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# **The Role of Housing and Mortgage Markets in the Financial Crisis**

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## **Abstract**

Ten years after the financial crisis there is widespread agreement that the boom in mortgage lending and its subsequent reversal were at the core of the Great Recession. We survey the existing evidence which suggests that inflated house price expectations across the economy played a central role in driving both demand and supply of mortgage credit before the crisis. The great misnomer of the 2008 crisis is that it was not a "subprime" crisis but rather a middle-class crisis. Inflated house price expectations led households across all income groups, especially the middle class, to increase their demand for housing and mortgage leverage. Similarly, banks lent against increasing collateral values and underestimated the risk of defaults. We highlight how these emerging facts have essential implications for policy.

We thank Matt Richardson (referee) for insightful comments. All errors are our own.

Ten years after the financial crisis of 2008 some of the drivers and implications of the crisis are starting to come into better focus. The majority of observers agrees that mortgage lending and housing markets were at the core of the recession. US housing markets experienced an unparalleled boom in house prices and a steep expansion in mortgage credit to individual households before 2007. Once house prices started to collapse, the drop in collateral values not only led to increased defaults but also affected the stability of the financial markets. The ensuing dislocations in the financial sector led to a drying up of credit flows and other financial functions in the economy and ultimately a significant slowdown of economic activity, which cumulated in the great recession.

In this paper we take stock of what has been learned about the origins of the crisis and in particular the role that house prices and expectations played for the increase in mortgage debt and ultimately defaults. The evidence that has started to accumulate suggests that the housing market was subject to a classical asset bubble<sup>1</sup>. Inflated (or over-optimistic) house price expectations appear to have led banks to lend against increasing collateral values and underestimate the risk of defaults. Similarly, optimistic households, maybe enticed by the expectation of further house price increases, or an under-appreciation of a potential downturn, stepped up their demand for housing and mortgage debt. This increase in household debt was widespread among the population and encompassed all income groups, especially middle-class borrowers. The great misnomer of the 2008 crisis is that it was not a “subprime” crisis but a middle-class crisis. The financial sector acted as an amplification mechanism for these changes in expectations by lending into the bubble, rather than guarding against overoptimistic collateral values by reducing their exposures or curtailing loan to value (LTV) ratios. Some studies also suggest that the housing boom led to broader allocative distortions, e.g., on structural labor market imbalances, or even students’ educational outcomes (see, e.g., Kerwin, Hurst, and Notowidigdo 2015, 2016).

A number of recent theory papers provide micro foundations for how the impact of optimistic agents in the housing markets can be time-varying and as a result generate boom and bust cycles. One set of theories suggests that the number of optimistic agents changes with the credit cycle. For example, if house price expectations are extrapolative or adaptive, initial increases in house prices can feed on themselves, see for instance Glaser and Nathanson (2015), Barberis et al. (2015); Lo (2004); or DeFusco, Nathanson, and Zwick (2017). Burnside, Eichenbaum, and Rebelo (2016) provide a different micro-foundation via social contagion, where optimistic agents with tighter priors can convince less optimistic agents to change their beliefs. Geannakopolus (2010) or Piazzesi et al (2016) suggest that banks can amplify these expectations by providing higher combined loan-to-value ratios (CLTV), when house prices are expected to go up. This can allow more optimistic agents to hold a more significant fraction of assets and as a result, drive up house prices. Using a structural model, Kaplan, Mitman, and Violante (2017) show that the main driver of movements in house prices was a shift in beliefs, they argue that changes in credit conditions did not move house prices, but they are important for homeownership, leverage, and defaults. Consistently, Justiniano, Primiceri, and Tambalotti (2015) develop a quantitative model that argues that the credit cycle of the Great Recession was most likely due to factor impacting house prices rather than relaxation of mortgage markets.<sup>2</sup>

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<sup>1</sup> See for example Case and Schiller (2003) or Cutler et al (1991) for a discussion of price dynamics in housing markets.

<sup>2</sup> Earlier work by Bernanke, Gertler, and Gilchrist (1999) and Kiyotaki and Moore (1997) argue that credit-constrained borrowers need collateral to borrow due to information asymmetries or limited contract enforcement (see also, Gertler, and Gilchrist (1994); and Rampini and Vishwanathan (2014)). However, these models of the collateral lending channel

An alternative view of the mortgage crisis is that the financial sector was the causal driver of house price increases, since it had misaligned incentives that led to unsustainable lending to poor and marginal borrowers, often associated with subprime lending. Popular narratives (such as the Big Short (2010) and Inside Job (2010) and theoretical papers, such as ParLOUR and Plantin (2008), Dang et al. (2010), and Chemla and Hennessey (2014), highlight the channels through which the misalignment of incentives can lead to a provision of credit to low-income or poor-credit-quality borrowers, that would not have received credit otherwise (see, e.g., Mian and Sufi (2014)). This channel often relies on short-term managerial incentives as an important source of distortions that let banks to knowingly lend to poor credit risk borrowers. It is important to differentiate this view from the general idea that banks fail to internalize the buildup of systemic risk in the economy since they have an implicit protection against negative states of the economy through implicit government bailout guarantees, the infamous central bank put, see for example Acharya et al (2014) for a discussion.

The problem for empiricists is that both incentives and expectations are difficult to measure directly. The empirical challenge is exacerbated by the fact that the two channels are not mutually exclusive. If lenders believed that house prices were going to keep rising, they might rationally decide that it was less important to carefully screen borrowers, since the expected collateral value would protect the lender from potential defaults. Therefore, changes in expectations about house prices could lead to the loosening of credit standards. However, it is crucial to assess the relative importance of these views, since it not only affects the diagnosis of the recession but also prescribes different policies to protect the economy from future crisis.<sup>3</sup>

We review the main empirical findings about the housing market in the run up to the crisis and during the crisis itself. We argue that these findings support the view that overoptimistic house price expectations played a central role in the crisis. First, the recent literature has shown that the mortgage credit expansion leading up to the crisis was widespread across the entire population and not concentrated on marginal or low credit score borrowers. Debt to income ratios (DTI) rose proportionally for all groups. Second, the distribution of Loan to Value (LTV) ratios for new home purchases did not change over the boom period. Banks seem to have taken house prices (“V”) at face value and almost “mechanically” lent against these increased collateral values. These results suggest that financial institutions did not display major dislocations in their credit provision, neither in whom they were lending to nor how they were using collateral. These results also run counter to the view that relaxation of credit standards and misaligned incentives in the banking industry were causal drivers of the boom, since this argument rests on the idea that there were cross-sectional distortions in the allocation of credit, especially to marginal borrowers, such as low income or poor-credit quality borrowers (Mian and Sufi, 2009). The systematic mistake in the banking market appears to have been not to take into account that collateral values were highly inflated but lend into the bubble and at the same time not to guard against a possible downturn in prices.

