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CREDIT SUPPLY AND HOUSE PRICES: EVIDENCE FROM MORTGAGE MARKET SEGMENTATION

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ABSTRACT

We show that easier access to credit significantly increases house prices by using exogenous changes in the conforming loan limit as an instrument for lower cost of financing and higher supply. Houses that become eligible for financing with a conforming loan show an increase in house values of 1.1 dollars per square foot (for an average price per square foot of 224 dollars) and higher overall house prices controlling for a rich set of house characteristics. These coefficients are consistent with a local elasticity of house prices to interest rates below 10. In addition, loan to value ratios around the conforming loan limit deviate significantly from the common 80 percent norm, which confirms that it is an important factor in the financing choices of home buyers. In line with our interpretation, the results are stronger in the first half of our sample (1998-2001) when the conforming loan limit was more important, given that other forms of financing were less common and substantially more expensive.

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1 Introduction

One of the central debates in finance is about the role of credit on the level of asset prices and the creation of bubbles (Kiyotaki and Moore, 1997; Kindleberger, Aliber, Solow, 2005).A salient recent example is the US housing market: House prices in the US increased two-fold in nominal terms between the beginning of 2000 and the end of 2006[1] Over the same period mortgage rates fell by approximately 25% (from 8.2% to 6.1% for conventional 30-year fixed rate mortgages) and were accompanied by a reduction in credit standards, including the growth of new mortgage products such as subprime mortgages that made credit more widely available (Mian and Sufi, 2009; Dell'Ariccia, Igan and Laeven, 2009). Many observers of the crisis have proposed that easy access to credit and the reduced cost of credit were the central factors fueling the boom in housing prices as well as the subsequent reversal in house price growth when credit dried up (Favilukis, Ludvigson and Van Nieuwerburgh, 2010; Hubbard and Mayer, 2008; Khandani, Lo and Merton, 2009, Mayer, 2011). Proponents on the other side of the debate argue that cheap credit alone cannot explain the house price boom and bust and that other forces are likely to have been at play (Glaeser, Gottlieb and Gyourko, 2010).

The key difficulty in settling this debate is establishing the direction of causality between credit availability and house price growth: On the one hand, easier access to credit might reduce borrower financing constraints and increase total demand for housing, which in turn would lead to higher prices. On the other hand, however, credit conditions might be responding to expectations of stronger housing demand and, as a consequence, higher house prices. In this latter scenario, cheaper credit is not the driver of house price increases but a byproduct of increased demand for housing, since housing as collateral becomes more valuable. As we see in the existing literature, it has been very difficult to separate these two effects.[2]

In this paper we use the annual changes in the conforming loan limit (CLL) as an instrument for exogenous variation in the cost of obtaining credit and in the availability of credit itself. We show that exogenous changes in the availability of credit due to changes in the CLL have a significant effect on the pricing of houses that can be financed more easily using a conforming loan. The CLL determines the maximum size of a mortgage that

[1] This is based on an increase in the Case-Shiller 20-city composite index. While there was some cross-sectional variation in the pace of appreciation across different cities (Miami, FL prices rose by 180 percent whereas those in Atlanta, GA rose by just 34 percent), most of the country shared this sharp increase in prices.

[2] A recent paper by Favara and Imbs (2011) uses branching deregulation in the 1990s to identify the causal link between credit supply and house prices and finds that states where there is deregulation subsequently experience larger house price increases.

can be purchased or securitized by Fannie Mae or Freddie Mac. This implicit (and since 2008 explicit) government support for loans below the conforming loan limit provides easier access to credit for a wide range of borrowers and reduces the cost of credit relative to jumbo loans. The difference in interest rates between conforming loans and jumbo loans (those that are above the conforming limit) is estimated to be up to 24 basis points in the 90's and 2000's (McKenzie, 2002; Ambrose, LaCour-Little and Sanders, 2004; Sherlund, 2008). In terms of the ease of access to loans, Loutskina and Strahan (2009, 2010) show that bank funding conditions and bank diversification change the origination of information-intensive jumbo loans but not that of conforming loans, which suggests that the screening behavior of lenders is different for the two types of loans.

The key idea of our identification strategy is that changes in the conforming loan limit (CLL) from one year to the next are exogenous not only to individual transactions, but also to the conditions of local housing markets or the local economy, since this change is based on the countrywide average appreciation in house prices. We can thus compare houses with a price that can be financed more easily using a conforming loan and houses that cannot. Furthermore, we can track houses in this price range in the year that the limit is in effect and in the subsequent year, once all houses in this range become eligible for easier access to credit. This setup enables us to cleanly identify the effect of access to credit based on the exogenous variation of the CLL and control for any overall trends in house prices.

The threshold that we use to define houses that are "easy" to finance with a conforming loan in a given year is the conforming loan limit divided by 0.8 (or, equivalently, 125 percent of the CLL).[3] By construction, houses below this threshold can get a conforming loan that makes up 80 percent of the price of the house, whereas houses that transact above 125 percent of the CLL can no longer be financed at 80 percent with a conforming loan.[4] For transactions above this price threshold, borrowers either finance their home with an 80 percent first mortgage using a jumbo loan (i.e. a loan above the CLL) at a higher interest rate or, if they want to take advantage of the lower interest rate below the CLL, they end up with a loan to value (LTV) ratio below 0.8 and have to use savings or alternative forms of financing to make a larger down payment. Either way, this group of transactions has a more constrained access to finance and higher cost of capital.

Under the null hypothesis that access to credit does not affect house prices, houses that

[3]Kaufman (2010) uses a similar threshold for the period of 2006-2007 to study the effect of the conforming status of a loan on its cost and contract structure.

[4]80 percent loan to value ratios (LTV) are widely used in the industry as an important threshold for first lien mortgages. Loans with an LTV ratio below 80 are associated with more attractive terms and conforming loans above 80 percent require private mortgage insurance in order to qualify for purchase by Fannie Mae or Freddie Mac (Green and Wachter, 2005).

can be financed using a conforming loan should have similar valuations to those that cannot, and thus the threshold of 125 percent of the CLL should not matter. Under the alternative hypothesis that credit access does influence house valuation, houses that cannot be financed as easily with a conforming loan should have lower valuation as measured by their value per square foot.

The intuition behind this estimation strategy is that transactions that fall just above the threshold are harder to finance and thus their prices have been bid up less relative to the underlying fundamentals of the house. An increase in the conforming loan limit should affect this part of the house price distribution more strongly since it allows borrowers who previously were not able to get attractive financing to enter this segment of the market. In addition, since house price levels differ across the various states of the United States, the change in the CLL affects different parts of the housing stock across areas depending on the price level of the area. This allows us to control for the possibility that there are differential growth rates within the distribution of house types across the country. For example, one concern would be that middle class families might be the ones buying a certain type of house and, at the same time, have a different income growth from other parts of the economy. Our instrument allows us to rule this out, because the same "type" of house will have different prices depending on the part of the country it is in.

We use data on individual house transactions from Dataquick, which contains information on the prices and financing arrangements of all transactions within a Metropolitan Statistical Area (MSA) based on deeds registries. The data also allows us to carefully control for house characteristics such as the size and quality of the property, which is important for distinguishing between pure "price" effects from differences in quality of the houses being transacted. We focus on single-family house purchases in 10 MSAs between 1998 and 2006.[5]

We first confirm that the CLL has a significant impact on borrowers' choice of financing. The data shows that the norm in the mortgage market during this period was to borrow at an LTV of *exactly* 0.8 (on average 60 percent of transactions are at an LTV of 0.8). However, for houses that transact just above 125 percent of the CLL, a much larger fraction of purchases are at an LTV just below 0.8, since many borrowers choose to take out a mortgage at the conforming loan limit. This translates to an average LTV that is 0.3 to 0.5 percentage points lower for transactions just above the threshold relative to those just below. This suggests that the CLL is an important determinant of mortgage finance. Borrowers that buy "expensive" houses may choose a conforming loan either because they are excluded altogether from the jumbo loan market or because the combination of a conforming loan

[5]Because the conforming loan limit did not change after 2006 we cannot implement our identification strategy after that year.

and additional financing is a cheaper option. Whatever the reason, these borrowers are *de facto* constrained in their choice of financing relative to borrowers who buy houses at a price below 125 percent of the CLL.

In our main analysis, we test the impact of easier access to credit, instrumented via the change in the conforming loan limit, on house prices. We compare transactions just above and below the threshold of 125 percent of the CLL in the year that the limit is in effect relative to the subsequent year, in which the limit is higher. To increase the comparability of house characteristics, we focus on houses that transact within a band of 10,000 dollars around the conforming loan limit divided by 0.8. Because we look locally around the threshold, all of the transactions above the CLL that we include in a given year would be eligible to be financed at 80 percent LTV in the subsequent year, i.e. after the limit was raised.[6]

We estimate differences in differences regressions for each year between 1998 and 2005 using houses above and below the threshold of 125 percent of the CLL in the year the limit is in effect and in the subsequent year. We construct averages of the cross sectional coefficients based on Fama and MacBeth (1973). We use three different dependent variables to capture the value of a property: (1) the value per square foot; (2) the residuals of house prices from a hedonic regression using a large set of controls for the underlying characteristics of the house, and (3) the residuals of the value per square foot from similar hedonic regressions. [7] We find that transactions in the "constrained" group of borrowers, i.e. those with transaction values just above 125 percent of the CLL, are made at lower values per square foot than those for the unconstrained group. We see a 1.1 dollar discount per square foot for a mean value per square foot of 224 dollars and mean size of 1900 square feet. This difference is still significant but reduced to 0.6 dollars per square foot after we control for house characteristics. These results suggest that an increase in the CLL leads to a significant increase in the price per square foot of properties that can now be financed with a loan below the CLL relative to houses that were below the limit before and thus could have previously been bought with a conforming loan. This effect becomes smaller (and often insignificant) in the second half of

[6] This is the case for all years between 1998 and 2005. For example, the CLL in 1999 is USD $240,000$, which gives a threshold of USD $240,000/0.8 = 300,000$ for this year. This means that in the regression for 1999 we include houses priced at between $290,000$ and $310,000$ in the years of 1999 (the year the CLL is in effect) and 2000. The CLL in the year 2000 was raised to $252,700$, so the new threshold for that year is $315,875$. Clearly, all the houses we included in the analysis for 1999 can be financed at 80 percent with a conforming loan in the year 2000.

[7] We run the hedonic regressions by year and by metropolitan statistical area (of which we have 10) and we use the set of controls available from deeds registries data, which includes common variables such as number of rooms and number of bedrooms, but also detail on the type of heating, architectural type, building type, among many others (we discuss these controls in more detail in Section 2.2).

our sample (2002-2005), which is the period when jumbo loans and second lien mortgages became widely available (see Figure 3) and thus the CLL was less important.

We also test whether our instrument reduces the number of transactions we observe above the threshold. We find no significant effect of our instrument on the quantity of houses transacted during the first half of the sample, but we do see fewer transactions above the threshold when the limit was in place in the period 2002-2005. Along with the other reasons we mention above, this effect on the number of transactions may help explain the weaker response in prices that we find in the later period.

Using the differences in interest rates between conforming and jumbo loans given in previous literature that range from 13 to 24 basis points, we can calculate the house price semi-elasticity to interest rates in the region around 125 percent of the CLL. We obtain elasticities that range from as low as 2 to as high as 10 depending on the period and the exact estimate for the interest rate differential between jumbo and conforming loans we use for our calculations. While we do not observe the jumbo-conforming spread directly, this spread would have to be as low as 8 basis points in order to reach an elasticity above 10 in any time period or for any of our measures of house value.

One basic assumption underlying our analysis is that the CLL provides a significant improvement in access to finance for people buying houses at a price just around the threshold. We expect this effect to be stronger when buyers face other types of constraints at the same time, namely in terms of their income. To test this intuition, we interact the changes in the CLL with the economic condition of the average household in a neighborhood. We find that the effect of credit supply on value per square foot is much stronger in zip codes and years that experience a negative income growth. The point estimate shows that value per square foot is 2.2 dollars higher in the year that a house becomes eligible to be financed with a conforming loan. This is double the size of the average effect that we found in the overall sample.

Our estimation strategy allows us to estimate directly the effect of changes in credit availability on the valuation of houses. However, we do not observe the exact mechanism through which credit conditions feed through to house prices. There are at least two alternative ways that credit could affect prices: First, better access to credit increases demand for houses, since more people can now bid on properties and, as a result, we see an increase in the price of the transactions. A second and alternative channel would be that borrowers who have easier access to finance bargain less hard for a reduction in property prices relative to borrowers who struggle to find financing. Importantly, in either of these channels a change in access to finance is driving the change in borrower behavior and consequently house prices.

