The Effect of Government Mortgage Guarantees on Homeownership

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December 20, 2018

Abstract

The U.S. government guarantees a majority of residential mortgages, which is often justified as a means to promote homeownership. In this paper we use detailed property-level data to estimate the effect of government mortgage guarantees on homeownership by exploiting changes in the conforming loan limits (CLLs). We find that CLL changes have a substantial effect on government guarantees, but find no robust effect on homeownership. This suggests that government guarantees could be considerably reduced with modest effects on the homeownership rate. Our finding is particularly relevant for housing finance reform plans that propose to gradually reduce the government's involvement in the mortgage market by reducing the CLLs.

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1 Introduction

A vast majority of residential mortgages in the U.S. are guaranteed by the government through the Government Sponsored Enterprises (GSEs), Freddie Mac and Fannie Mae, and the Federal Housing Administration (FHA). The large presence of the government in mortgage financing is controversial because it exposes taxpayers to the risks of the mortgage market. Indeed, the two GSEs went into conservatorship during the financial crisis in 2008 and received $187 billion from taxpayers.[1]

The government's involvement in mortgage financing is often justified with the goal of making mortgage credit more available and thereby promoting homeownership. Indeed, the GSEs and the FHA state explicitly that homeownership is one of their goals.[2] On the one hand, government guarantees could raise homeownership by providing access to mortgage credit to borrowers who would otherwise not meet the underwriting standards, or by lowering the interest rates. On the other hand, government guarantees could have no effect on homeownership and only benefit existing homeowners or new homeowners who would have bought a house even without government guarantees. This raises the question whether and how much government mortgage guarantees increase homeownership.

In this paper we estimate the effect of government mortgage guarantees on homeownership by exploiting changes in the conforming loan limits (CLLs). The CLL for a county is the maximum loan size that can be guaranteed by the government. To obtain the effect of government guarantees on homeownership we separately estimate the effect of CLL changes on government guarantees and on homeownership. Dividing the effect on homeownership by the effect on government guarantees yields the effect of government guarantees on homeownership.

We use geographic variation in CLL changes. The CLLs were increased in 2008, and the increase was larger in counties with higher median house prices.[3] In 2011 the CLLs were partially reduced, and again these reductions were larger in counties with high median house prices. The intention of these CLL changes was not to increase homeownership, but to temporarily support the housing market. Nevertheless these changes provide useful geographic variation that can be used to estimate the effect on homeownership.

The potential problem with using variation in the CLL changes is that the changes were not

[1]Since then however, the GSEs have paid more than $270 billion of their profits to the treasury.

[2]For example, the mission of the HUD Office of Housing, which oversees the FHA, includes to "maintain and expand homeownership..." (www.hud.gov/program_offices/housing). Similarly, Freddie Mac states that it makes "homeownership and renting more accessible and affordable" (http://www.freddiemac.com/about/). For Fannie Mae's commitment to homeownership see http://www.fanniemae.com/portal/about-fm/homeownership.html.

[3]For example, the GSE CLLs were increased from $417,000 to $729,750 in counties with high median house prices, but remained unchanged in counties with lower house prices. The FHA CLLs were increased everywhere, but were increased more in high price counties.

assigned randomly but were a function of the median house price in a county. We circumvent this problem by constructing a sample of adjacent zip codes that were located in different counties and therefore experienced different CLL changes. We show that prior to the CLL changes these adjacent zip codes had similar average house prices and house price distributions, similar levels of government guarantees per house, and similar levels of homeownership. Moreover, we can allow for different time trends across different border regions with border-time fixed effects in our difference-in-differences analysis. By including these fixed effects we exploit variation in CLLs within fairly small geographic areas with similar housing markets on both sides of the border.

Our main contribution is to provide causal evidence for the effects of government guarantees on homeownership based on a quasi-experimental research design and property-level data. This is an advantage compared to recent papers on this topic that relied on calibrated macro models (Jeske et al. (2013), Gete and Zecchetto (2017)) or aggregate time-series data (Fieldhouse et al. (2018)).

Our research question is highly relevant for the ongoing policy discussion about housing finance reform. After the government bailout of the GSEs in 2008, several proposals were made to reduce the role of the government in mortgage financing. Some of the proposals suggest to reduce the government's role gradually by lowering the CLLs.[4] Many reform proposals require a legislative act and have therefore a relatively small chance of being implemented. The conforming loan limit however can be changed without Congress solely as an administrative act. In particular recently it has been discussed that lower CLLs could be implemented by the new director of the Federal Housing Finance Agency (FHFA) who will be appointed by the beginning of 2019.[5]

While reform plans discuss lowering the CLLs, the actual CLLs were increased in 2017, 2018 and 2019 nationwide, because their level is linked to house prices.[6] These CLL increases were welcomed by some market participants arguing that they would increase homeownership, which further highlights the policy relevance of our research question.[7]

To estimate the effect on homeownership we use the CoreLogic real estate database, which provides information about characteristics of houses and their transactions at the property level. This database is particularly suitable for studying homeownership because we are able to track

[4]For example, the U.S. Congressional Budget Office lays out different ways to reform the secondary mortgage market, including reducing the CLLs to the pre 2008 levels. See "Transitioning to Alternative Structures for Housing Finance" (link). Moreover, the "Housing Finance Reform and Taxpayer Protection Act" by Senator Corker (link) and the "The Taxpayer Protection Housing Finance Plan" by Wallison et al. (2018) from the "American Enterprise Institute" propose to reduce the government's role gradually by lowering the CLLs.

[5]https://www.housingwire.com/articles/47283-the-most-powerful-person-in-mortgage-lending-is-about-to-be-replaced

[6]The nationwide CLL was increased from $417,000 to $484,350 in these three years. This is an annual increase of more than 5 percent.

[7]For example, in an official statement the California Association of Realtors says, "Increasing the existing Fannie Mae and Freddie Mac conforming loan limits will provide stability and certainty to the housing market and give tens of thousands of California homebuyers a chance at homeownership." (link).

whether a house is owner-occupied over time and whether the owner-occupancy status changed as a result of a transaction. This is an important advantage compared to mortgage-level data sets. Such data sets sometimes record whether the buyer is a first time homebuyer, but there is no information about the owner-occupancy status of the seller. Moreover, we observe not only transactions that were financed with a mortgage but also cash purchases.

We find that CLL changes had a substantial effect on government guarantees. For example, our estimates suggest that the CLL increases in 2008 expanded guarantees for new originations on average by more than $50,000 per house. This is a sizable effect that is roughly equal to 25% of the average guarantee per house prior to the CLL increases. However, we find no robust effect of the CLL changes on homeownership for either the CLL increases or for the subsequent partial reductions. We then investigate whether the impact of CLL changes differed depending on a measure of credit constraints for a typical borrower, the average loan-to-income ratio in a zip code. We find that the effect on government exposure was larger in zip codes with higher loan-to-income ratios, but again find no effect on the homeownership rate.

This finding suggests that the CLL changes affected the financing choices, but not homeownership. The increase in government guarantees helped borrowers who switched to government-backed loans and may have helped some borrowers to increase their loan size, but had only a negligible effect on marginal potential homeowners.

Is this finding unsurprising? After all, the intention of the CLL increase in 2008 was not to expand homeownership but to support the housing market. Moreover, in 2008 the housing market was in turmoil and potential buyers may therefore have been reluctant to buy. Nevertheless, we argue that our finding is by no means obvious a priori. Indeed, in California for example, 41.5% of the purchase loans that became newly eligible for government guarantees in 2008 (jumbo-conforming loans) were taken out by first-time home buyers, compared to 42.1% among conventional conforming loans.[8] This suggests that the effect on homeownership could be sizable. Moreover, general housing market conditions in 2008 are unlikely to explain our findings because they are differenced out, and we do find a substantial effect of the CLL increases on government guarantees. In addition, we do not find an effect on homeownership using the CLL changes in 2011 when the housing market was calmer.

An important caveat regarding the scope and implications of our findings is that we cannot speak to the potential effects of abolishing government guarantees entirely.[9] We only observe CLL changes at relatively high levels and cannot extrapolate our estimates to a CLL of zero. Many borrowers who are directly affected by the changes we observe are relatively affluent and have

[8]Nationwide the share of first-time home buyers was 38% for jumbo-conforming loans and 32% for conventional conforming loans. These fractions were calculated from Fannie Mae loan level data (link) from March 2008 to February 2011.

[9]We discuss the limitations of our analysis in more detail in section 5.2.

high credit scores. Government guarantees might be most valuable for low and moderate income borrowers who would find it more difficult to access mortgage credit otherwise and typically take out smaller mortgages.

Despite this caveat we argue that our estimates are relevant for two reasons. First, they are relevant for housing finance reform plans that propose to reduce the CLLs gradually from their current level. Unlike other housing finance reform proposals such CLL decreases could be implemented administratively through the FHFA, without a legislative act. In particular, it has been discussed whether the new FHFA director, who will be appointed by the beginning of 2019, could lower the CLLs.

Second, our estimates are not only relevant for a narrow segment of the housing market. The CLL changes we observe cover a considerable portion of the housing market. For example in 2008, the GSE CLLs were increased from \$417,000 to \$729,500 in counties with high median house prices. The loans that became newly eligible for government guarantees as a result of the CLL increases accounted nationwide for up to 20% of the monthly dollar volume of new government-guaranteed loans, and in the counties with the largest CLL increases for up to 37%.[10]

What are the policy implications of our findings? Regarding housing finance reform our findings suggest that lowering the CLLs, at least to pre-2008 levels, would result in a substantial reduction of government exposure and have at most have a moderate effect on the homeownership rate. Conversely, the nationwide CLL increases in 2017, 2018 and 2019 will at most have a moderate impact on the homeownership rate, but a sizable impact on government guarantees. This is concerning, because CLL increases can raise house prices (Adelino et al. (2012), Kung (2014)) and the CLL levels are themselves tied to house prices, which could lead to a positive feedback loop that destabilizes the housing market but has no sizable effect on homeownership.[11]

Literature There are few recent papers trying to estimate the effect of the government's involvement in the mortgage market. An important exception is Fieldhouse et al. (2018), which find that expansions of agency mortgage portfolios have increased homeownership. Methodologically their approach differs substantially from ours and is therefore complementary. They use a narrative approach where some changes in the agency mortgage holdings are classified as unrelated to "short-run cyclical or credit market shocks". One advantage of this approach compared to ours is

[10]This number includes large parts of the country that were only affected through increases of the FHA CLLs, but had unchanged GSE CLLs. If we focus on counties with large increases of the GSE CLLs the numbers are substantially larger. For example in counties where the GSE CLLs were raised to the ceiling of \$729,750 the share of the newly eligible loans reached 37%.

[11]Our assessment of the 2017, 2018 and 2019 CLL increases stands in stark contrast to the assessment of the California Association of Realtors quoted in footnote 7 with respect to the effect on the homeownership rate and on the stability of the housing market. Kung (2014) finds a sizable effect of CLL changes on house prices. This effect can not only lead to a positive feedback loop of increasing prices and CLLs, but also partly explain the moderate effect on the homeownership rate as affordability gains through CLL increases are offset by price increases.

that it allows them to study macroeconomic effects. An advantage of our approach is that we use plausible exogenous regional variation in the government's involvement in the mortgage market, which allows us to estimate effects relative to an adjacent zip code that serves as a control group.

