Leaving Households Behind: Institutional Investors and the U.S. Housing Recovery*

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Abstract

Ten years after the mortgage crisis, the U.S. housing market rebounded significantly with house prices now near the peak achieved during the boom. Homeownership rates, on the other hand, continued to decline. We reconcile the two phenomena by documenting the rising presence of institutional investors in this market. Our analysis makes use of housing transaction data. By exploiting heterogeneity in zip codes' exposure to regulatory shocks that affected lenders differently, changes in FHFA conforming loan limits, as well as capital gains tax rates, we establish the causal relationship between the increasing presence of institutions in the housing market and the subsequent recovery in house prices and decline in homeownership rates between 2007 and 2014. We identify housing rehabilitation/renovation as well as improvement in the local labor market as the main transmitting channels. We further demonstrate that institutional investors also contributed to the decline in the growth rates of the local rent-price-ratio and the increase in eviction rates in areas with either moderate housing supply elasticity or with high foreclosure rates.

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1 Introduction

Between 2007 and 2010, the U.S. economy experienced its worst recession since the Great Depression. The crisis was particularly severe in the housing market, where house prices fell 31 percent at the trough from the peak at the national level. Homeownership rates also declined. Following the crisis, house prices rapidly recovered in most areas, but homeownership rates continued to collapse to historic lows. In 2016, while the national house price index has recovered nearly to its 2006 peak level, the national homeownership rate hovered at 63 percent, the lowest in recent history (Figure 1).[1]

This paper reconciles these observations by documenting a rising share of institutional investors in the housing market after the crisis. We classify a transaction as having an institutional buyer or seller if it is bought or sold by a company instead of a named individual. Our study is based on property-level transaction data from CoreLogic Solutions, a national vendor supplying mortgage and real estate data and analytics. We focus our analysis on single-family housing transactions conducted in the 20 cities covered by the S&P CoreLogic Case-Shiller 20-City Composite House Price Index.[2] We document that the institutional investor-purchased share of single-family homes has been mostly flat during the early 2000s but picked up significantly since the mortgage crisis broke out in 2007.[3] This phenomenon is widespread but particularly prominent in high-priced areas such as Miami and San Diego, as well as in high-foreclosure areas such as Las Vegas and Atlanta, where prices had soared during the housing bubble and where, during the crash, prices dropped significantly.[4] This finding is in strong contrast to the experience of the booming years before the crisis, when individual investors were mostly responsible for home purchases (Haughwout, Lee, Tracy, and Van Der Klaaum 2011, Chinco and Mayer 2016, Gao and Li 2015, Gao, Sockin, and Xiong 2017, Bayer, Geissler, and Mangum 2016, and Albanesi 2018).[5]

Several factors drove this trend. First, since the outbreak of the mortgage crisis, banks have been subject to greater regulation, especially after the passage of the Dodd-Frank Wall Street Reform and Consumer Protection Act. As a result, they contracted mortgage supply. Individual borrowers in turn found mortgage access difficult as they had to turn to other potentially more expensive creditors. Second, a consistent rigid downward trend in housing prices since the crisis further prevents many

[1] Meanwhile, total housing units have been increasing albeit slowly and homeowner vacancy rates have returned to their 2000 levels.

[2] The 20 major U.S. metropolitan areas are Atlanta, Boston, Charlotte, Chicago, Cleveland, Dallas, Denver, Detroit, Las Vegas, Los Angeles, Miami, Minneapolis, New York, Phoenix, Portland, San Diego, San Francisco, Seattle, Tampa and Washington, D.C.

[3] The trend has retreated somewhat after 2014.

[4] The observations on Las Vegas and Atlanta are consistent with case studies on these two cities by Mallach (2013) and Immergluck (2013), respectively.

[5] Interestingly, very few of the institutional buyers are affiliated with large financial firms. Furthermore, the institutions affiliated with the largest financial or real estate firms such as Blackstone, American Homes 4 Rent, Colony Starwood Homes and Progress Residential as identified by Amherst Capital Market Report conduct business only in selected areas.

households from buying without or with little credit. For foreclosed-upon borrowers, it takes at least three to five years to qualify for a new mortgage after a foreclosure (Goodman, Zhu, and George 2014). This creates a buying opportunity for institutions with better access to finance. As these institutions enter into the housing market and turn their purchased properties into rentals, house prices begin to recover while homeownership rates continue to decline.[6]

To investigate the extent to which institutional investors' presence affects local housing market, we conduct analysis using an instrumental variables approach to deal with the endogeneity concern, that is, institutional investors buy in areas where house prices are about to recover. We use several identification strategies that are tied closely to the driving factors discussed above. The first instrument comes from Gete and Reher (2018). Specifically, we exploit the heterogeneity across zip codes in exposure to lenders which suffered regulatory shocks following the Dodd-Frank Act, approved after the crisis. The rationale is that zip codes that had more exposure to lenders more affected by the passage of Dodd-Frank will suffer more from tightened lending standards.[7]

The second instrument follows Loutskina and Strahan (2015), which takes advantage of changes in conforming loan limits since 2008. Mortgages below the conforming limit benefit from the guarantee of Government Sponsored Enterprises such as Fannie Mae and Freddie Mac. Prior to 2008, these limits were uniform and determined at the national level. After 2008, the Economic Stimulus Act revised the methodology so that the conforming limit is now tied to the cost of living in a given county. Our instrument intends to capture the heterogeneity in zip code exposure to changes in these limits by calculating the percentage of mortgage loan applications that had an amount in excess of 125 percent of the limit. The more mortgage loans that exceed 125 percent of the conforming limit, the less relevant regulations are.[8] Our third instrument explores variations in state capital gains taxation as in Gao, Sockin, and Wei (2018). We calculate, at each zip code, the income tax rate for a household making average income and the rate the average household would be paying on its capital gains from housing investment. For states with no income tax, the number will be set at zero. The higher the tax rate, the less profitable it is for investors with passthroughs such as LLCs to buy and sell properties, as profits from these transactions are counted as personal income.[9]

Our main results can be summarized as follows, for the period between 2007 and 2014, the

[6]Global capital inflow as well as institutions chasing yields as a result of the lackluster bond market performance also contributed to the trend (Lambie-Hanson, Li, and Slonkosky 2018).

[7]Buchak, Matvos, Piskorski and Seru (2018) use similar regulatory burden measures across space to study the impact on traditional lenders. They argue that shadow banks come in and fill some of the gap, however, these shadow banks typically charge higher prices. Gilchrist, Siemer and Zakrajsek (2018) also use similar identification strategies to study the real effects of changes in mortgage supply.

[8]Grundl and Kim (2018) study the marginal effect of lowering government mortgage guarantees and find that lowering the limit increased the government guarantee significantly but homeownership rates modestly.