We can rule out an alternative hypothesis related to a selection effect driving our results whereby buyers of houses "above the threshold" in the year that the conforming loan limit is in effect are different along some unobservable characteristics from the other buyers. Several features of our analysis make selection an unlikely explanation of the results. First, for a selection hypothesis to be a true alternative to our explanation of the results, it would have to involve arguments other than access to credit to explain why buyers were different above and below the threshold. Second, these "special" buyers would both have to be better able to deal with the reduced access to credit (potentially because they are wealthier or have higher income) and bargain harder for houses. It is unclear why wealthier borrowers should pay less for a similar house than poorer borrowers. If wealthier people bought higher quality houses and we did not observe these differences, these unobservable characteristics would create bias in the opposite direction. Third, our identification strategy would require that the selection effect change each year parallel to the change in the size of the conforming loan limit, which is very unlikely. Finally, to help further rule out this selection hypothesis, we run our main regressions excluding borrowers that choose LTVs below 80 percent in the year that the CLL is in effect. If selection was the explanation of the results, these transactions should be the ones by "wealthy" borrowers driving the results. We find that the results do not change materially when we exclude this subset of transactions.

The rest of the paper is structured as follows: Section 2 describes our data and the identification strategy. In Section 3 we lay out the regressions results and robustness checks of our main analysis. Section 4 discusses the findings and concludes.

2 Data and Methodology

The dataset we use in this paper contains all the ownership transfers of residential properties available in deeds and assessors records for the cities that are covered by Dataquick. Our dataset spans 11 years, from 1998 to 2008, and contains all transactions recorded on the deeds registries for seventy-four counties in ten metropolitan statistical areas (MSAs) - Boston, Chicago, DC, Denver, Las Vegas, Los Angeles, Miami, New York, San Diego and San Francisco. We limit our attention to transactions of single-family houses, which account for the large majority (approximately 78 percent) of all observations.

Each observation in the data contains the date of the transaction, the amount for which a house was sold, the size of the first mortgage and an extensive set of variables about the property itself. These characteristics include the property address, interior square footage, lot size, number of bedrooms, number of bathrooms, total rooms, house age, type of house (single family house or condo), renovation status and date of renovation. Additional more detailed characteristics include the availability of a fireplace, parking, the architectural and structural style of the building, the type of construction, exterior material, availability of heating or cooling, heating and cooling mechanism, type of roof, view, attic, basement, and garage. We describe the procedure for cleaning the raw data received from Dataquick in Appendix 1.

2.1 Summary Statistics

The sample that we use for this paper contains 4.7 million transactions of single-family houses that are summarized in Tables 1 and 2. We can see in Panel A of Table 1 that the average transaction value in our sample is 298,720 dollars with a standard deviation of 122,450 dollars. The average size of the houses in the cleaned dataset is 1,603sqft and the houses have, on average, 3 bedrooms and 2 bathrooms. The average loan to value is 0.81 (including only the first mortgage for each transaction) and the median LTV is 80 percent. The average value per square foot is 203 dollars with a standard deviation of 96 dollars per square foot (first row of Panel B).

Table 1 also shows the summary statistics for the restricted sample we use in the regressions in the final three columns. For the restricted sample, the average price for each house is higher than in the whole dataset, given that this subsample includes only houses that are close to the conforming loan limit. This is consistent with the fact that the conforming loan limit was set to cover substantially more than 50 percent of the mortgages made every year (Acharya, Richardson, Nieuwerburgh, White, 2011). These houses are also, on average, larger and have more bedrooms and bathrooms than the whole Dataquick sample.

Panel A of Table 2 shows marked differences in the summary statistics for each of the ten MSAs included in our data. The table shows that San Francisco is the metropolitan area with the highest valuation with an average house price of 370 thousand dollars. Denver and Las Vegas represent the areas with the lowest valuation with an average of approximately 238 thousand dollars. When we compare values per square foot we get a similar picture, namely San Francisco is the area with the highest valuation with an average of 277 dollars per square foot and Las Vegas is the area with the lowest valuation with an average of 132 dollars per square foot.

Table 2 Panel B shows the evolution of prices through time. Here we see the increase in house prices from an average of 236 thousand dollars in 1998 to a peak of 352 thousand dollars in 2006, as well as the increase in the volume of transactions over the same period. The increase in prices and volume is linked to an increase in volatility. The standard deviation of the transactions increased from 100 thousand dollars in 1998 to 124 thousand dollars in 2006. A similar pattern can be observed for the value per square foot measure, where standard deviation is 138 dollars per square foot in 1998 and increases to 262 dollars per square foot in 2006. Finally, the loan to value average (including only the first mortgage) is stable both across MSAs and through time at around 0.8.

2.2 Hedonic Regression

One of the advantages of using deeds registry data is the richness of the information provided on the property characteristics, which allows us to account for price differences between houses that can be attributed to observable features. Specifically, we will be able to assess whether the price impact we observe due to the changes in the conforming loan limit can be attributed to differences in the quality of the houses or whether these differences are there even after accounting for quality.

In order to distinguish between these two explanations, we estimate hedonic regressions of value per square foot and house price on a number of house characteristics and estimate the residuals for each of these two left-hand side variables (which we denote by LHS_i). Specifically, we estimate the following regressions by MSA and by year:

$$LHS_i = \gamma_0 + \Gamma X_i + month_i + zipcode_i + \varepsilon_i$$

We use both the price of a transaction as well as the value per square foot as our dependent variables. By estimating these regressions by year and by MSA we allow the coefficients on the characteristics to vary along these two dimensions. We also use monthly indicator variables to account for seasonality in the housing market, as well as zip code fixed effects. The set of controls X_i is a similar set of controls to that used in Campbell, Giglio and Pathak (2010) with some additional characteristics. The controls include square footage and its square, the size of the lot, number of bedrooms and bathrooms and a number of indicators for interior and exterior house characteristics (fireplace, style of the building, etc.). We describe which variables are included, as well as the detail of the construction of each variable, in Appendix 2.

The estimated R^2 of each of these regressions (80 in total for each of the two left-hand side variable–10 MSAs in 8 years) is between 40 and 60 percent for the price of the transaction and 50 to 70 percent when we use value per square foot as a dependent variable[8].

Summary statistics for the residuals from the hedonic regressions for the whole sample are shown in Panel B of Table 1. The average residuals are, by construction, zero. The standard deviation of the errors is about 44 dollars per square foot and 54 thousand dollars for the

[8]Unreported regressions.

price of the house. The hedonic regressions are estimated on the whole clean sample[9], so when we restrict our attention to the regression sample the average error no longer has to be zero. Indeed, for the regression sample the average residual from the hedonic regressions for the value per square foot is positive at 5.60 dollars and the average error for the transaction value of the house is USD 4,200 (last three columns of Panel B of Table 1). The standard deviation of the residuals for the regression subsample is similar in magnitude to what we obtain for all the transactions.

2.3 Empirical Approach

2.3.1 Identification Strategy

To identify the effect of changes in credit conditions on house prices we restrict our analysis to two groups of buyers who all buy houses in a tight price range, but differ in the financing available to them. The sample for our regressions is made up of houses that transact in a band around 125 percent of each year's conforming loan limit, as well as houses in the subsequent year in the same price range. Specifically, we divide houses into two groups: houses *below* the threshold of 125 percent of the year's CLL (i.e. transactions that fall between 125 percent of CLL minus USD 10,000 and 125 percent of CLL) and houses *above* that threshold that transact between 125 percent of CLL and 125 percent of CLL$+10,000$. By construction, in the year that the conforming loan limit is in effect, houses above the threshold of 125 percent of the CLL cannot be financed at 80 percent using a conforming loan, whereas the houses below the threshold can. Thus, home buyers that bid for houses priced above 125 percent of CLL cannot finance a full 80 percent of the transaction with the cheaper and more easily available conforming loans. In the subsequent year the CLL is raised and both groups of transactions can be financed at 80 percent with a conforming loan. While this was no longer true for the years after 2006, in all cases between 1998 and 2005 the limit increases enough from year to year to make up 80 percent of the price of the transactions we have in the sample.

The identification strategy is best understood through an example. Consider the year 1999: In that year, the conforming loan limit (CLL) for single family houses was USD $240,000$. The corresponding threshold for house prices that we use for this year is $300,000$ ($240,000/0.8$ or, equivalently, $1.25 * 240,000$). In this year, the group of houses "above the threshold" have prices between USD $300,000$ and USD $(300,000 + 10,000) = 310,000$ and houses "below the threshold" have a transaction price between USD $(300,000 - 10,000) = 290,000$ and USD $300,000$ (those that transact at exactly USD $300,000$ are included in

[9]Please see Appendix 1 for a detailed description of what is included in this subset of the data.

this second group). For the purposes of our main regressions, we track these two groups of houses from 1999 to 2000, where 1999 is the year in which the CLL is in effect and 2000 is the year in which all these transactions could be bought using a conforming loan at a full 80 percent LTV. In fact, the CLL changed in 2000 to USD $252,700$, so the threshold of 125 percent of CLL was now USD $315,875$ and even our "above the threshold" group for 1999 is now eligible to get an 80 percent LTV conforming loan.

One important assumption in our analysis is that borrowers in the group "above the threshold" of 125 percent are constrained in their choice of financing. In order to stay at an LTV of 0.8 they now have to take a jumbo loan. Alternatively, they can borrow up to the CLL and then cover the rest of the house price with savings or other funding, which means having a first mortgage LTV of less than 80 percent. We see in the data that many borrowers end up with an LTV of 77-79.5 percent for this group of transactions, whereas this is very infrequent anywhere else in the distribution.

Figure 1 shows that the most frequent choice on the part of borrowers is to have a LTV of 80 percent except at exactly the conforming loan limit, where a significant mass of borrowers chooses an LTV below 0.8 by sticking to a conforming loan. In unreported analyses, we find that in the year in which the CLL is in effect about 45 percent of the houses "below the threshold" in our sample are bought with an LTV of *exactly* 80 percent, whereas for houses above this boundary just 19 percent of borrowers pick 80 percent LTVs (which for these transactions means using a jumbo loan). Additionally, on average 55 percent of the transactions just above the threshold are financed using a conforming loan, which means having an LTV lower than 80 percent. Again, these borrowers might have a lower LTV because they choose to stay below the CLL due to the cost of the loan, or because they are excluded from the jumbo market altogether. Whatever the reason, this is the group of borrowers that we consider to be "constrained" in their set of options for financing their house.

2.3.2 Empirical Specification

Our main regressions estimate the size of the effect of the constraint imposed by the conforming loan limit on the valuation of transactions made just above the threshold of 125 percent of the CLL. We run differences in differences regressions year by year with one indicator variable for houses priced above the conforming loan limit divided by 0.8, another indicator for the year in which the CLL is in effect and an interaction of these two indicator variables. We also include ZIP code fixed effects in all regressions so our estimates do not reflect differences between neighborhoods but rather variation within zip codes.

The sample for each year by year regression includes houses within a USD 10,000 band around the conforming loan limit in the year in which the limit is in force and in the subsequent year. This implies that the "Above the Threshold" indicator variable takes a value of 1 if the price at which a house transacts is greater than 125 percent of the conforming loan limit of a certain year and less than that amount plus 10,000 dollars. This same variable is a 0 for transactions between 125 percent of the CLL and 125 percent of the CLL minus 10,000 dollars. The "Year CLL" indicator variable is a 1 in the year in which the CLL is in effect for each regression and a 0 in the subsequent year. We use a tight band around the threshold so that all transactions in the year after the limit is in effect are eligible for an 80 percent LTV conforming loan. We thus have a group of transactions that is "easy to finance and another one that is "hard to finance in the year that the limit is in effect, but all transactions in the sample are "easy to finance once the limit is raised.

We run regressions of the following form:

$$Valuation\, measure_i = \beta_0+\beta_1 1_{AboveThreshold}+\beta_2 1_{Year\_CLL}+\beta_3 1_{Above\ Threshold\times Year\_CLL}+\gamma_{ZIP}+\varepsilon_i$$

We estimate this regression for each year between 1998 and 2005. We cannot include 2006 and 2007 in our estimates because the conforming loan limit did not change after 2006 in our data (house prices dropped and the administration left the limit unchanged). After we obtain β_1, β_2 and β_3 for all 8 years (1998-2005) we estimate Fama MacBeth averages of these coefficients and obtain the standard errors of this average by using the standard deviation of the estimated coefficients and dividing it by the square root of the number of coefficients.