Our paper is also complementary papers that study the effect of the GSEs on the broader economy and the financial system with calibrated macro models. Jeske et al. (2013) and Gete and Zecchetto (2017) study the distributional impacts of the government mortgage guarantees in the economy. Elenev et al. (2016) study the effects of phasing out the GSEs on the mortgage, housing and financial markets, allowing for rich interactions between the markets.

In addition, this paper is more broadly related to several strands of the literature. First, it is related to papers that study the effects of government mortgage guarantees on the mortgage market. A large body of work studied how GSE-eligibility affected mortgage interest rates by comparing jumbo and conforming rates. Early work includes Passmore et al. (2005) and Sherlund (2008). More recently, Kaufman (2014) used a regression discontinuity design around the CLL to estimate the effect of GSE-eligibility on mortgage characteristics such as interest rates. In addition, Fuster and Vickery (2015) study the effects of securitization on the prevalence of fixed-rate mortgages, exploiting the fact that it is more difficult to securitize a jumbo mortgage above the CLL. To our knowledge, however, there is no existing work that studies the effects of government guarantees on homeownership, which is one of the primary justifications for the government's involvement in mortgage financing.

Second, this paper is also related to the literature that studies the determinants and consequences of homeownership. There are several papers that study the effect of the mortgage interest tax deduction on homeownership, including Poterba (1984), Glaeser and Shapiro (2003), Hilber and Turner (2014), and Sommer and Sullivan (2018). Adelino et al. (2018) study the importance of perceptions of house price risk for homeownership choices. However, there are relatively few papers that study the effect of credit market conditions on homeownership. Most closely related to our study is Bostic and Gabriel (2006) who exploit differences in the definition of lower-income and underserved neighborhoods under the 1992 GSE Act and find only a small effect of the GSE mortgage purchase goals on homeownership using data from California.[12] Fetter (2013) uses the mid-century GI-bills to study the effect of mortgage subsidies on homeownership among veterans. Acolin et al. (2016) and Fuster and Zafar (2016) study the role of borrowing constraints on homeownership using survey data. Caplin et al. (2015) follow FHA borrowers between 2007 and 2009 over time and estimate that at most three quarters of the borrowers will be able to leave the FHA system by selling their house or by refinancing into a non-FHA loan.

A high homeownership rate is often considered desirable due to the potential positive externalities of homeownership. DiPasquale and Glaeser (1999) find some evidence that homeowners are

[12] See also An et al. (2007) and Gabriel and Rosenthal (2008).

"better citizens". Amior and Halket (2014) study the insurance role of homeownership. Homeownership can however also have detrimental effects on the labor market as studied by Blanchflower and Oswald (2013) and Laamanen (2017).

Third, another related body of work is the literature that studies the effects of credit conditions on the housing market more generally. There are many papers that study the effects of interest rates on various market outcomes: mortgage size (DeFusco and Paciorek (2017)), housing market dynamics (Anenberg and Kung 2017), and home buying (Bhutta and Ringo 2017). Moreover, Adelino et al. (2012) and Kung (2014) study the effects of credit availability on house prices, exploiting an increase in CLLs at different times, and Anenberg et al. (2016) study the effects of credit availability on construction as well as house prices using a different identification approach.

The rest of the paper is organized as follows. In Section 2, we explain the CLL changes that we use for our analysis. In Section 3, we discuss the data, how we measure treatment intensity and some summary statistics. In Section 4, we present the main results. Section 5 discusses the policy implications and limitations. In Section 6, we conclude.

2 Changes in Conforming Loan Limits

The GSEs can only purchase mortgage loans below a certain limit for the mortgage principal, called the conforming loan limit (CLL). Similarly, the FHA can only insure loans below certain loan limit. Loans above these limits are called jumbo loans and either have to stay on the balance sheets of the lender or have to be privately securitized. The CLLs therefore limit the government's involvement in mortgage financing. We exploit regional changes of CLLs to estimate the impact of government guarantees on homeownership.

2.1 Timeline of CLL Changes

Figure 1 shows a timeline of the legislation that resulted in changes of the GSE CLLs. The shaded regions in the graphs show the range of CLLs, which could vary across counties.

Before March 2008, the GSE CLLs were set uniformly at $417,000 in the entire country except for Alaska, Guam, Hawaii, and the U.S. Virgin Islands. In March 2008, the Economic Stimulus Act (ESA) increased the CLLs. Under the ESA, both the GSE CLLs were set to 125 percent of a county's median house price with an upper cap of $729,750 and a lower bound that of $417,000.

In December 2008 the CLLs specified in the ESA were reduced to the lower CLLs specified in the Housing and Economic Recovery Act (HERA). Under HERA the CLLs were equal to 115 percent of the county's median house price and the cap was lowered to $625,500, while the lower CLL bound remained unchanged at $417,000. However, only two months later in February 2009, the American Recovery and Reinvestment Act (ARRA) increased the CLLs back to the ESA levels again. In October 2011, the GSE CLLs were eventually lowered to the lower levels specified in HERA permanently.

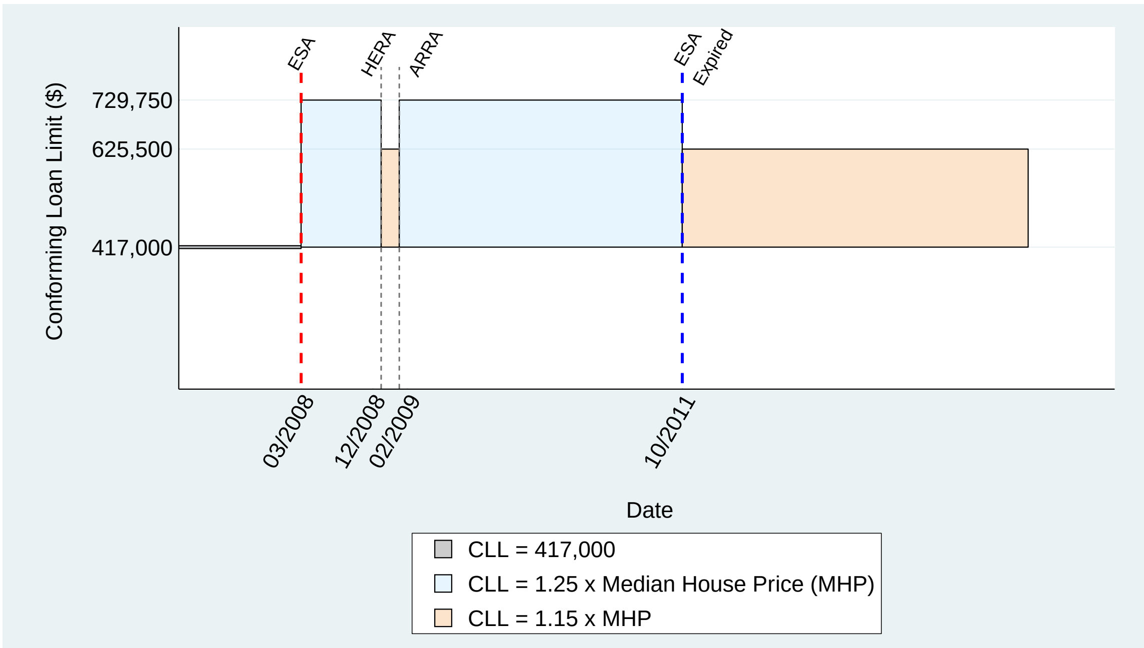


Figure 1: **Timeline of CLL Changes:** This timeline shows how the conforming loan limits for the GSEs were changed by the Economic Stimulus Act (ESA) in 3/2008, the Housing and Economic Recovery Act (HERA) in 12/2008 and the American Recovery and Reinvestment Act in 2/2009. In 10/2011 the GSE CLLs specified in the ESA expired and the lower CLLs specified in HERA were used thereafter.

The intention of the ESA, the HERA and the ARRA was not to increase homeownership, but to support the housing market during the crisis. In this paper we do not aim to evaluate whether the CLL changes achieved their intended goal, but instead use the policy changes to estimate the effect on homeownership. Indeed, for our analysis it is advantageous that the intention of the legislation was not to increase homeownership. This makes it less likely that the extent by which a county benefited from the CLL increases is related to unobservables that are related to homeownership.

We would like to note that these legislations changed not only GSE CLLs but also FHA CLLs. As shown in Figure 8 in the Appendix, the ESA increased FHA CLLs to the same level as GSE CLLs in March 2008, but the FHA CLLs were lower than the GSE CLLs before the ESA. In January 2014 the FHA CLLs were decreased to the levels specified by the HERA, which are the same as the GSE CLLs under the HERA. However, the GSE CLLs were already decreased in October 2011.

Jumbo-Conforming Share Figure 2 demonstrates the impact of the CLL changes on the portfolio of government guaranteed loans nationwide. The increase in CLLs made loans between the pre-ESA and the post-ESA limits eligible for the GSEs and FHA insurance. Such newly eligible loans are commonly referred to as "jumbo-conforming" loans.[13] The graph plots the share of jumbo-conforming loans among new purchase loan originations over time. The figure shows the jumbo-conforming share if it is measured as the fraction of the total loan count (count measure) and if it is measured as the share of the total credit extended (dollar measure).

It shows that the share of jumbo-conforming loans increased after the CLLs were increased in March 2008. Due to the temporary decrease in the CLLs in early 2009 before the ARRA was passed, the share decreased slightly around that time. Eventually, the jumbo conforming share reached a level close to 10% using the loan count measure and levels close to 20% using the dollar measure. This difference arises because jumbo-conforming loans are larger than a conventional conforming loans. Thus, the figure suggests that the increase in CLLs potentially led to a substantial increase in government guarantees.[14]

After the GSE CLLs were lowered in October 2011 the jumbo-conforming shares decreased substantially. The reduction of FHA CLLs in January 2014 had only a modest effect on the jumbo-conforming share because prior to that change only a small share of FHA loans (2-3%) was between the ESA and the HERA limits and some of these borrowers responded to the CLL reduction by decreasing the loan size in order to be within the new limits.

[13] Because the GSEs and the FHA had different pre- and post-ESA limits for a county, a loan that would be classified as jumbo-conforming by the FHA might still be a conforming loan. For example, consider a county whose FHA limit increased from \$362,790 to \$729,750 and whose GSE limit increased from \$417,000 to \$729,000. An FHA loan of \$400,000 would be a jumbo-conforming loan, but a GSE loan with the same size would still be a conforming loan.

[14] If we focus on counties that were most affected by the ESA the jumbo-conforming share increased even more. For example in counties where the GSE CLLs were raised to the ceiling of \$729,750 the jumbo-conforming share reached 23% using the count measure and 37% using the dollar measure.