[9]An implicit assumption here is that investors using LLCs would be residing in the same zip code of the property and hence on average having the zip code's income. According to the National Association of Realtors' 2014 Investment and Vacation Home Buyers Survey, 15 percent of the investment property is within 5 miles of the buyer's primary residence, 30 percent is within 10 miles, and the median is 20 miles. The land area of a zip code varies widely between less than 1 square mile to 13,431 square miles with a mean of 90 square miles.

significant rise in institutional buyers and the relatively little change in institutional sellers in the single-family residential market contributed to 12 percent of the increase in the real house price growth, and 30 percent of the decline in changes in homeownership rates. We further identify increased housing renovation and/or rehabilitation and improved local labor market as the main transmitting channels. Additionally, we find that institutional buyers are also responsible for 13 percent of the decline in the growth rates of the local rent-to-price ratio. There is also some evidence that the presence of institutional buyers led to rises in eviction rates in areas with moderate housing supply elasticity or high foreclosure.

Our paper belongs to the small but growing literature that studies the dynamics of the post-crisis housing market. In particular, our paper complements that of Gete and Reher (2018) by showing that when mortgage supply contracts, this creates opportunities for institutional investors that have better access to credit than individual borrowers. These investors purchase residential properties and then often turn them into rental properties. In other words, these institutions are responsible for the rental increase in the post-crisis housing market studied in Gete and Reher (2018). However, we point out that the presence of these institutional investors also help local house prices to recover when they participate in the market as buyers. As a result, areas in our sample actually experienced a decline in the growth in rent-price ratio due the presence of institutional investors. These results are consistent with prior case studies of investor activity that relied on interview evidence and narrower data analysis to argue that investors exerted a stabilizing force when house prices were declining (Lambie-Hanson, Herbert, Lew, and Sanchez-Moyano 2015). Note that these results stand in contrast to the role of investors during the boom leading to the house crisis, suggesting that the presence of investors vary importantly with the macroeconomic environment.

Our paper also complements those of Molloy and Zarutskie (2013), Lambie-Hanson, Herbert, Lew, and Sanchez-Moyano (2015), Mills, Molloy and Zarutskie (2017), and Allen, Rutherford, Rutherford and Yavas (2018), by studying a more representative sample of the nation and by focusing on the overall housing market, distressed as well as non-distressed. More importantly, our instrumental variable approach allows us to make a causal statement by linking tightened lending standards directly with the emergence of institutional investors as separate large asset holders. Finally, we also investigate the impact of institutional presence on the local rental market.

The rest of the paper is organized as follows. In section 2, we describe the data used for our main analysis. In section 3, we present our empirical model and discuss main results of the paper as well as the robustness of our results along many dimensions. Section 4 analyzes the transmitting mechanisms as well as the impact on the local rental market. Section 5 concludes.

2 Data and Investor Classification

2.1 Description of Datasets

We use and combine the following datasets in our paper.

CoreLogic Solutions Deeds Data: This is our main dataset and it contains property-level information on deed and mortgage transactions as well as foreclosure actions, as was originally electronically keyed at county registries (or recorders) of deeds. For each transaction, the dataset provides the names of the buyer(s) and seller(s); the nature of the transaction: whether it is a purchase or mortgage refinance, whether it is a regular sale or distressed sale such as foreclosure or REO (real estate owned) sale, whether it is an arm's length transaction or a nominal transfer between parties (for example, family numbers transfer properties at nominal prices among each other); the transaction price; the address; the transaction date; and some mortgage characteristics such as the origination amount and the identity of the lender if CoreLogic Solutions finds a mortgage origination associated with the sale recorded on the same date and for the same property.

CoreLogic Solutions Home Price Index Data: We use the single-family combined home price index at the zip code level for the benchmark analysis, which includes all sales, regular as well as distressed. The Home Price Index (HPI) or "repeat sales index" database matches house price changes on the same properties in the public record files and then computes separate indexes by zip codes. Since the data are from public records, the HPI is representative of all sales in the market.[10]

Home Mortgage Disclosure Act (HMDA): HMDA records the vast majority of home mortgage applications and approved loans in the United States for both purchases and mortgage refinances. The data provide, among other things, mortgage applicants' application status, income, race, ethnicity, loan amount, purpose of borrowing, occupancy type, and, importantly for this paper, the name of their mortgage lenders.

Individual Income Tax Zip Code Data: We use zip code level income tax data from the Internal Revenue Service to obtain, at the zip code level, average household income as proxied by average adjusted gross income, and total population proxied by total returns filed.

Other Miscellaneous Data: We obtain county-level homeownership rates from the Census Bureau; county-level unemployment rates from the Bureau of Labor Statistics; MSA-level and county-level rent price indices from Zillow Research at Zillow.com/data downloaded from January 2018 to August 2018; MSA-level housing supply elasticity from Saiz (2010); state-level income tax rate from the Tax Foundation; and finally county-level eviction rates from The Eviction Lab at the Princeton University.[11]

[10] Note that when there are not sufficient repeated house sales, as sometimes happens at small zip codes, the house price index is recorded as missing.

[11] More information about The Eviction Lab at Princeton University can be found at https://evictionlab.org. The lab was founded by Matthew Desmond in 2017. The data collected by the lab is comprised of formal eviction records from 48 states and the District of Columbia. Informal evictions happened outside the court room, as when landlords

2.2 Identify Institutional Investors

Several strategies have been used in the literature to identify investor activities in the housing market. For individual investors who borrowed mortgages, mortgage loan data often provide information on occupancy status reported either by mortgage borrowers as in HMDA (Gao and Li 2015, and Gao, Sockin and Xiong 2018) or by mortgage servicers as in BlackKnight McDash Data (Go and Li 2015). Using mortgage data, however, only allows us to identify individual investors who borrowed mortgages. This limitation can be serious during the housing crisis when many foreclosed properties were purchased with cash. Second, self-report may be imprecise. By matching credit bureau and mortgage data, Elul and Tilson (2015) find that borrowers often misrepresent their occupancy status as owner occupants rather than residential real estate investors. The occupancy fraud rate ranges from an estimated low of 1.54 percent in Kansas to an estimated high of 15.30 percent in Hawaii. Fisher and Lambie-Hanson (2015) also find that there are a lot of misreporting in HMDA concerning investor status in Chelsea, Massachusetts.

Researchers working on credit bureau data such as Equifax have used the number of first-lien mortgages to identify real estate investors (Haughwout, Lee, Tracy and van der Klauuw 2011). The idea is that people reporting multiple first-lien mortgages must own more than one property, and the additional ones would then be either vacation homes or rental properties. This multi-first-lien mortgage approach, unfortunately, also does not capture all-cash transactions and transactions by nonindividuals who would not have a credit score at any credit bureau. Additionally, the methodology does not help identify the location of investment properties, making it hard to assess the impact of the investor behavior.

Using similar transaction data as in this paper, Bayer, Geissler, Mangum and Roberts (2016) separate buyers into different categories according to their house tenure, i.e., investors would be those who buy residential real estate with the aim of quickly of reselling it for a profit. Giacoletti and Westrupp (2017) also use a similar strategy. The caveat with this approach is that it may overstate the underlying investor activity as households sometimes end up buying and selling properties within a short period for reasons related to their jobs or family situation instead of profits. This approach may also understate the true investor activity as it does not capture those investors who are unable but not unwilling to "unload" their properties quickly or they buy to let.[12]

In this paper we focus on institutional investors as these investors can be easily identified from their names listed in the Deeds dataset. For example, we classify all buyers/sellers with "LLC," "Corporation", "Partnership," "Trust," "Enterprise," "Company," "Construction," "Building," "Hospital," "Real Estate," "Holdings," or numbers other than first, second, third, and fourth in their names as institutional buyers/sellers. To further ensure the accuracy of our methodology, for each MSA,

pay renters to leave or execute illegal lockouts, are not captured by the dataset.