We should point out that our approach is *not a regression discontinuity design*, but rather differences in differences for each pair of years. There are a couple of reasons for this: First, the threshold that we use does not imply a sharp discontinuity in the ease of financing a home. For a house just one dollar above the threshold, a homebuyer only has to come up with one additional dollar of equity (and still obtain a conforming mortgage), which means the total cost of financing the house is almost unchanged. As we move progressively away from the threshold, transactions become harder to finance. For our differences-in-differences estimator to be valid all we need is that houses above the threshold are somewhat harder to finance, though not necessarily discontinuously so.

The second reason for not using a regression discontinuity design is that in the year that the limit is in effect, homebuyers choose to buy houses above or below the threshold, i.e. the position with respect to the limit is not exogenous. On the contrary, our differences in differences specification uses the exogenous *change* in the conforming loan limit to compare a group of transactions that are above the limit in a year, but below in the next with a group of transaction that are always below the limit, achieving a clean identification of the effect of credit availability on house prices.

2.3.3 Differences in Financing Choices

As we pointed out above, the equivalent to a first stage in our empirical strategy is to show that the changes in the conforming loan limit have a significant effect on the financing choices of borrowers. In figure 1 we can see the importance of both the 80 percent LTV rule, as well as the conforming loan limit, in determining financing choices for the whole distribution of transactions. In Figure 2 we focus on the groups of transactions that we include in the regressions. The first panel tracks transactions up to USD 10,000 below 125 percent of the conforming loan limit in each year, whereas the second panel includes transactions up to USD 10,000 above the threshold. We show the total number of transactions (for all years between 1998 and 2006) in each month during the year prior to the limit being in effect, in the year that the limit is valid and in the subsequent year. We also break down the transactions by the choice of LTV - the transactions at the bottom of each panel have an LTV below 75 percent, the second group includes transactions with an LTV between 75 percent and 79.5 percent, the third has transactions with LTV=80 percent and the top group has all the transactions with an LTV above 80.1 percent. The main message from Figure 2 is that in the year that the CLL is in effect, the composition of financing choices by borrowers differs very significantly, with the 80 percent group becoming very prominent for the transactions below 125 percent of the CLL, whereas it is small for the transactions above the threshold. At the same time, the borrowers who stick with a conforming loan and buy houses above 125 percent of the CLL become an important fraction of all borrowers (they have an LTV between 75 and 79.5 percent).[10] In the year after the limit is in effect, the choice of LTV across the two groups becomes indistinguishable.

In Table 3 we present the effect of the changes in the conforming loan limit on the financing choices made by the borrowers included in the sample of our main regressions. In this table, we are verifying what we see in the pictures, namely that borrowers on average end up with lower LTVs when they buy houses above the threshold of 125 percent of CLL.

[10] The first picture for the group below 125 percent of the CLL also shows a noticeable fraction of borrowers with an LTV between 75 and 79.5 percent in the year before the CLL is in effect. This is because these transactions were not eligible for a conforming loan at an 80 percent LTV in the year before the new limit was in effect and were, in general, just slightly above that threshold. This is thus a reflection of the same phenomenon we see for the group above 125 percent of the CLL in the year that the new limit is in place.

Results for the effect of the CLL on financing choices are shown in Table 3. We find that LTVs are on average 0.3 to 0.5 percentage points lower for the group of transactions that happens above the threshold of 125 percent of the CLL in the year that the limit is in effect. The effect is statistically and economically significant both when we consider all transactions from our main regression (for more detail see Section 3.1) and when we restrict attention to the subsample of LTVs between 0.5 and 0.8 that we used in Table 7 (for further details, see Section 3.3). The second panel on Table 3 shows that borrowers also obtain on average smaller loans in the year that the limit is in effect and when the price of the house is above the threshold. The difference is, on average, 1,800 to 2,000 dollars and we conjecture that it is the fact that borrowers obtain smaller first mortgages that leads to the difference of approximately 1.1 dollars per square foot (for an average value per square foot of 224 dollars) we find in our main results.

2.3.4 Differences in the Number of Transactions

There are several reasons to expect quantities to change due to differential ease in access to credit, including different levels of downpayment (Stein, 1995) or sellers waiting for buyers to obtain better credit conditions (Genesove and Mayer, 1997). In fact, unless the supply elasticity of houses is very low (or zero), we expect the price effect due to a change in the demand for housing to be accompanied by a change in the number of transactions.

In order to test whether there are differences in the number of transactions above and below the threshold we consider the difference in the share of transactions in our sample that fall above and below the threshold in the year that the limit is in effect and in the subsequent year in a differences-in-differences setup. This test is equivalent to a T-test for the mean of the variable "Above Threshold" that compares the average of this variable in the year that the limit is in effect and in the subsequent year. If our instrument affects the quantity of transactions we should see an increase in the share of observations above the threshold when the limit is raised, as access to credit become easier for those transactions. For the same reasons that we discuss in Section 2.3.2, we do not use a regression discontinuity approach to address the question of the change in the quantity of transactions (Figure 4 confirms that this would produce no significant result).

We show in Table 4 that this test reveals no changes in the share of transactions above and below the threshold for the first part of our sample (1998-2001) and that there is a statistically significant effect for the second part of the sample. This effect means that the share of transactions above the threshold is approximately 40 basis points lower in the year that the conforming loan limit is in effect during the period 2002-2005. This exercise shows that the effect of cheaper credit provided by conforming loans is reflected only on house prices in the first part of our sample and that in the second part of the sample it impacts both quantities and prices, which may help explain why the effect we find on prices is smaller relative to the earlier years.

3 Access to Credit and House Prices

3.1 Main Regression Results

We present the results for our canonical specification in Table 5. This table presents Fama-MacBeth coefficients from year-by-year regressions, as described before in Section 2.3.2. The coefficient of interest in Panel A of Table 5 is that on the interaction variable and it shows that houses above the threshold of CLL/0.8 transacted at a value per square foot that was lower by about USD 1.1 in the year that the CLL was in effect. The results are stronger for the first half of the sample, where the point estimate is USD -1.4 per square foot for this set of transactions.

The other coefficients on the regressions for value per square foot are consistent with what we know about house prices over this period. First, houses that are above the threshold of 125 percent of CLL (i.e. the more expensive houses in the regression sample) are associated with a higher average value per square foot. In unreported analyses we find that more expensive houses are generally associated with a higher value per square foot (i.e. price rises quicker than house size in the whole distribution of transactions) and here we find that this is also the case for the regression sample. Also, the "Year CLL" dummy variable is associated with a strong negative effect, reflecting the strong increase in house valuations that we saw in this period in the US. Given that the year in which the CLL is in effect is always the "pre" year in the regressions, we expect those transactions to be associated with a lower value per square foot on average.

In Panels B and C we use the residuals from the regressions we described in Section 2.2 as the dependent variable to account for differences in quality between houses. The results are qualitatively and quantitatively very similar to the ones we present in Panel A. In Panel B we are using the residuals of a regression of house price on a set of characteristics and we find that those residuals are lower by USD 330 for houses above the threshold of 125 percent of the CLL when the CLL binds. This suggests that transactions that cannot be financed at 80 percent with conforming loans are made at lower prices even after we control for a rich set of house characteristics. A similar conclusion can be drawn from Panel C, where the point estimate is that the value per square foot after we control for house quality is lower by about USD 0.65.

For both measures that account for house quality, and similarly to what happens with value per square foot, the constraint imposed by the conforming loan limit is stronger in the first half of the sample than in the second half. This is in line with our expectations, given that borrowers had easier access to second lien loans after 2002, as we see in Figure 3. Additionally, we see in the data that more borrowers use jumbo loans, which may reflect a reduction the cost differential of this type of loan relative to conforming loans and an increase in the ease of access to this type of loans.

3.2 Credit Supply and Income

We now turn to how the effect of credit supply on house prices changes with the growth in income in a zip code. To do this we obtain data on zip code level average household income each year from 2000 to 2007 from Melissa Data.[11] We create a new variable that is a "1" if a zip code has negative nominal average income growth form one year to the next and "0" otherwise. We then run similar regressions to what we did before (year by year), adding an interaction between our previous variables and this new zip code level "Negative Income Growth" variable. Looking at the coefficient on the triple interaction term (negative income growth, the year that the CLL is in effect and being above 125 percent of the CLL) allows us to identify how the effect of credit supply differs in times of positive and negative income growth. Our hypothesis is that the effect of credit supply is stronger in times of negative income growth, as households in a certain zip code are more likely to be constrained and there is likely to be less competition for housing, which increases the probability that a seller sells to a constrained buyer.

We show the results for these regressions in Table 6. In the first column of Table 6 we repeat our main regressions for the period 2001-2005 only, as this is the period for which we were able to construct the income growth indicator variable. The results are consistent with those in Table 5. In the second column of Table 6 we show Fama MacBeth coefficients from the regressions with the income growth interaction term. The triple interaction terms shows that the effect of credit supply on value per square foot is significantly stronger in zip codes and years that there is negative income growth. The point estimate shows that value per square foot is 2.2 dollars lower in the year that the conforming loan limit is in effect for houses above 125 percent of the limit when income drops in a zip code. We also find that the main effect from our main regressions in Table 5 is quantitatively similar to before.

In Figure 5 we split ZIP codes by their median income in order to consider the effect of

[11] Melissa Data obtains this data from the IRS and provides it in an easy to read format.

the conforming loan limit on the distribution of value per square foot on the whole sample of transactions. We plot the average value per square foot as a function of the distance of each transaction to the threshold of 125 percent of the CLL. We can see that for the ZIP codes in the lowest quartile of the income distribution the average value per square foot is monotonically increasing for up to conforming loan limit threshold and from this point onwards the distribution becomes flat. This pattern is not visible for zip codes with higher median incomes, where the distribution seems monotonically increasing both below and above the threshold.

3.3 Robustness and Refinements

3.3.1 Restrict LTV Choices

We first want to test that our estimates are not driven by borrowers with very unusual LTV levels, namely those with LTV below 50 percent and above 80 percent. Borrowers with those choices of LTV are likely to either have access to abundant equity to put up when buying a home or to be very constrained and need a very high LTV. By constraining our sample to include only borrowers who choose a first lien LTV between 50 and 80 percent we capture the transactions that should be most affected by the conforming loan limit. In particular, this subsample includes the group of borrowers that end up with an LTV between 77 percent and 79.5 percent in the year that the CLL is in effect because they stick with a conforming loan, even though their house costs more than 125 percent of the CLL. This choice of LTV is very common for the "Above the Threshold" group of borrowers in the year that the limit is in effect, but very infrequent everywhere else in the distribution of transactions. Also, this subsample includes all the borrowers that choose an 80 percent LTV, the most frequent choice in the data. This means getting a jumbo loan for transactions "Above the Threshold" and a conforming loan for transactions below that threshold. Finally, the transactions that are excluded from this sample should be least affected by the conforming loan limit, either because their LTVs are very low, in which case they are never affected by the limit anyway or, alternatively, because they have high LTVs and thus obtain jumbo loans in the year in which the limit is in effect whether the price of the transactions is above or below the 125 percent of the CLL threshold.

Table 7 shows the results for Fama MacBeth coefficients from year by year regressions, much like we described in Section 2.3.2, except using only transactions with an LTV between 0.5 and 0.8. The results are quantitatively similar to those we obtain for the whole sample, which means that our mains results are not being driven by very low or very high LTVs. This reinforces our interpretation that the results we find in Table 5 are caused by the CLL and not some other spurious factor. The magnitude of the coefficients is very similar to the ones in the previous table, but we lose statistical significance for the coefficient of interest when we use the "Value Residual" measure as the left-hand side measure.

3.3.2 Differential House Price Trends

We want to rule out that our results are driven by differences in secular trends between houses above and below the threshold of CLL/0.8. Specifically, if more expensive houses have, on average, lower house price growth from one year to the next relative to less expensive houses, we might obtain the results reported in Table 5, but we might obtain similar results for samples with transactions above and below other arbitrary thresholds.