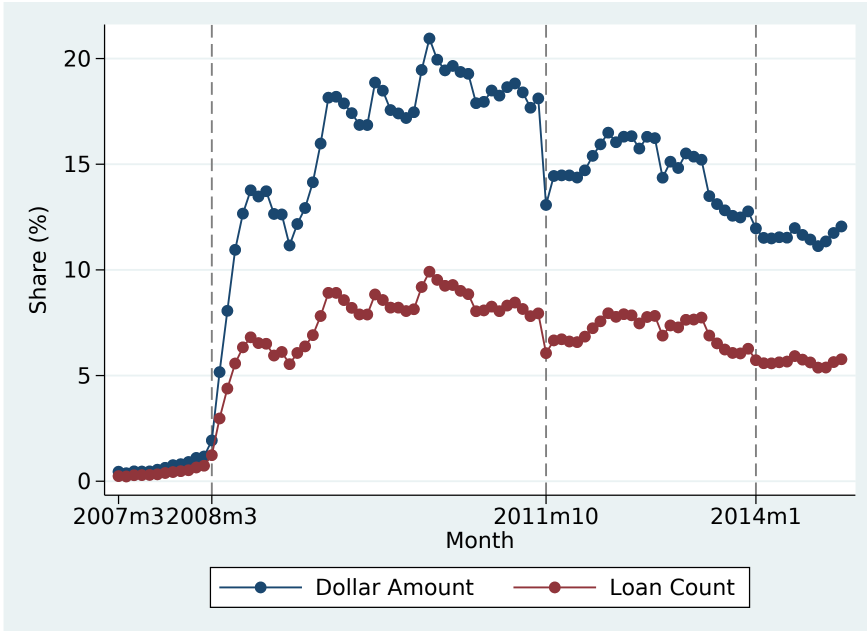


Figure 2: **The Share of Jumbo-Conforming Loans among New Originations Guaranteed by the Government.** This figure displays the share of jumbo-conforming loans among purchase loans originated in each month that are eventually securitized by the GSEs or insured by the FHA. The vertical gray line denotes March 2008 when the ESA increased the CLLs. Source: McDash data.

For our analysis, we do not distinguish whether a loan is guaranteed by the GSEs or insured by the FHA because the government would be exposed to the credit risk of the loan either way. However, we use the GSE CLLs rather than the FHA CLLs to define our treatment intensity measure, which captures how much a house was affected by the CLL changes. Moreover we focus on the effect of the GSE CLL reduction in 2011 rather than the effect of the FHA CLL reduction in 2014. We made this choice because as shown in Figure 2 the reduction of GSE CLLs had a much larger effect. Nevertheless, we also obtained estimates using the FHA CLLs to define the treatment intensity as a robustness check.

2.2 Variation of CLL Changes Across Counties

The extent to which the CLLs were raised or lowered varied across counties. This is illustrated in Figure 3, where the GSE CLLs are plotted as a function of a county's median house price, before and after the ESA. The CLLs prior to March 2008 are shown by the red lines and the post-ESA CLLs by the blue lines.

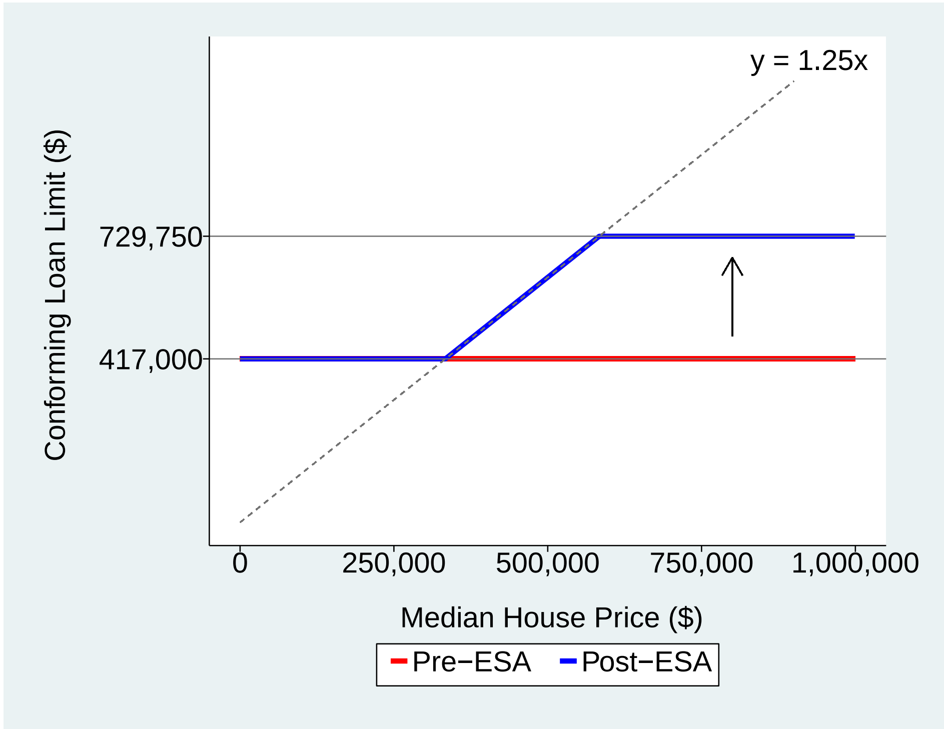


Figure 3: **Conforming Loan Limit Changes for GSEs through the Economic Stimulus Act (ESA).** This figure describes how a county's GSE CLLs were determined before and after the ESA. The red lines represent the old CLLs before the ESA, and the blue lines represent the new CLLs after the ESA.

The majority of counties, where 125 percent of the median house price did not exceed $417,000, did not experience any increase in the GSE CLLs, so the red and blue lines coincide. However, the CLL increased, in so called high-cost counties, where 125 percent of the median house price did exceed $417,000. The increase was larger for counties with higher median house prices, but as the CLLs were capped at $729,750 the maximum increase was $729,750-$417,000=$312,750.

In our empirical analysis, we will exploit the regional differences in CLL increases to estimate the effect of government guarantees on homeownership. However, naively using this cross-county variation could be problematic if counties with lower median house prices are not a valid control group for the high price counties with larger CLL changes. As we explain in more detail below, we circumvent this problem by focusing on adjacent zip codes along a county border that experienced different CLL changes. We show that prior to the CLL changes these adjacent zip codes had similar house price levels, house price distributions, government guarantees and homeownership rates.

3 Data, Treatment Intensity and Summary Statistics

3.1 Data

Homeownership Data The main data set we use to estimate the effect of CLL changes on homeownership is the CoreLogic Real Estate Data (CoreLogic data, henceforth). This data set provides multiple files that contain different types of information. For this paper, we use the file with information about individual house transactions (the deeds file) and the file with information about characteristics of individual houses (the tax file).

The deeds file provides detailed information about individual house transactions such as the date of the house sale, mortgage characteristics associated with the sale, whether a buyer is an owner-occupant[15], etc. Important variables from the tax file are whether a house is owner-occupied and the assessed value of the house by tax authorities. Information about whether a house is owner-occupied is crucial for studying homeownership. We need to observe the owner-occupancy status of a house before and after its sale to see whether a house sale leads to a net increase or decrease in homeownership. Thus, this data set allows us to measure homeownership at the house level: whether a house is owner-occupied or not.[16]

This is an important advantage compared to typical mortgage data sets. Such data sets sometimes record whether the buyer is a first time home buyer, but there is no information about whether the seller is an owner-occupant. Moreover, we observe not only transactions that were financed with mortgages but also cash purchases, which could also lead to a change in owner occupancy status.

Another important variable that is available in this data set is the assessed value of a house by tax authorities. This variable is important for predicting the loan size necessary to purchase a house. Many previous papers on related topics used appraisal values or list prices, which are only available for houses that are on the market.[17] Moreover, the assessed value also allows us to control for potential differential trends for different segments of the housing market.

We select the subsample for our analysis as follows. We keep only residential properties such

[15] CoreLogic constructs the variable indicating whether a buyer is an owner-occupant by comparing the buyer's mailing address with the property address. We would like thank Lauren Lambie-Hanson for helping us to understand how this is done.

[16] This definition of homeownership is similar to the definition of homeownership used by the U.S. Census Bureau that is the ratio of owner-occupied housing units and total occupied housing units. The only difference between our definition and the Census definition is the denominator. Because we cannot distinguish occupied and unoccupied houses, our denominator includes more houses. For example, houses used as vacation homes are included in our denominator, whereas they are excluded in the Census denominator. Our definition of homeownership is therefore likely to understate the homeownership rate slightly, compared with the Census definition. See the following link for more information about the definition of homeownership used by the Census: https://www.census.gov/housing/hvs/definitions.pdf.

[17] For example, Adelino et al. (2012) use the appraisal value in predicting whether a house will benefit from an increase in CLLs. Kung (2014) uses the list price of a house on the market for a similar purpose.

as single-family houses or condos. However, we exclude apartments. Throughout the paper, we will refer to all properties in our sample, including condos, as “houses”.

Government Guarantee Data To estimate the effect of CLL changes on the amount of government guarantees we also use the CoreLogic data. An important limitation is that the data does not allow us to observe directly whether a loan carries a government guarantee. Instead we assume that a loan carries a government guarantee if it is eligible for a guarantee. To evaluate whether this is a reasonable approximation we use the McDash mortgage data set, which assembles data from several large mortgage servicers.[18] This data allows us to see whether a loan carries a government guarantee, either through the GSEs or the FHA, which is not recorded in the CoreLogic data. In the McDash data, 91.4% of loans that are eligible for goverment guarantees are indeed guaranteed by the government. We have also obtained estimates of the effect on government guarantees using McDash directly and obtained similar results. We report the estimates using the CoreLogic data because it makes our estimates more comparable to our home ownership estimates that use the same data. In particular this allows us to calculate our measure of treatment intensity using the same variable for the house value.

3.2 Treatment Intensity

We measure the treatment intensity at the house level by calculating how much the CLL change increases or decreases the fraction of the house value that can be financed with a conforming GSE loan. Formally we define house i's treatment intensity T_i as follows:

$$T_i = \frac{\min\left\{0.8V_i, CLL^{GSE}_{c(i),post}\right\} - \min\left\{0.8V_i, CLL^{GSE}_{c(i),pre}\right\}}{V_i}, \quad (1)$$

where V_i refers to house i's value assessed for tax purposes prior to the beginning of our sample period.[19] $CLL^{GSE}_{c(i),pre}$ and $CLL^{GSE}_{c(i),post}$ refer to the GSE CLL before and after the CLL changes for house i's county $c(i)$, respectively. In words, for a CLL increase T_i measures the additional proportion of V_i that can be financed with a GSE loan, assuming a borrower makes a down payment of 20%. Analogously, for the partial CLL decrease in 2011 T_i measures the reduction of the share of V_i that can be financed with a GSE loan. We use house i's value assessed for tax purposes prior to the beginning of our sample period to measure V_i, so T_i is unchanged throughout our sample period. As assessed values are close to actual prices in some counties but not in others, we rescale

[18]The data contains information on more than 175 million mortgages and home equity loans.

[19]For the analysis of the CLL increases in 2008 we use the assessed value in 2006 and for the analysis of the CLL reductions in 2011 and 2014 we use the assessed value in 2010. Note that in the CoreLogic data the assessed values are available regardless of whether a house was sold.

the assessed values by multiplying it with the median ratio of purchase price to assessed value for each county.

Our main estimates are based on the changes in GSE CLLs to calculate the treatment intensity. As a robustness check we also obtain estimates using the changes in FHA CLLs:

$$T_i = \frac{\min\left\{0.8V_i, CLL^{FHA}_{c(i),post}\right\} - \min\left\{0.8V_i, CLL^{FHA}_{c(i),pre}\right\}}{V_i}, \tag{2}$$

3.3 Sample of Border Zip Codes

Using the variation in CLL changes across counties is potentially problematic because the changes were not assigned randomly but were a function of the median house price in a county. To circumvent this problem we assemble a sample of adjacent zip codes that are located in two different counties where the zip code to the left and to the right of their common border experienced different changes of GSE CLLs. In 2008 the CLLs for GSE loans were increased in so called "high-cost" counties, but remained constant elsewhere. Similarly, the GSE CLLs were partially decreased in high-cost counties in 2011 and remained unchanged elsewhere.