[12]For instance, in our analysis, we find many institutional investors holding on to their properties for 2, 3, or even longer years.

we check, based on their market share, the top 20 buyers/sellers in each city each year and classify them accordingly. In the case that these buyers/sellers' names are not indicative, we search online for their information. The advantage of our approach is that it is straightforward and less prone to classification errors since institutions clearly buy single family houses for investment purposes.[13] However, this approach does miss individual investors who purchased homes using their own names. As a result, our measurement serves as a lower bound of true investor activity.

As an effort to further study the identities of the institutional investors, we adopt a top-down strategy. From the many industry reports, Amherst Capital Market Reports in particular, we gather the names of top 20 institutions that have bought in the single family housing market.[14] Large investors often buy properties under a variety of names. The way we identify purchaser names affiliated with these large firms is to link together buyers that use the same mailing address. We manually inspect each buyer to confirm that it is, indeed, part of the larger company, rather than being erroneously linked as a result of sharing the same attorney, for example.

2.3 Descriptive Statistics

2.3.1 Data Construction

To provide background, we study single family house purchases between 2000 and 2014, a period that spans housing boom, bust, and recovery. To further control the sample size, we narrow our analysis to housing transactions in the 20 major metropolitan areas covered by the S&P CoreLogic Case-Shiller 20-City Composite Home Price Index from Standard & Poor's/Haver Analytics.[15] From the thus constructed dataset, we keep only arm's length transactions with a sale's price of at least $1,000. We also exclude foreclosure sales that are nominal transfers between borrowers and banks or banks and agencies such as Fannie Mae and Freddie Mac. However, foreclosure sales to third parties are included in the analysis. Next, we drop observations that have relocation companies as buyers or sellers because purchase prices by relocation companies do not necessarily reflect market prices at the time. For example, relocation companies base their offers on "relocation appraisals" where the guidelines are very different from those of "bank appraisals" used by other buyers. We identify a buyer as a relocation company if it has "relocation" or "mobility" in the name. Finally, we delete

[13] Although it is possible that there may be individual home buyers who purchase their primary residences using LLCs or Trusts for tax or privacy reasons, the real estate attorneys we spoke to assured us that the number of such individuals is negligible.

[14] These institutions include Blackstone (Invitation Homes), American Homes 4 Rent, Colony Starwood, Progress Residential, Main Street Renewal, Silver Bay, Tricon American Homes, Cerberus Capital, Altisource Residential, Connorex-Lucinda, Havenbrook Homes, Golden Tree, Vinebrook Homes, Gorelick Brothers, Lafayette Real Estate, Camillo Properties, Haven Homes, Transcendent, Broadtree, and Reven Housing REIT. See Exhibit 1 in "U.S. Single Family Rental-Institutional Activity in 2016/2017" published by Amherst Capital market Update in August 2017.

[15] See footnote 2 for a list of the 20 cities.

observations which list buyer name or seller name as blank or "owner record."[16]

The final sample contains in total 16.4 million single-family purchase transactions between 2000 and 2014. Of the 20 MSAs that we analyze, New York MSA has the most transactions, 1.8 million, which amounts to almost 11 percent of the total transactions, followed by the Los Angeles. Atlanta, Chicago, Dallas, Phoenix and Washington D.C. all have over one million transactions during this period as well.

2.3.2 Single Family Transactions, House Prices and Foreclosure Sales

In Figure 2, we plot the total number of transactions and share of foreclosure sales of the 20 MSAs on average and of four selected MSAs: Atlanta, Las Vegas, New York City, and Washington D.C. According to Figure 2 panel a, for the average MSA, the volume of total housing transactions went up sharply between 2000 and 2005. It started to plummet in 2006 and bottomed out in 2008. Despite the recovery after 2010, its level in 2014 remained 10,000 units below that of 2000. The four MSAs all experienced a similar cycle, though the peak and trough time differed by a year or two. Turning to panel b of Figure 2, for the average MSA, prior to 2006, foreclosure sales were almost non-existent. They shot up to over 30 percent of total sales by 2009. The decline in foreclosure sales after 2009 was more gradual than the increase. In 2014, about 10 percent of total sales remained foreclosure sales. Not surprisingly, Las Vegas had the greatest rise in foreclosure rates among the four cities, followed by Atlanta. New York City, by comparison, had a foreclosure rate of only about 10 percent in its worst year.

Figure 3 describes the real house price growth rate and the homeownership rate of the 20 MSAs on average and for the four selected cities. The real house price growth rate in the region, as depicted in panel a of Figure 3, was between 9 and 13 percent between 2000 and 2006, but went down to negative 20 percent in 2008. By 2013, however, the average house price growth rate has nearly returned to its pre-crisis level. Not surprisingly, among the four cities, Las Vegas had the most dramatic run-up in house prices during the boom years and the most dramatic decline during the bust. In 2013, its real house price growth rate remained 10 percentage points below the peak (30 percent) achieved in 2004. Interestingly, Atlanta had very muted house price appreciation during the boom years, and the fall in house prices was also less than the average, but it had a very impressive recovery. In 2013, its real house price growth rate was about 8 percentage points higher than the rates seen during the boom years. Washington D.C., on the other hand, had a nice boom, a bad bust, and a muted recovery. New York City followed roughly the average 20-city pattern.

In panel b of Figure 3, we see that, for the average MSA, the homeownership rate had been increasing between 2000 and 2005, albeit at a decreasing speed. Starting in 2006, however, the

[16] Treating the latter case as noninstitution purchases do not change the analysis as they constitute a small portion of the overall transactions.

homeownership rate began its steady fall. In 2014, it is only a touch above 60 percent. The movements of the homeownership rates were quite different across the four cities. Las Vegas had the greatest fall but started to recover in 2012. The homeownership rate moved within a much narrow range for Atlanta and Washington D.C. than for the other cities. New York City had an early rise in the homeownership rate, followed by a persistent decline.

In Table 1, we present real house price growth rate, homeownership rate, total transaction volume, and share of foreclosure sales for all 20 MSAs in 2005, 2009, and 2014. For all 20 MSAs, housing prices were near the peak in 2005, near the trough in 2009, and well into recovery in 2014. Not surprisingly, of the 20 cities, Las Vegas, Miami, Phoenix, and Tampa had the most run up in house prices leading to the crisis, but also suffered the most declines during the crisis before recovering somewhat post crisis. Detroit fared the worst, with virtually no house price appreciation prior to the crisis and yet suffered significantly during the crisis. Boston, Charlotte, Dallas, and Minneapolis had the least house price fluctuations over the cycle. All cities experienced declines in homeownerhip rates in 2014. Most also suffered declines in homeownership rates in 2009 except for Atlanta and Charlotte where the homeownership rates went up in 2009.

