime lending and increased credit availability in Hispanic communities, consistent with Mayer and Pence (2008). This coefficient estimate holds up, and is more precise, in column 2 which includes state fixed effects. In addition, the coefficient on black population share is now larger and statistically significant. The vacation-home share coefficient in column 2 is much

smaller and no longer statistically significant, indicating that the finding in column 1 may be driven by a few states in particular (e.g. Florida).

The third column adds in county house price growth from 2000-2006 on the right hand side. Including this variable drives down the magnitudes of the most of the coefficients, and unemployment rate growth is no longer statistically significant. This specification highlights a tight linkage between house price growth and the expansion of inflows during the housing boom, and suggests that unemployment declines and other factors may be related to credit growth during the boom only through an association with house price growth. In other words, areas with higher shares of black residents or larger declines in unemployment experienced more growth in inflows to the extent that house prices appreciated significantly in those areas as well. This finding is somewhat inconsistent with the notion that a credit boom led to a house price boom (e.g. Pavlov and Wachter 2011) rather than the other way around (e.g. Ferreira and Gyourko 2011; Bruekner et al. 2012). If an expansion in credit availability occurred independently of house prices, one would expect more credit growth in counties with higher shares of black residents (who tend to have lower wealth, income and credit scores) even after conditioning on house price growth. That said, the coefficient on the Hispanic share of residents, though substantially smaller in column 3, remains sizeable and statistically significant and thus there is still some support for the credit-led house price boom story (also, the black population share coefficient is statistically significant at the 10 percent level).

Columns 4-7 present similar regressions, but focus on the housing bust period (2006-2010) when mortgage inflows declined sharply. The first two columns, similar to columns 1 and 2, indicate a strong relationship between inflow growth and unemployment and population growth. But in contrast to the regressions for the boom period, columns 4 and 5 indicate that

mortgage inflows declined sharply in minority areas and in counties with more vacation homes, holding constant changes in unemployment and population. Together, the evidence from the boom and bust periods seems to suggest that inflows were most volatile in predominantly minority counties and counties with high shares of vacation homes. Also, even after controlling for inflow growth during the boom (column 3), the coefficients on black population share and vacation home share are still large and statistically significant, indicating that the decline in new mortgage credit in certain areas is not simply a mirror image of the boom.

Finally, the last column includes county house price growth from 2006-2010 on the right hand side. Again, including this variable significantly reduces many of the other coefficient estimates, but unlike the boom-period regression (column 3), the coefficients on unemployment rate growth and vacation-use share of housing units remain economically meaningful and statistically significant. The declines in inflows, holding constant house price growth, associated with rising unemployment, and high shares of Hispanic residents and vacation-use homes could reflect both reduced credit demand and tightened credit supply. For example, demand for vacation homes may have declined, but credit to purchase such properties also may have become more difficult to get, since lending for non-principal residences is typically considered riskier. In the next section, I use data at the individual level to more clearly identify the role of tightened credit supply in the reduction of mortgage inflows, focusing specifically on first-time homebuying activity.

4.4. The contraction in credit supply: Evidence from first-time homebuying activity

To what extent has tightened credit supply contributed to reduced mortgage inflows since the financial crisis? This section aims at addressing this question by studying first-time

homebuying activity, as proxied by first-time mortgage borrowing. Owning one's home, rather than renting, is very popular in the U.S., with well over 70 percent of households headed by someone at least 40 years old owing their home as of 2007 according to the U.S. Census Bureau.[20] When house prices (and mortgage rates) dropped sharply after 2007, potential first-time buyers were beneficiaries from the perspective that housing became much more affordable.[21] However, the weak job market and tight credit conditions may have dampened first-time homebuying activity.

Table 2 shows how the propensity of young people to get a mortgage for the first time over a two-year period has changed over time. In panel A, the number in the top row of column 1 indicates that 11.1 percent of 20-39 year olds (as of 1999:Q3) with no history of ever having a mortgage, got a mortgage over the next two years. This propensity dropped sharply in 2007, and by 2011 was at just 5.1 percent – less than half the 1999 rate, as shown in column 9.

The next four rows show the time pattern separately by initial credit score of potential first-time buyers. The numbers in column 9 indicate that the decline in the propensity to get a mortgage for the first-time has been significant across all groups, but far more dramatic for those with low credit scores. For the highest score group (740+), the propensity in the most recent period was 69 percent of what it was at the beginning of the decade, and just 21 percent for the lowest score group (<620).

One potential concern with comparing these propensities over time and across score groups is that many of the 20-39 year olds in 2011 were adults during the housing boom years, and a large share of those most interested in homeownership may have exited the sample prior to

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[20] See https://www.census.gov/housing/hvs/data/q114ind.html.

[21] In addition, Congress provided tax incentives to help spur first-time homebuying from 2008 to 2010. The most generous program was a tax credit of $8000 available in 2009 through April 2010.

2011, leaving the 2011 cohort somewhat skewed towards those less interested in owning. However, this potential selection (or attrition) issue is mitigated in panel B, which focuses on the youngest individuals (20-25 year olds) who are just beginning their adult lives. Thus, most of the 2011 cohort would have had limited exposure as adults to the housing boom. Nevertheless, the relative propensities in column 9 are quite similar to patterns for 20-39 year olds.

A simple interpretation of the patterns in Table 2 is that the decline in first-time borrowing in 2011 relative to 1999 among higher-score individuals represents the decline in demand for mortgage credit, while the differential decline for low-score individuals reflects the effects of tightened credit access. Such an interpretation relies on two assumptions. First, it assumes that access to credit for high credit score individuals remained stable during the downturn. A main reason to think this assumption is valid is that the government-sponsored enterprises (Fannie Mae and Freddie Mac) continued to provide mortgage credit to creditworthy borrowers with a significant downpayment (at least 15-20 percent), while other government entities like the Federal Housing Administration (FHA) and the Veteran's Administration (VA) supported mortgages with little or no downpayment. Indeed, after 2007, FHA and VA lending grew dramatically, accounting for nearly half of owner-occupied home purchase loans in 2010, and most of such loans have LTV ratios of 95 percent or more.[22]

Second, it assumes that the decline in demand for purchase mortgages among low-score individuals was similar to the decline in demand among high-score individuals. This assumption is less obviously true. Younger people, minorities and less educated individuals tend

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[22] Avery et al. (2011) tracks the government-backed share of lending from 2006-2010. The Department of Housing and Urban Development (2013) reports that in 2013 nearly three-quarters of FHA loans had LTV ratios of 95 percent or more.

to have lower credit scores (Federal Reserve 2007), and the Great Recession could have affected these groups more acutely.[23]

Table 3 shows results of regressions that test the robustness of the relationship between credit scores and the decline in first-time borrowing. I run logit regressions of the following form:

$$Y_{it} = \Lambda\{\beta_0 + \beta_1(score_{it}) + \beta_2(1[t=2011]) + \beta_3(score_{it})(1[t=2011]) + \mathbf{x}'_{it}\boldsymbol{\delta})\} \qquad (1)$$

The estimation sample consists of young potential first-time borrowers in 1999 and 2011. $Y=1$ if person i has a mortgage in year $t+2$, and the coefficient of interest is β_3, which captures the change in the relationship between first-time borrowing and credit scores in 2011 relative to 1999 (assumed to be a more "normal" period). Finally, $\mathbf{x}$ is a vector of control variables to help better identify β_3. For example, one regression will include controls for age of the individual, and education and minority status measured at the census tract level, with all three variables interacted with the 2011 year dummy, thus controlling for time-varying effects specific to certain demographic groups that might be correlated with the time-varying credit score effect of interest.[24]

The first column of Table 3 provides an estimate of β_3 without any controls for 20-39 year olds. Note that *score* has been re-centered so that zero corresponds to a credit score of 760

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[23] For example, the decline in employment from 2007 to 2013 was much stronger for younger individuals, as shown here: http://www.washingtonpost.com/blogs/wonkblog/wp/2013/09/06/forget-the-unemployment-rate-heres-the-chart-to-focus-on-on-jobs-day/.

[24] About 70 percent of potential first-time borrowers have a street address on file, as opposed to about 90 percent for people who already have a mortgage, as noted earlier. About 25 percent of potential first-time borrowers have an address that refers to a high-rise or office building, and only about 5 percent have a PO Box address. Although a larger percentage of high-rise addresses for non-homeowners is to be expected, to the extent that mailing addresses for potential first-time borrowers do not reflect their actual residential location, the census tract variables will be even noisier measures of individual demographic characteristics.

– the average score of entrants in the 740+ group. Re-centering in this way makes the coefficient on the 2011 dummy variable represent the proportional change in the odds of entry from the first to last period for someone with an excellent credit score of 760. Thus, column 1 indicates that the odds of a potential entrant with a 760 score was about 0.51 log points lower in 2011 than in 1999.

The coefficient on the interaction term (β_3) is 0.466 and highly significant, and implies that the relationship between credit scores and first-time homebuying was far steeper in 2011 than it was in 1999, exactly as expected given the results from Table 2.[25] This estimate is basically unchanged in column 2 after controlling for age and census tract characteristics and their interaction with the 2011 indicator variable (note that the coefficient on the 2011 dummy variable no longer has the same interpretation as in column 1 because of the additional interaction terms). Thus there is no evidence that time-varying effects specific to certain demographic groups confound the raw patterns shown in Table 2.[26]

Column 3 shows another specification where I interact county unemployment rate from the BLS (in 2000 for the 1999 cohort and in 2012 for the 2011 cohort) with *score* and the 2011 dummy. I re-center the county unemployment rate variable at 5 percent – approximately the national average from 2000-2006 – and thus the estimate of β_3 in this regression can be interpreted as the relationship between credit score and first-time borrowing in a county with an unemployment rate at the pre-crisis average. To the extent that negative labor market shocks

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[25] The "effect" of a 100-point increase in score on the (log) odds of first-time borrowing in 2011 is estimated to be 0.978 (i.e. 0.466 + 0.512) in 2011 versus 0.512 in 1999.

[26] As expected, the estimates suggest that first-time borrowing is less likely among minorities, and that minorities experienced a sharper decline in first-time borrowing during the housing bust. However, with respect to consumer age, the estimates in columns 2-4 indicate that while age is positively related to first-time homebuying as expected, the decline in first-time borrowing was slightly more pronounced among older potential first-time borrowers. The estimates in columns 6-8 for 20-25 year olds indicate that the decline in first-time borrowing was slightly more pronounced among younger potential first-time borrowers.

affect low-score individuals more than high-score individuals, areas where unemployment did not jump sharply should provide a better-identified estimate of β_3.