Our sample includes borders between high-cost counties where the GSE CLLs were increased and adjacent counties where the GSE CLLs remained unchanged. In addition, we also exploit variation of CLL changes within the region of high-cost counties by including borders where the CLL changes on both sides of the county border were different. We exclude border regions where the CLLs differed by less than $50,000 to guarantee a minimum within-border variation of CLLs.

Figure 4: **Map of Border Zip Codes** This map shows the zip codes along county borders we use in our analysis. Adjacent zip codes to both sides of the county border experienced CLL changes through the ESA that differed by at least $50,000.

Figure 4 shows the zip codes in our sample on a map. Naturally both coasts and especially California account for a sizeable part of the sample, because they account for a large share of high-cost counties.

We focus on houses with assessed values in 2006 between $500,000 and $1,000,000. We argue that this segment of the housing market was most affected by the CLL changes. The idea is that houses with values below $500,000 were not much affected by the CLL increases because even with the prior CLLs of $417,000 they could have been financed with a conforming loan. For houses above $1,000,000 the CLL increases likely also play a smaller role because the CLL increases represent a smaller fraction of the house value. Moreover, unless the down payment is unusually large, such houses cannot be financed with a conforming loan even after the CLL increases.[20]

[20] In the next subsection in Figure 5b we show that government guarantees have increased for houses between $500,000 and $1,000,000 as a result of the CLL increases in 2008. In the Appendix, Figure 9 we show that this is not the case for houses below $500,000. This suggests that this segment of the housing market was indeed not substantially affected by the CLL changes.

Table 1: **Border Sample Summary Statistics - Prior to CLL Increase.** This table presents summary statistics from March 2007 before the ESA increased the CLLs. Column (1) contains border zip codes where the CLL either remained constant or increased only slightly, whereas column (2) shows adjacent zip codes where the CLL was increased substantially.

	(1) Lower CLL	(2) Higher CLL
Pre-Treatment CLL ($)	417,000	417,000
Post-Treatment CLL ($)	487,371	694,264
Change in CLL ($)	70,371	277,264
Assessed House Value in 2006 ($)	672,033	683,110
Share of House Value $\in$ [$500K,$600K)	0.383	0.351
Share of House Value $\in$ [$600K,$700K)	0.254	0.248
Share of House Value $\in$ [$700K,$800K)	0.170	0.182
Share of House Value $\in$ [$800K,$900K)	0.116	0.129
Share of House Value $\in$ [$900K,$1000K)	0.077	0.090
Share of Houses with $T_i > 0$	0.660	0.903
Avg T_i	0.064	0.157
Avg T_i for House Value $\in$ [$500K,$600K)	0.025	0.040
Avg T_i for House Value $\in$ [$600K,$700K)	0.086	0.154
Avg T_i for House Value $\in$ [$700K,$800K)	0.096	0.233
Avg T_i for House Value $\in$ [$800K,$900K)	0.089	0.282
Avg T_i for House Value $\in$ [$900K,$1000K)	0.077	0.293
Share of Owner-occupied Houses	0.838	0.830
Probability of House Sale	0.008	0.007
Number of Houses	247,752	323,231

Summary Statistics Prior to CLL Increase Table 1 shows summary statistics from March 2007 prior to the CLL increase. In our econometric analysis we exploit variation in treatment intensity, which varies continuously at the house level. To present summary statistics and graphs however, we divide the houses by zip code into two groups. The left column shows the zip code for each border that experienced the smaller CLL change and the right column shows the zip code with the higher CLL change. We refer to these two groups as "Lower CLL" and "Higher CLL" zip codes, respectively.

Before the CLLs were increased in 2008 the CLLs were set at $417,000 nationwide. After the CLL increase they increased by $70,371 to $487,371 for the zip codes in the left column. For the zip codes in the right column the CLLs increased by $277,264 to $694,264.

The average assessed house value in 2006 is similar in both groups of zip codes. The average assessed value in "Lower CLL" zip codes was $672,033 compared to $683,110 in "Higher CLL" zip codes. The indicator variables for house value bins ranging from $500,000 to $1,000,000 show that not only the average assessed value was similar but also the house value distribution.

Next, consider the treatment intensity for both groups. The average treatment intensity in zip codes with smaller CLL increases was 0.064 compared to 0.157 in zip codes with larger increases. This means the in the lower-CLL zip codes an additional 6.4% of the assessed house value can be financed with a GSE loan due to the CLL increases, compared to 15.7% in the adjacent higher-CLL zip codes. Moreover, 90.3% of the houses in the right column have a positive treatment intensity compared to only 66.0% for the zip codes in the left column.

Notice that the treatment intensity is higher for houses with higher assessed values. This is because less expensive houses could be financed almost entirely with a GSE loan even prior to the CLL increases. For each house value bin however the average treatment intensity is also higher in zip codes with large CLL changes. In our difference-in-differences analysis we include interaction terms between house value bins and quarters, which absorb the variation in treatment intensity across different value bins. Therefore, our analysis uses mainly variation treatment intensity within value bins across zip codes.

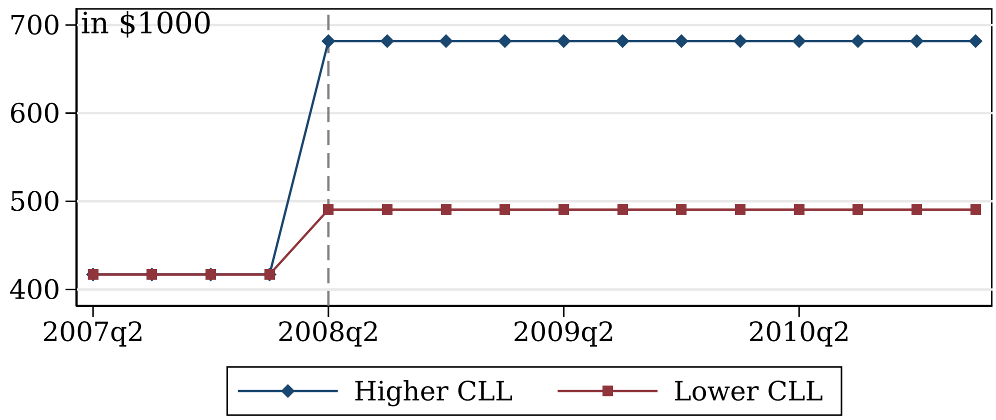
The share of owner-occupied houses is very similar in both groups with 83% in zip codes where the CLL changes were small compared to 83.8% in zip codes where the CLLs changed more. This number is higher than the national homeownership rate of 64.4% for two reasons. First, the main reason is that we include single-family homes and condominiums in our analysis but we exclude apartments.[21] Second, we only consider properties above $500,000 in assessed value and more expensive properties are more likely to be owner-occupied.

Lastly, the probability that a house was sold in a quarter was 0.8% in the zip codes with small changes and 0.7% in the zip codes with larger changes.

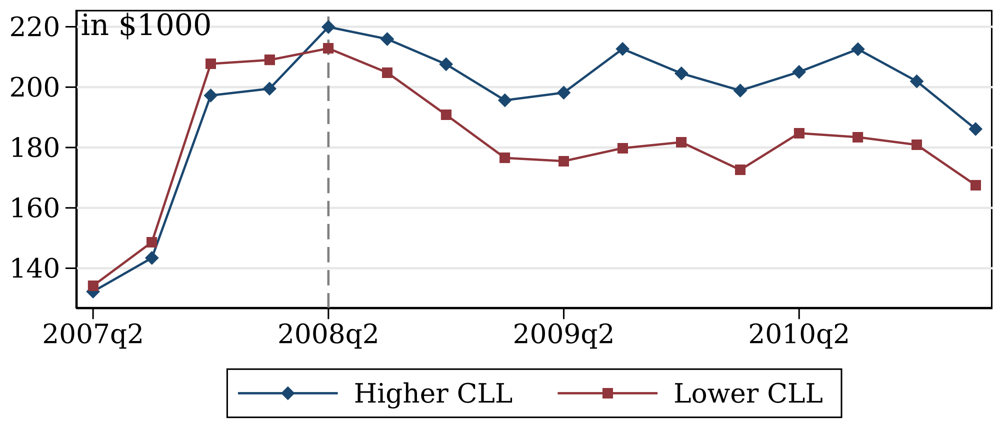
3.4 Graphs: CLLs, Guarantees and Homeownership

Figure 5 present graphs showing how the ESA in March 2008 affected CLLs, government exposure and the homeownership rate. The graphs show two separate lines for zip codes that experienced the larger CLL increases ("Higher CLL") within a border and the zip codes with smaller increases ("Lower CLL"). The zip codes are grouped in the same way as in Table 1. Figure 5a shows the conforming loan limits, which increased from $417,000 to $487,371 in zip codes with small CLL changes, and from $417,000 to $694,264 in adjacent zip codes with large changes.

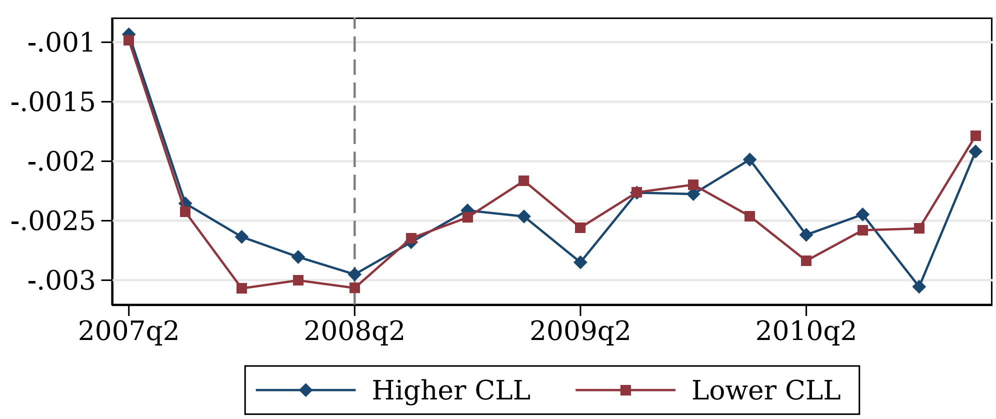
[21] If apartments are included, the homeownership rate in our subsample is close to the national rate in the data.



(a) **CLLs**



(b) **Government Guarantees**



(c) **Homeownership Transitions**

Figure 5: **Adjacent Zip Codes with Small ("Lower CLL") and Large ("Higher CLL") CLL Changes.** These figures show zip codes where the CLLs were increased substantially (blue line) and for adjacent zip codes where the CLLs were either increased less or remained unchanged (red line).

Next consider Figure 5b, which shows the average government guarantee for houses that were sold in the same two zip code groups. The government guarantee of a house is equal to the mortgage principal if the house was bought with government-backed loan, and zero otherwise. Prior to the CLL increases average government guarantees are almost identical in both zip code groups and change in a parallel fashion. In both groups government guarantees increased substantially in 2007 as the private securitization market collapsed. After the CLL increase, however, the average guarantees diverge and guarantees in zip codes with larger CLL increases are about $20,000 higher.