2.3.3 The Rise of Institutional Investors

Figures 4 and 5 depict institutional investors' purchase and sale of single family homes in the 20 MSAs on average and for selected cities. According to Figure 4, the share of transactions with institutional buyers hovered at around 6 percent prior to the crisis. It picked up significantly starting in 2007, reaching a peak of almost 14 percent in 2013 (panel a, Figure 4). Institutional purchases had a small run-up during the boom years (2000 to 2004) for Atlanta and Las Vegas but a much larger run up during the recovery. At the peak, over 20 percent of the purchases were by institutional buyers for the two cities. The share of institutional purchases was much smaller in New York City and Washington D.C. during our sample period but the cities nevertheless experienced an increase in the share. Institutional buyers constitute a larger share of housing transaction in foreclosure sales than in regular sales ,as depicted in panel b of Figure 4. However, despite that Las Vegas had the highest foreclosure rates, its institutional purchases of foreclosed properties were far below that of Atlanta, but in line with the other three cities. We do not plot the share of institutional purchases in regular nonforeclosure transactions, as they resemble those of the overall transactions in panel a of Figure 4 closely.

Turning to institutional sales (Figure 5), for the average city, the share started out in the mid 20 percent in the early 2000s and peaked at almost 50 percent in 2009. It has since come down to 30 percent (panel a, Figure 5). In the non-distressed market, institutional sales exhibited a u-shape, starting out at 25 percent in the early 2000s, falling to 20 percent in 2005, rising to 26 percent in 2012 before falling back to 23 percent in 2014 (panel b, Figure 5). Prior to the crisis, institutional sellers

were mostly construction companies. They reduced new housing construction as the market headed to the crisis. All four MSAs had a run up in institutional sales during the crisis. However, most of the increase was due to the rise in foreclosure sales, which by definition have institutions as sellers. Excluding the sales where banks are selling the properties they they foreclosured upon (which can be very different from institutions selling properties they bought previously), the share by institutional sellers moved up somewhat for New York City and Washington D.C., but fell slightly for Atlanta. Las Vegas is the only one whose pattern for institutional sales in the nondistressed market followed somewhat that in the overall market.[17]

2.3.4 Identities of Institutional Investors

We have described the selection of these 20 institutions in the data section. These institutions are Blackstone (Invitation Homes), American Homes 4 Rent, Colony Starwood, Progress Residential, Main Street Renewal, Silver Bay, Tricon American Homes, Cerberus Capital, Altisource Residential, Connorex-Lucinda, Havenbrook Homes, Golden Tree, Vinebrook Homes, Gorelick Brothers, Lafayette Real Estate, Camillo Properties, Haven Homes, Transcendent, Broadtree, and Reven Housing REIT. Of the 20 firms, Blackstone is a private equity financial firm, Tricon American Homes, Cerberus Capital, Golden Tree, and Transcendent all have dealings with investment management, hedge fund, or private equity. American Homes 4 Rent, Colony Starwood, Silver Bay, Altisource Residential, Connorex-Lucinda, Havenbrook Homes, Broadtree, and Reven Housing REIT are REITs (Real Estate Investment Trust).[18]

Over our sample period, these large institutions have also increased their presence both as buyers and as sellers in single-family housing, but only in selected markets. As buyers, they are most active in Charlotte, Miami, Atlanta, and Tampa. With the exception of Dallas, they have not particularly increased their presence in the sellers' market. More importantly, these large institutions did not appear to be more active in the foreclosure market than in the regular market. It is worth noting that large institutions' share of single-family purchases or sales were close to zero in 2007. Despite the rise that began after 2010, in 2014, their shares remained small. The average share of large institutions as buyers was 1.44 percent and the average share as sellers was 0.27 percent.

At the other end of the spectrum are individual investors who set up Limited Liabilities Companies (LLCs) or Trusts with cryptic names when purchasing properties. LLCs and Trusts help homeowners and/or investors avoid not only publicity, but also scams, identity theft, and frivolous lawsuits. Unlike large institutions, LLCs and Trusts have increased their presence as buyers in all 20 MSAs, more so in San Francisco, Los Angeles, Miami, and San Diego. Additionally, depending on the cities, they were either more active in the regular market or the foreclosure market. On the sale

[17] As we have pointed out repeatedly, our sample excludes nonarm's length foreclosure sales, readers shall not compare Figures 4 and 5 to get the "net" investor stock.

[18] Note that this list overlaps significantly with Mills, Molloy, and Zarutskie (2017).

side, with the exception of Phoenix, Tampa, and the regular market of Dallas and Denver, LLCs and Trusts have generally increased their presence. The other interesting difference between LLCs and Trusts and large institutions is that LLCs and Trusts' presence in the single-family housing market, though small, started much earlier, 2006 on average.

3 Institutional Investors and the Housing Recovery

3.1 Sample Construction

In the last section, we have documented the rising presence of institutions as both buyers and sellers in the single-family housing market. We have shown that this phenomenon occurred after the mortgage crisis, more specifically, since 2007. In this section, we study how this rising presence of institutional buyers and sellers affected the recovery of the local housing market. To that end, we focus our benchmark analysis on the periods between 2007 and 2014.[19] Our large property-level data allow us to collapse the data to the zip code level, which is important as it presents far more heterogeneity than does a city let alone a state. In particular, we construct, by zip code and by year, the percentage of individual house purchases and sales by institutions, and then merge by zip code and by year with zip code level average household adjusted gross income and total number of households who file for tax returns each year from the Internal Revenue Services, the zip code level CoreLogic Solutions house price indexes for single family housing, unemployment rates at the county level from the Bureau of Labor Statistics, and county-level homeownership rate from the Census Bureau.

Our final sample consists of 22,825 observations spanning 4,776 zip codes. The majority of the zip codes are present in all 8 years from 2007 to 2014. Table 2 presents the summary statistics of the variables used in our analysis. As can be seen from the table, the average share of institutional buyers is 10 percent, while the average share of institutional sellers is 37 percent between 2007 and 2014, reflecting the high level of foreclosure sales during this period. Excluding the foreclosure sales, the share of institutional sellers averages at about 24 percent. For our main analysis, we will use the second measure but conduct robustness analysis using the first. The amount of heterogeneity of institutional presence either as buyers or sellers is large. During this period, the zip code level real house prices fall on average 3 percent annually again with substantial heterogeneity. Homeownership rate averages 64 percent, but the average changes are negative with large variances. The population size is quite homogeneous across zip codes with both mean and median at around 16 to 17 thousand. Unemployment rates are high for almost all zip codes, averaging about 7 percent. Real average household income has a mean of $32,000 and a median of $27,000 in 1982 dollars, and the growth

[19] The availability of data including annual zip code level income and population also limits our ability to study earlier years.

rate of the real average income was nearly zero during this period.