This specification also includes a control for whether person i had a decline in their credit of 20 points or more from the previous quarter.[27] A significant score decline reflects either a new delinquency or an increase in credit utilization, which may signify a recent economic shock that would limit demand for a new mortgage. If lower score borrowers in 2011 are more likely to have had a recent shock than lower score borrowers in 1999, this variable will help account for such a confounding factor.

Despite these additional controls, the estimate of β_3 (and β_2) in column 3 is similar in magnitude and not statistically different from the previous estimates. Although higher unemployment rates are associated with reduced odds of getting a mortgage for the first time, none of the interactions with unemployment are large or statistically significant.[28] In addition, the score change dummy variable has a strong negative effect on first-time borrowing, but it's inclusion in the regression does not alter the estimate of β_3 much.

Finally, the fourth column adds in state-by-year fixed effects. Average credit scores actually differ quite significantly across states (southern states tend to have lower scores), and to the extent that states with lower credit scores happened to have more significant declines in first-time homebuying for reasons unrelated to credit scores, it would confound the estimate of β_3. However, again, the estimate in column 4 is largely unchanged.

Columns 5-8 replicate the first four columns using the sample of 20-25 year olds. The point estimates for β_3 across the four specifications are again similar; they are slightly smaller

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[27] So for someone in the 1999 cohort, for example, this variable would indicate whether there he had a score decline from 1999:Q2 to 1999:Q3 that was 20 points or more.

[28] I also tried using the difference between the current unemployment rate and the long-term average unemployment rate for the county from 1998-2007, but the results were unchanged.

than for the broader sample of 20-39 year olds, but not significantly. Overall, given the consistency of results across samples and specifications, these results suggest that the steep relationship between credit scores and first-time homebuying in 2011 relative to 1999 may largely reflect tightened credit standards.

In order to further quantify the effect of tightened credit standards on first-time homebuying, I generate counterfactual predicted values using the coefficient estimates shown in column 2, but set $\beta_3 = 0$, corresponding to a counterfactual where the relationship between credit scores and first-time borrowing was the same in 2011 as in 1999. Under this scenario, the likelihood of getting a mortgage for the first time in the next two years would have been about 8 percent in 2011, about 42 percent higher than the actual likelihood of about 5.5 percent. Because standards could have been tightened along other dimensions (for example, debt-to-income ratio or length of employment), I view the estimated effect of higher credit score thresholds as a lower bound estimate of the overall effect of tightened credit standards. That said, the counterfactual estimate is still considerably lower than the first-time borrowing propensity in 1999 of about 12 percent. At least some, if not most, of the remaining gap reflects weak demand, consistent with a view that a serious contraction in both credit supply and credit demand explain depressed inflows.[29]

5. Conclusion

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[29] Because the relationship between credit scores and default varies over time, lenders could have increased their score thresholds in recent years while holding constant risk. However, an examination of mortgage performance indicates that risk-taking has been ratcheted back. I examined mortgages originated in the third quarter of 2000, 2006 and 2010 to first-time borrowers and calculated the fraction at least 30 days behind as of the end of the third quarter in the following year. This number was 6 percent for the 2000 cohort, jumped to 10 percent for the 2006 cohort, and dropped sharply to about 2.5 percent for the 2010 cohort.

In this paper, I take advantage of comprehensive, individual-level panel data on consumer liabilities to better understand why mortgage debt surged and then dropped from 1999 to 2013. This is the first paper to break down changes in aggregate mortgage debt into inflows and outflows and further attribute these inflows and outflows to more micro-level components such as investor activity and first-time homebuying, and borrower attributes such as credit score. Quantifying these various flows into and out of the pool of mortgage debt allows for a precise assessment of their relative importance over time, and creating such data on an ongoing basis might be useful to aid policy makers and prudential regulators in interpreting fluctuations in aggregate credit growth.

Although explanations for troubles in the mortgage market often emphasize government's push to increase homeownership in the 1990s and 2000s, the data shows that inflows from real estate investors grew much more sharply than any other major category of inflows, while inflows from first-time homebuyers – even those with low credit scores – grew modestly. This paper, along with Haughwaut et al. (2011), underscores that investor activity has been underappreciated and that more research is needed to understand their role in the housing boom and bust and the financial crisis.

While some have concluded that mortgage defaults are the primary, if not only, reason for the recent decline in debt, the flow data indicate that the collapse in new credit issuance has far outstripped the rise in outflows associate with mortgage default. Total inflows in 2011-13 were significantly lower (in real terms) than even well before the peak of the housing market in 1999-01. This finding highlights the still-considerable weakness of credit demand and/or credit supply.

Focusing on first-time homebuying and using data on credit scores, I estimate that

tightened credit standards can explain at least 40 percent of the decline in first-time homebuying

relative to a (presumably) more normal historical period. Separating credit supply and demand

remains a challenge, and is an important topic for future research in order to better understand

why growth in mortgage credit, and credit more generally, remains weak.

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Figure 1: Stock of mortgage debt over time
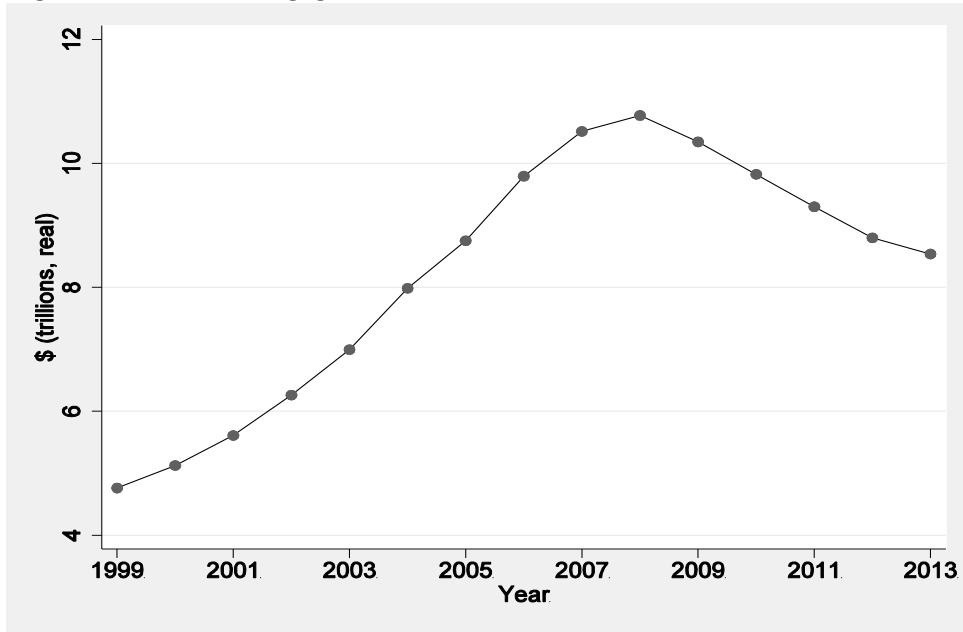
This graph shows the stock of mortgage each year (in 2013q3 dollars) as of the end of the 3rd quarter since 1999, as estimated from a five percent sample of the CCP. Joint mortgages are assumed to be held by two borrowers and are weighted at one-half to avoid double-counting their balances.

Figure 2: Inflows and outflows

A. Dollar Inflows and Outflows

Legend: Entrants, Increasers, Exiters, Decreasers

B. Number of Borrowers in Each Group
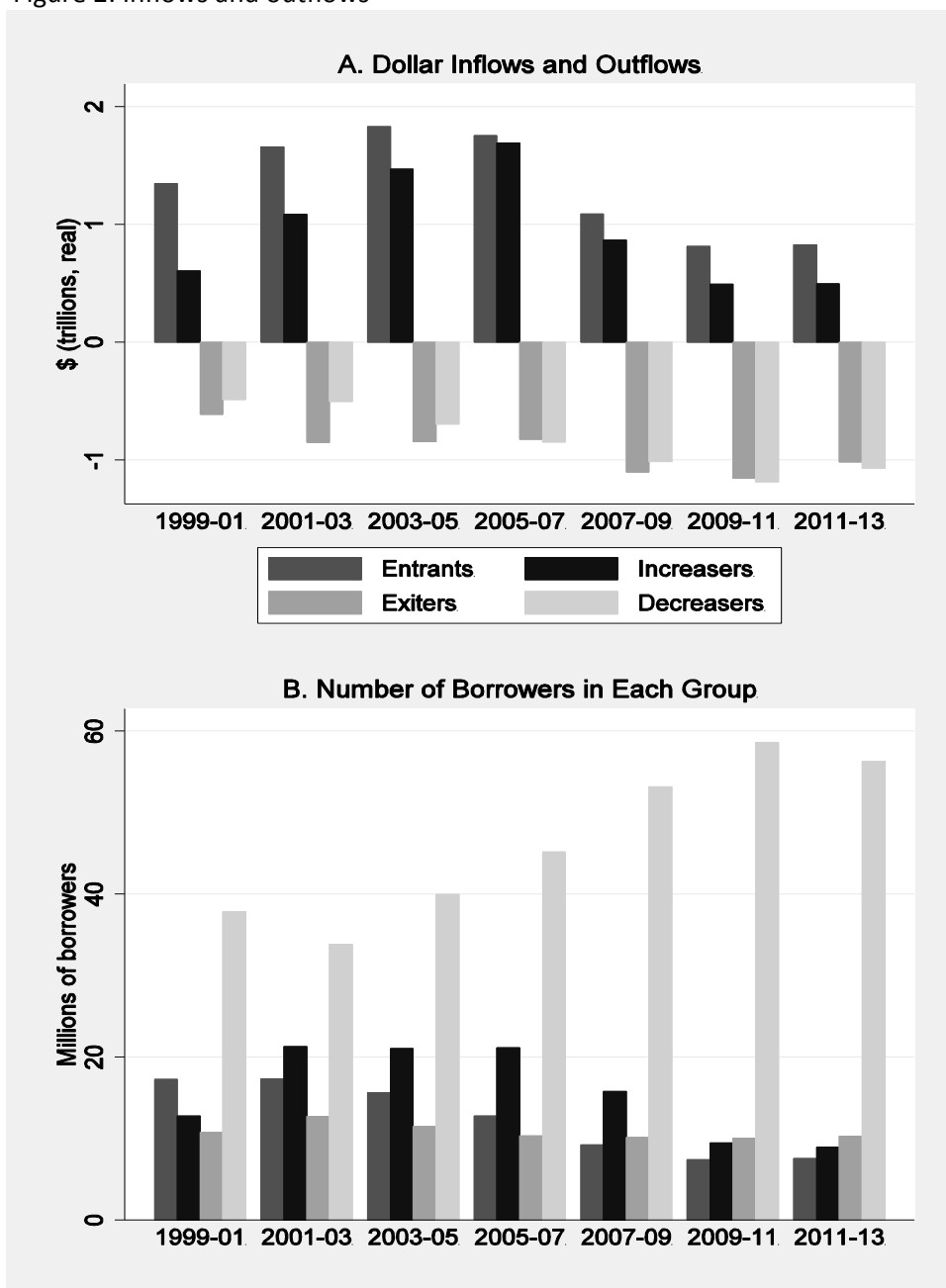
The top panel shows mortgage inflows and outflows over seven two-year periods spanning 1999q3 to 2013q3, adjusted to 2013q3 dollars, estimated from a five percent sample of the CCP. Inflows reflect the aggregate change in mortgage debt across consumers who increased their mortgage debt in a given period, with "entrants" starting the period with no mortgage debt (including those who did not have a credit record at the start of the period). Outflows reflect the aggregate change across those who decreased their mortgage debt in a given period, with "exiters" ending the period with no mortgage debt (including those who disappear from the credit record system). The bottom panel shows the number of consumers in each flow group. For jointly-held mortgages, there is more than one consumer (usually two); dollar inflows and outflows are adjusted to avoid double-counting balances from joint mortgages by giving such mortgages a weight of one-half.