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assume rational homeowners and banks, and thus would not predict a crash. If agency problems vary over the business cycle, it can lead to flight to quality and with it reduced collateral values in the bust.

<sup>3</sup> It is beyond the scope of this paper to describe the drivers of house price dynamics. Rajan (2010) argues, that the cumulative effect of low interest rates over the decade leading up to the housing boom may have increase the demand for credit and subsequently increased house prices. See also, Himmelberg, Mayer, and Sinai 2005; Bernanke 2007.

Third, (optimistic) house price expectations played an important role in explaining the behavior of households during the boom period. A number of studies have documented that the speed with which houses were sold and bought (churn) increased significantly during the boom. Furthermore, the fraction of properties that were bought for speculative investment purposes or as second homes shot up during the boom period, especially in areas that experience rapid house price increases.

Finally, after the onset of the crisis, middle and high-income borrowers, as well as prime borrowers, made up a much larger fraction of defaults than in normal times. Mortgage holders with a FICO score about 720 went from a default rate close to zero before the crisis to a default rate of more than 5 percent. Since richer households have larger mortgages, the dollar value of mortgage defaults was most pronounced among middle and high-income borrowers. So, the largest increase in defaults came from a group of mortgage holders who previously had never defaulted at high rates and constituted good credit risks at the time the mortgages were originated. These defaults were disproportionately high in areas where house prices first increased the most and then dropped the most at the onset of the crisis. This last result suggests that asset values played an important role in explaining defaults, independent of the identity of the borrowers.

Only a proper diagnosis of the origins of the financial crisis allows for meaningful responses that prevent similar events in the future. As discussed above, many early explanations of the crisis assumed that bank incentives for loan origination exogenously changed and led to distortions in lending standards, especially to the poor. Instead, our analysis shows that lending standards likely changed endogenously in response to increasing collateral values and optimistic expectations about future asset growth. Banks seem to take collateral values as given and mechanically lend against increased collateral values, holding loan to value (LTV) ratios constant. In aggregate this leads to a systemic build-up of leverage, in the sense of increasing debt to income (DTI) ratios. These results point to a need for macro-prudential regulation to prevent systemic buildup of debt across the economy, and to ensure that there is sufficient slack in the financial system to guard against systemic shock to asset values. Macro-prudential tools such as requiring higher (or time-varying) capital requirements and higher standards on asset quality have been proposed to prevent banks from taking on too much leverage and shrinking their balance sheet in response to negative macro shocks, see for example Hanson et al. (2011). The Basel III regulations that are currently being implemented incorporate some of these suggestions though capital requirements are lower than originally called for by academics or consumer groups. Similarly, the GSEs could impose counter-cyclical LTV requirements, which tighten LTVs after periods of steep house price appreciation.

### **Widespread increases in mortgage leverage**

The significant increase in mortgages and other household debt in the period leading up to the 2008 crisis has been widely documented. Brown et al (2010), shows that household mortgage debt almost doubled between 2000 and 2007, and contrary to earlier periods, increases in mortgage debt were not offset by reductions in other household debt. What was remarkable in the run up to the crisis is that this increase in leverage was prevalent across all income groups; and was closely tied to house price appreciation across neighborhoods. Adelino, Schoar, and Severino (2016) document that the increase in household leverage, measured as Debt to Income levels (DTI), went up across

all income groups and all FICO scores. Figure 1 documents that the increase in mortgage credit during the boom, but also that the flow of new (purchase) mortgages across income was stable over the 2001-2007 period. Adelino, Schoar and Severino (2016) documents similar patterns are true also across the credit score distribution. In other words, the fraction of credit going to low, middle or high-income households did not change over that time period. But since richer (and higher FICO) households take out larger mortgages, the dollar value of mortgage credit held by middle and up-middle class borrowers increased significantly over this time period. Adelino, Schoar and Severino (2017) also show that the increase in DTI was almost twice as high in states with high house price appreciation compared to those with low appreciation.

New credit flows, however, may not tell the whole story of how indebted the average household is, since the stock of household leverage is also affected by (1) the speed with which households retire or refinance existing debt; (2) the velocity of buying and selling houses (churn); or (3) the likelihood of entering into home ownership. To track the entire stock of mortgage debt, Adelino, Schoar, and Severino (2016) use Survey of Consumer Finances (SCF) data, which includes purchase mortgages, second liens, and other home equity lines to show that the stock of DTI at the household level increased proportionally across the income distribution. Foote, Lowenstein, and Willen (2016) confirm this finding using the stock of debt from credit registry data. Similarly, Albanesi, De Giorgio and Nosal (2017) using the New York Fed Consumer Credit Panel shows that credit growth between 2001 and 2008 was concentrated in the prime segment, and that debt to low FICO borrowers was constant across all debt categories. These results confirm the idea that the credit expansion was a phenomenon that affected all groups of the population.