3.2 Estimation Strategy

Our baseline specification explores the panel nature of our dataset and is described as follows,

$$y_{i,t} = \beta_1 x^1_{i,t} + \beta_2 x^2_{i,t} + \beta_3 Z_{i,t-1} + \epsilon_{i,t}, \tag{1}$$

where i indexes zip code and t year; $y_{i,t}$ is the dependent variable, which for the benchmark case is the real zip code level house price growth rate and changes in homeownership rate; of the explanatory variables on the right-hand-side of the equation, $x^1_{i,t}$ represents the share of institutional buyers at zip code i and in year t; $x^2_{i,t}$ represents the share of institutional sellers at zip code i and in year t; $z_{i,t-1}$ includes all other control variables including the one-period lagged total population growth, changes in unemployment rate and foreclosure rate, growth in real average household income as well as MSA and time fixed effects.[20] The variables of interests are β_1 and β_2 as they measure the separate effects of institutional buyers and sellers on the local market.

If we estimate equation (1) using Ordinary Least Squares (OLS), our estimates will be biased because common shocks can drive both house price dynamics, homeownership rates as well as institutional investors' participation in the local housing market. For instance, a large fraction of institutional investors in the local housing market may be a response to local economic conditions rather than a cause of the housing and economic cycles. To resolve this identification issue, we use a Two-Stage least squares (2SLS) for the regression analysis, an extension of the ordinary least squares (OLS). Specifically, in the first stage we estimate

$$x^j_{i,t} = \gamma_1 q^1_{i,t} + \gamma_2 q^2_{i,t} + \gamma_3 Z_{i,t-1} + \upsilon_{i,t}, \qquad j = 1, 2. \tag{2}$$

where $q^j_{i,t}$ are the instrumental variables that are related to $x^j_{i,t}$ but unrelated to the error term $\epsilon_{i,t}$ in equation (2).

3.3 Instruments

We construct three instruments. As discussed in the introduction, our first instrument captures zip codes' heterogeneous exposure to lenders subject to the Federal Reserve System's Comprehensive Capital Analysis and Review (CCAR) stress test after the crisis. These tests are meant to ensure that the largest bank holding companies have enough capital to weather a financial crisis, but as a side-effect they have encouraged those institutions to tighten their standards in mortgage markets (Calem, Correa, and Lee 2016). Our methodology follows Gete and Reher (2018)'s construction of panel instrument, which in turn followed that of Khwaja and Mian (2008). The Khwaja and

[20] The large number of zip codes relative to sample size precludes us from using zip code fixed effects.

Mian (2008) methodology extracts a measure of lenders' propensity to deny a loan that is purged of borrower, zip code, and time effects. The construction of the instrument takes two steps. In the first step, we estimate a probability of loan denial using HMDA data controlling for a key variable, whether the loan was from a lender subject to the stress test in that particular year, as well as other control variables including borrowers' income, their requested loan-to-income ratio, borrowers' race, and zip code and time fixed effects as described in equation (3), where i represents each loan, j zip code, t year, and l whether the lender is subject to the stress test. The coefficient of the key variable, $\Lambda_{t,l}$, which measures whether the loan was from a lender subject to the stress test that year, is our stress shock.

$$Pr(Denied_{i,j,t,l} = 1) = \Lambda_{t,l} + \gamma_4 W_{i,j,t,l} + \alpha_j + \theta_t. \tag{3}$$

In the second step, we weight the coefficient by the zip code mortgage application shares of these stress-test-affected lenders as of 2005, two years prior to our sample period, i.e.,

$$q^1_{j,t} = \Lambda_{t,test} * Stress\,Test\,Share_{j,2005}. \tag{4}$$

For more details on the construction of the instrument, see the appendix in Gete and Reher (2017). In Figure 6 panel a, we chart the instrument averaging over the 20 cities and for four selected cities. As can be seen, prior to 2008, banks that would have been subject to the stress test tended to have lower mortgage denial rates than lenders that would not be subject to the stress test. After 2008, however, these banks were denying mortgage applications at much higher rates than lenders not subject to the stress test. The differences peaked in 2010. After a dip in 2011, they went back up to the level we saw in 2010.[21]

The construction of our second instrument follows that of Loutskina and Strahan (2015). As mentioned in the introduction, lenders are more willing to lend conforming loans defined as loans below the conforming limit as these loans are guaranteed by Fannie Mae and Freddie Mac. These limits were set at the national level before 2008. After 2008, they became tied to local (county) housing conditions, but remained nevertheless sticky. To account for this, we compute national average conforming limit excluding a zip code i. Then for that zip code, we use the fraction of mortgage applications from zip code i in year t-1 that exceeds 1.25 times of the national average as our instrument. By excluding zip code i when computing the national average, we avoid capturing the local factors driving changes in the conforming limits as argued by Loutkina and Strahan (2015). From Figure 6 panel b, we observe that prior to 2008, a much larger fraction of applicants applied for mortgages that were outside of 1.25 times of the conforming limits. The big drop in 2008 partially reflected the change of the limit to be more aligned with local housing information. Put differently, more expensive areas had much higher conforming loan limits beginning in 2008. Another

[21] It is important to point out that this chart is only suggestive as the composition of loan applications have changed over time.

confounding factor is the decline in local house prices that led to smaller mortgages needed for housing transactions. After 2011, we began to see a slow increase in the fraction of mortgage applications that have loans over and above 1.25 times the conforming limit.

Our third instrument follows Gao, Sockin, and Xiong (2018). We construct at zip code level capital gains tax rate for a household with mean income. In other words, while the tax rate is set at the state level, the household mean income is at the zip code level. The primary residence exclusion allows homeowners to exclude up to $250,000 ($500,000 per couple) of capital gains from the sale of their primary residence, at both the federal and state levels, if the homeowners have owned and lived in the house for at least two of the five years prior to the sale. There is, however, no capital gains exclusion for sales of non-owner-occupied homes, including those owned by institutional buyers. Different states impose different capital gains tax rates, and some impose no capital gains tax at all. More importantly, theses tax rates are not driven by shocks to the housing market. See Gao et al. (2017) for more detailed discussion. Though our analysis focuses on institutional investors in the housing market, as we pointed out earlier, many of these institutions take the form of LLCs. LLCs are not taxed as a separate business entity. Instead, all profits and losses pass through the business to members of the LLC. LLC members pay federal as well as state income taxes on profits.[22]

In Table 2 under the heading of "Instruments," we present summary statistics of our instruments. On average, between 2007 and 2014, mortgage applications to banks subject to stress tests are more likely to be denied by 26 basis points with a median of 15 basis points. During the same period, the share of mortgage applications with loan amount exceeding 125 percent of the limit has a mean of 0.76 percent and a median of 0. The capital gains tax at mean income averages about 4.5 percent with a median of 4.8 percent.