Figure 3: Inflows and outflows as a fraction of initial stock of mortgage debt
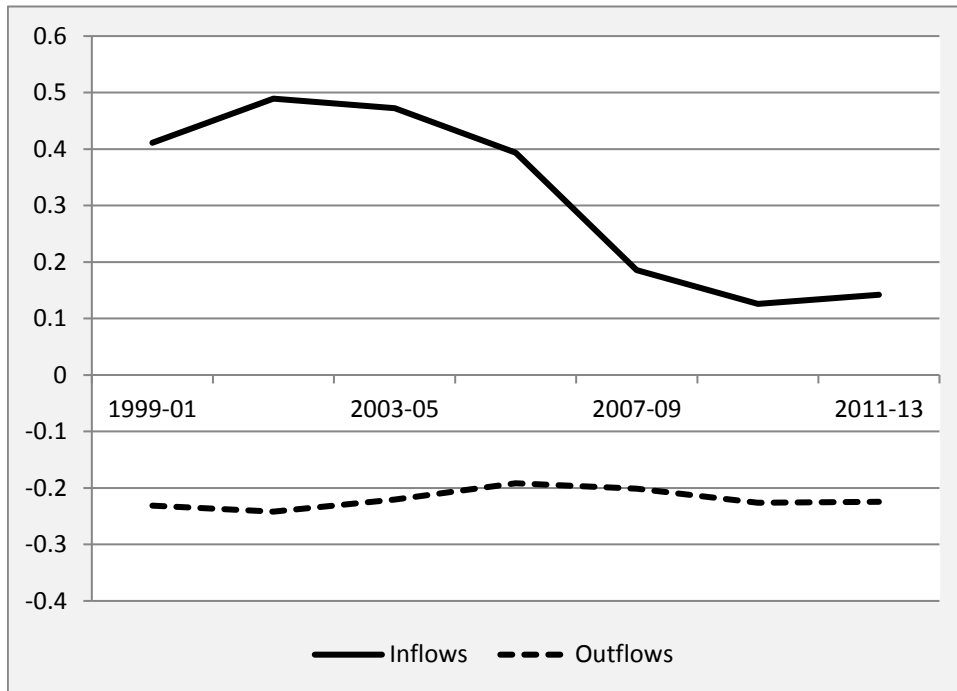
The figure shows mortgage inflows and outflows over seven two-year periods spanning 1999q3 to 2013q3, estimated from a five percent sample of the CCP, as a fraction of mortgage debt outstanding at the beginning of each two-year period. Inflows reflect the aggregate change in mortgage debt across consumers who increased their mortgage debt in a given period; outflows reflect the aggregate change across those who decreased their mortgage debt in a given period.

Figure 4: Decomposition of inflows and outflows
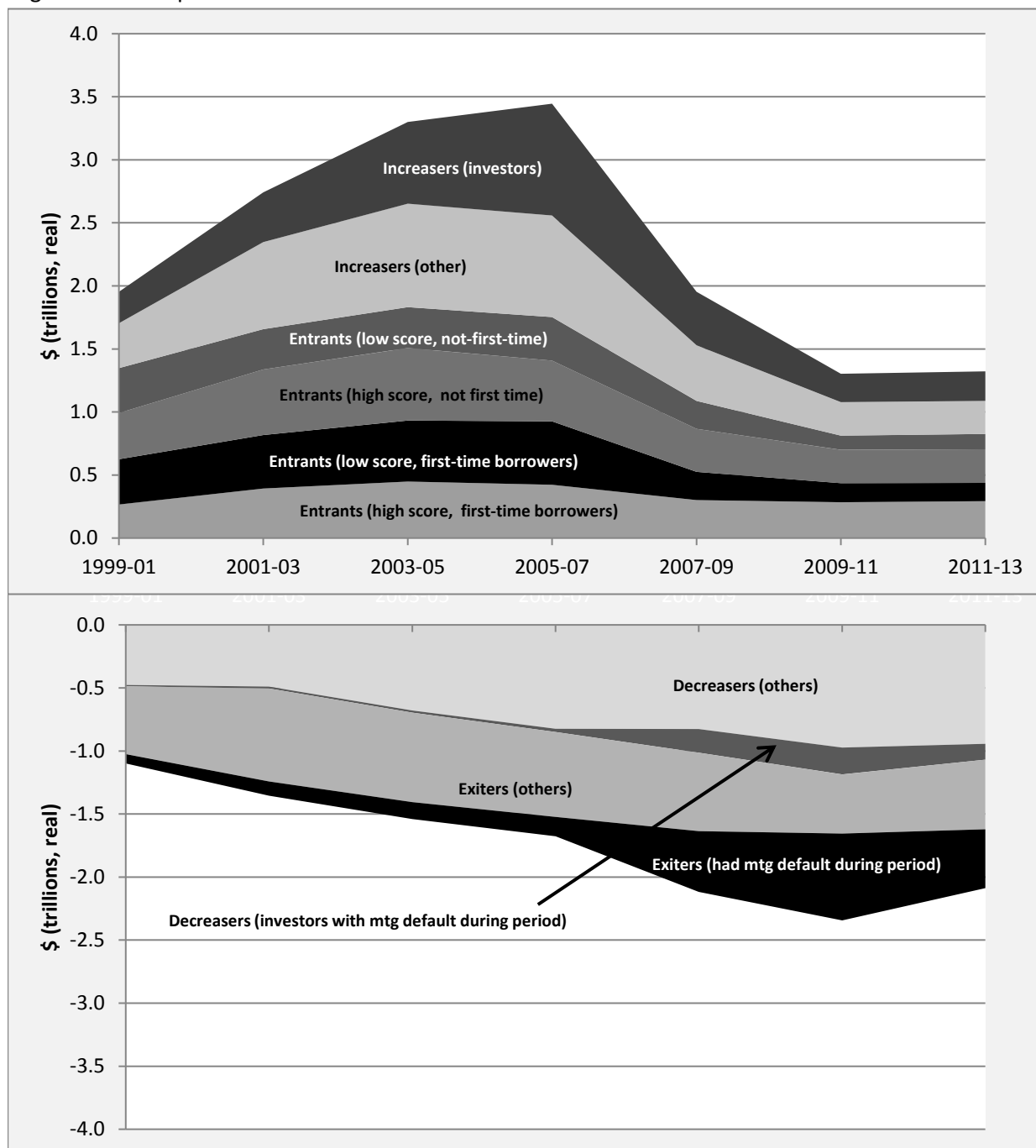
Top and bottom panels show mortgage inflows and outflows decomposed into six and four mutually exclusive groups, respectively, over seven two-year periods spanning 1999q3 to 2013q3, adjusted to 2013q3 dollars, estimated using a five percent sample of the CCP. Inflows reflect the aggregate change in mortgage debt across those who increased their mortgage debt in a given period, while outflows reflect the aggregate change across those who decreased their mortgage debt in a given period. Investor increaser refers to those who increased debt and have at least two mortgaged properties at the end of a period; investor decreaser refers to those who reduced debt and have at least two mortgaged properties at the start of a period. Credit score refers to the Equifax risk score measured at the start of a given period. Low score is defined as under 680 and includes those without a credit score at the start of the period. Those entrants for whom first-time borrower status cannot be inferred are included in the high-score, not-first-time group. Mortgage default is defined as having at least one mortgage account reported as at least 90 days past due.

Figure 5: Inflow and outflow growth by state, 2005-07 to 2009-11
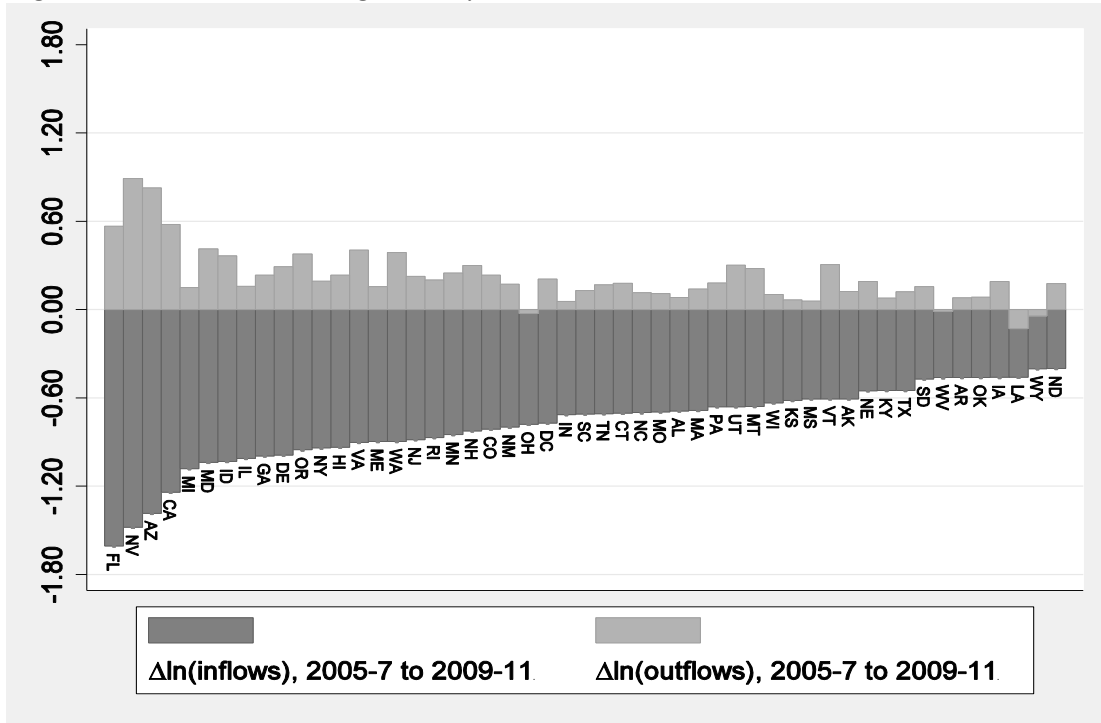
Figure shows the change in (log) total mortgage inflows and the change in (log) total mortgage outflows between the two-year period just before the Great Recession (2005q3-2007q3) and the two-year period when inflows were at their lowest (2009q3-2011q3) by state, estimated from a 15 percent sample of the CCP. Inflows reflect the aggregate change in mortgage debt across consumers who increased their mortgage debt in a two-year period; outflows reflect the aggregate change across those who decreased their mortgage debt in a two-year period. Inflows and outflows are assigned according to the state of residence (mailing address) of consumers reported in the CCP.