One of the most important channels by which homeowners increased the leverage on their houses even without moving were (cash out) refinancing. Here a home owner takes out a new, higher mortgage on the house, if the price of a house has gone up, and thus the owner has equity in their house. Mortgage refinancing and equity extraction played an important role in the credit expansion. Bhutta and Keys (2016) show that home equity extraction peaked in 2003, when interest rates went down in the US for the first time in more than a decade. The authors show that a 100-basis point interest rate decline led to a 25 percent rise in extraction. Using cross-sectional variation in house price fluctuations, they estimate that that rate effect is half the magnitude of the house price effect. Mian and Sufi (2011) provide evidence that the equity extraction was closely tied to increasing house prices, since equity extractions were particularly concentrated in areas where prices had gone up. Similarly, Mian and Sufi 2011; Brown, Stein, and Zafar 2015 show that credit rose more in areas with high house appreciation, and previous research has shown the sensitivity of consumption to housing wealth fluctuations consistent with the equity extraction channel (see Hurst and Stafford 2004; Lehnert 2004; Campbell and Cocco 2007; Bostic, Gabriel, and Painter 2009)

### **How did lending standards change in the boom?**

In the previous section we showed that DTI levels increased proportionally for all income groups. DTI levels are usually seen as an indicator for a household's ability to pay their mortgage. But since mortgage loans are collateralized by the value of the home, the key indicator of changing lending standards is (Cumulative) Loan-to-Value ratios at origination, or CLTV levels. This is amount of mortgage leverage including any second liens or home equity loans on the house. It is

often argued that the way the financial sector can create a bubble in housing markets is by relaxing CLTV levels, see for example Geanakoplos (2010).

Figure 2 show that the distribution of CLTV ratios for mortgage purchase at origination remained completely stable between 2001 and 2007. The median home purchased between 2001 and 2007 had a CLTV of 90%, and mortgages in the 90<sup>th</sup> percentile of the leverage distribution had a CLTV just lower than 100%. Furthermore, Adelino, Schoar, and Severino (2017) also shows that there is no difference in the stability of the CLTV distribution between areas with high and low house price growth. Ferreira and Gyourko (2016) also show that CLTV between 1997 and 2011 were stable and did not increase dramatically during the boom period. Somewhat contrary to popular believe, lenders did not loosen CLTV requirements significantly during the boom period. It is important to understand that even prior to the boom of the 2000s, the American mortgage system provided very high LTV loans to a subset of the population primarily via FHA loans. Therefore, subprime loans basically substituted for high LTV loans from FHA but did not change the distribution.

Furthermore, Ferreira and Gyourko (2018) provide evidence that the housing boom started at different times across different cities in the US. For example, places like Boston or San Francisco saw increasing housing price already at the end of the 1990s, which kept rising at a steady level until 2007. In contrast, states such as Phoenix or Nevada had a much shorter and dramatic boom and bust cycle starting only in the mid 2000s. But the authors show that mortgage financing at the beginning of each of these local booms did not show a change in LTV ratios. This means that the increase in local house prices was not correlated with any relaxation of loan to value conditions at origination. Similarly, Glaeser et al (2010) suggest that reduced cost of lending alone cannot explain the increase in mortgage debt.

But of course, house prices were going up rapidly during this time period. So even if lenders did not loosen CLTV standards, as the prior papers confirm, by just mechanically lending against higher house values (Vs), homeowners were taking on larger loans relative to their income. See Greenwald (2016) for a discussion of the interaction between DTI and LTV constraints. A series of papers confirms this argument and shows that loan values became less correlated with household's personal characteristics, see for example Keys et al. (2010), Di Maggio and Kermani (2017), Jiang, Nelson, and Vytlačil (2014), Agarwal et al. 2014 and Barlevy and Fisher (2010). This supports the idea that lenders were putting more and more weight on collateral values. Keys et al. (2010) show that lenders might have reduced their screening of unobservable characteristics, since for non-agency loans that had easier access to private securitization defaults increased by around 10%–25%. Gerardi et al (2008) document that even in the subprime segment the major change in underwriting standards was an increase of LTV levels. The authors provide evidence from contemporary sources that market participants understood that a drop in house prices would have dire consequences for mortgage repayments but they assigned a low likelihood to that state of the world.

Also, in line with the idea that lenders mechanically lent against increased house prices but otherwise did not significantly increase access to finance for marginal borrowers, Adelino, Schoar and Severino (2017) find that households in all income quintiles who purchase homes have similar (and small) drops terms of the stability of employment over the boom. The cross-sectional differences across income groups did not change over the boom. However, at the onset of the

mortgage crisis, there is a sudden spike in the share of households with full-time employment, which most likely reflects the tightening of credit during the Great Recession after prices plummeted.

Taken together, the evidence seems consistent with a view where lenders increased mortgage origination against increased home prices without adequately accounting the risk that house price levels can go down again. However, we did not observe a change in the average CLTV ratios over this time period. These results are consistent with a financial market that is This view is shared by Shiller (2007) and supported by Shiller (2014) and Cheng, Raina, and Xiong (2014), who use personal home transaction data to show that midlevel managers in securitized finance did not seem to anticipate the housing downturn.

### **No expansion of homeownership**

A number of papers have explicitly asked if the erosion of credit standards happened at the extensive margin. In other words, did distortions in credit originations allow low-income and poor credit quality households, who previously were rationed out of the market, to become homeowners, see Mian and Sufi (2015). Goodman and Mayer (2018) present evidence that runs counter to this hypothesis. Using data from the American Housing Survey, the paper shows that overall US homeownership rate rose from 63.5 percent in 1985 to 68.8 percent in 2005. However most of the increase was concentrated in the period before 2000 that means before the onset of the mortgage expansion. It then dropped to 62.7 percent after the onset of the financial crisis.

But aggregate homeownership rates might mask important changes in the composition of borrowers if there was a significant expansion of credit to marginal households. Adelino et al. (2017) test this idea by comparing changes in ownership rates for high versus low income households across regions. Figure 3, shows that the housing boom made homeownership less accessible for the lowest-income households. In particular, starting in 2001, low-income households entered homeownership at lower rates than middle- and high-income households, and households above the 20th percentile all saw similar increases in homeownership over the period. The results are then broken out by areas with fast and slow house price growth; similar pattern emerges in both types of areas. However, the steep decline in ownership rates for the lowest-income group already starts in 2001 for areas with low house price appreciation. These results are consistent across three large-scale Census surveys (the ACS, the American Housing Survey, and the Consumer Population Survey). These patterns are inconsistent with a view where the marginal or low-income borrower benefited disproportionately more by the credit expansion during the housing boom.