3.4 Main Results

We present our benchmark estimation results using OLS as well as 2SLS estimation techniques in Table 3. All analyses are weighted by the number of housing transactions in the zip code. As seen in the table, in the OLS analysis where no instruments are used, a one-percentage increase in the share of institutional buyers leads to an increase in real house price growth rates of 12 basis points, while a one-percentage point increase in the share of institutional sellers leads to a decrease of 6 basis points in real house price growth rates. For the other explanatory variables, a one-percentage point increase in past real HPI growth rate increases the current one by 30 basis points suggesting strong auto-regressive property in real house price appreciate rate. Areas that had high unemployment rates or high foreclosure rates in the previous period also had lower house price recovery. Lagged

[22]Most states tax LLC profits the same way the IRS does: The LLC owners pay taxes to the state on their personal returns. A few states, however, charge the LLC a tax based on the amount of income the LLC makes, in addition to the income tax its owners pay. For instance, California levies a tax on LLCs that make over $250,000 per year; the tax ranges from about $1,000 to $9,000.

real average household income growth, on the other hand, contributes positively to the current house price appreciation rate.

In the 2SLS estimation where instruments are used, a one-percentage point increase in the share of institutional buyers now leads to an increase of 21 basis points in real house price growth rates, while an increase of one percentage point in the share of institutional sellers leads to a decline of house price growth rate of 56 basis points. In percentage terms, these numbers amount to 7.3 and 20 percent of real house price growth rates. The effects of the other explanatory variables remain similar to those in the OLS regression analysis.

Turning to homeownership rate, an one-percentage-point increase in institutional buyers lowers changes in the homeownership rate by 0.5 basis point in the OLS analysis and 2.6 basis points in the 2SLS analysis. While changes in the share of institutional sellers does not affect changes in the homeownership rate in the OLS analysis, it raises the changes in homeownership rate by 3.6 basis points in the 2SLS analysis for each percentage increase in the sellers share. Put differently, a one-percentage point increase in institutional buyers lower percentage point changes in the homeownership rate by 4 percent, while an one-percentage point increase in institutional sellers raises the percentage change by 5 percent.

Table 4 presents the first stage regression results of the 2SLS analysis of the real house price growth rate. We omit the first stage results for the homeownership rates as they are the same as those reported in Table 4. Shares of institutional buyers are negatively correlated with lagged zip code real house price growth, lagged zip code population growth, lagged changes in county unemployment rate, lagged changes in zip code foreclosure rate, as well as lagged growth rate of real average household income at the zip code level. The result that institutional buyers respond negatively to lagged house price growth rates is particularly interesting, as it contrasts with the individual investors' behavior during the housing room. According to Gao et al. (2017), individual investors responded strongly and positively to lagged real house price growth rates, suggesting that they were forming their expectation of future house price movements from the recent experience, i.e., they are momentum traders. Our analysis here suggests the institutional investors during the housing recovery acted like contrarian, by targeting low-growth areas expecting a turn around in house prices in those areas.

Turning to selling activity, shares of institutional sellers are negatively correlated with lagged real house price growth rate, but positively correlated with lagged zip code population growth, and lagged changes in foreclosure as well as lagged changes in unemployment rates. All three instruments affect institutional purchases and institutional sales statistically significantly. In particular, areas that had more exposure to banks subject to the stress test or with more loans far exceeding the conforming loan limit are more likely to have both more institutional buyers and sellers because in these areas households face greater difficulty obtaining mortgages or cheaper mortgages to buy their

residences. By contrast, a higher capital gains tax rate makes investment in housing more expensive, as a result, fewer institutions buy or sell.

To arrive at an estimate of the overall impact of institutional buyers and sellers on the local housing market, we time the average effect from these estimations with changes in institutional buyers and sellers, add the two effects together, and then divide by their mean during the period. Specifically, between 2007 and 2014, shares of institutional buyers went up by 6.54 percentage points while shares of institutional sellers went up by 6.7 basis points. The overall net effect is 1.3 percentage points for house price growth rates and negative 16.8 basis points for changes in homeownership rate, or 12 percent for changes in house price growth rates and 30 percent for changes in homeownership rates.

3.5 Robustness Analysis

We now conduct several robustness tests. First, we use alternative instruments. Then we conduct our analysis without the weights, i.e., we treat all zip codes the same and do not overweight large and active areas. For the third robustness analysis, we include REO sales where sellers are banks in our institutional sales measure. For the fourth, we study how the results vary with the housing supply elasticity as constructed by Saiz (2010). For the last experiment, we study how the effect of institutional buyers and sellers changes with the intensity of foreclosure sales in the area.

In our benchmark analysis, we used all three instruments for the two endogenous variables, the fraction of purchases by institutions and the fraction of sales by institutions. In theory, two instruments are suffice for two endogenous variables. We, therefore, experiment with using two of the three in our first robustness analysis and present the results in Table 5. As can be seen, the results vary a bit for both house price growth rates and changes in homeownership rates, but the effects are statistically as well as economically significant. For our second robustness check as reported in Table 6, when we treat all zip codes equally instead of weighting large and active areas more heavily as in the benchmark analysis, the effects of institutional buying and selling on local house price growth and changes in homeownership rates remain both economically and statistically significant and somewhat smaller than those obtained in the benchmark analysis for house price growth rates but larger than the benchmark results for changes in homeownership rate (Table 3). For the third where we use a broader measurement of institutional sales, the impact of institutional sales become a bit smaller but the impact of institutional purchases are largerly unchanged.

Turning to housing supply elasticity (Table 7), interestingly, cities with medium range housing supply elasticity had the largest impact from the presence of institutions in the single family housing market both as buyers and as sellers. This result is consistent with the theoretical work in Gao, Sockin, and Xiong (2017), where they demonstrate that when there exists information frictions where households cannot separate a housing supply shock from a demand shock, households and

hence house prices will overreact in areas with intermediate supply elasticity. The intuition is straightforward, prices are fully revealing when supply is perfectly inelastic, and prices are completely uninformative about demand when supply is very elastic.

In terms of foreclosure intensity (Table 7), in Figure 4 we have shown that institutional buyers are much more active in the distressed market than in the regular market. It is not surprising, therefore, that these institutions have the biggest impact in terms of both real house price growth rates and changes in homeownership rate, particularly for the presence of institutional sellers.

4 Transmitting Mechanisms and the Impact on the Rental Market

Having established a causal relationship between the increase in institutional activities in the single-family housing market and the recovery in the local house prices as well as the decline in homeownership rate, we now investigate the potential mechanisms through which these activities affect the local housing market. We will also investigate the impact on the rental market of the presence of institutional owners in the housing market.

4.1 Transmitting Mechanisms

There are several candidates for the transmitting mechanisms. First, institutional owners may engage in more housing rehabilitation, either because they have the financial ability to do so or because they feel that they can better capture the investment returns via rental income stemming from better management, etc. We test this channel by studying how county-level building permits are impacted by the increasing presence of institutional buyers and sellers. Second, the increased institutional activities may help drive the local economy by creating more jobs and hence reducing local unemployment rates and boosting local household income. As a result, local housing demand may increase, which helps push up local housing prices. We test this channel by studying how county-level unemployment rate and growth in zip code level average household income respond to the increasing presence of institutional buyers and sellers in their local market.

Table 8 summarizes our results. To arrive at these results, we run regressions similar to those in the baseline case, except that we replace house price growth rate/changes in homeownerhsip rate by the variable that we are interested in as the dependent variable. We also add lagged value of the new dependent variables as an additional explanatory variable.