In order to address whether the effect that we find is indeed the product of the true conforming loan limits and not due to different trends along the distribution of houses, we run the same regressions described in Section 2.3.2 for "placebo" loan limits. We do this by shifting the true conforming loan limit in USD 10,000 steps from the true value each year. We start at CLL-100,000 and move 20 steps until we reach CLL+100,000. For each of these 21 tests we first define the "shift" relative to the true conforming loan limits and then we change the limits for all years by that amount. For example, when we are changing all the limits by -20,000, this means that the "placebo" limit for 1999 is 220,000 dollars instead of the true 240,000 dollars, the "placebo" limit for 2000 is 232,700 instead of 252,700, and so on. We then run the same year-by-year regressions and produce Fama MacBeth coefficients for each of the 20 alternative "placebo" values for the CLL. The results from this exercise are shown in Table 8. The coefficient we report for each regression is that on the interaction of the "Above the Threshold" and the "Year CLL" dummies.

The table shows that the coefficients of interest we obtain for all three dependent variables (values per square foot, residuals from the transaction amounts and residuals of values per square foot) are systematically among the lowest of all obtained with the 20 "placebo" trials. The coefficient on the value per square foot measure is the lowest of the 21 trials whether we use the whole sample or whether we limit our attention to the restricted sample with an LTV between 0.5 and 0.8. When we use the whole sample and the two residual measures from the hedonic regressions as the left hand side variables in the regressions, the coefficients for the true conforming loan limits are the second and third lowest. In the restricted sample with LTVs between 0.5 and 0.8, these two measures produce the second lowest and the lowest coefficient out of the 21 trials. If we limit our attention to placebo limits that are below the true limits (i.e. the top half of Table 8), all our measures produce the lowest coefficients out of those trials. We consider these to be true placebos, because all the transactions used for those regressions are, by construction, below the "eligibility" criteria of 125 percent of the true conforming loan limit both in the year that the limit is in effect and in the subsequent year. As such, these transactions should not have any changes in credit availability from one year to the next.

If we assume the 21 trials are independent trials and compute the standard deviation of those coefficients, we find that the coefficients using value per square foot as the dependent variable are statistically significantly different from the average of the other coefficients at a 5 percent level in both the whole sample and in the restricted sample with LTV between 0.5 and 0.8. When we use the value per square foot residual measure as a left hand side variable, the coefficient has a p-value of 12 percent in the whole sample and 6 percent in the restricted sample. Finally, the coefficient from the regression that uses the residual from the house price hedonic regression as a left-hand side variable has a p-value of 23 and 26 percent when we use the whole sample and the restricted sample, respectively. It is not surprising that the results from the regressions that use residuals as left hand side variables are weaker statistically, given the level of noise that is added by having the hedonic regressions as an intermediate step for obtaining the residuals. The fact that all results are directionally the same and that there is no "placebo" limit that consistently produces results that are as strong as the ones from the true limit further confirms that our coefficients are not obtained by pure chance.

3.3.3 Selection Into Treatment

As discussed in the introduction, there can be at least two alternative mechanisms for the effect of the conforming loan limits on house valuation. The first mechanism is that easier access to credit around the threshold leads to an increase in the demand for houses of a certain type, which then leads to higher valuation of these houses (or, conversely, tighter access to credit reduces the demand for houses above the threshold in the year that the limit is in effect). The alternative mechanism is that different credit conditions above and below the threshold attract a type of buyer in the year that the limit is in effect that is both better able to deal with the worse access to credit (possibly because of higher wealth or income) and is a more effective negotiator than other "typical" buyers. This would still mean that our results are driven by credit conditions being different above and below the threshold, but it would be a different mechanism for our results. This selection effect results from the fact that borrowers can *choose* the level of their LTV. If all borrowers mechanically had to use an LTV of 80 percent, there would not be any possibility for selection.

To understand whether the above mentioned form of selection is important, we divide transactions that are just above the cut off for being eligible for a CLL at 80 percent in a given year into two groups: (1) transactions that nevertheless use a conforming loan and therefore choose to have an LTV below 80 percent and (2) transactions that use a jumbo loan with an 80 percent LTV, which means they do not get a conforming loan. The first group isolates the set of borrowers where selection could be an issue: These borrowers might be optimizing around the CLL threshold and could therefore have other unobservable differences from the rest of the borrowers. For example, these "special" buyers could have more wealth or higher income and thus might also differ in other unobservables such as their ability to bargain. By excluding the group of home buyers who choose this type of financing, we can test if these are driving our results, i.e. whether they alone buy *cheaper* houses. As an aside, it is ex ante not clear why those borrowers would buy cheaper houses (based on value per square foot). The fact that they are wealthier would usually lead us to believe that the omitted variable bias goes in the other direction, i.e. they buy houses with higher unobservable quality. The following regressions show that this group of borrowers does not drive our results.

To test the importance of the selection effect, we run differences in differences regressions excluding each of the two groups described above at a time (in the year that the limit is in effect) and construct Fama MacBeth coefficients, as we did in Tables 5 and 7. The results are shown in Table 9. We find that results do not change much when we exclude the jumbo loans or when we exclude the conforming loans, which implies that our main results are not being driven solely by either one of these groups of transactions. The statistical significance of the results is similar and the magnitude of the coefficients sometimes is larger for one group and other times for the other, depending on the left hand side measure we use. Overall, the results point in the same direction for both sets of regressions.

This robustness test shows that the effect of credit conditions on house prices in our setting is not likely to be driven solely by selection of different buyers in our "treated" group. If this were the case, we would expect the borrowers that pick a conforming loan and end up with an LTV below 80 percent to be the ones driving our main result. The fact that we see similar results also when we exclude this subgroup increases the likelihood of our alternative explanation, namely that credit access changes demand for housing and that this shift in demand for housing drives the change in house valuation.

3.3.4 Constraints to Housing Supply

To understand whether the effect of credit supply is amplified by the inability of housing supply to adjust quickly to demand, we divide zip codes into high and low house supply elasticity according to the measure in Saiz (2010). In this test, we find that the constraint imposed by the conforming loan limit is stronger in zip codes located in more inelastic metropolitan statistical areas (MSAs) according to the Saiz measure (Table 10). This result is in line with what we expect, namely that better access to credit will feed through to house prices more in regions where the supply of houses cannot adjust as easily. We are cautious to interpret this result, however, because we have limited cross-sectional variation in the elasticity measure in our data. In fact, all of the MSAs in our sample are above the median elasticity found in Saiz (2010) for the whole country and 7 of the 10 MSAs are in the top 20 percent of MSAs with the least elasticity in the nation.

3.3.5 Timing of the Control Group

We run a final robustness test in which, instead of comparing the year in which the limit is in effect with the subsequent year, we compare it to the previous year. When we do this, we are comparing houses that are never eligible for an 80 percent conforming loan (those above the threshold) to transactions that initially are not eligible and then become eligible once the limit changes. The research design is the same as before, but we shift the window of analysis one year back. Table 11 shows the Fama-MacBeth coefficients for this specification. The point estimates are smaller than the ones in Table 11, but they are in the same direction and remain statistically significant for the first years in the sample.

3.4 Economic Magnitude of the Effect

To understand the magnitude of our estimated effect, we compute the semi-elasticity of house prices to interest rates, calculated as the percentage change in prices divided by the change in interest rates. The change in the CLL gives us an unbiased local estimate of the numerator of this semi-elasticity. To obtain an estimate of the denominator, we use the differential in interest rates between jumbo and conforming loans, which were estimated in the prior literature.

Table 12 shows our estimates for different scenarios. The change in house prices around the CLL that we estimated ranges from 29 to 82 basis points. We obtain the low of 29 basis points when we use the residuals from the hedonic regressions of value per square foot as the dependent variable and include the whole time period (1998 to 2006). [12]. The high end of the estimate (82 basis points) comes from the specification where we constrain the period to 1998-2001 and use the raw value per square foot as the dependent variable. We

[12] The point estimate in the regressions is 0.65 dollars from Panel C in Table 5 and we scale that by the average value per square foot for the sample to obtain 29 basis point change in value per square foot.

exclude our estimates for the period 2002 to 2005 because since we know that the CLL was less important during that time.

There is an extensive literature that provides estimates of the jumbo-conforming spread, see McKenzie (2002), Ambrose, LaCour-Little and Sanders (2004), Sherlund (2008). The most common estimates that have been found across all the papers range from 13 to 24 basis points. If we divide our estimated range of house price changes by the range in the jumbo-conforming spread we obtain estimates for the elasticity of house prices to interest rates that vary between 1.2 and 6.3 (Table 12). These results are at the lower end of the elasticity that has previously been estimated in the literature (see, for example, Glaeser, Gottlieb and Gyourko, 2010).

The prior calculation is our preferred method of obtaining an estimate of the elasticity. However, we can obtain an alternative estimate of the elasticity by looking at borrowers who choose to obtain a conforming loan of less than 80 percent LTV above the threshold. This means they put up additional equity which either has to be financed through a third party loan or through savings. On average, given the range of transactions in our sample, these borrowers put up an additional USD 5,000. If we assume that the cost of the additional equity is at least 5 percentage points above the conforming mortgage rate this is equivalent to a spread of 6-8 basis points in the total cost of financing for these borrowers relative to those who buy a house below the threshold. This then translates into an elasticity of between 4.5 and 10, depending on the house price effect we use from our regressions. The assumption for the spread of 5 percentage points over the conforming mortgage rate is not high if we consider that many people use a jumbo loan even very close to the threshold of the CLL (indicating that the cost of additional equity is, at least for some borrowers, very substantial). Also, the fact that we see borrowers stick with a conforming loan and put up additional equity may be an indication that they are excluded from the jumbo market altogether, rather than evidence that this option is cheaper. As Loutskina and Strahan (2009, 2010) show, jumbo loans are associated with more careful screening of borrowers, which may mean that many household simply could not use an 80 percent LTV above the threshold of 125 percent of the CLL even if they were looking to do so

Another way of assessing the economic importance of the effect we find is by comparing the dollar amount of savings through lower interest rates and the house price differential we find. Assume a loan of USD 300,000, which is approximately the conforming loan limit midway through our sample (2002). If we use the upper end of the jumbo-conforming spread of 24 basis points, we calculate a cost difference of USD 720 in the first year of the life of the loan. The present value of the cost difference over 30 years is USD 8,557 assuming a 6 percent discount rate. If we use the lower end of the jumbo-conforming spread that has been estimated (13 basis points), this cost difference is USD 4,674. Our estimated effect of the conforming loan is a price difference of USD 1.1 per square foot for an average size of a house of 1,900 square feet. This translates into a USD 2,090 difference in the price of the house. So the savings in the present value of interest costs of USD 4,600-8,500 leads to an increase in the value of the house of about USD 2,000.

One factor that is often raised when estimating house price elasticity is that home buyers might expect the conforming loan limit to rise in the subsequent year and will thus refinance their loan shortly after obtaining it. So, if refinancing were frictionless, buying a house above the threshold would cost 13-24 basis points more than the conforming loan rate for just one year, because borrowers who took a jumbo loan would immediately refinance into a conforming loan in the following year (once the limit was raised). This would imply a very high elasticity of house prices to interest rates, as the difference in the effective interest rate over the life of the loan paid by a borrower who took a conforming loan and one who took a jumbo loan would be very small. However, this analysis misses the transaction costs of refinancing. The estimates of these transaction costs that have been found in the literature are very large. An early paper by Stanton (1995) finds that transaction costs for mortgage prepayment are around 30 to 50 percent of the remaining principal balance of a mortgage. These transaction costs include both explicit monetary costs (about one-sixth of the total costs) and non-monetary prepayment costs (the remaining five-sixths). A more recent paper by Downing, Stanton and Wallace (2005) produced a lower, but still substantial, average transaction cost of refinancing of 11.5 percent of face value. The bottom line from both these studies is clear - transaction costs are too high for the jumbo conforming spread alone to change the prepayment behavior of borrowers significantly. In other words, the lower interest rates from refinancing to a conforming loan in a year or two are too small to overcome the cost of refinancing.

4 Conclusion

In this paper we use the exogenous changes in the annual level of the conforming loan limit as an instrument for easier access to finance and lower cost of credit. We find that a home that becomes eligible for easier access to credit due to an increase in the CLL has on average a 1.1 dollar higher value per square foot compared to a similar quality house that is just above the threshold that allows it to be financed with a conforming loan at 80 percent loan to value. The magnitude of the difference that we find is economically important given the average value per square foot of houses that transact around the CLL of 224 dollars, which means that a 1 dollar increase constitutes almost a 0.5 percent increase in prices. Under our assumptions for the interest rate differential for transactions above and below the threshold, this corresponds to a semi-elasticity of prices to interest rates of less than 10.