In a similar vein, Foote, Loewenstein, and Willen (2016) find no increases in homeownership for low-income households, in particular, their evidence suggests that transition into first-time mortgage borrowing became less frequent during the boom for persons with low credit score. Acolin, Calem, Jagtiani and Wachter (2017) use a new measure of first-time homebuyers, based on the New York Fed Consumer Credit Panel-Equifax, that the decline in the share of first-time homebuyers is connected with the decline in homeownership in young households since the early 2000s, a trend also documented in Bhutta (2015). Furthermore, Acolin, An, Bostic, and Wachter



(2016), show consistent evidence by documenting that subprime lending was not associated with increases in homeownership rates.

Cross-sectional dynamics within geographical areas are also important when looking at homeownership rates<sup>4</sup>. For example, in principle gentrification matters for more impoverished neighborhoods that are geographically close to high-price areas within a city. Guerreri, Hartley, and Hurst (2013) highlight the role of house price appreciation on endogenous gentrification, driving by income spill across neighbors these patterns could help explain small changes in homeownership for middle-income neighborhoods

The fact that homeownership rates increase with income is of course not unique to the boom and bust period but has been widely documented. Gyourko and Linneman (1997) use decennial census data from 1960 until 1990 to show that homeownership rates increase with income even after conditioning on age. Turner and Smith (2009) provide evidence that low income and minority households are less able to sustain homeownership using the PSID from 1970 to 2005.

In sum, there is no evidence that the housing boom of the 2000s increased the entry of marginal borrowers into the housing market. If anything, we saw a reduction in the transition to home ownership among poorer and marginal households. The results also suggest that in the post-2000 period the Community Reinvestment Act did not achieve its goal of increasing homeownership of lower-income households.

## **Churn and speculative buying**

Another part of the literature has focused on whether increasing house prices and collateral values affected the demand side of the housing market, i.e. purchase behavior by households. Inflated house price expectations might lead households to increase the speed by which they buy new and potentially larger homes in order to take advantage of growing house prices. But each time a household moves to a new home, it typically repays an older mortgage (that usually has lower LTV and DTI) and gets a new mortgage, which resets leverage to a new and higher level. Optimistic house price expectations might also entice households to see housing as an investment vehicle and engage in speculation in the housing market. A similar mechanism is discussed in theoretical work related to stock price bubbles, see Allen and Gorton (1993). In their setup trades are not motivated by changes in information or fundamentals, but rather by the desire to profit from gains.

Stein (1995) also highlights the idea that optimistic homeowners exploited increasing house prices by flipping houses more quickly and using the capital gains in one property as a down payment for a larger home. For example, Piazzesi and Schneider (2009) show that the fraction of homeowners who are very optimistic about house prices doubled between 2004 and 2006 (from 10% to 20% of the population) even in the face of already highly increased house prices. Foote, Geradi and Willen (2012) show that banks themselves expected and published favorable scenarios of house price changes. Also, Bailey, Davila, Kuchler, and Stroebl (2018) provide evidence for

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<sup>4</sup> Landvoigt et al. (2015) and Kuminoff and Pope (2013) show that regions with a different house or land prices experience differential house appreciation during a boom.

the important role of heterogeneous belief about house prices to explain individuals home buying decisions. Adelino, Schoar and Severino (2016) show that the rate at which owners moved into new homes peaked in 2006, with approximately 8% of households moving in each year. And high-income households had higher levels of churn relative to low-income ones during the boom. Table 1, shows the summary statistics per year for the percentages of houses that sold in a month that were also transacted within the last 12 months, similar patterns the measure of churn increases during the boom and the difference between house price appreciation areas also increase in the cross-section during the boom.

Chinco and Mayer (2015) provide evidence of the role of out-of-town second-house buyers on the housing market. Demand from out-of-town second-house buyers during the mid-2000s predicted house-price appreciation rates. They argue that out of town investors behave like misinformed speculators, earning lower capital gains and consuming smaller dividends from housing<sup>5</sup>. Haughwout, Lee, Tracy and van der Klaauw (2011) document the importance that real estate investor played in the housing market crisis, they argue that real estate speculators made up a large increase in the share of purchases during the boom, and subsequently suffered significant delinquencies. Overall the evidence suggests that house prices dynamics during the boom, exacerbated by speculative behavior that follow that increase, may have led to increases in mortgage debt of existing homeowners that were trading up their house stock, a behavior that is consistent with an over-optimistic view of homeowners concerning house price increases.<sup>6</sup>

### **Defaults in the middle class**

Early on during the crisis most commentators focused on the high levels of subprime foreclosures experience during the bust (using different definitions of subprime, as pointed out in Mayer and Pence (2009)). This is not surprising given that in some areas subprime foreclose rates were as high as twenty percent during the crisis. And the cost to families and neighborhoods are very higher, see Campbell et al (2011). However, subprime default levels are high even in good economic times, with an average of almost six percent, and subprime mortgage are small compared to the prime mortgage market (Amromin and Paulson (2009)).

Adelino et al (2016) show that ex-post defaults, increased most sharply for middle-income and prime borrowers. Since these borrowers take on larger mortgages, the fraction of mortgage dollars in delinquency increased most steeply for this group. Mayer, Pence and Sherlund (2009) point out that already at the beginning of the foreclosure crisis the proportional increase in default rates for Alt-A, or near-prime, loans, was larger than for subprime loans. Ferreira and Gyourko (2016) similarly show that defaults during the housing bust occurred on prime and subprime mortgages, they estimate that more than twice as many prime as subprime borrowers lost their homes over between 2009 and 2012. Adelino et al (2016) also show that this pattern of prime borrower defaults is concentrated in areas which experienced high house appreciation in the boom. Figure 4,

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<sup>5</sup> Nathanson and Zwick (2018) provide evidence linked to landowner supply speculation that helps explain house price booms in the United States between 2000 and 2006 occurred in areas with elastic housing supply. The mechanism that we focus on this is different because it is related to the turnover rates of existing houses

<sup>6</sup> Cheng, Raina, and Xiong (2014), show that even managers of mortgage back securities were over-optimistic in their own home buying decision during the boom. Coleman, LaCour-Little, and Vandell (2008) argue that subprime lending may have been a joint product rather than the cause of the increase in house prices

extracted from Adelino, Schoar, and Severino (2016), shows that the increase in prime defaults is closely tied to house price appreciation, which highlights the critical role that house prices play in the rise in defaults during the Great Recession. Albanesi, Di Giorgi, and Nosal (2017) using credit registry data confirm that the rise in mortgage defaults during the crisis was concentrated in the middle of the credit score distribution, and mostly attributable to real estate investors.