Figure 6: Growth in inflows by state, boom versus bust
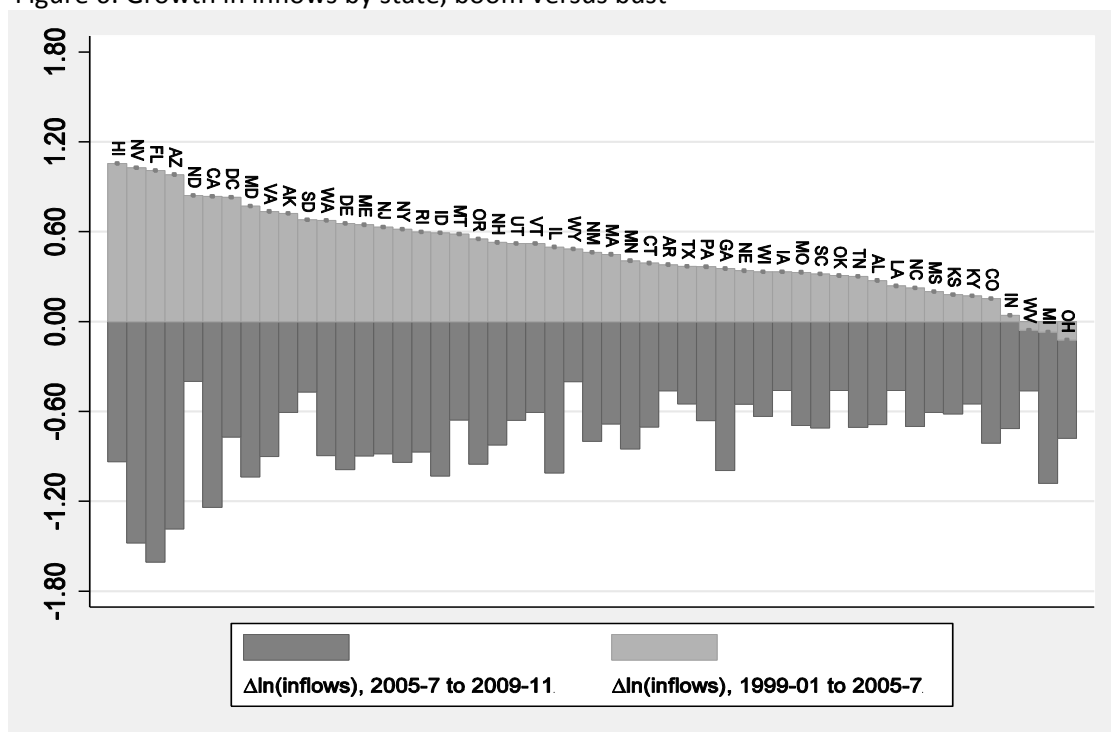
The figure shows the change in (log) total mortgage inflows from 2005q3-2007q3 to 2009q3-2011q3 and from 1999q3-2001q3 to 2005q3-2007q3 by state, estimated from a 15 percent sample of the CCP, and shows a negative correlation between inflow growth during the housing boom and inflow contractions during the housing bust. Inflows reflect the aggregate change in mortgage debt across consumers who increased their mortgage debt in a two-year period, and are assigned according to the state of residence (mailing address) of consumers reported in the CCP.

Table 1: Correlates of the boom and bust in county-level inflows

Outcome variable: Δln(inflows)$_t$

	Housing boom period			Housing bust period			
Δln(unemp rate)$_t$	-0.694**	-0.489**	-0.131	-0.992**	-0.670**	-0.521**	-0.303**
	(0.140)	(0.108)	(0.111)	(0.093)	(0.170)	(0.155)	(0.082)
Δln(population)$_t$	1.276**	1.491**	1.201**	2.071**	0.806*	1.819**	0.960**
	(0.327)	(0.187)	(0.128)	(0.565)	(0.385)	(0.431)	(0.286)
Δln(median home value)$_t$			0.824**				0.938**
			(0.115)				(0.111)
Δln(inflows)$_{t-1}$						-0.438**	
						(0.043)	
Black share of population	0.144	0.472**	0.198	-0.517**	-0.728**	-0.546**	-0.104
	(0.235)	(0.174)	(0.114)	(0.189)	(0.153)	(0.137)	(0.155)
Hispanic share of population	0.848*	0.775**	0.388**	-0.866**	-0.700**	-0.271	-0.294**
	(0.321)	(0.144)	(0.069)	(0.215)	(0.253)	(0.229)	(0.101)
College-educated share of adult population	0.416*	0.023	0.017	0.023	0.060	-0.072	-0.015
	(0.194)	(0.142)	(0.083)	(0.167)	(0.172)	(0.123)	(0.131)
Owner-occupied share of occupied housing units	0.039	0.341	0.194	-0.440	-0.580**	-0.358*	-0.037
	(0.283)	(0.205)	(0.108)	(0.222)	(0.171)	(0.145)	(0.108)
Vacation-use share of housing units	1.558**	0.381	-0.074	-1.437**	-1.066**	-0.723**	-0.831**
	(0.373)	(0.213)	(0.206)	(0.319)	(0.272)	(0.228)	(0.176)
Constant	0.261	0.113	-0.168	0.227	0.104	-0.022	-0.440**
	(0.252)	(0.191)	(0.100)	(0.182)	(0.202)	(0.172)	(0.117)
State fixed effects		yes	yes		yes	yes	yes
R-squared	0.54	0.79	0.83	0.55	0.68	0.73	0.74
N	844	844	844	844	844	844	844

Robust standard errors clustered at the state level in parentheses. *p< 0.05, **p< 0.01. County-level regressions are weighted by the number of mortgage borrowers in a county at the beginning of the boom or bust period. The housing boom refers to 2000 to 2006, with inflows measured using the 1999-01 and 2005-07 periods, while the bust refers to 2006-2010, with inflows measured using the 2005-07 and 2009-11 periods. Mortgage inflows reflect the aggregate change in mortgage debt across consumers who increased their mortgage debt in a given two-year period. Inflows at the county level are estimated using a 15 percent sample of the CCP and the reported county of residence (mailing address) of the sampled borrower. Annual county unemployment data are from the Bureau of Labor Statistics (BLS), county population data are from the Bureau of Economic Analysis, and county house price data are from Zillow as of September of each year. County demographic and housing characteristics data are from the 2000 Census. Counties included in the analysis are those with coverage in the Zillow data, and cover about 80 percent of mortgage borrowers.

Table 2: Fraction of young people getting a mortgage for the first time over the next two years

Initial credit score	(1) 1999	(2) 2001	(3) 2003	(4) 2005	(5) 2007	(6) 2009	(7) 2011	(8) 2011 relative to 1999	(9) Share of potential borrowers 1999	(10) 2011
					A. 20-39 year olds					
All	0.111	0.111	0.108	0.092	0.062	0.056	0.051	0.46	100%	100%
All (has score)	0.121	0.119	0.117	0.101	0.069	0.061	0.056	0.46	91%	91%
740+	0.184	0.219	0.211	0.163	0.138	0.138	0.127	0.69	10%	12%
680-739	0.173	0.190	0.189	0.156	0.112	0.104	0.096	0.56	16%	18%
620-679	0.151	0.150	0.151	0.129	0.083	0.074	0.064	0.43	19%	19%
< 620	0.077	0.063	0.063	0.058	0.032	0.019	0.016	0.21	46%	43%
					B. 20-25 year olds					
All	0.077	0.079	0.084	0.075	0.053	0.044	0.040	0.52	100%	100%
All (has score)	0.081	0.083	0.089	0.083	0.058	0.047	0.042	0.52	93%	94%
740+	0.132	0.144	0.155	0.127	0.111	0.097	0.082	0.62	5%	8%
680-739	0.109	0.133	0.143	0.125	0.089	0.078	0.073	0.67	20%	24%
620-679	0.106	0.105	0.117	0.103	0.068	0.055	0.045	0.43	22%	24%
< 620	0.052	0.046	0.045	0.044	0.027	0.014	0.012	0.24	46%	38%

This table shows estimates of the propensity of younger people to get a mortgage for the first-time (a proxy for first-time homebuying) within two years at different starting points since 1999 using a 10 percent sample of the CCP. Each starting point is the end of the third quarter of the given year, and the sample for each year is comprised of 20-39 years olds (or 20-25 year olds) with zero mortgage debt and no evidence of ever having a mortgage at the starting point. Age and credit scores are measured at the start of the two-year period.