Lastly, consider the homeownership transitions shown in Figure 5c. The variable plotted on this graph captures changes in homeownership. For house sales from investors to owner-occupants it takes a value of 1, as these transactions create one additional homeowner, and for sales from owner-occupants to investors it takes a value of -1.[22] It takes a value of zero otherwise. The graph shows that average homeownership transitions in both groups change in a parallel fashion - both before and after the CLL change.

Taken together the graphs in Figure 5 suggest that the CLL increases had an effect on government guarantees, but no visible effect on the home ownership rate. In our difference-in-differences analysis we will investigate this further by controlling for various factors that could drive the patterns in the raw averages.

4 Main Analysis

4.1 Specifications

We estimate difference-in-differences regressions of the following form:

$$
\begin{aligned}
y_{i,q} = {} & \beta_0 Post_q \times T_i \\
& + \beta_1 T_i + X_{i,q}\beta_x + \xi_{zip} + \mu_{border \times q} + \varepsilon_{i,q}.
\end{aligned} \tag{3}
$$

$$
\begin{aligned}
y_{i,q} = {} & \sum_{q'} \beta_{0,q} 1[q = q'] \times T_i \\
& + \beta_1 T_i + X_{i,q}\beta_x + \xi_{zip} + \mu_{border \times q} + \varepsilon_{i,q}.
\end{aligned} \tag{4}
$$

The unit of analysis is at the level of a house (i) and quarter (q) pair. The outcome variable

[22] In the Appendix we also show the graph for the level of homeownership in Figure 10.

$y_{i,q}$ is either the amount of government guarantees, or a variable capturing changes of the owner-occupancy status of the house. T_i is our treatment intensity measure that varies at the house level. Next, $X_{i,q}$ contains a set of variables that control for time-varying characteristics of house i and its neighborhood. We also include zip code fixed effects ξ_{zip}. Lastly, in our main specification we also include fixed effects for each combination of a border region and a quarter $\mu_{border \times q}$.[23] These fixed effects capture any unobserved differential trends for different border regions. Controlling for such differential trends is important as the housing crisis and the subsequent recovery affected different regions differently. By including these fixed effects we exploit variation in CLLs within a fairly small geographic areas with similar housing markets on both sides of the border.

The main coefficients of interest are β_0 and $\beta_{0,q}$, respectively. The difference between the two specifications is that in Equation (3) we estimate a single coefficient of interest that combines all quarters prior to the CLL increase and all quarters after the CLL increase, whereas in Equation (4) we estimate a separate coefficient for each quarter.

The time window for the analysis of the the CLL increases runs from Q2 2007 to Q1 2011. The time window for the analysis of the CLL reductions runs from Q4 2010 to Q3 2014.

The vector $X_{i,q}$ contains interaction terms between ten decile bins for the estimated sales price in 2006, prior to the CLL increase, interacted with quarter fixed effects. These interaction terms are meant to control for different trends across different segments of the housing market. Thus, our estimates of the treatment effect use mainly variation of T_i within a segment of the housing market across different zip codes.

4.2 Effect on Government Guarantees

First we investigate whether and how much the higher loan limits increased the government's exposure to the mortgage market. We consider only purchase loans, because refinancing loans are not directly associated with changes of the homeowner and can therefore not have a direct impact on the homeownership rate.[24]

Our outcome variable is the amount of government guarantees for each loan. Formally,

$$GovAmt_i = 1\left\{\text{Loan } i \text{ is guaranteed by the government}\right\} \times LoanSize_i$$

where $LoanSize_i$ refers to the size of loan i. This outcome variable measures changes in the extensive and intensive margins, so it captures the possibilities that the number of guaranteed loans increases but also that borrowers increase the loan size due to the higher loan limits.

[23] We also show some estimates without $\mu_{border \times q}$ in Tables 2 and 4. In this case we include quarter fixed effects instead.

[24] Refinancing loans could however have an effect on the homeownership rate if refinancing helps troubled homeowners to keep their house.

The sample for the analysis consists of all houses that were sold in a quarter. This means that our analysis captures the effect on government guarantees conditional on a sale. CLL changes could also affect guarantees through their effect on the number of sales. In section 4.5 we investigage the effect of CLL changes on sales and find no substantial effect. Therefore the effect on government guarantees conditional on a sale is close to the effect unconditional effect.

In the CoreLogic data we do not observe directly whether a loan is guaranteed by the government. Instead we assume that loans, which are eligible for government guarantees are indeed guaranteed by the government. We assume that any fixed-rate mortgage under the CLL is eligible for a government guarantee. This assumption is a reasonable approximation. In the McDash data, which contains information about whether a loan carries a government guarantee, 91.4% of loans that are eligible for government guarantees are indeed guaranteed by the government. We have also obtained estimates of the effect on government guarantees using McDash directly and obtained similar results. Here we report the estimates using the CoreLogic data because it makes our estimates more comparable to our homeownership estimates that use the same data. In particular this allows us to calculate our measure of treatment intensity using the same variable for the assessed house value.

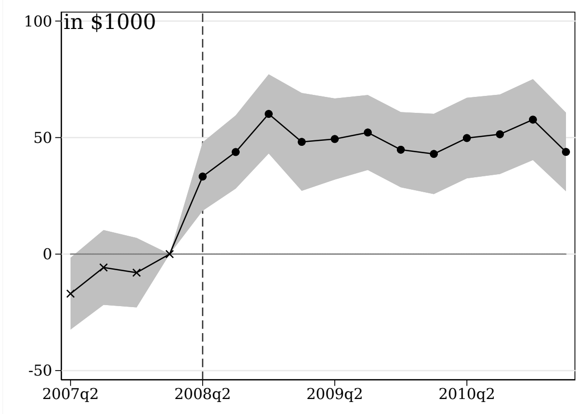
Table 2: **Effect on Government Guarantees**. This table shows estimates from a difference-in-differences as in Equation (3). The dependent variable is the loan size guaranteed by the government ($GovAmt_i$). The table shows $\beta_0 \times \overline{T_i}$ rather than β_0, where the average treatment intensity $\overline{T_i}$ is the average in the counties with high CLLs. The magnitude of the estimates is expressed in \$1,000. Standard errors are clustered at the zip code level.

	CLL Increase		Partial CLL Reduction	
	(1)	(2)	(3)	(4)
T_i	-32.9***	-32.9***	3.3	3.3
	(7.5)	(7.5)	(2.3)	(2.3)
Post=1 $\times$ T_i	57.1***	57.1***	-10.2***	-10.2***
	(8.1)	(8.2)	(2.8)	(2.8)
Qtr FE	Y	N	Y	N
Zipcode FE	Y	Y	Y	Y
House Value Bin x Qtr	Y	Y	Y	Y
Border x Qtr FE	N	Y	N	Y
N. Obs.	64,744	64,744	41,752	41,752
Adj. R^2	0.152	0.151	0.169	0.167

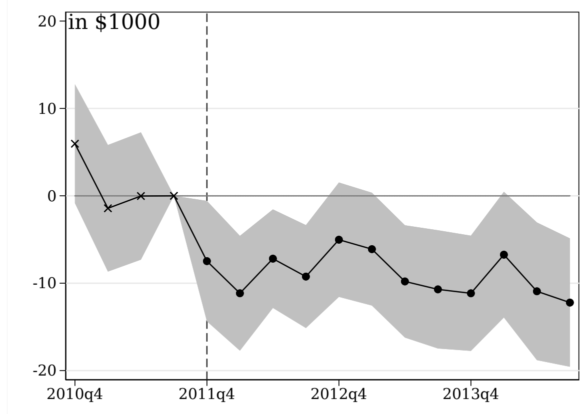
Table 2 shows estimates from Equation (3). To make the estimates easier to interpret we report $\beta_0 \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in zip codes with larger CLL changes. Our estimates suggest that for the average house in the zip codes with larger CLL changes government guarantees increased by \$57,000 as a result of the CLL increases. This is a sizable effect that corresponds to more than 25% of the average government guarantees prior to the CLL increase.

Similarly, the partial CLL reductions in 2011 reduced government guarantees by \$10,200. The impact of the CLL reductions was smaller because the CLLs were not reduced all the way to their levels before the ESA, and therefore $\overline{T_i}$ was smaller in magnitude. The estimates are identical whether we include border-quarter fixed effects (columns (2) and (4)) or not (columns (1) and (3)).

Figure 6: **Effect on Government Guarantees.**This figure plots estimated difference-in-differences coefficients from the regression given by Equation (4). The dependent variable is the loan size guaranteed by the government ($GovAmt_i$). The marker shows $\beta_{0,q} \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in the zip codes with large CLL changes. The shaded area shows the 90% confidence interval of each estimate. The magnitude of the estimates is expressed in \$1,000. The regression contains year-quarter fixed effects, zip code fixed effects, border-quarter fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.



(a) CLL Increase



(b) Partial CLL Reduction

Figure 6 shows estimates from the difference-in-differences specification given by Equation (4) for the CLL increase in 2008 in panel (a), and the CLL reduction in 2011 in panel (b). The introduction of the ESA in 2008 and the reduction of the GSE limits in 2011 are demarcated with vertical lines. We plot the product of the coefficient point estimates and the average treatment intensity $\beta_{0,ym} \times \overline{T_i}$, where the average treatment intensity $\overline{T_i}$ is the average in the counties with high CLLs.

In panel (a) we see that the increase of the loan limits in 2008 led to an increase of average guarantees by approximately \$50,000 within one or two quarters. In panel (b) we see that the reduction of the GSE limits in 2011 lowered government guarantees within one or two quarters by approximately \$10,000 for a house with the average treatment intensity in the high CLL group. The effect of the CLL increase in 2008 was much larger than the effect of the CLL reduction in 2011, because the increase in 2008 was larger than the reduction in 2011. Therefore the treatment intensity was larger for the 2008 increase than for the 2011 reduction.

In Figure 12 we use the measure of treatment intensity based on the FHA CLL in Equation 2. Recall that the FHA CLLs were increased simultaneously with the GSE CLLs in 2008, but the FHA CLLs were reduced later in 2014 rather than 2011. As the FHA CLLs were not changed in 2011 it is perhaps questionable to use the FHA based treatment intensity measure for the reduction of GSE CLLs in 2011. However, for completeness we show both, the estimates for the CLL increase in 2008, and the estimates for the partial CLL reduction in 2011 in Figure 12.

We obtain very similar estimates of around \$50,000 for the CLL increase in 2008. For the CLL reduction in 2011 the estimates look similar with effects of \$5,000 to \$10,000 for most of the sample window, but the effect disappears toward the end of the sample window in 2014. To the extent that the estimates differ from the baseline estimates we believe that the baseline estimates are more relevant as we argue above.

4.3 Effect on Homeownership Transitions

Next we consider the effect on homeownership. We construct a variable that takes a value of 1 if a house transitions from non-owner-occupied to owner-occupied, a value of -1 if it transitions from owner-occupied to non-owner-occupied, and zero otherwise. This is shown in Table 3.