Another way of stating our results is to say that the interest rate subsidy granted by the GSEs and, ultimately, the taxpayer, does not fully benefit the buyers of homes and, instead, partially accrues to the sellers of homes in the form of higher house prices.

In addition, we see that the CLL constitutes a first order factor in how houses are financed: there is a significant fraction of borrowers who choose an LTV below 80 percent, between 77 and 79.5 percent, in order to stay below the conforming loan limit. These borrowers either were unable to get a jumbo loan or are trying to take advantage of the lower interest rate of a conforming loan. But, as a result, many borrowers end up holding a larger fraction of equity in their house than most other borrowers.

In line with our expectations, these results are stronger in the earlier part of our sample when borrowers were less likely to have access to other forms of financing such as second liens and when the interest rate differential between jumbo loans and conforming loans was larger. After 2004 in particular we see that the vast majority of borrowers even above the threshold of 125 percent of the CLL choose an LTV of 80 percent, which supports the idea that access to jumbo loans and other forms of financing became much easier in the second half of the sample. At the same time, the house price impact of the conforming loan limit is also smaller in this time period. This suggests that those houses which were previously just out of reach of being financed by a conforming loan at 80 percent could now be bid up in price since people had easier access to jumbo loans and other forms of finance. The CLL lost its importance in terms of price impact in the second half of the sample.

While we can only estimate a local treatment effect around the CLL, this presents a first test of the exogenous effect of cheaper mortgage loans on house prices. We cannot infer from our estimates that credit conditions can fully account for the increase in house prices between 2000 and 2006. In particular, we do not want to claim that the CLL led to *overpricing* of those houses that are eligible for it; it just might have allowed prices to converge to their long run average, if constrained buyers are not able to realize the full value of an asset. However, we do show that those credit conditions matter for the formation of prices. Our results do not support a view that credit market conditions purely respond to housing demand and point instead to a directional effect that easier credit supply leads to an increase in house prices.

5 Appendix 1 - Data Cleaning

In order to clean the raw data received from Dataquick, we perform the following modifications to the data:

Table 0: Data Cleaning Description

Criterion	*Deleted Observations*	*Remaining Observations*
Initial data		**11,884,730**
Transaction value equal to zero	2,806,562	9,078,168
Missing zipcode	9,542	9,068,626
Missing square feet	1,196,026	7,872,600
Mislabeled year	5	7,872,595
Missing property unique identifier	34	7,872,561
First loan greater than transaction value	319,377	7,553,184
House of less than 500 square feet	37,824	7,515,360
Transaction greater than 1,2 MM and smaller than 30 M	306,946	7,208,414
Company owned observation based on Dataquick flag	385,151	6,823,263
Company owned obs based on owner/seller/buyer information	414,749	6,408,514
Simple duplicated transactions	5,641	6,402,873
Value per square feet yearly outliers	129,545	6,273,328
Same property, date and buyer/seller information	10,353	6,262,975
Same property, and date and no seller information	291	6,262,684
Same property, date and transaction value	38,320	6,224,364
Same property, date and A sell to B and B sell to C	19,902	6,204,462
Special transaction, based on Dataquick flag	486	6,203,976
Same property and date, multiple sales in a day	224	6,203,752
Clean data		**6,203,752**
Transaction greater than 600 M and smaller than 130 M	1,451,538	4,752,214
Whole sample for hedonic regressions		**4,752,214**
Remove single family houses	1,064,516	3,687,698
Transactions outside the 10k band for each year	3,458,091	229,607
Regression sample		**229,607**

Note: This table enumerates the steps taken in the data cleaning process and gives the number of observations that are dropped in each step, as well as the remaining observations after each step.

Table 0 shows the number of observations deleted in each step of the data preparation and a basic description of the criterion used to drop those observations from the sample. In the following paragraphs we categorize each step, we describe the criteria we used in detail and provide additional information about the data construction. We start with 11,884,730 observations.

Missing observations and outliers

- We drop records with missing transaction value, house size, zip code, property unique identifier or mislabeled year.

- We drop a record if the house size is smaller than 500 square feet, as well as records with transaction values smaller than three thousand and greater than one million and two hundred thousand dollars.

- Value per square foot outliers per year: We drop observations that are above the ninety-ninth percentile for the value per square foot variable or below the first percentile each year.

Company owned observations

- We drop observations that Dataquick identifies as being bought by a corporation.

- Company owned observations based on owner/seller/buyer information: If the owner, seller or buyer names contain LLC, CORP or LTD the observation is removed from the sample.

Duplicate transactions

- Simple duplicated transactions: Remove records for which all the property information is the same.

- Same property, date and buyer/seller information: Drop observations that are duplicated based on transaction value, date and buyer-seller information.

- Same property and date, no seller information: Drop observations for which the property unique identifier and date are the same and have no seller information.

- Same property, date and transaction value: Drop observations for which property unique identifier, date and transaction value are the same.

- Same property and date and A sells to B and B sells to C: If person A sells to B and B sells to C in the same date, we keep the most recent transaction.

- Special transaction, based on Dataquick flag: This flag allows us to identify records that are not actual transactions. For example, if a transaction was only an ownership transfer without a cash transfer this field is populated, allowing us to delete this transaction.

- Same property and date, multiple sales in a day: If a property is sold more than twice during the same day, we keep only one transaction.

Additional information

- We merge the Metropolitan Statistical Area (MSA) classification obtained from the Census Bureau definition, using FIPS unique code identifier by county[13].
- Change the second lien amount to missing if the first loan amount is equal to the second loan amount, or if second loan amount is greater than the transaction value.
- Change the second lien amount to missing if combined loan to value (CLT) is greater than two and loan to value (LTV) is equal to one.
- Change house age to missing if house age, calculated using transaction year minus year built, is smaller than zero.

This procedure gives us our clean sample with 6,203,752.

Whole Sample for Hedonic Regression Sample

- We further restricted the sample for the hedonic regressions to transactions that are between six hundred thousand and one hundred and thirty thousand dollars. This selection aims to avoid that the estimates from the hedonic regression be driven by transactions that are far from the region of interest.

This gives us our whole sample with 4,752,214 observations that are summarized in Table 1

Regression Sample

- Non-single family houses: Our identification strategy relies on the change in the conforming loan limit for single family houses, therefore we restrict our attention to this type of house.
- Transactions outside the USD 10,000 band for each year: Based on the threshold value for each year that we describe in the Identification Strategy subsection, we define a relevant transaction band around that threshold. For example, in 1999 the house

[13]FIPS county code is a five-digit Federal Information Processing Standard (FIPS) code which uniquely identifies counties and county equivalents in the United States, certain U.S. possessions, and certain freely associated states. The first two digits are the FIPS state code and the last three are the county code within the state or possession.

threshold (1.25 of the conforming loan limit) is 300,000 dollars. Therefore, we keep records with transactions values between 290,000 and 310,000 dollars that happened between 1999 and 2000. This subsample will be the sample used to run the differences-in-differences specification using the 1999 threshold.

This gives us our regression sample with 229,607 observations

6 Appendix 2 - Variable Construction

In this appendix we describe in more detail the variables used in the hedonic regressions. The hedonic regressions use two left-hand side variables: value per square foot and for price of each transaction. As we pointed out in Section 2.2, we use a similar set of controls to those used in Campbell, Giglio and Pathak (2010), and we add a few more characteristics. The variables we use are interior square feet (linearly, squared and cubed), lot size, bedrooms, bathrooms, total rooms, house age (linearly and squared), type of house, an indicator for whether the house was renovated, an indicator for fireplace and parking, indicators for style of building (architectural style and structural style), and additional indicators for type of construction, exterior material, heating and cooling, heating and cooling mechanism, type of roof, view, attic, basement, and garage.
While interior square feet, lot size and age are included as continuous variables, all the other controls are included as indicator variables.

- *Type of house:* This variable is 1 if the house is a single family house and zero if it is a condo or a multifamily property.

- *Bedrooms:* This characteristic is divided into four categories (dummies): one bedroom, two bedrooms, three bedrooms and more than three bedrooms.

- *Bathrooms:* This characteristic is divided into four categories: one bathroom, one and half bathrooms, two bathrooms and more than two bathrooms.

- *Rooms:* This characteristic is divided into five categories (dummies): one room, two rooms, three rooms, four rooms and more than four rooms.

- *Building Shape, Architectural Code, Structural Code, Exterior Material, Construction Code, Roof Code, View Code:* These characteristics were divided based on the numeric categorization of the original field. For example, construction code was divided into 10 different categories that indicated the material used on the framework of the building. In this case, we created 10 dummies based on this categorization.

· *Heating and cooling:* This information was divided into four categories: only heating, only cooling, both heating and cooling and heating-cooling information missing. The last variable was created to avoid dropping transactions for which the information was not available.

· *Heating and cooling type:* These characteristics were divided based on the numeric categorization of the original field. In this case they discriminate the type of cooling or heating system that is being used in the house.

· *Garage and Garage Carport:* A dummy is created to account for houses that have garage surface greater than 50 square feet. For those transactions without the information a missing dummy is created for this category. Finally, we used additional information to create a dummy that indicates if the houses have a garage carport or not.

· *Renovation:* This variable accounts for the number of years since the last renovation. Based on this continuous variable five categories (dummies) are defined: missing renovation if the renovation date is missing or renovation period is negative, last renovation in less than 10 years, renovated between 10 and 20 years, renovated between 20 and 30 years , and last renovation in more than or equal to 30 years.

· *Attic:* This characteristic is accounted for using a dummy for houses with an attic greater than 50 square feet, and another dummy to account for missing information about the attic in the houses.

· *Basement Finished and Unfinished:* For the finished basement information we created a dummy for houses with basement size greater than 100 square feet, and another dummy to account for missing information about the finished basement. The same procedure is used to incorporate the information about unfinished basement.

We use both the price of a transaction as well as the value per square foot as our dependent variables. By estimating these regressions by year and by Metropolitan Statistical Areas (MSA) we allow the coefficients on the characteristics to vary along these two dimensions. We included monthly indicator variables to account for seasonality in the housing market, as well as zip code fixed effects. The set of controls X_i is composed of all the variables described above, but in the case of the value per square foot regression we exclude the interior square feet continuous variables.

$$LHS_i = \gamma_0 + \Gamma X_i + month_i + zipcode_i + \varepsilon_i$$

When a record is missing the interior square feet, the lot size, the number of bedrooms or bathroom or information on a houses age, we do not include this observation in the hedonic regressions. This explains the difference between the number of observations for the value per square foot hedonic regressions (where we exclude interior square footage) and the transaction value residual in table 5.

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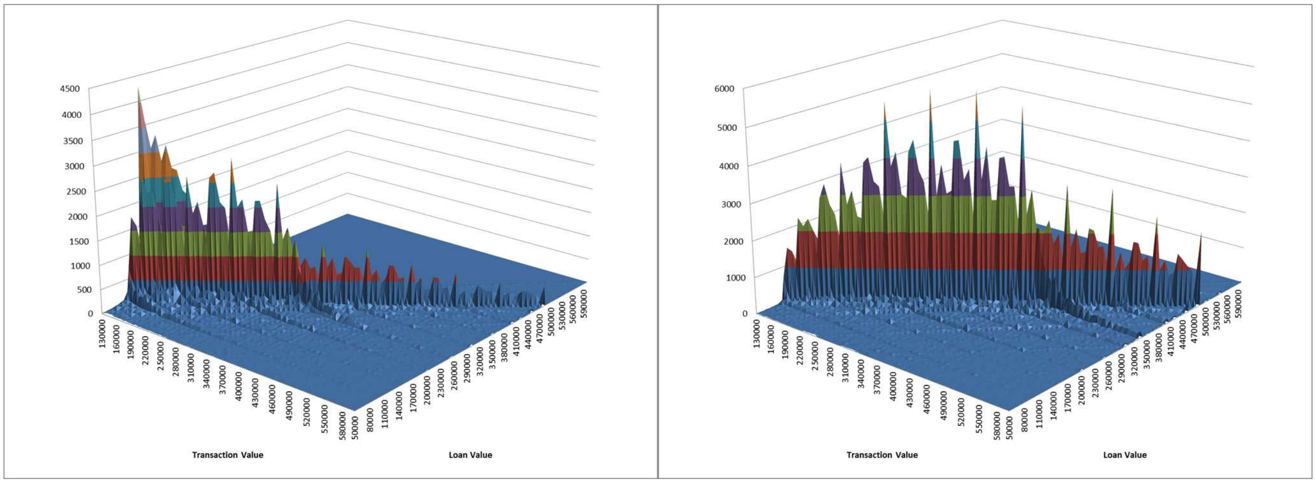
Figure 1: Transaction-Loan Value Surface