3. Credit scores and the incidence of first-time mortgage borrowing over the next two years in 2011 versus 1999

Outcome variable: 1[mtg debt>0 after two years]

	20-39 year olds				20-25 year olds			
(Efx risk score)*1[year=2011]	0.466**	0.468**	0.517**	0.517**	0.448**	0.411**	0.398**	0.390**
	(0.028)	(0.025)	(0.030)	(0.024)	(0.037)	(0.037)	(0.038)	(0.038)
Efx risk score (00's; centered at 760)	0.512**	0.488**	0.530**	0.551**	0.540**	0.548**	0.583**	0.616**
	(0.014)	(0.017)	(0.024)	(0.023)	(0.017)	(0.024)	(0.030)	(0.032)
1[year=2011]	-0.518**	0.445	0.337	0.351	-0.420**	-5.863**	-5.867**	-5.928**
	(0.050)	(0.242)	(0.226)	(0.224)	(0.060)	(1.253)	(1.228)	(1.190)
County unemployment rate (centered at 5.0)			-0.052*	-0.031			-0.039	-0.005
			(0.024)	(0.018)			(0.036)	(0.035)
(Cnty unemp rate)*1[year=2011]			0.009	0.024			-0.010	0.009
			(0.019)	(0.014)			(0.035)	(0.034)
(Cnty unemp rate)*score			0.003	0.004			0.022	0.025
			(0.011)	(0.010)			(0.018)	(0.017)
(Cnty unemp rate)*(score)*1[year=2011]			-0.000	0.002			-0.016	-0.014
			(0.016)	(0.015)			(0.023)	(0.024)
ln(age)		1.072**	1.144**	1.178**		4.991**	4.979**	5.122**
		(0.057)	(0.057)	(0.061)		(0.186)	(0.187)	(0.192)
ln(age)*1[year=2011]		-0.253**	-0.149*	-0.158*		1.771**	1.836**	1.724**
		(0.071)	(0.071)	(0.072)		(0.392)	(0.391)	(0.378)
Share tract pop w/ college degree		-0.275*	-0.347**	-0.240**		-1.168**	-1.266**	-1.115**
		(0.111)	(0.112)	(0.089)		(0.143)	(0.144)	(0.132)
(Share w/ college)*1[year=2011]		-0.041	-0.044	0.006		-0.253	-0.241	-0.096
		(0.114)	(0.102)	(0.092)		(0.190)	(0.183)	(0.193)
Minority share of tract pop		-0.642**	-0.587**	-0.568**		-0.968**	-0.904**	-0.860**
		(0.070)	(0.063)	(0.063)		(0.115)	(0.110)	(0.107)
(Minority share)*1[year=2011]		-0.275**	-0.242*	-0.219*		-0.479**	-0.418**	-0.407*
		(0.100)	(0.107)	(0.090)		(0.153)	(0.152)	(0.168)
1[Δscore < -20]			-0.754**	-0.752**			-0.912**	-0.924**
			(0.044)	(0.043)			(0.182)	(0.180)
1[no score in previous qtr]			-0.563**	-0.569**			-0.327**	-0.342**
			(0.084)	(0.083)			(0.117)	(0.117)
Constant	-1.34**	-4.693**	-4.912**	-4.900**	-1.72**	-16.695**	-16.667**	-16.898**
	(0.042)	(0.179)	(0.177)	(0.184)	(0.068)	(0.592)	(0.598)	(0.603)
State x year fixed effects				yes				yes
ln(L)	-115,485	-99,176	-98,768	-98,336	-29,380	-25,033	-24,973	-24,711
N	425,820	381,994	381,994	381,994	139,244	126,267	126,267	126,267

Robust standard errors clustered at the state level in parentheses. *p< 0.05, **p< 0.01. Coefficients represent the impact on the log odds ratio of having a mortgage after two years given no record initially of ever having a mortgage. The sample for the regressions is based on a 10 percent sample of the CCP and includes potential first-time borrowers as of 1999q3 and 2011q3. The first four columns focus on 20-39 year olds, while the last four columns restrict to 20-25 year olds. County unemployment rate data are from the Bureau of Labor Statistics and refer to the annual average as of the middle of the two-year period (i.e. 2000 and 2012). Census tract data are from the 2000 Census. The main coefficient of interest in on the interaction between credit score and the 2011 dummy variable, and the estimate indicates a much stronger relationship between credit scores and first-time borrowing in recent years, consistent with a significantly tightened underwriting standards.

Appendix Tables and Figures

Appendix figure 1: Alternative measures of stock of mortgage debt
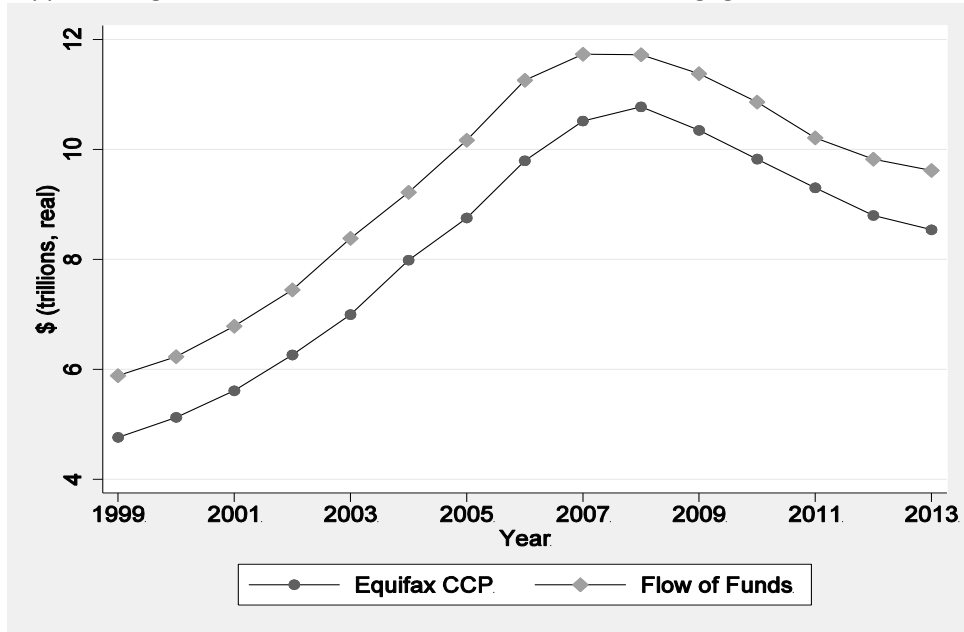
This graph shows the stock of mortgage each year as of the end of the 3rd quarter since 1999, as estimated from a five percent sample of the CCP, alongside data on household mortgage debt from the Federal Reserve Flow of Funds. Mortgage debt estimated from the CCP is adjusted to avoid double-counting balances of jointly-held mortgages. The two series are somewhat different in their levels, but they move over time in parallel.

Appendix Figure 2: Growth in household mortgage debt
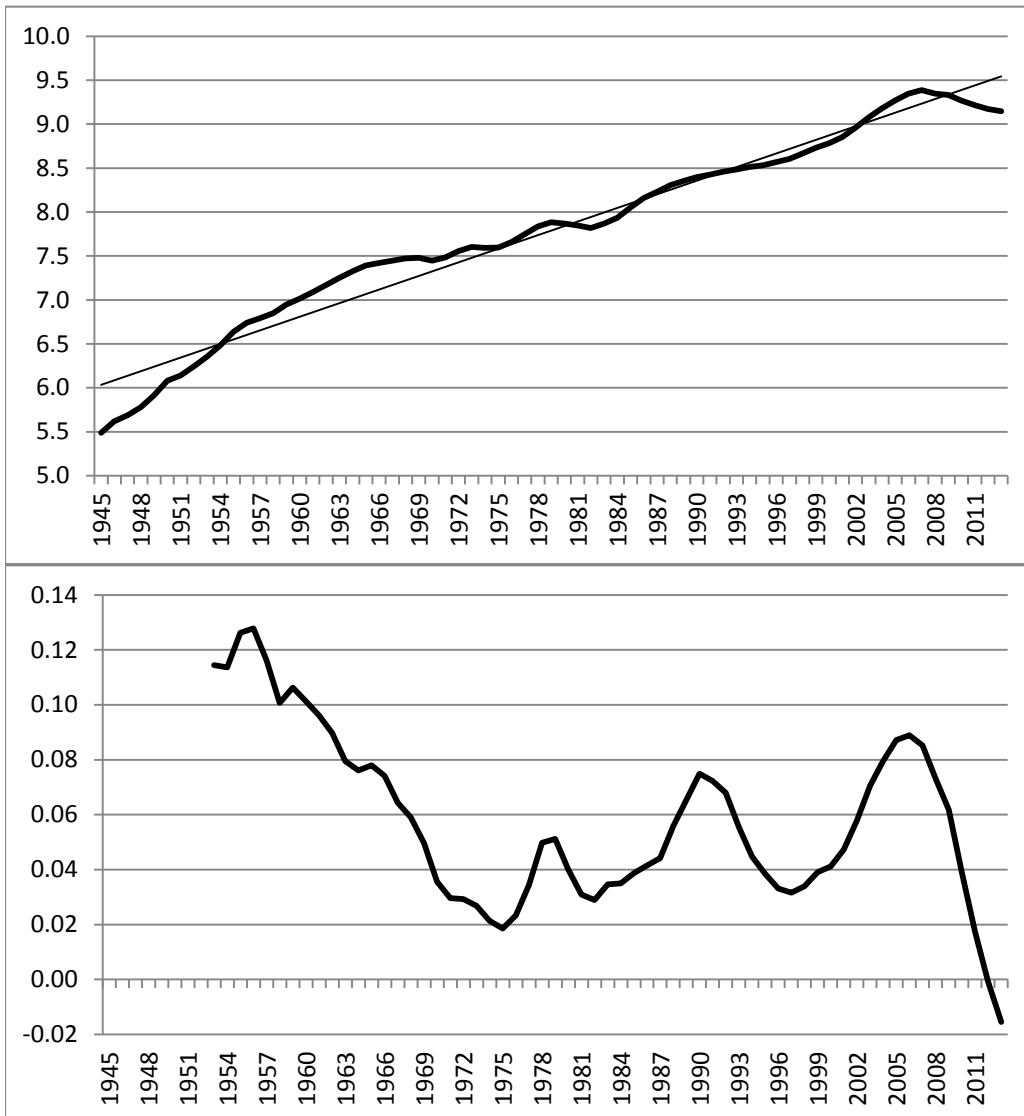
Top panel shows the natural log of real total household mortgage debt (in billions) since 1945 using data from the Federal Reserve's Flow of Funds, along with a trendline. The bottom panel shows the average annual rate of growth over rolling eight year periods, and reveals that growth from 1999-2007 was higher than at any other time since the early 1960's, while the current growth rate is weaker than at any other time.