Table 3: Transition Matrix of Owner Occupancy Status

		Buyer	
		Owner Occupied	Not Owner Occupied
Seller	Owner Occupied	0	-1
	Not Owner Occupied	+1	0

Thus, in this case

$$y_{i,q} = \begin{cases} 1 & \text{if house } i\text{'s status transitions from investor-owned to owner-occupied} \\ 0 & \text{if house } i\text{'s status does not change as a result of a sale or is not sold} \\ -1 & \text{if house } i\text{'s status transitions from owner-occupied to investor-owned} \end{cases} \tag{5}$$

Note that $y_{i,q} = 0$ in each of the three following cases: (i) a transition from an owner-occupant seller to an owner-occupant buyer, (ii) a transition from a non-owner-occupant seller to a non-owner-occupant buyer, and (iii) the house is not sold. Thus we estimate the effect on homeownership using all houses in our sample, regardless of whether they were sold or not.

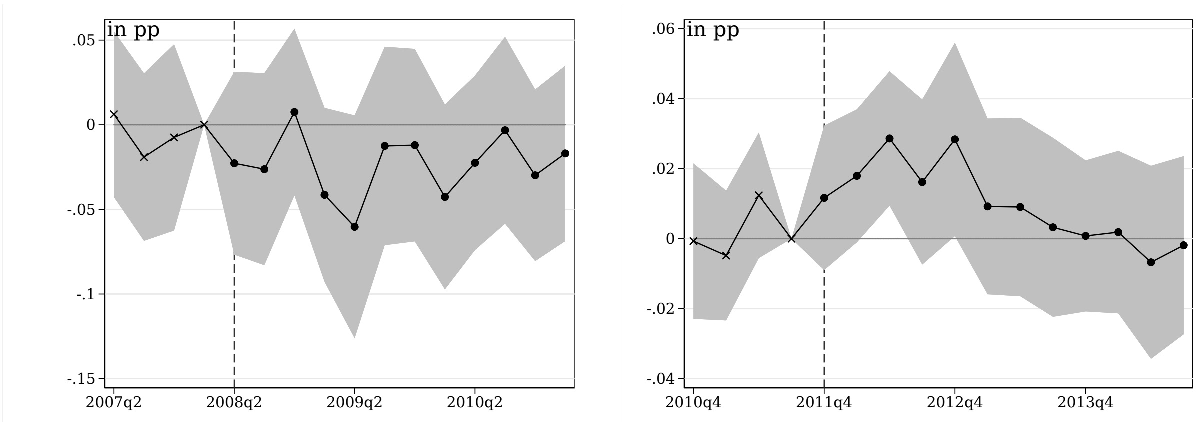
Table 4: **Effect on Homeownership Transitions.** This table shows estimates from the difference-in-differences specification in Equation (3). The dependent variable takes a value of 1 if a house transitions from non-owner-occupied to owner-occupied, a value of -1 if it transitions from owner-occupied to non-owner-occupied, and zero otherwise. The table shows $\beta_0 \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in the zip codes with large CLL changes. The magnitude of the estimates is expressed in percentage points. The regression contains quarter fixed effects, zip code fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.

	CLL Increase		Partial CLL Reduction	
	(1)	(2)	(3)	(4)
T_i	0.026	0.024	0.019***	-0.004
	(0.016)	(0.015)	(0.007)	(0.006)
Post=1 $\times$ T_i	-0.021	-0.018	-0.022***	0.008*
	(0.014)	(0.013)	(0.007)	(0.005)
Qtr FE	Y	N	Y	N
Zipcode FE	Y	Y	Y	Y
House Value Bin x Qtr	Y	Y	Y	Y
Border x Qtr FE	N	Y	N	Y
N. Obs.	9,930,192	9,930,192	4,592,992	4,592,931
Adj. R^2	0.001	0.001	0.001	0.001

Table 4 shows estimates from the specification in Equation (3) measured in percentage points. For the CLL increase, we find no statistically significant effect and the point estimates imply that the CLL increase led to a small reduction in home ownership. For the partial CLL reduction, we find a small negative statistically significant effect on home ownership in column (3). However, the sign flips once we include border-quarter fixed effects in column (4), and we obtain a small positive effect. Overall the estimates in Table 4 show little evidence for a substantial effect of the CLL changes on homeownership.

Figure 7 shows estimates using Equation (4). This specification includes border-quarter fixed effects. There appears to be no positive effect of the CLL increases in 2008 and no negative effect of the CLL reductions in 2011.

Figure 7: **Effect on Homeownership Transitions.** This figure plots estimated difference-in-differences coefficients with the regression given by Equation (4). The dependent variable takes a value of 1 if a house transitions from non-owner-occupied to owner-occupied, a value of -1 if it transitions from owner-occupied to non-owner-occupied, and zero otherwise. The vertical axis is measured in percentage points. The marker shows $\beta_{0,q} \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in the zip codes with large CLL changes. The shaded area shows the 90% confidence interval of each estimate. The regression contains quarter fixed effects, zip code fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.



(a) CLL Increase

(b) Partial CLL Reduction

In Figure 13 we use the measure of treatment intensity based on the FHA CLL in Equation (2). The estimates are similar to the main specification as the point estimates typically have the "wrong" sign and are not statistically significant.

4.4 Heterogeneous Effects

So far we have shown that the effects of CLL changes are substantial for government guarantees, but not robust effects for homeownership. One possibility is that we do not find any effect on homeownership because it only has an effect in regions where potential home buyers are more credit-constrained. To investigate this hypothesis we use the use the average loan-to-income ratio at the zip code level as a measure of credit constraints. We measure the loan-to-income ratio prior to the CLL changes, in 2007 for the CLL increase, and in 2010 for the partial CLL reduction. We then estimate the following "triple-diff" regression:

$$
\begin{aligned}
y_{i,q} = {} & \beta_0 Post_q \times T_i + \beta_1 Post_q \times T_i \times LTI_{zip} \\
& + \beta_2 T_i + \beta_3 Post_q \times LTI_{zip} + \beta_4 T_i \times LTI_{zip} + X_{i,q}\beta_x + \xi_{zip} + \mu_{border \times q} + \varepsilon_{i,q}. \qquad (6)
\end{aligned}
$$

Here our main coefficient of interest is β_1, which captures how much the effect changes with the zipcode-level loan-to-income ratio LTI_{zip}.

Table 5: **Heterogeneous Effects on Government Guarantees**. This table shows estimates from a difference-in-differences as in Equation (6). The dependent variable is the loan size guaranteed by the government ($GovAmt_i$). The table shows the product of the estimated coefficients and the average treatment intensity $\overline{T_i}$ in the zip codes with large CLL changes. Here we also include interaction terms with the loan-to-income ratio at the zip code level. The regression contains quarter fixed effects, zip code fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.

	CLL Increase		Partial CLL Reduction	
	(1)	(2)	(3)	(4)
T_i	152.6***	152.6***	-17.5**	-17.5**
	(38.7)	(38.7)	(7.9)	(7.9)
Post=1 × T_i	-192.1***	-192.1***	26.1***	26.1***
	(38.2)	(38.2)	(9.2)	(9.2)
T_i × Loan-to-Income Ratio	-64.1***	-64.1***	7.5***	7.5***
	(13.2)	(13.2)	(2.8)	(2.9)
Post=1 × Loan-to-Income Ratio	0.0	0.0	-0.2***	-0.2***
	(0.1)	(0.1)	(0.1)	(0.1)
Post=1 × T_i × Loan-to-Income Ratio	86.0***	86.0***	-13.0***	-13.0***
	(13.0)	(13.0)	(3.3)	(3.3)
Qtr FE	Y	N	Y	N
Zipcode FE	Y	Y	Y	Y
House Value Bin x Qtr	Y	Y	Y	Y
Border x Qtr FE	N	Y	N	Y
N. Obs.	64,744	64,744	37,156	37,156
Adj. R^2	0.156	0.154	0.168	0.166

First, we investigate whether there are larger effects on government guarantees in zip codes where loans are larger relative to incomes in Table 5. Indeed we find that the effect is larger in zip codes with with higher loan-to-income ratios for both the CLL increase and the CLL reduction. The estimates imply that there are positive effects for all except about 10 percent of zip codes with the lowest loan-to-income ratios, but the effects are substantially larger for zip codes with high loan-to-income ratios.

In Table 6 we look for heterogeneous effects for homeownership transitions by interacting the treatment variable with the loan-to-income ratio. The interaction terms are not statistically significant at conventional levels. For the CLL increase the estimated sign suggests that zip codes with larger loan-to-income ratios have smaller positive or even negative effects on homeownership.

This is inconsistent with the estimates in Table 5 and with basic economic theory. Thus these estimates suggest that there was no substantial effect on homeownership - not even in zip codes with relatively high loan-to-income ratios.

Table 6: **Heterogeneous Effects on Homeownership Transitions.** This table shows estimates from a difference-in-differences as in Equation (6). The dependent variable is given by Equation (5). The table shows the product of the estimated coefficients and the average treatment intensity $\overline{T_i}$ in the zip codes with large CLL changes. Here we also include interaction terms with the loan-to-income ratio at the zip code level. The magnitude of the estimates is expressed in percentage points. The regression contains year-quarter fixed effects, zip code fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.

	CLL Increase		Partial CLL Reduction	
	(1)	(2)	(3)	(4)
T_i	0.156	0.190	0.004	-0.054
	(0.137)	(0.126)	(0.040)	(0.037)
Post=1 $\times$ T_i	0.089	0.043	-0.037	0.040
	(0.091)	(0.078)	(0.039)	(0.030)
T_i $\times$ Loan-to-Income Ratio	-0.042	-0.059	0.005	0.017
	(0.049)	(0.045)	(0.014)	(0.013)
Post=1 $\times$ Loan-to-Income Ratio	0.001***	0.000	-0.002***	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Post=1 $\times$ T_i $\times$ Loan-to-Income Ratio	-0.044	-0.022	0.006	-0.011
	(0.032)	(0.028)	(0.013)	(0.010)
Qtr FE	Y	N	Y	N
Zipcode FE	Y	Y	Y	Y
House Value Bin x Qtr	Y	Y	Y	Y
Border x Qtr FE	N	Y	N	Y
N. Obs.	9,930,192	9,930,192	4,143,616	4,143,555
Adj. R^2	0.001	0.001	0.001	0.001

4.5 Effect on Sales

In Table 7 we estimate the effect of the CLL changes on the probability that a house is sold measured in percentage points. Even if higher CLLs have no substantial effect on homeownership they might be beneficial if they increase the turnover of houses, which results in a better allocation of houses to households and may increase geographic mobility. The signs of our coefficient estimates are consistent with this hypothesis, but with the exception of column (4) the estimates are not statistically significant. The economic magnitude of the coefficients is also moderate. For example the estimates in columns (2) and (4) suggest that the effect on the average house in a county with large CLL changes is approximately 1-2% of the average sale probability (see Table 1).

Table 7: **Effect on Sales.** This table shows estimates from a difference-in-differences as in Equation (3). The dependent variable is an indicator variable that is equal to one if the house was sold during the quarter. The table shows $\beta_0 \times \overline{T_i}$, where the average treatment intensity $\overline{T_i}$ is the average in the counties with high CLLs. The magnitude of the estimates is expressed in percentage points. The regression contains year-quarter fixed effects, zip code fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.