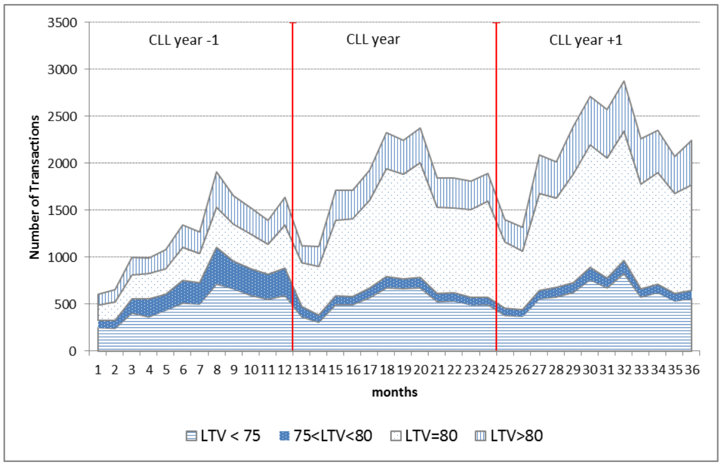
(a) 2000 (b) 2004



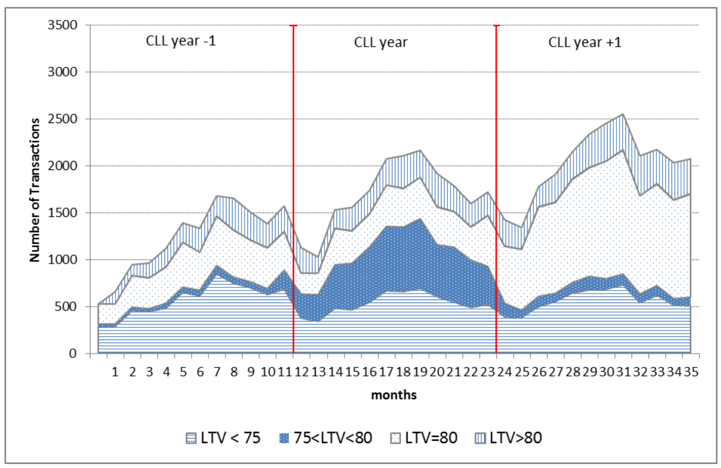
Note: This figure shows the frequency of transactions at each house price-loan value combination for the year 2000 and 2004, and the 10 MSAs covered in our data, where both house prices and loan values were binned at USD 10,000 intervals. The mass of transactions on the diagonal have a loan to value of approximately 0.8.

Figure 2: Borrower Composition for the Regression Sample

(a) Transactions below 125 percent of CLL

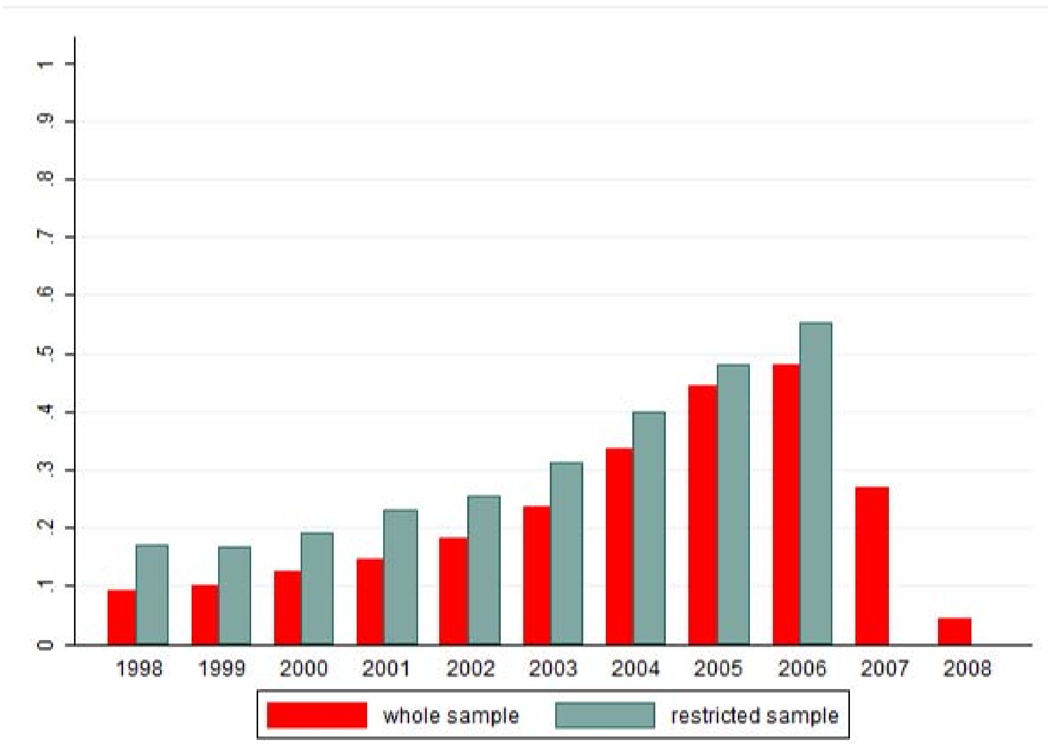


(b) Transactions above 125 percent of CLL



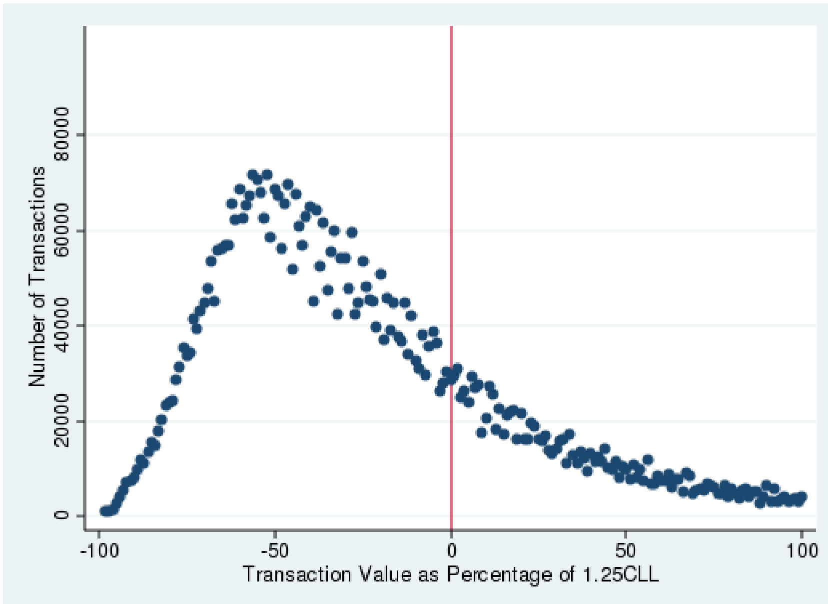
Note: This figure shows the number of transactions by month for transactions within USD 10,000 of the threshold of 125 percent of CLL. Transactions below and above this threshold are tracked from the year prior to the CLL being in effect to the year after the CLL is lifted to its new value. We break down transactions by LTV range to show the differences that emerge between houses above and below 125 percent of the CLL.

Figure 3: Fraction of Transactions with a Second Lien Loan by Year



Note: This figure shows the average fraction of transactions with a second lien loan by year for the whole sample and the restricted sample used in the regression. Years 2007 and 2008 are excluded from the regression sample because there was no change on the conforming loan limits on those years

Figure 4: Frequency of Transactions as Percentage of CLL Threshold



Note: This figure shows the frequency of transactions by their distance to the threshold of 125 percent of the conforming loan limit. The vertical red line is the threshold and the transactions for all years are centered around that value. The x-axis is represented as one minus the transaction value as a percentage of each year's threshold of 125 percent of the conforming loan limit (e.g. if the threshold is 200,000, a transaction of 150,000 will appear as -25 percent).

Figure 5: Value per Square Foot by House Value and by ZIP Code Income

Note: This figure shows the average value per square foot plotted against the value of the house. We split ZIP codes into quartiles according to their median income, where 1 includes the ZIP codes in the lowest income quartile and 4 includes the ZIP codes with the highest median income. We use the average of the median yearly income over the whole sample to place ZIP codes into the quartiles. The x-axis is represented as one minus the transaction value as a percentage of each year's threshold of 125 percent of the conforming loan limit (e.g. if the threshold is 200,000, a transaction of 150,000 will appear as -25 percent). The vertical red line is the threshold and the transactions for all years are centered around that value.

Table 1: Summary Statistics

Panel A. House Characteristics.

	Whole Sample N=4,752,214			Restricted Sample N=229,607		
	Mean	*Std. Dev.*	*Median*	*Mean*	*Std. Dev.*	*Median*
Transaction Value (USD 1000)	298.72	122.45	275.00	369.37	54.98	375.00
Loan to value	0.81	0.15	0.80	0.76	0.13	0.80
House Size (sqft)	1,603	630	1,463	1,887	681	1,765
Lot Size (sqft)	8,669	15,299	5,998	11,539	17,323	7,200
Number of rooms	6.54	1.69	6.00	7.19	1.62	7.00
Number of bedrooms	2.94	0.86	3.00	3.30	0.78	3.00
Number of bathrooms	1.92	1.00	2.00	2.05	1.04	2.00
House age (years)	34.56	26.35	30.00	36.59	26.90	36.00

Panel B. House Valuation.

	Whole Sample N=4,752,214			Restricted Sample N=229,607		
	Mean	*Std. Dev.*	*Median*	*Mean*	*Std. Dev.*	*Median*
Value per sqft (USD/sqft)	203.21	96.42	180.47	223.93	94.98	205.45
Value per sqft residual (USD/sqft	0.00	43.60	-1.34	5.60	46.13	3.31
Transaction value residual (USD)	0	53,690	-751	4,200	47,433	4,868

Note: Panel A shows the descriptive statistics for all transactions in our data from 1998 to 2008. The data was extracted from deeds records by Dataquick. Panel B shows the different valuation measures we use in the regression analysis. Value per sqft is the transaction amount divided by the size of the house measured in square feet. Both the residual measures are obtained from hedonic regressions run by year and by metropolitan area of value per sqft and transaction value on a set of detailed house characteristics. We give more information on the construction of the residuals in Section 2, Data and Methodology.

Table 2: Summary Statistics by Geography and Year

Panel A. Geographic Distribution

MSA		Transaction Value		Value per sqft		Loan to Value	
	N Obs	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*
Boston	332,791	309.98	113.03	216.34	86.75	0.78	0.16
Chicago	405,725	258.31	106.53	174.00	67.92	0.81	0.15
DC	557,312	307.22	118.58	200.36	91.61	0.83	0.14
Denver	416,826	238.42	91.61	156.47	50.38	0.84	0.15
Las Vegas	280,192	238.16	96.03	132.10	46.23	0.82	0.14
Los Angeles	988,823	321.70	127.51	235.86	106.66	0.81	0.13
Miami	610,156	253.30	107.06	153.71	65.03	0.81	0.14
New York	499,782	337.48	121.30	226.22	97.51	0.78	0.17
San Diego	302,206	332.05	123.01	230.93	95.85	0.80	0.14
San Francisco	358,401	370.07	123.97	277.25	110.43	0.78	0.13
Total	4,752,214	298.72	122.45	203.21	96.42	0.81	0.15

Panel B. Distribution By Year and Thresholds

Year		Thresholds		Transaction Value		Value per sqft		Loan to Value	
	N Obs	*House Price*	*Conf. Loan*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*
1998	156,729	283,938	227,150	236.85	100.53	138.20	53.11	0.81	0.15
1999	418,980	300,000	240,000	242.42	103.15	143.51	56.14	0.81	0.15
2000	431,831	315,875	252,700	252.22	107.49	154.34	63.98	0.81	0.16
2001	449,992	343,750	275,000	258.37	107.17	161.40	65.20	0.82	0.15
2002	495,545	375,875	300,700	275.47	112.55	177.20	73.63	0.81	0.15
2003	518,138	403,375	322,700	294.09	116.43	196.85	81.91	0.81	0.15
2004	630,352	417,125	333,700	320.33	120.84	225.65	95.43	0.79	0.14
2005	567,804	449,563	359,650	344.59	123.74	253.26	106.45	0.78	0.13
2006	434,905	521,250	417,000	352.65	124.02	262.69	109.34	0.79	0.13
2007	337,265	521,250	417,000	347.97	123.63	253.64	106.18	0.82	0.15
2008	310,673	521,250	417,000	317.13	119.91	222.15	95.34	0.84	0.15
Total	4,752,214			298.72	122.45	203.21	96.42	0.81	0.15

Note: This table uses all the deed registry data on house transactions for 10 MSAs. Panel A shows the mean and standard deviation by city of (i) house price, (ii) value per sqft and (iii) loan to value. Panel B the mean and standard deviation by year for the same three variables.