Appendix Table 1a: Detailed decomposition of inflows and outflows, dollars (real)

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Inflows	**1.953**	**2.741**	**3.299**	**3.445**	**1.953**	**1.303**	**1.322**
Entrants	1.348	1.657	1.831	1.753	1.087	0.812	0.825
First-time mortgage borrowers	0.626	0.816	0.932	0.925	0.525	0.435	0.438
No credit score or score not available	0.091	0.101	0.082	0.071	0.023	0.014	0.015
Low score (< 620)	0.133	0.155	0.199	0.219	0.095	0.048	0.044
Mid-low score (620 - 679)	0.136	0.168	0.203	0.213	0.107	0.089	0.086
Mid-high score (680 - 739)	0.146	0.205	0.239	0.228	0.141	0.122	0.120
High score (740 - 850)	0.120	0.187	0.210	0.194	0.159	0.163	0.173
Memo: Address change reported	*0.329*	*0.439*	*0.670*	*0.656*	*0.397*	*0.342*	*0.313*
Memo: Under 40 years old	*0.396*	*0.511*	*0.636*	*0.625*	*0.370*	*0.310*	*0.305*
Not first-time borrowers	0.703	0.804	0.865	0.807	0.545	0.367	0.375
No credit score or score not available	0.109	0.055	0.037	0.045	0.082	0.014	0.013
Low score	0.128	0.119	0.133	0.144	0.066	0.047	0.044
Mid-low score	0.119	0.146	0.155	0.157	0.074	0.051	0.063
Mid-high score	0.143	0.185	0.212	0.190	0.117	0.077	0.071
High score	0.204	0.299	0.328	0.271	0.206	0.179	0.183
Memo: Address change reported	*0.212*	*0.270*	*0.415*	*0.363*	*0.227*	*0.173*	*0.158*
Memo: Under 40 years old	*0.259*	*0.312*	*0.353*	*0.328*	*0.188*	*0.137*	*0.123*
Memo: Has a foreclosure on record	*0.016*	*0.014*	*0.012*	*0.032*	*0.023*	*0.010*	*0.013*
Other (first-time status not inferrable)	0.019	0.037	0.035	0.021	0.017	0.010	0.012
By median family income (MFI) of census tract							
MFI ≤ $37k	0.126	0.171	0.187	0.209	0.112	0.078	0.076
$37k < MFI ≤ $63k	0.536	0.743	0.840	0.842	0.504	0.368	0.366
MFI > $63k	0.518	0.718	0.782	0.683	0.453	0.353	0.373
MFI not available	0.167	0.026	0.022	0.019	0.018	0.012	0.010
Increasers	0.605	1.084	1.468	1.692	0.866	0.491	0.497
By (mortgaged) property count:							
One property at start & end of period	0.339	0.654	0.784	0.763	0.420	0.255	0.253
Memo: Address change reported	*0.142*	*0.219*	*0.347*	*0.289*	*0.137*	*0.095*	*0.095*
2+ properties at end of period	0.250	0.394	0.646	0.886	0.424	0.225	0.234
Increased from 1 to 2+ properties	0.185	0.287	0.464	0.592	0.263	0.162	0.172
2+ properties at start & end of period	0.065	0.107	0.182	0.294	0.161	0.062	0.062
Other	0.016	0.036	0.038	0.043	0.022	0.011	0.010
By credit score:							
No credit score	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Low score	0.065	0.101	0.136	0.140	0.040	0.030	0.025
Mid-low score	0.099	0.167	0.226	0.252	0.078	0.030	0.030
Mid-high score	0.156	0.282	0.415	0.459	0.190	0.075	0.081
High score	0.285	0.534	0.691	0.840	0.558	0.355	0.361
By median family income (MFI) of census tract							
MFI ≤ $37k	0.033	0.076	0.102	0.137	0.063	0.032	0.029
$37k < MFI ≤ $63k	0.200	0.399	0.553	0.652	0.333	0.173	0.173
MFI > $63k	0.298	0.597	0.800	0.889	0.459	0.281	0.288
MFI not available	0.073	0.012	0.012	0.014	0.010	0.005	0.007
Memo: Under 40 years old	*0.210*	*0.350*	*0.498*	*0.567*	*0.253*	*0.131*	*0.132*

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Outflows	**-1.100**	**-1.356**	**-1.541**	**-1.677**	**-2.117**	**-2.344**	**-2.088**
Exiters	-0.612	-0.851	-0.846	-0.827	-1.103	-1.158	-1.018
Had mortgage default (90+) in period	-0.075	-0.114	-0.135	-0.154	-0.481	-0.689	-0.468
Memo: 2+ properties at start of period	*-0.008*	*-0.016*	*-0.017*	*-0.022*	*-0.128*	*-0.152*	*-0.064*
Memo: All mortgage accounts in default	*-0.069*	*-0.105*	*-0.124*	*-0.140*	*-0.448*	*-0.659*	*-0.445*
Memo: Had mortgage in severe derogatory status or bankruptcy	*-0.059*	*-0.092*	*-0.105*	*-0.119*	*-0.411*	*-0.588*	*-0.358*
Memo: Public record foreclosure on file	*-0.027*	*-0.039*	*-0.046*	*-0.059*	*-0.205*	*-0.231*	*-0.161*
Memo: Address change reported, or exited credit records	*-0.025*	*-0.037*	*-0.056*	*-0.057*	*-0.225*	*-0.280*	*-0.172*
Had non-mtg default (90+) in period	-0.076	-0.111	-0.139	-0.131	-0.094	-0.058	-0.057
Memo: Address change reported, or exited credit records	*-0.025*	*-0.043*	*-0.068*	*-0.058*	*-0.040*	*-0.025*	*-0.019*
No defaults in period	-0.462	-0.626	-0.571	-0.542	-0.529	-0.411	-0.493
Memo: Address change reported, or exited credit records	*-0.177*	*-0.255*	*-0.319*	*-0.277*	*-0.277*	*-0.176*	*-0.174*
By median fam income (MFI) of census tract							
MFI ≤ $37k	-0.050	-0.068	-0.089	-0.091	-0.117	-0.114	-0.096
$37k < MFI ≤ $63k	-0.220	-0.307	-0.355	-0.375	-0.492	-0.519	-0.436
MFI > $63k	-0.231	-0.350	-0.347	-0.332	-0.474	-0.509	-0.471
MFI not available	-0.111	-0.127	-0.055	-0.030	-0.021	-0.016	-0.016
Memo: Under 40 years old	*-0.192*	*-0.260*	*-0.253*	*-0.265*	*-0.361*	*-0.334*	*-0.247*
Decreasers	-0.487	-0.504	-0.696	-0.850	-1.013	-1.186	-1.070
2+ properties at start of period	-0.167	-0.187	-0.228	-0.306	-0.455	-0.505	-0.430
Default on at least one mortgage account during period	-0.011	-0.014	-0.016	-0.026	-0.188	-0.212	-0.126
No mortgage defaults during period	-0.156	-0.173	-0.213	-0.280	-0.268	-0.293	-0.304
Single property at start of period:	-0.320	-0.318	-0.467	-0.543	-0.558	-0.680	-0.639
By median family income (MFI) of census tract							
MFI ≤ $37k	-0.030	-0.031	-0.053	-0.062	-0.081	-0.094	-0.079
$37k < MFI ≤ $63k	-0.159	-0.168	-0.255	-0.324	-0.402	-0.457	-0.415
MFI > $63k	-0.209	-0.229	-0.346	-0.436	-0.511	-0.615	-0.559
MFI not available	-0.089	-0.076	-0.042	-0.027	-0.019	-0.020	-0.016
Memo: Under 40 years old	*-0.119*	*-0.126*	*-0.171*	*-0.215*	*-0.275*	*-0.253*	*-0.184*
Memo: Address change reported	*-0.099*	*-0.110*	*-0.182*	*-0.164*	*-0.227*	*-0.281*	*-0.172*

This table shows mortgage inflows and outflows in seven two-year periods spanning 1999q3 to 2013q3, estimated from a five percent sample of the CCP and adjusted to 2013q3 dollars, disaggregated into various categories. Subcategories add up to total, unless in italics. Inflows and outflows are adjusted to avoid double-counting balances from joint mortgages by giving such mortgages a weight of one-half. Inflows reflect the aggregate change in mortgage debt across consumers who increased their mortgage debt in a given period, with "entrants" starting the period with no mortgage debt (including those who did not have a credit record at the start of the period). Outflows reflect the aggregate change across those who decreased their mortgage debt in a given period, with "exiters" ending the period with no mortgage debt (including those who disappear from the credit records). "First-time borrower" refers to entrants whose credit record indicates that the mortgage obtained during the period is their first one ever. Credit score refers to the Equifax risk score, and is measured at the start of the period. Address changes are inferred from a change in the census block of the reported mailing address between the start and end of a period, not including those whose address is unavailable at either the start or end of a period. Census tract income is measured from the 2000 Census; for entrants and increasers census tract at the end of the period is used and for exiters and decreasers the census tract at the beginning of the period is used. The income categorizations break the general population roughly into thirds. The number of mortgaged properties at the start or end of a period is inferred from the number of mortgage accounts and their relative balances since lien status is not reported.

Appendix Table 1b: Number of borrowers associated with (real) dollar inflows and outflows

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Inflows	**30.06**	**38.66**	**36.72**	**33.93**	**25.03**	**16.92**	**16.56**
Entrants	17.26	17.34	15.67	12.78	9.23	7.43	7.58
First-time mortgage borrowers	6.86	7.55	6.92	6.22	4.26	3.59	3.64
No credit score or score not available	1.07	0.97	0.66	0.48	0.23	0.13	0.16
Low score (< 620)	1.66	1.61	1.74	1.73	0.93	0.47	0.43
Mid-low score (620 - 679)	1.49	1.59	1.49	1.35	0.93	0.81	0.79
Mid-high score (680 - 739)	1.47	1.80	1.66	1.44	1.09	1.04	1.01
High score (740 - 850)	1.16	1.57	1.38	1.23	1.08	1.15	1.25
Memo: Address change reported	*3.21*	*3.67*	*4.61*	*4.14*	*3.01*	*2.71*	*2.45*
Memo: Under 40 years old	*4.13*	*4.47*	*4.52*	*4.07*	*2.92*	*2.52*	*2.47*
Not first-time borrowers	9.54	8.50	7.71	5.82	4.41	3.42	3.41
No credit score or score not available	1.53	0.64	0.41	0.31	0.51	0.14	0.16
Low score	2.13	1.57	1.43	1.19	0.68	0.53	0.49
Mid-low score	1.61	1.50	1.29	1.03	0.66	0.52	0.60
Mid-high score	1.77	1.80	1.67	1.18	0.84	0.63	0.60
High score	2.50	2.99	2.91	2.11	1.74	1.60	1.56
Memo: Address change reported	*2.16*	*2.21*	*2.96*	*2.18*	*1.53*	*1.36*	*1.16*
Memo: Under 40 years old	*3.29*	*3.01*	*2.73*	*2.11*	*1.39*	*1.08*	*0.97*
Memo: Has a foreclosure on record	*0.20*	*0.14*	*0.12*	*0.17*	*0.12*	*0.09*	*0.12*
Other (first-time status not inferrable)	0.86	1.30	1.03	0.75	0.56	0.42	0.54
By median family income (MFI) of census tract							
MFI ≤ $37k	2.34	2.60	2.31	1.98	1.32	1.00	0.97
$37k < MFI ≤ $63k	7.83	9.05	8.34	7.00	4.98	3.95	4.02
MFI > $63k	4.46	5.32	4.71	3.57	2.73	2.34	2.46
MFI not available	2.63	0.37	0.30	0.24	0.21	0.14	0.13
Increasers	12.80	21.32	21.05	21.15	15.79	9.50	8.98
By (mortgaged) property count:							
One property at start & end of period	9.15	16.67	15.92	15.06	11.68	7.12	6.68
Memo: Address change reported	*2.51*	*3.43*	*4.54*	*3.37*	*2.07*	*1.72*	*1.37*
2+ properties at end of period	3.31	3.78	4.42	5.47	3.61	2.10	2.08
Increased from 1 to 2+ properties	2.58	2.74	3.26	3.83	2.10	1.39	1.43
2+ properties at start & end of period	0.73	1.04	1.16	1.64	1.51	0.71	0.65
Other	0.34	0.86	0.70	0.62	0.50	0.27	0.22
By credit score:							
No credit score	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Low score	1.68	2.41	2.71	2.55	1.59	1.10	0.85
Mid-low score	2.27	3.29	3.47	3.36	1.79	0.68	0.64
Mid-high score	3.36	5.39	5.47	5.37	3.29	1.47	1.41
High score	5.50	10.22	9.39	9.87	9.12	6.25	6.08
By median family income (MFI) of census tract							
MFI ≤ $37k	0.96	1.92	1.96	2.10	1.53	0.87	0.77
$37k < MFI ≤ $63k	5.42	10.16	10.19	10.47	7.74	4.56	4.31
MFI > $63k	4.89	8.96	8.65	8.33	6.31	3.95	3.77
MFI not available	1.53	0.27	0.26	0.24	0.22	0.13	0.13
Memo: Under 40 years old	*4.30*	*6.79*	*6.56*	*6.56*	*4.12*	*2.11*	*1.89*