Foote, Gerardi and Willen (2008), and later Palmer (2015) explicitly look at the role of house price changes and changing contract characteristics on defaults, and find that prices are the important factor in explaining the increase in defaults. Palmer (2015) argues that price declines unrelated to the credit expansion causally explain the majority of the disparity in cohort performance. Using counterfactual simulations Palmer (2015) shows that if 2006 borrowers had faced the price paths that the average 2003 borrower did, their annual default rate would have dropped from 12% to 5.6%.

Furthermore, Gerardi et al. (2017) find that individual unemployment is the most reliable predictor of default. It shows that unemployment increases the probability of default. Regarding the importance of strategic motives, while approximately 38 percent of defaulters do have the ability to pay, they find that the estimated likelihood of default among low equity borrowers with the ability to pay is relatively small. The double trigger effect of unemployment and negative equity is also key friction in Hsu, Matsa, and Melzer (2018).

Despite this documented effects Bhutta, Dokko, and Shan (2010), find that the role of strategic behavior during the crisis is small. They document that borrowers do not walk away from their house until they are deep underwater, which confirms the idea that the big declines in house prices during the burst played a crucial role on the subsequent defaults<sup>7</sup>. Consistent with the important role of house prices, Bhutta (2015) find that post-crisis decline in debt reflects collapsing inflows more than defaults. Inflow declines across counties are related to housing price declines, rising unemployment, and minority population shares.<sup>8</sup>

This set of facts is most consistent with the expectations view, where borrowers took out mortgages against inflated house price values and defaulted when house prices dropped.

### **Deterioration of Origination Practices over the housing boom**

Finally, a number of papers have also shown that loan origination practices deteriorated over the boom period (Keys et al (2010), Demyanyk and Van Hemert (2011), Dell’Ariccia, Igan, and Laeven (2012)). For example, originators misrepresented collateral quality or overstated borrower characteristics and incomes. In line with the idea that lending practices were affected by inflated house prices and overoptimistic expectations about further appreciation, the majority of the incidences of misstatements that have been reported, occurred late in the boom period. Similarly,

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<sup>7</sup> Mayer, Morrison, Piskorski and Gupta (2014) provide evidence that underwater borrowers become delinquent in search of a mortgage modification, but this effect was the household response to a change in mortgage modification rules linked to a specific lender and not something systematic across lenders.

<sup>8</sup> There is a series of papers documenting the externalities of foreclosures, that highlight the potential spillovers and the importance of understanding the origins of defaults. See, for example, Campbell, Giglio, and Pathak (2011), Gupta (2017), among others.

loans that show incidences of misrepresentation are equally likely to show up on banks' own books as well as securitized loan pools.

Consistent with this interpretation, Elul and Tilson (2015) use a matched credit bureau and mortgage data set to identify occupancy fraud in residential mortgage originations, that is, borrowers who misrepresented their occupancy status as owner occupants rather than residential real estate investors. They find that misrepresentations appeared in the government-sponsored enterprise market as well as loans held on bank portfolios. Similarly, Griffin and Maturana (2016) analyze apparent fraud among securitized non-agency loans using three indicators: unreported second liens, owner occupancy misreporting, and appraisal overstatements. They find that around 48% of loans exhibited at least one indicator of misrepresentation. But again, misreporting is similar in both low and full-documentation loans.

Piskorski, Seru, and Witkin (2015) document that contractual disclosures by intermediaries during the sale of mortgages contained false information about the borrower's housing equity in 7–14% of loans, which were also more likely to default *ex post*. In support of the idea that investors misestimate the future increase in house prices, they find that the misrepresentations exist among securities sold even by the most reputable intermediaries. See also Ben-David (2011) and Garmaise (2015) for more evidence on collateral misrepresentations.

Finally, a few papers have carefully documented the magnitudes of the overstatement that lenders engaged in. Jiang, Nelson, and Vytlačil (2014) using information from a loan originator who went bankrupt, show that income was overstated by 20% to 25% for low-documentation or no-documentation loans, which themselves a small fraction of loans originated in this period (about 30%). Ambrose, Conklin, and Yoshida (2015) estimate an 11% mean overstatement in the sample of borrowers most likely to exaggerate income. While these papers show that overstatements happened, the magnitude of the distortions are relatively modest. Several papers have shown that the size of the income shocks that are needed to trigger mortgage defaults by households are a multiple of these numbers, see Fuster and Willen (2017) and the discussion in chapter four above. Similarly Adelino et al (2015) show that the fraction of loans that can be affected by overstatement are too small to play a major role for the housing crisis.

## **Conclusions**

In sum, a careful review of the significant trends in mortgage markets leading up to the 2008 crisis supports a view of the boom in which financial institutions and household alike bought into increasing house prices because of overly optimistic expectations. This broad-based increase in borrowing and housing prices might have been triggered initially through lower interest rates at the beginning of the 2000s. In turn, credit standards appear to have fallen *as a result* of higher house prices, because lenders were too willing to rely on collateral values alone. Once house prices started falling it was especially middle class and higher income household, as well as high FICO borrowers who defaulted at unprecedented levels and created strain on the financial system. Therefore, calling the crisis a “subprime crisis” is one of the big misnomer of this episode in US financial markets. At its heart this crisis was driven by unprecedented leverage and defaults in the middle class.

These emerging facts also show why it is essential for policy evaluation to understand the drivers of the crisis. Many early responses to the crisis focused predominantly micro-prudential regulation such as changing borrower screening processes or excluding certain borrower groups from credit altogether, in particular low-income borrowers. But in a classical asset bubble there is a need for macro-prudential regulation to prevent systemic buildup of debt across the households, and to ensure that there is sufficient slack in the financial system to guard against systemic shocks that are not tied to individual borrower characteristics. It also points toward a central role of the financial sector: if the buildup of systemic risk can have widespread economic impact, macro-prudential regulation ultimately has to trade off how much to restrict lending ex ante to minimize potential losses versus how to assign ex post who bears the losses in case of a crisis.