	CLL Increase		Partial CLL Reduction	
	(1)	(2)	(3)	(4)
T_i	0.015	0.048	0.017	0.027*
	(0.040)	(0.039)	(0.016)	(0.016)
Post=1 $\times$ T_i	0.053	0.008	-0.010	-0.022*
	(0.032)	(0.029)	(0.011)	(0.012)
Qtr FE	Y	N	Y	N
Zipcode FE	Y	Y	Y	Y
House Value Bin x Qtr	Y	Y	Y	Y
Border x Qtr FE	N	Y	N	Y
N. Obs.	9,930,192	9,930,192	4,592,992	4,592,937
Adj. R^2	0.004	0.004	0.006	0.006

4.6 Summary of Findings

In summary, we find that the CLL changes had a substantial effect on GSE guarantees. Jumbo-conforming loans that became newly eligible for government guarantees as a result of the CLL increase accounted nationwide for up to 20 percent of the GSE portfolio in dollar terms. Our estimates using the sample of adjacent border zip codes suggest that for the average house located on the side of the border where the CLLs increased more government guarantees increased by about \$50,000 or 25% of its mean when the CLLs were increased in 2008 and decreased by about \$10,000 when the CLLs were lowered in 2011.

Despite this sizable effect on GSE guarantees we find no significant effect on homeownership. Our estimates are typically not statistically significant, and in addition the point estimates often suggest that increased guarantees are associated with lower homeownership.

We find that the effect on GSE guarantees was larger in zip codes with high loan-to-income ratios. This suggests that government guarantees are more important in regions where house prices are high relative to incomes, because borrowers in these regions might not qualify for a loan that isn't guaranteed by the government. We also investigate whether the effect on homeownership varied depending on the loan-to-income ratio, but again find no effect.

This finding suggests that the CLL changes affected the financing choices, but not homeownership. The increase in government guarantees helped borrowers who switched to government-backed loans and may have helped some borrowers to increase their loan size, but had only a negligible effect on marginal potential homeowners.

Is this Finding Unsurprising? The intention of the CLL increase in 2008 was not to expand homeownership but to support the housing market. Moreover, in 2008 the housing market was in turmoil and potential buyers may therefore have been reluctant to buy. Nevertheless, we argue that our finding is by no means obvious a priori. Indeed, in California for example, 41.5% of the purchase loans that became newly eligible for government guarantees in 2008 (jumbo-conforming loans) were taken out by first-time home buyers, compared to 42.1% among conventional conforming loans.[25] This suggests that the effect on homeownership could be sizable. Moreover, general housing market conditions in 2008 are unlikely to explain our findings because they are differenced out, and we do find a substantial effect of the CLL increases on government guarantees. In addition, we obtain even smaller estimates for the effect on homeownership using the CLL changes in 2011 when the housing market was calmer.

In addition we argue that even if our findings are qualitatively unsurprising for some policy decisions should be based be based on quantitative estimates. For example, our estimates can guide policy makers as they help to project the expected reduction in government exposure if CLLs are reduced.

5 Policy Implications and Limitations

5.1 Policy Implications

In this section we discuss the policy implications of our findings. The estimated effects of CLL changes inform two current policy issues. First, the GSE CLLs were increased nationwide in the past three years. Second, several housing reform proposals suggest that the GSEs could be phased out by gradually lowering the CLLs.

Recent CLL Increases We first discuss the recent CLL increase. Between 2017 and 2019 the CLLs for the GSEs and the FHA were increased from $417,000 to $484,350 outside of the high cost areas, or more than five percent per year. Our findings suggest that such increases are likely to

[25]Nationwide the share of first-time home buyers was 38% for jumbo-conforming loans and 32% for conventional conforming loans. These fractions were calculated from Fannie Mae loan level data (link) from March 2008 to February 2011.

increase the government's exposure to the mortgage market, but will likely at most have a modest effect on the homeownership rate.

The reason for the CLL increase is that the CLLs are tied to house prices and house prices have increased in recent years. Tying CLLs to house prices is problematic if CLL increases themselves contribute to house price increases, which then could lead to further CLL increases, and so forth. This could result in a positive feedback loop, that leads to continually increasing house prices and increased government exposure to the mortgage market, whilst the homeownership rate would be largely unaffected. Moreover, the increase in house prices that is driven by CLL increases could destabilize the housing market in the long run.

Our assessment stands in stark contrast to commentary by the California Association of Realtors (C.A.R.), which commented the CLL increase as follows[26]:

"C.A.R. applauds the FHFA for recognizing California's continuing home price increases over the last few years and raising maximum conforming loan limits," said C.A.R. President Steve White. "Increasing the existing Fannie Mae and Freddie Mac conforming loan limits will provide stability and certainty to the housing market and give tens of thousands of California homebuyers a chance at homeownership."[27]

Housing Finance Reform Next, we turn to the ongoing debate on housing finance reform. This debate evolves around two broad issues: First, *how* the government should be involved in the mortgage market. Second, the *scope* of the government's involvement. The *how* issue is concerned with questions like which kinds of mortgage contract the government should favor (e.g. 30 year FRM), or whether the mortgage insurance model by the FHA is preferable to the GSE model. The *scope* issue is related to this paper, because one way to determine the scope of the government's involvement is by adjusting the conforming loan limits.

Indeed, some of the reform plans propose to phase out the GSEs by gradually lowering the CLLs. For example the reform proposals by AEI (Wallison et al., 2018) or the "Housing Finance Reform and Taxpayer Protection Act" by Senator Corker.[28] Moreover, the Congregational Budget Office discussed a reduction of CLLs in "Transitioning to Alternative Structures for Housing Finance" (CBO, 2014). Many reform proposals require a legislative act and have therefore a relatively small chance of being implemented. The conforming loan limit however can be changed without Congress solely as an administrative act. In particular recently it has been discussed that lower CLLs could be implemented by the new director of the Federal Housing Finance Agency

[26] It should be noted that realtors stand to gain from increased house prices, because their they typically earn a percentage of the house price from house transactions.

[27] See https://www.prnewswire.com/news-releases/california-realtors-commend-fhfa-for-raising-fannie-mae-and-freddie-mac-conforming-loan-limits-300563003.html

[28] For the complete text of the bill, see https://www.congress.gov/bill/113th-congress/senate-bill/1217.

who will be appointed by the beginning of 2019.[29] Our findings suggest that decreasing the CLLs to the pre-ESA levels would likely reduce the government's exposure to the mortgage market substantially, but would likely have only a modest effect on the homeownership rate.

We conclude this section with three remarks regarding the implications of our findings for housing finance reform. First, even though we argue that the CLLs could be lowered from current levels without substantially affecting the homeownership rate, there may be other policy goals that justify the high CLLs. Second, besides lowering the CLLs there may be other policies to better align the government with the goal of increasing homeownership. For example, if the government guarantees were restricted to purchase loans, the government's exposure to the mortgage market could be lowered, arguably without substantial impacts on the homeownership rate. Third, there may be more direct ways to achieve the goal of increased homeownership than to intervene in the mortgage market.

5.2 Limitations

There are several important limitations of our analysis.

First, our analysis does not answer the question what would happen if government mortgage guarantees would be eliminated entirely. We only observe a change in CLLs at relatively high levels, which allows us to estimate the marginal effect of changes in government guarantees. Our findings suggest that this change does not affect marginal homeowners for the most part. It is entirely possible that reducing the CLL to zero would affect more low and moderate income households, who are more likely to have difficulties in obtaining credit in the private market, and are therefore marginal homeowners. Reducing the CLLs to zero could therefore have a substantial effect on the homeownership rate. Our paper is therefore complementary to theoretical papers that simulate counterfactuals in which government guarantees are entirely eliminated such as Jeske et al. (2013), Elenev et al. (2016) and Gete and Zecchetto (2017).

Second, our analysis does not take into account some of the effects that may be present if the CLLs would be lowered in the whole country rather than only in some counties. For example it may be the case that banks are able to absorb only a certain amount of mortgages on their balance sheets and additional mortgages would have to be privately securitized. There may also be macroeconomic effects of a nationwide reduction in the CLLs that are not present for the regional reduction we observe. Our paper is therefore complementary to Fieldhouse et al. (2018), which estimates the macroeconomic effects of mortgage asset purchases by the government.

Lastly, in 2013 the GSEs started to shift part of their credit risk to private investors, which reduced the government's exposure to the mortgage market (Finkelstein et al. (2018)). These

[29] https://www.housingwire.com/articles/47283-the-most-powerful-person-in-mortgage-lending-is-about-to-be-replaced

credit risk transfer programs are structured such that the GSEs bear the "first loss" in a mortgage pool – a tranche of about 0.5 percent. The tranches from about 0.5 to about 4.0 percent are sold to private investors and the "catastrophic risk" above 4.0 percent is borne by the GSEs again. Due to these programs, changes in the loan volume that is sold to the GSEs are not equivalent to changes in government exposure. These programs highlight that reform proposals that suggest to lower the CLLs are not the only way to lower government exposure to the mortgage market.

6 Conclusion

The U.S. government guarantees a majority of mortgages through the Government Sponsored Enterprises and the Federal Housing Administration. Although the government's involvement in the mortgage market is controversial, it is often justified as a means to promote homeownership. However, very little is known about the effect of government mortgage guarantees on homeownership. In this paper we estimate the effect by using a difference-in-differences design, with detailed property-level data, that exploits regional changes in the conforming loan limits (CLLs). We find a sizable effect of CLLs on government guarantees but no robust effect on homeownership. Thus government exposure to the mortgage market could be considerably reduced with very modest effects on the homeownership rate. Our finding is particularly relevant for recent housing finance reform plans that propose to gradually reduce the government's involvement in the mortgage market by reducing the CLLs.

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A Additional Figures

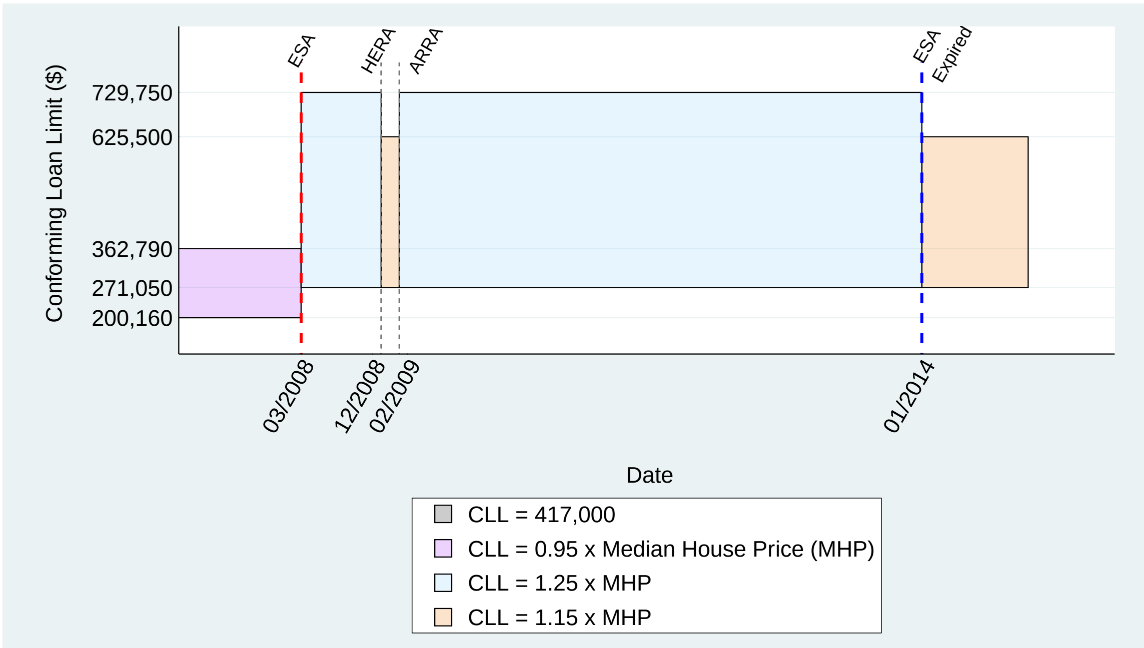


Figure 8: **Timeline of FHA CLL Changes:** This timeline shows how the conforming loan limits for the FHA were changed by the Economic Stimulus Act (ESA) in 3/2008, the Housing and Economic Recovery Act (HERA) in 12/2008 and the American Recovery and Reinvestment Act in 2/2009. In 1/2014 the CLLs specified in ESA expired and the lower CLLs specified in HERA were used thereafter.