Table 3: Verification of the Impact of the CLL on Financing Choices

Panel A: Loan to Value

	All Transactions			0.5<LTV≤0.8 Transactions		
	All years	*1998-2001*	*2002-2005*	*All years*	*1998-2001*	*2002-2005*
Above Threshold	-0.004***	-0.006***	-0.002***	0.000	0.000	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Year CLL	-0.008***	-0.006**	-0.011***	-0.004***	-0.001	-0.007***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Above Threshold x	-0.003**	-0.003	-0.003*	-0.005***	-0.005***	-0.005***
Year CLL	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
No. Obs.	212,392	92,173	120,219	166,888	68,951	97,937

Panel B: Loan Amount

	All Transactions			0.5<LTV≤0.8 Transactions		
	All years	*1998-2001*	*2002-2005*	*All years*	*1998-2001*	*2002-2005*
Above Threshold	6,000***	4,574***	7,426***	6,771***	6,822***	6,721***
	(768)	(1,163)	(218)	(180)	(285)	(262)
Year CLL	-2,318**	-2,290	-2,347**	-1,683***	-368	-2,997***
	(914)	(1,748)	(918)	(539)	(338)	(302)
Above Threshold x	-2,097**	-1,303	-2,892***	-1,795***	-1,709***	-1,882***
Year CLL	(869)	(1,571)	(795)	(290)	(383)	(490)
No. Obs.	229,607	99,983	129,624	166,888	68,951	97,937

Note: This table shows Fama MacBeth coefficients computed from year by year regressions that use two measures of financing choice as the dependent variable in each of the two panels. The sample for the first three columns includes all transactions within USD 10,000 of each year's conforming loan limit, as well as transactions of the same amount in the subsequent year. The last three columns in each panel restrict the sample to transactions with an LTV between 0.5 and 0.8. Above the Threshold refers to transactions up to USD 10,000 above the conforming loan limit divided by 0.8 (i.e. the transactions that were "ineligible" to be bought with a conforming loan at a full 80 percent LTV) and Year CLL is the year in which the conforming loan limit is in effect.

Table 4: Impact of CLL on Number of Transactions

	All Transactions			0.5<LTV≤0.8 Transactions		
	All years	*1998-2001*	*2002-2005*	*All years*	*1998-2001*	*2002-2005*
Year CLL	-0.002***	0.000	-0.004***	-0.004***	-0.003***	-0.004***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No. Obs.	229,607	99,983	129,624	166,888	68,951	97,937

Note: This table shows Fama MacBeth coefficients computed from year by year regressions that use a dummy variable for whether a transaction happens above the threshold of 125 percent of the CLL as the dependent variable. The sample for the first three columns includes all transactions within USD 10,000 of each year's conforming loan limit, as well as transactions of the same amount in the subsequent year. The last three columns in each panel restrict the sample to transactions with an LTV between 0.5 and 0.8. Year CLL is the year in which the conforming loan limit is in effect.

Table 5: Effect of the CLL on House Valuation Measures

Panel A: Value Per Square Foot

	All years	*1998-2001*	*2002-2005*
Above Threshold	1.261**	1.470***	1.052
	(0.561)	(0.471)	(1.103)
Year CLL	-23.516***	-14.931***	-32.101***
	(4.225)	(2.328)	(5.364)
Above Threshold x	-1.113***	-1.359***	-0.867
Year CLL	(0.281)	(0.188)	(0.540)
No. Obs.	229,607	99,983	129,624

Panel B: Transaction Value Residual from Hedonic Regressions

	All years	*1998-2001*	*2002-2005*
Above Threshold	4,235.3***	4,092.1***	4,378.5***
	(181.8)	(103.4)	(360.3)
Year CLL	12,077.9***	9,107.2***	15,048.7***
	(1,876.7)	(1,324.9)	(2,966.0)
Above Threshold x	-331.1*	-415.5	-246.7
Year CLL	(172.8)	(323.0)	(174.0)
No. Obs.	221,195	94,645	126,550

Panel C: Value Per Square Foot Residual from Hedonic Regressions

	All years	*1998-2001*	*2002-2005*
Above Threshold	1.603***	1.918***	1.289*
	(0.405)	(0.415)	(0.725)
Year CLL	3.590***	3.456***	3.723***
	(0.658)	(0.472)	(1.337)
Above Threshold x	-0.646**	-0.985***	-0.308
Year CLL	(0.278)	(0.371)	(0.383)
No. Obs.	221,469	94,791	126,678

Note: This table shows Fama MacBeth coefficients computed from year by year regressions that use three alternative measures of valuation as the dependent variable in each of the three panels. The hedonic regressions that produce the residuals for panels B and C are described in Section 2.2. The sample for each year's regression includes all transactions within +/- USD 10,000 of that year's conforming loan limit, as well as transactions in the same band in the subsequent year. All year by year regressions include ZIP code fixed effects. Above the Threshold refers to transactions up to USD 10,000 above the conforming loan limit divided by 0.8 (i.e. the transactions that were "ineligible" to be bought with a conforming loan at a full 80 percent LTV) and Year CLL is the year in which the conforming loan limit is in effect.

Table 6: Effect of the CLL on House Valuation in Different Income Growth Areas

Panel A: Value Per Square Foot

	2001-2005	*2001-2005*
Above Threshold	0.886	0.889
	(0.853)	(0.831)
Year CLL	-29.713***	-31.802***
	(4.842)	(4.174)
Above Threshold x	-0.990**	-0.933**
Year CLL	(0.432)	(0.370)
Above Threshold x		-2.206**
Year CLL x Inc Decrease		(1.060)
No. Obs.	157,472	157,472

Panel B: Transaction Value Residual from Hedonic Regressions

	2001-2005	*2001-2005*
Above Threshold	4,264.0***	4,274.9***
	(275.1)	(279.7)
Year CLL	14,357.8***	14,823.8***
	(2,404.3)	(2,722.9)
Above Threshold x	-235.8	-477.8*
Year CLL	(198.8)	(270.5)
Above Threshold x		-1,838.3
Year CLL x Inc Decrease		(1,194.9)
No. Obs.	152,878	152,878

Panel C: Value Per Square Foot Residual from Hedonic Regressions

	2001-2005	*2001-2005*
Above Threshold	1.263**	1.118**
	(0.539)	(0.528)
Year CLL	3.780***	3.810***
	(1.044)	(1.190)
Above Threshold x	-0.482	-0.437
Year CLL	(0.312)	(0.299)
Above Threshold x		-0.304
Year CLL x Inc Decrease		(1.045)
No. Obs.	153,048	153,048

Note: This table shows Fama MacBeth coefficients computed from year by year regressions that use three alternative measures of valuation as the dependent variable in each of the three panels. The sample for each year's regression includes all transactions within +/- USD 10,000 of that year's conforming loan limit, as well as transactions in the same band in the subsequent year. Above the Threshold refers to transactions up to USD 10,000 above the conforming loan limit divided by 0.8 (i.e. the transactions that were "ineligible" to be bought with a conforming loan at a full 80 percent LTV) and Year CLL is the year in which the conforming loan limit is in effect. "Inc Decrease" is an indicator variable that is a 1 when a zip code has negative average income growth in a year and a 0 otherwise. The specification shown here includes the same variables as Table 5, as well as the "Inc Decrease" variable linearly (not shown), its interaction with "Above the Threshold" and "Year CLL" (not shown) and the triple interaction of all three variables. Because of data limitations, this regression is restricted to the period of 2001 to 2005. The first column repeats our canonical specification from Table 5 for the period of 2001-2005 for comparison purposes and the second column includes the triple difference specification.

Table 7: Effect of the CLL on House Valuation Measures, Constrained Sample (0.5<LTV≤0.8)

Panel A: Value Per Square Foot

	All years	*1998-2001*	*2002-2005*
Above Threshold	0.938*	1.495***	0.381
	(0.493)	(0.509)	(0.818)
Year CLL	-25.240***	-15.985***	-34.494***
	(4.555)	(2.607)	(5.739)
Above Threshold x	-1.189**	-1.448***	-0.929
Year CLL	(0.466)	(0.558)	(0.810)
No. Obs.	166,888	68,951	97,937

Panel B: Transaction Value Residual from Hedonic Regressions

	All years	*1998-2001*	*2002-2005*
Above Threshold	3,828.1***	4,028.5***	3,627.7***
	(230.8)	(253.1)	(397.2)
Year CLL	11,401.2***	8,626.3***	14,176.2***
	(1,733.9)	(1,056.8)	(2,789.2)
Above Threshold x	-365.9	-601.5	-130.2
Year CLL	(332.1)	(611.3)	(322.5)
No. Obs.	161,880	65,827	96,053

Panel C: Value Per Square Foot Residual from Hedonic Regressions

	All years	*1998-2001*	*2002-2005*
Above Threshold	1.405***	1.905***	0.905
	(0.377)	(0.403)	(0.578)
Year CLL	2.834***	2.976***	2.692**
	(0.550)	(0.365)	(1.123)
Above Threshold x	-0.851**	-1.100***	-0.602
Year CLL	(0.354)	(0.421)	(0.606)
No. Obs.	162,002	65,889	96,113

Note: This table shows Fama Macbeth coefficients computed from year by year regressions that use three alternative measures of valuation as the dependent variable in each of the three panels. The hedonic regressions that produce the residuals for panels B and C are described in Section 2.2. The sample for each year's regression includes transactions within +/- USD 10,000 of that year's conforming loan limit, as well as transactions in the same band in the subsequent year. Unlike Table 5, the sample for these regressions is constrained to transactions with an LTV between 0.5 and 0.8. All year by year regressions include ZIP code fixed effects. Above the Threshold refers to transactions up to USD 10,000 above the conforming loan limit divided by 0.8 (i.e. the transactions that were "ineligible" to be bought with a conforming loan at a full 80 percent LTV) and Year CLL is the year in which the conforming loan limit is in effect.

Table 8: Placebo Test for Coefficient of Interest

	All Transactions			*0.5<LTV≤0.8 Transactions*		
Shift on CLL	*Value Per Square Foot*	*Transaction Value Residual*	*Value Per Square Foot Residual*	*Value Per Square Foot*	*Transaction Value Residual*	*Value Per Square Foot Residual*
-100000	0.295	1,756.0	1.305	-0.607	1,750.5	1.078
-90000	0.310	145.9	-0.169	0.540	245.2	-0.049
-80000	-0.440	332.1	0.009	-0.833	-81.2	-0.105
-70000	-0.260	122.6	0.221	-0.254	-9.2	0.046
-60000	-0.294	633.3	0.229	-0.186	634.0	0.346
-50000	0.417	468.6	0.198	0.296	569.6	-0.130
-40000	-0.502	336.9	0.036	-0.241	219.4	0.366
-30000	-0.500	-317.0	-0.411	-0.526	-211.1	-0.536
-20000	-0.258	630.2	0.478	-0.341	517.7	0.409
-10000	0.287	84.8	-0.059	0.063	11.8	-0.167
CLL (0)	*-1.113*	*-331.1*	*-0.646*	*-1.189*	*-365.9*	*-0.851*
10000	0.820	399.1	0.243	0.834	238.7	0.164
20000	0.541	481.3	0.254	0.044	204.2	0.123
30000	0.581	756.0	0.312	0.415	574.3	0.010
40000	-0.962	-472.1	-0.968	-0.481	-102.8	-0.683
50000	0.256	130.9	-0.110	-0.322	-217.3	-0.669
60000	0.814	1,304.2	1.068	0.459	1,095.0	0.855
70000	0.915	257.4	0.623	0.851	-80.0	0.284
80000	0.532	403.0	0.284	0.339	367.4	0.317
90000	-0.067	-270.3	-0.098	-0.072	-655.7	-0.034
100000	0.010	-417.2	-0.250	0.001	-140.0	-0.308
CLL Rank	1	3	2	1	2	1
CLL Rank below only	1	1	1	1	1	1

Note: This table shows the Fama MacBeth coefficients for a series of 20 placebo tests we perform by shifting the conforming loan limit in USD 10,000 intervals from CLL-100,000 until CLL+100,000 (i.e. the limits of all years are first changed by -100,000, then by -90,000, etc.). We use these placebo loan limits to run year-by-year regressions and form Fama-MacBeth coefficients like those in Table 5 for each set of "false" loan limits. The three columns correspond to the three dependent variables we use in Tables 5 and 7. The coefficient of interest is on the interaction between our "above threshold" variable and the year in which the conforming loan limit is in effect. As in the previous tables, the sample for each year's regression includes transactions within +/- USD 10,000 of that year's CLL, as well as transactions in the same band in the subsequent year. The first three columns include all such transactions, whereas in the last three columns the sample is constrained to transactions with an LTV between 0.5 and 0.8. All year by year regressions include ZIP code fixed effects. The last two rows show the ranking of the coefficient when we use the true CLL, first for all 21 coefficients and then when we only consider the placebo tests below the true CLL.