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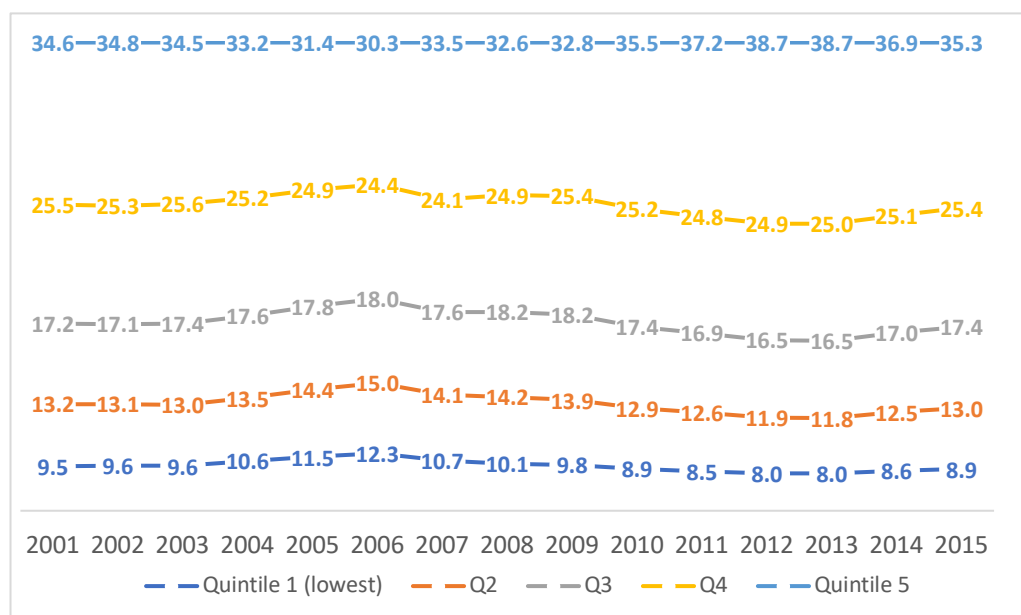
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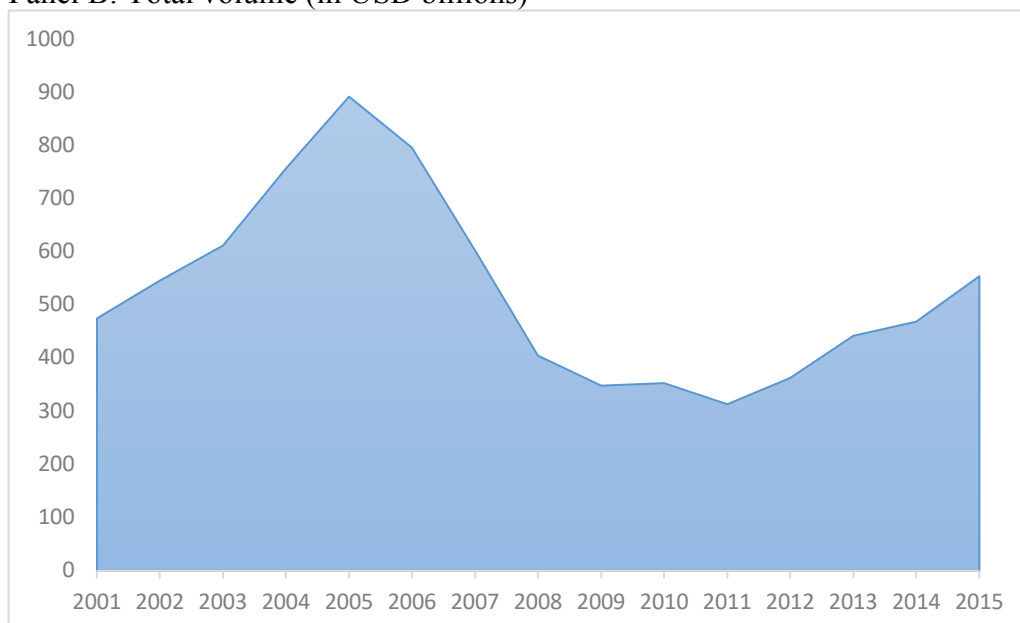
### Figure 1: Distribution of mortgage debt by income quintile

Note: Panel A shows the evolution over time from 2001 to 2015 of fraction of total dollar volume of purchase mortgages by income quintile, the lines are stacked together to one hundred percent, Panel B shows the total dollar volume on aggregate. We use household income from the IRS as of 2002 (i.e., the ZIP codes in each bin are fixed over time). The cutoff for the bottom quintile corresponds to an average household income in the ZIP code as of 2002 of \$34k, the second quintile corresponds to \$40k, the third quintile corresponds to \$48k, and the fourth quintile corresponds to \$61k. Sample includes 8,619 ZIP codes described in Adelino, Schoar and Severino (2017) “Data and summary statistics”.

Panel A: Share by income quintile (IRS ZIP code income)