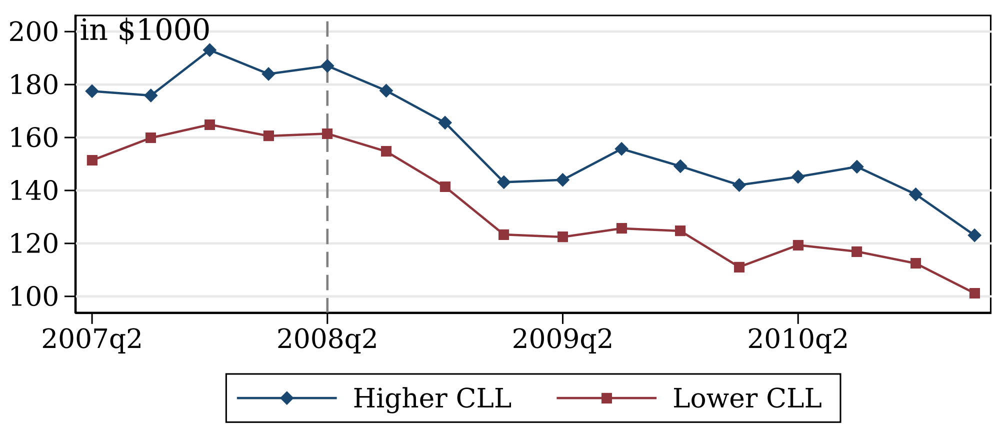


Figure 9: **GSE Guarantees Below $500,000.** This figure shows the average government guarantee for zip codes where the CLLs were increased a lot and for adjacent zip codes where the CLLs were increased less. Unlike Figure 5b this graph shows houses with assessed values below $500,000.

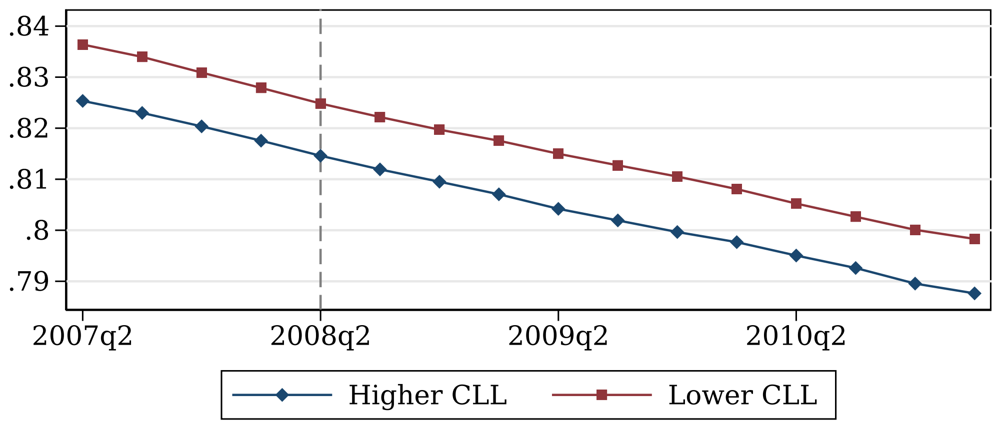
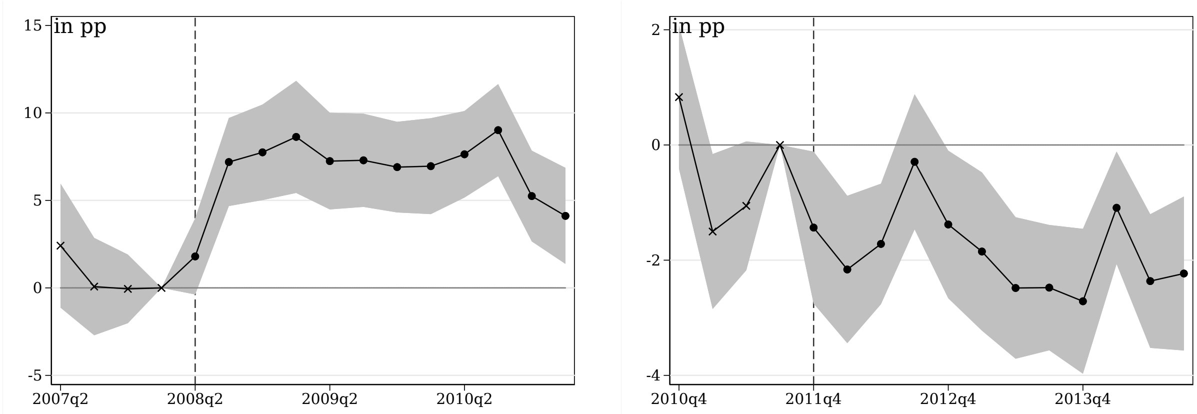


Figure 10: **Homeownership Rate.** This graph shows the same two groups of adjacent zip codes with different CLL changes as Figure 5c. However, unlike Figure 5c it shows the level of homeownership rather than changes of the homeownership rate.

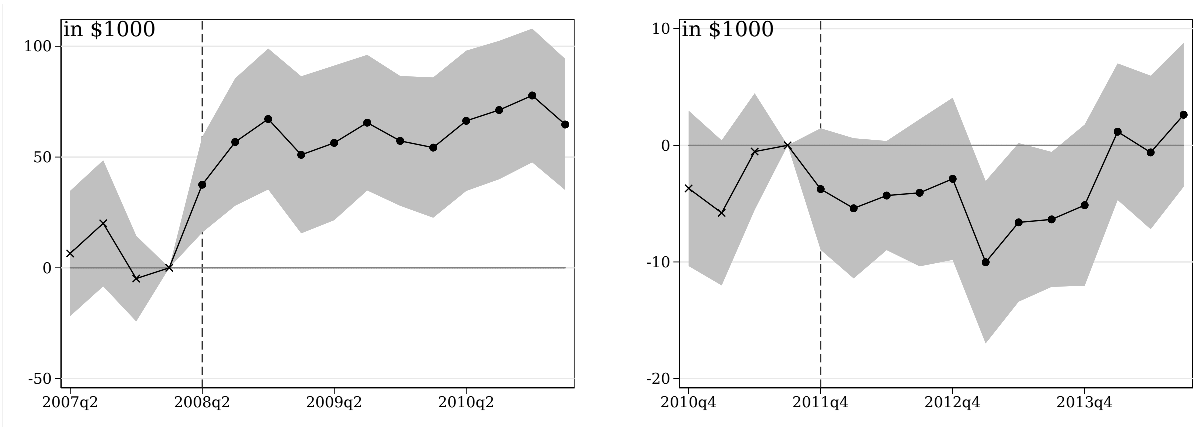
Figure 11: **Effect on Loan Size.** This figure plots estimated difference-in-differences coefficients from the regression given by Equation (4). The dependent variable is an indicator that is equal to one if the loan size is between the new and the old CLLs. The marker shows $\beta_0 \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in the zip codes with large CLL changes. The shaded area shows the 90% confidence interval of each estimate. The magnitude of the estimates is expressed in percentage points. The regression contains year-quarter fixed effects, zip code fixed effects, border-quarter fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.



(a) CLL Increase

(b) Partial CLL Reduction

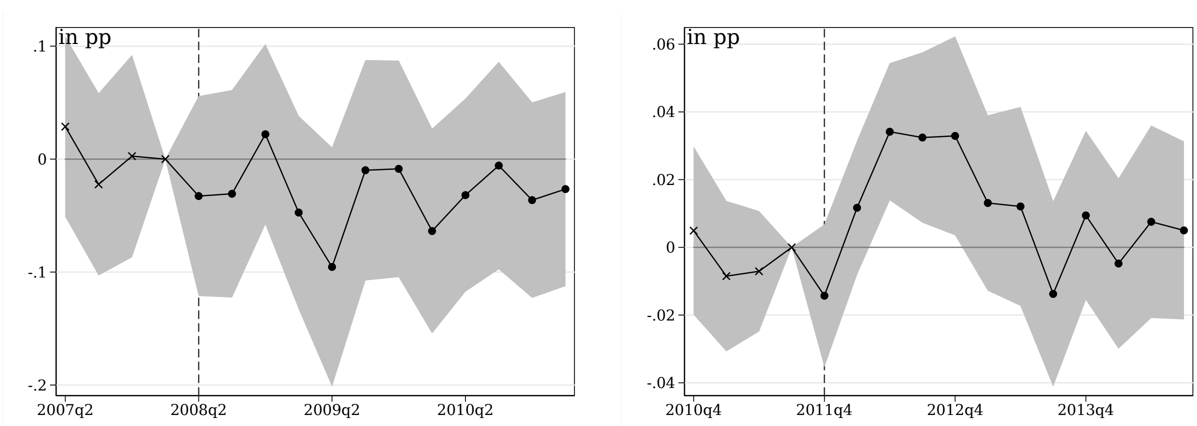
Figure 12: **Effect on Government Guarantees - FHA CLL Treatment Intensity.** This figure plots estimated difference-in-differences coefficients from the regression given by Equation (4). The dependent variable is the loan size guaranteed by the government ($GovAmt_i$). The marker shows $\beta_{0,q} \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in the zip codes with large CLL changes. The shaded area shows the 90% confidence interval of each estimate. The magnitude of the estimates is expressed in \$1,000. The regression contains year-quarter fixed effects, zip code fixed effects, border-quarter fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.



(a) CLL Increase

(b) Partial CLL Reduction

Figure 13: **Effect on Homeownership - FHA CLL Treatment Intensity.** This figure plots estimated difference-in-differences coefficients with the regression given by Equation (4). The dependent variable takes a value of 1 if a house transitions from non-owner-occupied to owner-occupied, a value of -1 if it transitions from owner-occupied to non-owner-occupied, and zero otherwise. The vertical axis is measured in percentage points. The marker shows $\beta_{0,q} \times \overline{T_i}$, where $\overline{T_i}$ is the average treatment intensity in the zip codes with large CLL changes. The shaded area shows the 90% confidence interval of each estimate. The regression contains quarter fixed effects, zip code fixed effects, and the additional control variables described in the main text. Standard errors are clustered at the zip code level.



(a) CLL Increase

(b) Partial CLL Reduction