Table 9: Effect of the CLL on the Valuation of Different Groups of Transactions

Panel A: Value Per Square Foot

	Keeping Conforming			Keeping Jumbo		
	All years	*1998-2001*	*2002-2005*	*All years*	*1998-2001*	*2002-2005*
Above Threshold	0.924*	1.487***	0.361	0.855*	1.462***	0.249
	(0.509)	(0.521)	(0.851)	(0.515)	(0.508)	(0.856)
Year CLL	-25.130***	-16.008***	-34.252***	-25.397***	-16.059***	-34.735***
	(4.513)	(2.587)	(5.736)	(4.588)	(2.622)	(5.763)
Above Threshold x	-0.873**	-1.075***	-0.671	-2.189***	-2.756**	-1.621
Year CLL	(0.405)	(0.367)	(0.777)	(0.756)	(1.204)	(1.000)
No. Obs.	155,826	66,338	89,488	142,131	58,451	83,680

Panel B: Transaction Value Residual from Hedonic Regressions

	Keeping Conforming			Keeping Jumbo		
	All years	*1998-2001*	*2002-2005*	*All years*	*1998-2001*	*2002-2005*
Above Threshold	3,834.0***	4,025.5***	3,642.5***	3,845.1***	4,057.7***	3,632.5***
	(230.1)	(261.7)	(392.5)	(222.7)	(213.9)	(394.5)
Year CLL	11,461.2***	8,651.9***	14,270.5***	11,518.9***	8,706.8***	14,331.0***
	(1,759.8)	(1,077.2)	(2,833.8)	(1,751.5)	(1,082.8)	(2,805.6)
Above Threshold x	-660.8**	-469.7	-852.0***	-2.1	-1,091.3	1,087.2**
Year CLL	(299.1)	(541.4)	(316.4)	(580.3)	(766.2)	(439.8)
No. Obs.	151,056	63,320	87,736	138,059	55,885	82,174

Panel C: Value Per Square Foot Residual from Hedonic Regressions

	Keeping Conforming			Keeping Jumbo		
	All years	*1998-2001*	*2002-2005*	*All years*	*1998-2001*	*2002-2005*
Above Threshold	1.418***	1.902***	0.933	1.428***	1.958***	0.898
	(0.373)	(0.408)	(0.573)	(0.390)	(0.393)	(0.606)
Year CLL	2.918***	2.983***	2.853**	2.909***	3.031***	2.787**
	(0.576)	(0.376)	(1.185)	(0.566)	(0.360)	(1.165)
Above Threshold x	-1.318***	-1.148**	-1.488**	0.130	-0.858	1.118
Year CLL	(0.392)	(0.507)	(0.663)	(0.602)	(0.609)	(0.819)
No. Obs.	151,171	63,380	87,791	138,147	55,930	82,217

Note: This table shows Fama Macbeth coefficients computed from year by year regressions that use three alternative measures of valuation as the dependent variable in each of the three panels. The hedonic regressions that produce the residuals for panels B and C are described in Section 2.2. The sample for each year's regression includes transactions within +/- USD 10,000 of that year's conforming loan limit, as well as transactions in the same band in the subsequent year and the sample is further constrained to transactions with an LTV between 0.5 and 0.8. All year by year regressions include ZIP code fixed effects. We divide the transactions that happen at a price above 125 percent of a year's CLL in the year that the limit is in effect into two groups: those with a conforming loan and those with a jumbo loan. We then run the same regressions including just one of these two groups at a time. The first three columns include the transactions with a conforming loan and the last three columns include transactions with a jumbo loan. Above the Threshold refers to transactions up to USD 10,000 above the conforming loan limit divided by 0.8 (i.e. the transactions that were "ineligible" to be bought with a conforming loan at a full 80 percent LTV) and Year CLL is the year in which the conforming loan limit is in effect.

Table 10: Effect of the CLL on Valuation in Low Supply Elasticity Areas (Elasticity≤1)

Panel A: Value Per Square Foot

	All	*All*	*1998-2001*	*1998-2001*	*2002-2005*	*2002-2005*
Above Threshold	1.261**	0.751	1.470***	2.344***	1.052	-0.842
	(0.561)	(0.890)	(0.471)	(0.836)	(1.103)	(1.144)
Year CLL	-23.516***	-16.421***	-14.931***	-8.017***	-32.101***	-24.825***
	(4.225)	(4.310)	(2.328)	(0.937)	(5.364)	(6.223)
Above Threshold x	-1.113***	0.310	-1.359***	-1.436	-0.867	2.056*
Year CLL	(0.281)	(1.055)	(0.188)	(1.290)	(0.540)	(1.222)
Above Threshold x		-1.708		0.104		-3.521**
Year CLL x Low Elasticity		(1.262)		(1.809)		(1.404)
No. Obs.	229,607	229,607	229,607	229,607	229,607	229,607

Panel B: Transaction Value Residual from Hedonic Regressions

	All	*All*	*1998-2001*	*1998-2001*	*2002-2005*	*2002-2005*
Above Threshold	4,235.3***	3,578.1***	4,092.1***	5,026.0***	4,378.5***	2,130.1**
	(181.8)	(864.7)	(103.4)	(1,086.4)	(360.3)	(954.9)
Year CLL	12,077.9***	8,422.1***	9,107.2***	8,140.8***	15,048.7***	8,703.4***
	(1,876.7)	(1,193.0)	(1,324.9)	(769.2)	(2,966.0)	(2,448.9)
Above Threshold x	-331.1*	846.1	-415.5	-431.5	-246.7	2,123.7***
Year CLL	(172.8)	(891.6)	(323.0)	(1,441.6)	(174.0)	(737.3)
Above Threshold x		-1,473.5		-19.7		-2,927.4***
Year CLL x Low Elasticity		(1103.548)		(1792.068)		(1,030.8)
No. Obs.	221,195	221,195	221,195	221,195	221,195	221,195

Panel C: Value Per Square Foot Residual from Hedonic Regressions

	All	*All*	*1998-2001*	*1998-2001*	*2002-2005*	*2002-2005*
Above Threshold	1.603***	1.256**	1.918***	2.432***	1.289*	0.080
	(0.405)	(0.533)	(0.415)	(0.111)	(0.725)	(0.627)
Year CLL	3.590***	1.382*	3.456***	3.151***	3.723***	-0.387
	(0.658)	(0.782)	(0.472)	(0.363)	(1.337)	(0.799)
Above Threshold x	-0.646**	-0.244	-0.985***	-1.519***	-0.308	1.031
Year CLL	(0.278)	(0.621)	(0.371)	(0.440)	(0.383)	(0.722)
Above Threshold x		-0.499		0.656		-1.654*
Year CLL x Low Elasticity		(0.757)		(0.982)		(0.906)
No. Obs.	221,469	221,469	221,469	221,469	221,469	221,469

Note: This table shows Fama MacBeth coefficients computed from year by year regressions that use three alternative measures of valuation as the dependent variable in each of the three panels. The sample for each year's regression is the same as the one used in Tables 5, 6 and 7 and the variables are defined the same way as in those tables. "Low Elasticity" is an indicator variable that is a 1 in Metropolitan Statistical Areas with an elasticity below 1 (Las Vegas, Denver and Washington, DC). The specification shown here includes the "Low Elasticity" variable linearly (not shown), its interaction with "Above the Threshold" and "Year CLL" (not shown) and the triple interaction of all three variables.

Table 11: Effect of CLL on Alternative Valuation Measures - Different Control Group

Panel A: Value Per Square Foot

	All Transactions			0.5<LTV≤0.8 Transactions		
	All years	*1999-2002*	*2003-2006*	*All years*	*1999-2002*	*2003-2006*
Below Threshold	0.053	0.016	0.090	0.498*	0.573	0.423
	(0.304)	(0.240)	(0.612)	(0.272)	(0.422)	(0.403)
Pre-Year CLL	-24.510***	-15.724***	-33.296***	-25.632***	-16.932***	-34.333***
	(4.682)	(2.724)	(6.588)	(4.837)	(2.762)	(7.148)
Below Threshold X	-0.294	-1.068*	0.480	-0.678*	-1.014***	-0.343
Pre-Year CLL	(0.628)	(0.629)	(1.023)	(0.393)	(0.234)	(0.768)
No. Obs.	203,559	88,599	114,960	151,425	62,675	88,750

Panel B: Transaction Value Residual from Hedonic Regressions

	All Transactions			0.5<LTV≤0.8 Transactions		
	All years	*1999-2002*	*2003-2006*	*All years*	*1999-2002*	*2003-2006*
Below Threshold	-3,892.0***	-3,338.4***	-4,445.5***	-3,413.7***	-2,766.3***	-4,061.0***
	(386.3)	(415.5)	(565.2)	(451.2)	(623.7)	(530.7)
Pre-Year CLL	12,061.4***	9,920.4***	14,202.5***	11,895.7***	9,467.2***	14,324.1***
	(1,829.3)	(1,155.0)	(3,350.5)	(1,882.1)	(1,546.6)	(3,194.8)
Below Threshold X	-230.3	-1,018.2*	557.6	-725.3	-1,274.6	-176.0
Pre-Year CLL	(537.0)	(606.3)	(751.1)	(499.9)	(856.9)	(480.2)
No. Obs.	196,164	83,780	112,384	146,846	59,712	87,134

Panel C: Value Per Square Foot Residual from Hedonic Regressions

	All Transactions			0.5<LTV≤0.8 Transactions		
	All years	*1999-2002*	*2003-2006*	*All years*	*1999-2002*	*2003-2006*
Below Threshold	-0.773***	-0.708***	-0.838	-0.386**	-0.321	-0.451
	(0.300)	(0.155)	(0.627)	(0.196)	(0.254)	(0.333)
Pre-Year CLL	2.682***	2.820***	2.545*	2.357***	2.145***	2.570**
	(0.704)	(0.494)	(1.434)	(0.560)	(0.568)	(1.054)
Below Threshold X	-0.084	-0.846***	0.678	-0.536**	-0.948***	-0.124
Pre-Year CLL	(0.509)	(0.232)	(0.877)	(0.251)	(0.169)	(0.391)
No. Obs.	196,474	83,959	112,515	147,006	59,802	87,204

Note: Table shows Fama McBeth coefficients computed from year by year regressions that use three alternative measures of valuation as the dependent variable in each of the three panels. The sample includes all transactions within USD 10,000 of each year's conforming loan limit, as well as transactions of the same amount in the *previous year* (unlike the previous tables where we use the subsequent year). In this table we include the results for all transactions, as well as those for the sample that is restricted to having an LTV between 0.5 and 0.8. Below the Threshold refers to transactions up to USD 10,000 below the conforming loan limit at year t divided by 0.8 (i.e. the transactions that were "eligible" to be bought with a conforming loan at a full 80 percent LTV in year t , but were "ineligible" in year t-1) and Pre-Year CLL is the previous year in which the conforming loan limit is in effect. This specification makes the interaction coefficient directly comparable to the main regression on signs and magnitudes.

Table 12: Estimates of Price Elasticity to Interest Rates

	Jumbo-Conforming Spread	
Δ House Prices in bp	*Min (13 bp)*	*Max (24 bp)*
Max: 81.7	6.3	3.4
Min: 29.0	2.2	1.2

Note: This table shows elasticity calculations for different scenarios of both the house price increase estimated in the regressions and the interest rate differential implied for transactions above and below the threshold of 125 percent of the conforming loan limit. We use the jumbo-conforming spread in mortgage rates as the denominator in the elasticity calculation.