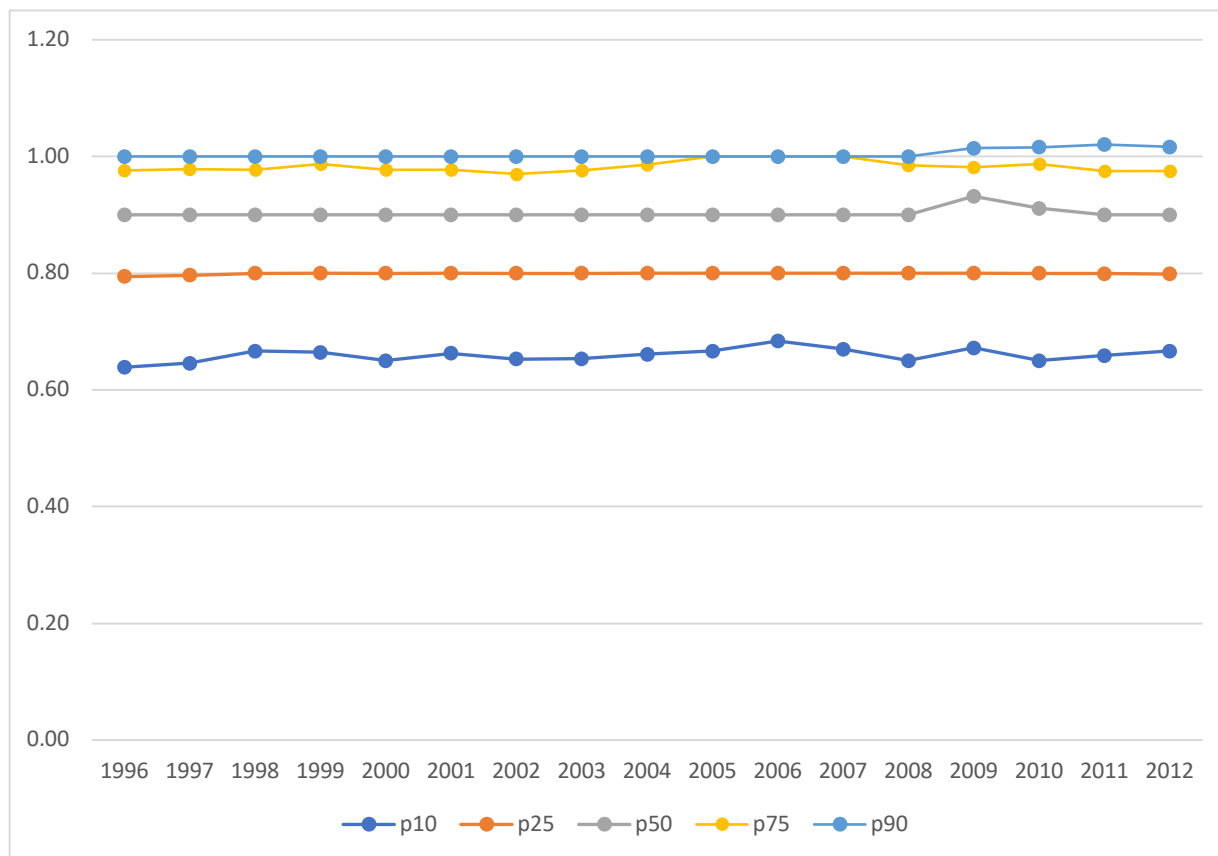


Panel B: Total volume (in USD billions)



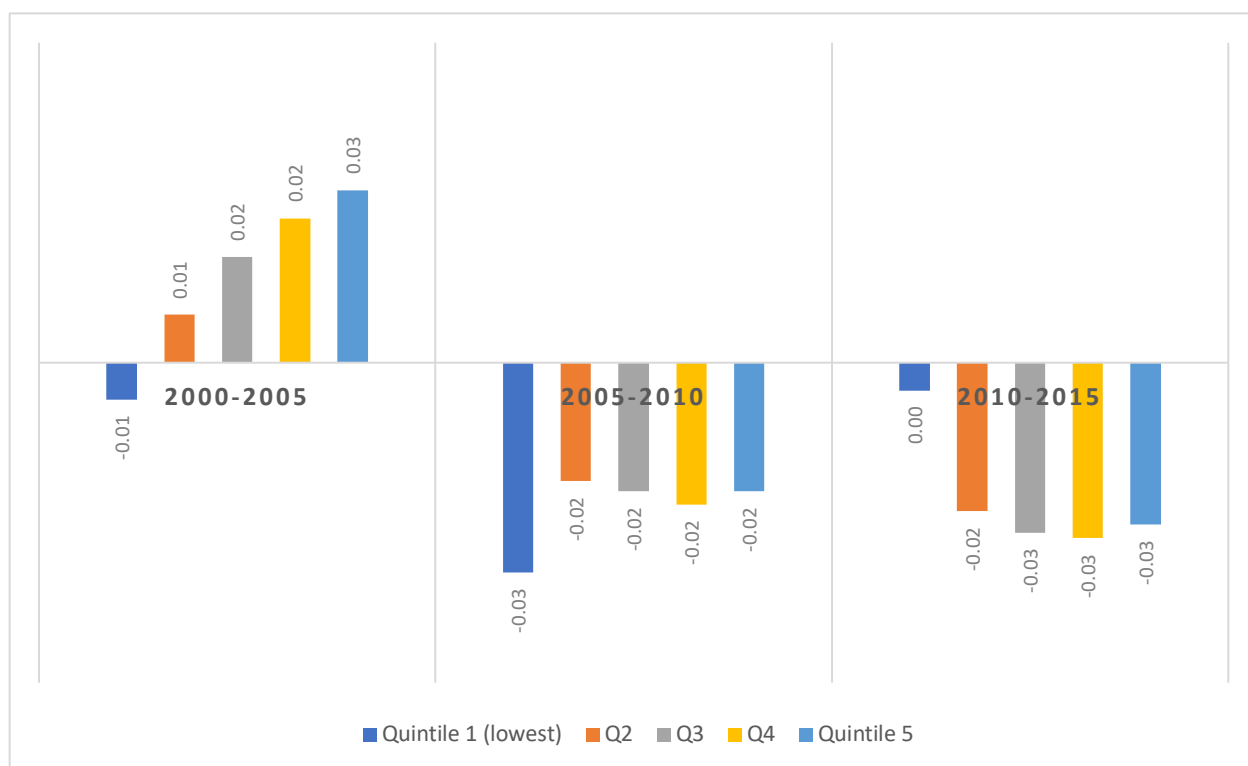
## Figure 2. Combined loan-to-value (CLTV) during boom and bust

Note: Data comes from Corelogic (formerly Dataquick). Sample includes all transactions with positive combined loan-to-value. Combined loan-to-value is computed as the sum of first, second and third liens taken up to 6 months after a home purchase transaction. Each time series represents the average CLTV in a year for the given percentile.