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Outflows	**48.62**	**46.61**	**51.47**	**55.56**	**63.33**	**68.69**	**66.59**
Exiters	10.76	12.75	11.49	10.36	10.17	10.04	10.30
Had mortgage default (90+) in period	1.22	1.69	1.81	1.66	2.61	3.91	3.16
Memo: 2+ properties at start of period	*0.08*	*0.11*	*0.12*	*0.09*	*0.26*	*0.38*	*0.20*
Memo: All mortgage accounts in default	*1.16*	*1.62*	*1.73*	*1.60*	*2.51*	*3.79*	*3.05*
Memo: Had mortgage in severe derogatory status or bankruptcy	*0.92*	*1.33*	*1.39*	*1.19*	*2.09*	*3.17*	*2.31*
Memo: Public record foreclosure on file	*0.37*	*0.50*	*0.55*	*0.54*	*0.94*	*1.24*	*1.06*
Memo: Address change reported, or exited credit records	*0.38*	*0.49*	*0.70*	*0.57*	*1.01*	*1.48*	*1.08*
Had non-mtg default (90+) in period	1.55	1.78	1.94	1.60	1.11	0.77	0.76
Memo: Address change reported, or exited credit records	*0.47*	*0.60*	*0.83*	*0.60*	*0.39*	*0.28*	*0.22*
No defaults in period	7.99	9.28	7.74	7.10	6.45	5.36	6.38
Memo: Address change reported, or exited credit records	*2.40*	*3.07*	*3.35*	*2.58*	*2.20*	*1.69*	*1.52*
By median fam income (MFI) of census tract							
MFI ≤ $37k	1.33	1.49	1.68	1.57	1.45	1.38	1.31
$37k < MFI ≤ $63k	4.46	5.40	5.47	5.19	5.10	5.20	5.22
MFI > $63k	2.75	3.63	3.17	2.86	3.06	3.09	3.40
MFI not available	2.22	2.23	1.17	0.74	0.55	0.38	0.37
Memo: Under 40 years old	*3.03*	*3.41*	*2.98*	*2.61*	*2.51*	*2.39*	*2.08*
Decreasers	37.86	33.86	39.98	45.20	53.16	58.65	56.29
Multiple properties at start of period	3.74	3.67	3.97	4.72	6.78	7.30	6.27
Default on at least one mortgage account during period	0.15	0.24	0.23	0.23	0.94	1.24	0.81
No mortgage defaults during period	3.59	3.43	3.74	4.49	5.84	6.06	5.46
Single property at start of period:	34.12	30.19	36.01	40.48	46.38	51.34	50.02
By median family income (MFI) of census tract							
MFI ≤ $37k	3.48	3.62	4.41	4.91	5.98	6.53	6.26
$37k < MFI ≤ $63k	15.19	14.17	18.24	21.26	25.91	28.89	27.83
MFI > $63k	12.23	10.38	13.71	16.34	19.09	21.23	20.54
MFI not available	6.96	5.69	3.62	2.69	2.18	1.99	1.66
Memo: Under 40 years old	*11.09*	*9.22*	*10.37*	*11.49*	*13.94*	*14.08*	*12.29*
Memo: Address change reported	*5.34*	*4.48*	*6.73*	*4.56*	*5.79*	*9.39*	*5.43*

This table shows the number of borrowers responsible for the inflows and outflows displayed in Appendix Table 1a. Note that for jointly-held mortgages, there is more than one borrower.

Appendix Table 1c: Detailed decomposition of inflows and outflows, dollars (nominal)

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Inflows	**1.572**	**2.308**	**2.987**	**3.287**	**1.892**	**1.320**	**1.352**
Entrants	1.063	1.356	1.590	1.601	1.019	0.791	0.825
First-time mortgage borrowers	0.494	0.668	0.809	0.845	0.492	0.424	0.438
No credit score or score not available	0.072	0.083	0.071	0.065	0.022	0.014	0.015
Low score (< 620)	0.105	0.126	0.173	0.200	0.089	0.046	0.044
Mid-low score (620 - 679)	0.107	0.137	0.176	0.194	0.100	0.086	0.086
Mid-high score (680 - 739)	0.115	0.168	0.208	0.208	0.132	0.119	0.120
High score (740 - 850)	0.095	0.153	0.182	0.177	0.149	0.158	0.173
Memo: Address change reported	*0.260*	*0.360*	*0.581*	*0.599*	*0.372*	*0.333*	*0.313*
Memo: Under 40 years old	*0.312*	*0.418*	*0.552*	*0.570*	*0.347*	*0.302*	*0.305*
Not first-time borrowers	0.554	0.658	0.751	0.737	0.511	0.358	0.375
No credit score or score not available	0.086	0.045	0.032	0.041	0.077	0.014	0.013
Low score	0.101	0.098	0.116	0.132	0.061	0.046	0.044
Mid-low score	0.094	0.120	0.134	0.144	0.069	0.049	0.063
Mid-high score	0.113	0.151	0.184	0.173	0.110	0.075	0.071
High score	0.161	0.244	0.285	0.247	0.194	0.174	0.183
Memo: Address change reported	*0.167*	*0.221*	*0.360*	*0.331*	*0.213*	*0.169*	*0.158*
Memo: Under 40 years old	*0.204*	*0.256*	*0.306*	*0.300*	*0.177*	*0.133*	*0.123*
Memo: Has a foreclosure on record	*0.013*	*0.011*	*0.010*	*0.029*	*0.022*	*0.010*	*0.013*
Other (first-time status not inferrable)	0.015	0.031	0.030	0.019	0.016	0.010	0.012
By median family income (MFI) of census tract							
MFI ≤ $37k	0.100	0.140	0.163	0.191	0.105	0.076	0.076
$37k < MFI ≤ $63k	0.423	0.608	0.729	0.769	0.472	0.359	0.366
MFI > $63k	0.408	0.587	0.679	0.624	0.425	0.344	0.373
MFI not available	0.132	0.021	0.019	0.018	0.017	0.012	0.010
Increasers	0.510	0.952	1.397	1.686	0.873	0.529	0.527
By (mortgaged) property count:							
One property at start & end of period	0.289	0.583	0.763	0.783	0.431	0.281	0.271
Memo: Address change reported	*0.118*	*0.189*	*0.324*	*0.282*	*0.134*	*0.100*	*0.099*
2+ properties at end of period	0.208	0.336	0.596	0.860	0.420	0.236	0.245
Increased from 1 to 2+ properties	0.152	0.242	0.422	0.564	0.254	0.165	0.177
2+ properties at start & end of period	0.056	0.094	0.174	0.295	0.166	0.071	0.067
Other	0.013	0.032	0.038	0.044	0.022	0.013	0.011
By credit score:							
No credit score	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Low score	0.055	0.089	0.131	0.141	0.043	0.037	0.028
Mid-low score	0.084	0.147	0.215	0.252	0.079	0.033	0.033
Mid-high score	0.132	0.247	0.394	0.458	0.191	0.081	0.085
High score	0.239	0.469	0.656	0.836	0.560	0.378	0.381
By median family income (MFI) of census tract							
MFI ≤ $37k	0.028	0.066	0.097	0.136	0.063	0.034	0.031
$37k < MFI ≤ $63k	0.169	0.352	0.529	0.651	0.337	0.187	0.184
MFI > $63k	0.252	0.523	0.760	0.886	0.462	0.302	0.305
MFI not available	0.061	0.010	0.012	0.014	0.010	0.005	0.007
Memo: Under 40 years old	*0.177*	*0.309*	*0.472*	*0.563*	*0.254*	*0.140*	*0.139*

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Outflows	**-0.762**	**-1.007**	**-1.114**	**-1.279**	**-1.787**	**-1.954**	**-1.876**
Exiters	-0.465	-0.671	-0.692	-0.718	-1.007	-1.086	-0.992
Had mortgage default (90+) in period	-0.057	-0.090	-0.110	-0.134	-0.439	-0.646	-0.456
Memo: 2+ properties at start of period	*-0.006*	*-0.012*	*-0.014*	*-0.020*	*-0.117*	*-0.143*	*-0.063*
Memo: All mortgage accounts in default	*-0.052*	*-0.083*	*-0.102*	*-0.121*	*-0.409*	*-0.618*	*-0.434*
Memo: Had mortgage in severe derogatory status or bankruptcy	*-0.045*	*-0.073*	*-0.086*	*-0.103*	*-0.375*	*-0.552*	*-0.349*
Memo: Public record foreclosure on file	*-0.020*	*-0.031*	*-0.038*	*-0.051*	*-0.187*	*-0.216*	*-0.157*
Memo: Address change reported, or exited credit records	*-0.019*	*-0.029*	*-0.046*	*-0.050*	*-0.205*	*-0.262*	*-0.167*
Had non-mtg default (90+) in period	-0.058	-0.087	-0.114	-0.114	-0.085	-0.054	-0.056
Memo: Address change reported, or exited credit records	*-0.019*	*-0.034*	*-0.056*	*-0.050*	*-0.036*	*-0.023*	*-0.018*
No defaults in period	-0.351	-0.494	-0.467	-0.470	-0.483	-0.385	-0.480
Memo: Address change reported, or exited credit records	*-0.134*	*-0.201*	*-0.261*	*-0.240*	*-0.253*	*-0.165*	*-0.169*
By median fam income (MFI) of census tract							
MFI ≤ $37k	-0.038	-0.053	-0.073	-0.079	-0.107	-0.106	-0.092
$37k < MFI ≤ $63k	-0.167	-0.242	-0.291	-0.327	-0.449	-0.488	-0.424
MFI > $63k	-0.175	-0.276	-0.286	-0.289	-0.433	-0.478	-0.461
MFI not available	-0.084	-0.100	-0.042	-0.023	-0.018	-0.015	-0.015
Memo: Under 40 years old	*-0.146*	*-0.205*	*-0.207*	*-0.230*	*-0.329*	*-0.313*	*-0.241*
Decreasers	-0.297	-0.335	-0.422	-0.561	-0.780	-0.869	-0.884
Multiple properties at start of period	-0.115	-0.135	-0.162	-0.231	-0.379	-0.414	-0.385
Default on at least one mortgage account during period	-0.008	-0.010	-0.012	-0.022	-0.164	-0.186	-0.118
No mortgage defaults during period	-0.107	-0.125	-0.150	-0.210	-0.215	-0.228	-0.268
Single property at start of period:	-0.181	-0.200	-0.259	-0.330	-0.401	-0.455	-0.499
By median family income (MFI) of census tract							
MFI ≤ $37k	-0.018	-0.020	-0.033	-0.041	-0.063	-0.068	-0.065
$37k < MFI ≤ $63k	-0.096	-0.110	-0.153	-0.214	-0.308	-0.329	-0.340
MFI > $63k	-0.127	-0.155	-0.213	-0.291	-0.396	-0.458	-0.467
MFI not available	-0.055	-0.050	-0.023	-0.016	-0.013	-0.013	-0.013
Memo: Under 40 years old	*-0.068*	*-0.082*	*-0.098*	*-0.135*	*-0.208*	*-0.174*	*-0.143*
Memo: Address change reported	*-0.063*	*-0.078*	*-0.120*	*-0.121*	*-0.188*	*-0.222*	*-0.151*