According to Table 8, for building permits measured in the growth rates of either units or value, an increase in an area's institutional buyers increases the growth rate of the building permit. By contrast, an increase in the area's institutional sellers decreases the growth rate of building permits. Overall between 2007 and 2014, changes in institutional shares of buyers and sellers contributed to between 18 and 20 percent of the growth in building permits measured in units or in value.

Turning to local labor market, on average, changes in institutions' presence as buyers in the local market decreases the local unemployment rate, while increasing shares of institutional sellers, on the other hand, increases local unemployment rate. Overall during our sample period, changes in institutional shares in the housing market contributed to about 6 percent of the changes in unemployment rates. Neither institutional presence, as buyer nor seller, affects the growth rate of the local average household income statistically significantly.

4.2 Impact on the Local Rental Market

Although we do not observe institutional activities after they purchase the houses, the fact that local homeownership rates continued to decline while institutional buyers kept increasing suggest that many institutional buyers may have chosen to rent their houses out instead of selling them, i.e., they "buy and let." Indeed, of those who bought and sold in our sample between 2007 and 2014, institutions had an average and median tenure of 1 year, and about 21 percent of them held their houses for 2 years or longer. By comparison, individuals had a mean and median house tenure of 3 years, and 73 percent of them had a tenure longer than 2 years.[23] To access the impact of institutional presence on the local rental market, we now turn to local rent-to-price ratios and eviction rates.

We obtain our county level rental index for single family houses from Zillow.com, data retrieved on dates between January 2018 and August 2018. Unfortunately, the county-level rent index is only available starting from 2010. We therefore use the MSA-level rental index for the earlier years 2007 to 2009. The zip-code level house price index is the same as those used in the benchmark analysis. The county eviction rates come from the Eviction Lab at Princeton University. The eviction rates, however, do not differentiate between housing types and are for all housing in the county. These rates serve as a lowered bound as they do not capture informal evictions occurred outside the courtroom.

In Table 9, we report our results. In terms of rent-price ratio, given our earlier result that institutional buyers raise local house price growth rates while institutional sellers lower local house price growth rates combined with the "buy to let" model which increases local rental housing supply, it is, therefore, not surprising that the growth rate in the local average rent-to-price ratio declines with increases in the share of institutional buyers but rises with increases in the share of institutional sellers. Overall, institutional investors' buy and sell explains 13 percent of the percentage changes in the rent-to-price ratio. The effect of institutional buyers is strongest in areas with medium housing supply elasticity. In high-foreclosure areas, however, the growth rate of rent-price ratio is not affected by the presence of institutional buyers or sellers. This implies that rents in these areas are not growing faster than house prices.[24]

[23] Note that many institutions and individuals didn't buy and sell during our sample periods, so the average holding periods for either category in actuality are much longer than reported here.

[24] Gete and Reher (2018) investigate whether tightening in local lending conditions leads to increases in local rents.

Turning to local eviction rates, our regression results are mixed. For the sample as a whole, we find weak evidence of increases in institutional sellers raising local eviction rates. For sub-samples with medium housing supply elasticity or with high foreclosure results, we find that increases in institutional buyers in the local housing market increase local eviction rates. Increases in institutional sellers, however, no longer raise local eviction rates for cities with medium supply elasticity and they lower local eviction rates in high foreclosure areas. Taking the results together, our analysis does not provide strong evidence that institutional landlords may be more ruthless in that they raise rents more and evict tenants more as depicted by the media.[25]

5 Conclusions

In this paper, using unique housing transaction data we document a rising trend of institutions as buyers and sellers in the single family housing market immediately following the mortgage crisis. This trend lasted well into 2014. We argue that this rising trend has led to a house price recovery without homeowners. Our empirical strategy exploits heterogeneity in zip codes' exposure to regulatory shocks that affect lenders differently, changes in FHFA conforming loan limits, as well capital gains tax rate.

Our main finding is that between 2007 and 2014, institutional investors as buyers have helped local house price recovery but depressed local homeownership rate while sellers have depressed local house price growth rates but helped with growth in the homeownership rate. Furthermore, these effects associated with institutional investors on house price growth are much stronger in areas with medium housing supply elasticity or areas with high foreclosure rates. We identify housing rehabilitation/renovation as well as improved labor market as the main transmitting mechanisms. Institutional investors' buying and selling in the single family housing market also affected the local rental market, reducing the changes in the rent-to-price ratio, but had no consistent effect on eviction rates.

Their study period is between 2010 and 2014. Our hypothesis is very different from theirs in that increases in institutinal presence in the local housing market stem from several factors including tightening in the local housing market, heterogeneity in local housing tax rates, as well as institutions chasing for yields. See Lambie-Hanson, Li, and Slonkosky (2018) for more detailed discussion.

[25]See, among others, "Wall Street: America's New Landlord, Kicks Tenants to the Curb,"Forbes, January 3, 2017. https://www.bloomberg.com/news/articles/2017-01-03/wall-street-america-s-new-landlord-kicks-tenants-to-the-curb, and "Here's What it's Like When Wall Street is Your Landlord," Huffington Post, July 21, 2014. http://www.huffingtonpost.com/2014/07/21/invitation-homes-problems_n_5606403.html.

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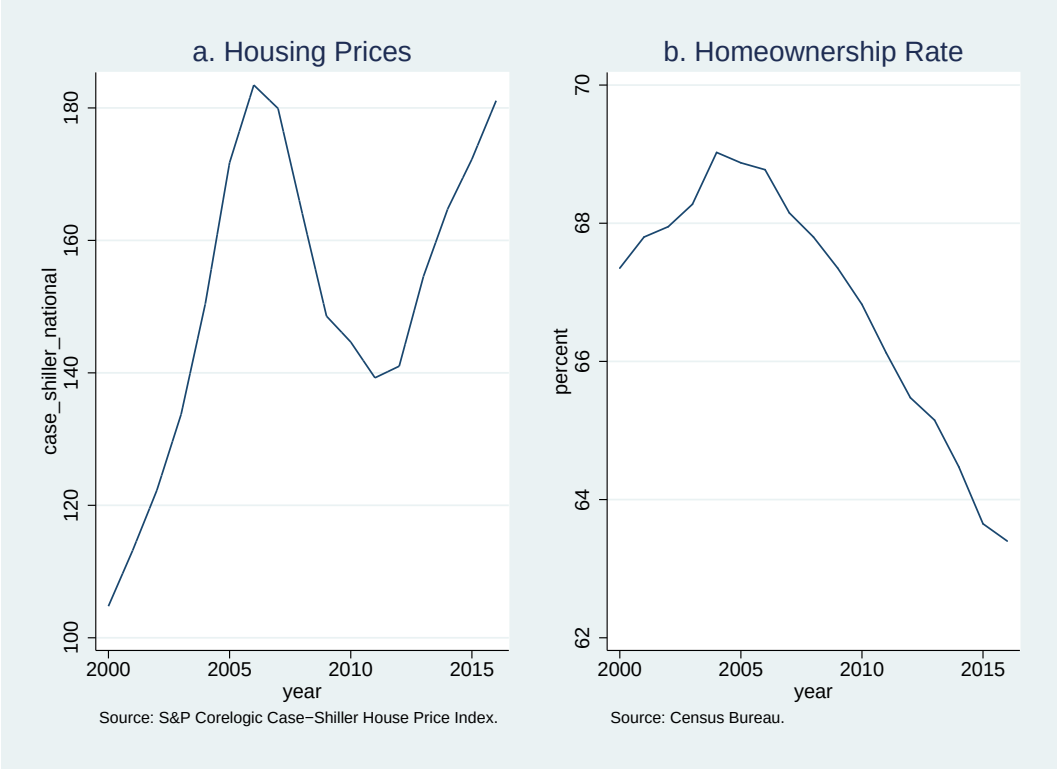