**Figure 3. Change in homeownership rate by income level**

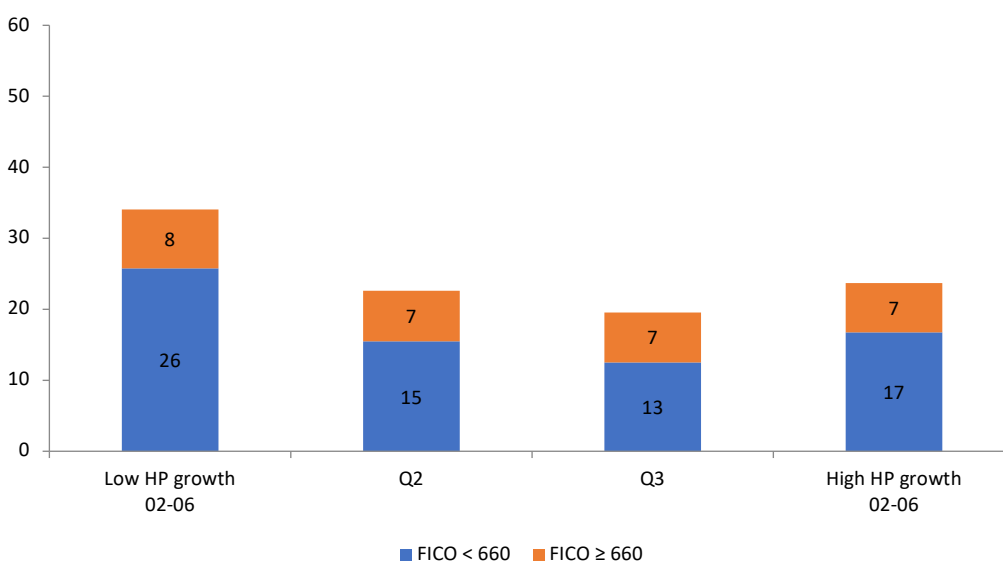
Note: Homeownership rate is calculated as the share of owner-occupied homes over the total number of occupied homes. Data comes from the Decennial Census for 2000, and from the American Community Survey 5-year public use microdata sample for 2005-2015. The bars represent the change in homeownership rate within that income quintile, between each 5-year interval.). The cutoff for the bottom quintile corresponds to an average household income of \$18k in 2000 and \$23k in 2015, the second quintile corresponds to \$33k in 2000 and \$43k in 2015, the third quintile corresponds to \$51k in 2000 and \$70k in 2015, and the fourth quintile corresponds to \$80k in 2000 and \$112k in 2015



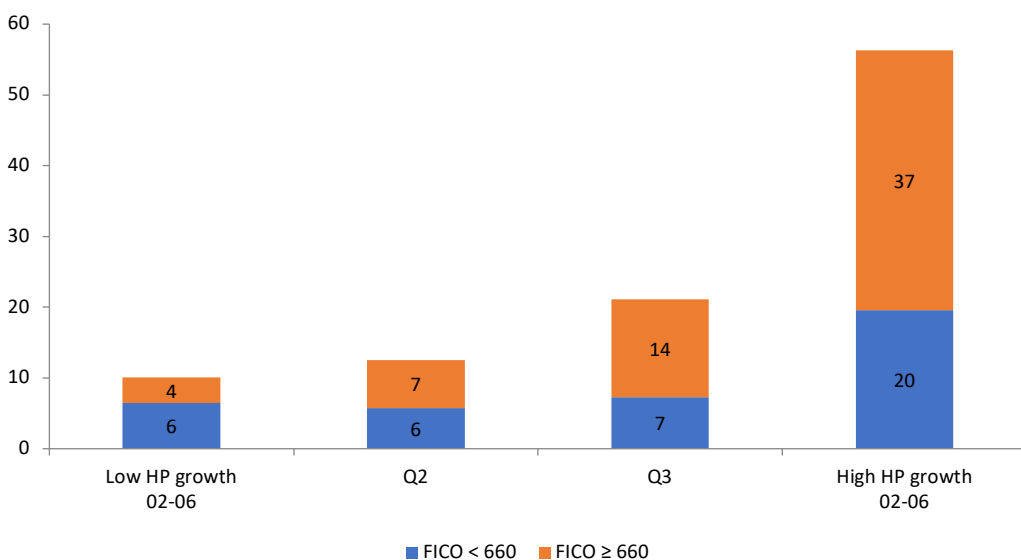
#### Figure 4. Delinquency by house price growth and credit score

Note: The figure shows the fraction of the dollar volume of purchase mortgages more than ninety days delinquent at any point during the three years after origination for the 2003 and 2006 origination cohorts. Panels show splits by quartiles of house price appreciation that the ZIP code experienced between 2002 and 2006, as well as by whether the borrower is above or below a credit score of 660 (a common FICO cutoff for subprime borrowers). In each panel fractions sum to 100 (the total amount of delinquent mortgages for each cohort), up to rounding error. Data are from the 5% sample of the LPS data set, and the sample includes ZIP codes with nonmissing Zillow house price data. This figure appears originally in Adelino, Schoar and Severino (2016) *Loan Originations and Defaults in the Mortgage Crisis: The Role of the Middle Class*. The Review of Financial Studies (2016) 29 (7): 1635-1670.

Panel A. 2003 mortgage cohort



Panel B. 2006 mortgage cohort





**Table 1. Percentage of homes sold in the past twelve months**

The table show the percentage of all transactions in each month for homes that also sold in the past twelve months (a measure of “flipping”). Data are provided by Zillow, and ZIP codes are broken down by house price growth between 2002 and 2006.

Year	House Price Growth 2002-2006 Quintile				Q4-Q1
	1	2	3	4	
2000	5.2	4.9	5.2	5.9	0.7
2001	5.3	4.9	5.2	6.1	0.8
2002	5.7	5.3	5.6	6.6	0.9
2003	6.1	5.7	5.9	7.0	0.9
2004	6.7	6.6	6.9	8.0	1.3
2005	6.9	7.1	7.3	8.5	1.6
2006	6.6	6.7	6.7	7.8	1.2
2007	6.1	6.0	5.8	6.0	0.0
2008	5.1	4.9	4.6	4.7	-0.5
2009	4.3	4.0	3.7	4.5	0.2
2010	4.4	4.2	4.0	4.9	0.5
2011	4.1	4.0	3.7	4.9	0.8
2012	4.5	4.4	4.0	5.0	0.4
2013	5.2	5.0	4.6	5.4	0.2
2014	4.9	4.7	4.4	5.1	0.2