This table shows mortgage inflows and outflows exactly as in Appendix Table 1a, but in nominal dollars as opposed to 2013q3 dollars.

Appendix Table 1d: Number of borrowers associated with (nominal) dollar inflows and outflows

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Inflows	**31.09**	**41.71**	**39.78**	**37.01**	**27.80**	**20.03**	**18.45**
Entrants	17.26	17.34	15.67	12.78	9.23	7.43	7.58
First-time mortgage borrowers	6.86	7.55	6.92	6.22	4.26	3.59	3.64
No credit score or score not available	1.07	0.97	0.66	0.48	0.23	0.13	0.16
Low score (< 620)	1.66	1.61	1.74	1.73	0.93	0.47	0.43
Mid-low score (620 - 679)	1.49	1.59	1.49	1.35	0.93	0.81	0.79
Mid-high score (680 - 739)	1.47	1.80	1.66	1.44	1.09	1.04	1.01
High score (740 - 850)	1.16	1.57	1.38	1.23	1.08	1.15	1.25
Memo: Address change reported	*3.21*	*3.67*	*4.61*	*4.14*	*3.01*	*2.71*	*2.45*
Memo: Under 40 years old	*4.13*	*4.47*	*4.52*	*4.07*	*2.92*	*2.52*	*2.47*
Not first-time borrowers	9.54	8.50	7.71	5.82	4.41	3.42	3.41
No credit score or score not available	1.53	0.64	0.41	0.31	0.51	0.14	0.16
Low score	2.13	1.57	1.43	1.19	0.68	0.53	0.49
Mid-low score	1.61	1.50	1.29	1.03	0.66	0.52	0.60
Mid-high score	1.77	1.80	1.67	1.18	0.84	0.63	0.60
High score	2.50	2.99	2.91	2.11	1.74	1.60	1.56
Memo: Address change reported	*2.16*	*2.21*	*2.96*	*2.18*	*1.53*	*1.36*	*1.16*
Memo: Under 40 years old	*3.29*	*3.01*	*2.73*	*2.11*	*1.39*	*1.08*	*0.97*
Memo: Has a foreclosure on record	*0.20*	*0.14*	*0.12*	*0.17*	*0.12*	*0.09*	*0.12*
Other (first-time status not inferrable)	0.86	1.30	1.03	0.75	0.56	0.42	0.54
By median family income (MFI) of census tract							
MFI ≤ $37k	2.34	2.60	2.31	1.98	1.32	1.00	0.97
$37k < MFI ≤ $63k	7.83	9.05	8.34	7.00	4.98	3.95	4.02
MFI > $63k	4.46	5.32	4.71	3.57	2.73	2.34	2.46
MFI not available	2.63	0.37	0.30	0.24	0.21	0.14	0.13
Increasers	13.83	24.36	24.11	24.22	18.57	12.61	10.87
By (mortgaged) property count:							
One property at start & end of period	10.01	19.44	18.58	17.64	14.00	9.85	8.40
Memo: Address change reported	*2.65*	*3.76*	*4.99*	*3.64*	*2.30*	*2.11*	*1.50*
2+ properties at end of period	3.45	3.94	4.71	5.88	4.00	2.41	2.23
Increased from 1 to 2+ properties	2.63	2.78	3.35	3.97	2.14	1.43	1.45
2+ properties at start & end of period	0.82	1.16	1.36	1.92	1.85	0.98	0.77
Other	0.38	0.98	0.83	0.70	0.57	0.35	0.25
By credit score:							
No credit score	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Low score	1.80	2.78	3.12	2.95	2.03	1.77	1.15
Mid-low score	2.42	3.73	3.93	3.73	2.14	1.02	0.85
Mid-high score	3.61	6.10	6.22	6.07	3.83	1.99	1.75
High score	6.00	11.75	10.84	11.47	10.57	7.82	7.12
By median family income (MFI) of census tract							
MFI ≤ $37k	1.05	2.17	2.23	2.36	1.76	1.15	0.94
$37k < MFI ≤ $63k	5.83	11.68	11.65	11.89	9.10	6.11	5.27
MFI > $63k	5.32	10.21	9.94	9.70	7.46	5.19	4.50
MFI not available	1.64	0.30	0.29	0.27	0.25	0.17	0.16
Memo: Under 40 years old	*4.65*	*7.98*	*7.57*	*7.57*	*5.03*	*2.96*	*2.35*

	1999-01	2001-03	2003-05	2005-07	2007-09	2009-11	2011-13
Outflows	**47.59**	**43.56**	**48.41**	**52.48**	**60.56**	**65.58**	**64.70**
Exiters	10.76	12.75	11.49	10.36	10.17	10.04	10.30
Had mortgage default (90+) in period	1.22	1.69	1.81	1.66	2.61	3.91	3.16
Memo: 2+ properties at start of period	*0.08*	*0.11*	*0.12*	*0.09*	*0.26*	*0.38*	*0.20*
Memo: All mortgage accounts in default	*1.16*	*1.62*	*1.73*	*1.60*	*2.51*	*3.79*	*3.05*
Memo: Had mortgage in severe derogatory status or bankruptcy	*0.92*	*1.33*	*1.39*	*1.19*	*2.09*	*3.17*	*2.31*
Memo: Public record foreclosure on file	*0.37*	*0.50*	*0.55*	*0.54*	*0.94*	*1.24*	*1.06*
Memo: Address change reported, or exited credit records	*0.38*	*0.49*	*0.70*	*0.57*	*1.01*	*1.48*	*1.08*
Had non-mtg default (90+) in period	1.55	1.78	1.94	1.60	1.11	0.77	0.76
Memo: Address change reported, or exited credit records	*0.47*	*0.60*	*0.83*	*0.60*	*0.39*	*0.28*	*0.22*
No defaults in period	7.99	9.28	7.74	7.10	6.45	5.36	6.38
Memo: Address change reported, or exited credit records	*2.40*	*3.07*	*3.35*	*2.58*	*2.20*	*1.69*	*1.52*
By median fam income (MFI) of census tract							
MFI ≤ $37k	1.33	1.49	1.69	1.58	1.45	1.38	1.30
$37k < MFI ≤ $63k	4.46	5.41	5.48	5.22	5.12	5.21	5.23
MFI > $63k	2.75	3.63	3.19	2.87	3.07	3.10	3.41
MFI not available	2.22	2.22	1.12	0.70	0.53	0.36	0.36
Memo: Under 40 years old	*3.03*	*3.41*	*2.98*	*2.61*	*2.51*	*2.39*	*2.08*
Decreasers	36.83	30.81	36.92	42.12	50.39	55.54	54.40
Multiple properties at start of period	3.62	3.43	3.65	4.36	6.36	6.96	6.12
Default on at least one mortgage account during period	0.15	0.23	0.22	0.22	0.87	1.16	0.79
No mortgage defaults during period	3.47	3.20	3.43	4.14	5.49	5.80	5.33
Single property at start of period:	33.22	27.38	33.27	37.76	44.03	48.58	48.29
By median family income (MFI) of census tract							
MFI ≤ $37k	3.41	3.40	4.17	4.68	5.75	6.26	6.10
$37k < MFI ≤ $63k	14.81	12.87	16.98	19.98	24.65	27.43	26.94
MFI > $63k	11.83	9.28	12.55	15.08	18.02	20.05	19.85
MFI not available	6.78	5.26	3.22	2.39	1.96	1.80	1.52
Memo: Under 40 years old	*10.74*	*8.03*	*9.36*	*10.49*	*13.04*	*13.23*	*11.83*
Memo: Address change reported	*5.17*	*4.11*	*6.20*	*4.22*	*5.49*	*8.93*	*5.27*

This table shows the number of borrowers responsible for the nominal inflows and outflows displayed in Appendix Table 1c. Note that for jointly-held mortgages, there is more than one borrower.

Appendix Table 2: Predictors of exit

Outcome variable: 1[mtg debt = 0 after two years]

Had mortgage default (90+) in period	0.299**
	(0.010)
Had non-mtg default (90+) in period	0.047**
	(0.003)
Initial credit score	-0.009**
	(0.003)
ln(initial mortgage balance)	-0.070**
	(0.002)
ln(age)	0.037**
	(0.004)
ln(tract median family income)	0.021**
	(0.004)
Minority share of tract pop	0.017
	(0.010)
Share tract pop w/ college degree	0.075**
	(0.006)
County unemployment rate	0.002
	(0.001)
County house price growth past two years	0.000**
	(0.000)
2001q3	0.004
	(0.004)
2003q3	-0.005
	(0.003)
2005q3	-0.013**
	(0.003)
2007q3	-0.020**
	(0.003)
2009q3	-0.018**
	(0.006)
2011q3	-0.002
	(0.005)
Constant	0.552**
	(0.054)
R-squared	0.104
N	962,631

Coefficient estimates are from a linear probability model. Robust standard errors clustered at the state level in parentheses. *p< 0.05, **p< 0.01. Sample for a given two-year period includes only individuals with positive mortgage debt at the start of the period and are from a 5 percent draw of the CCP; data for the seven two-year periods are pooled together. Tract-level data are from the 2000 Census, unemployment rate data are from the BLS for the mid-year of the period (e.g. 2002 for the 2001-03 period), and house price data are from Zillow.