Figure 1: **U.S. Residential House Price and Homeownership Rate**

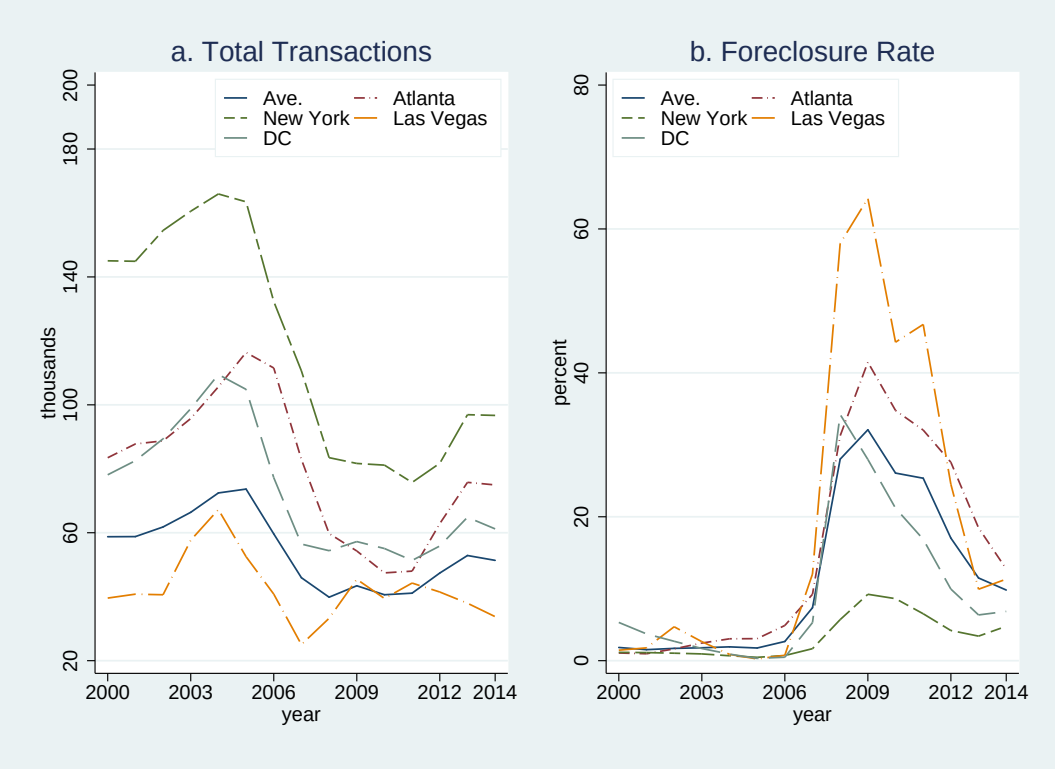

Figure 2: **Housing Transactions and Foreclosure Rate.** This figure describes housing transaction volume and shares of foreclosure sales of the average of the 20 MSAs covered by the S&P CoreLogic Case-Shiller 20-City Home Price Index and four selected MSAs including Atlanta, Las Vegas, New York City, and Washington D.C. The selection of the four MSAs is based on their diverse housing market conditions. Note that because we exclude nominal REO (real estate owned) sales and not all REO sales lead to foreclosure sales which we do include in our data, our foreclosure sales measurement understates the extent of housing distress in the economy.

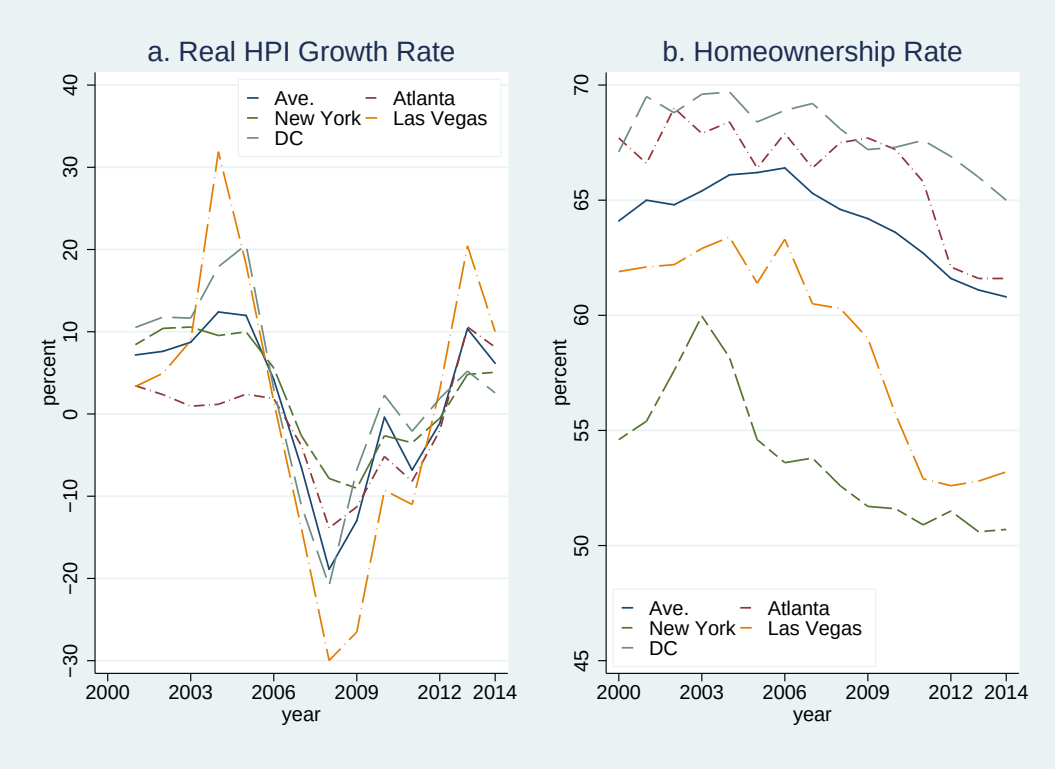

Figure 3: **House Price Growth Rate and Homeownership Rate.** This figure describes the real house price growth rates and homeownership rates of the average of the 20 MSAs covered by the S&P CoreLogic Case-Shiller 20-City Home Price Index and four selected MSAs including Atlanta, Las Vegas, New York City, and Washington D.C. The selection of the four MSAs is based on their diverse housing market conditions. The real house price index is obtained by deflating the nominal MSA house price index from CoreLogic Solutions by the headline Consumer Price Index.

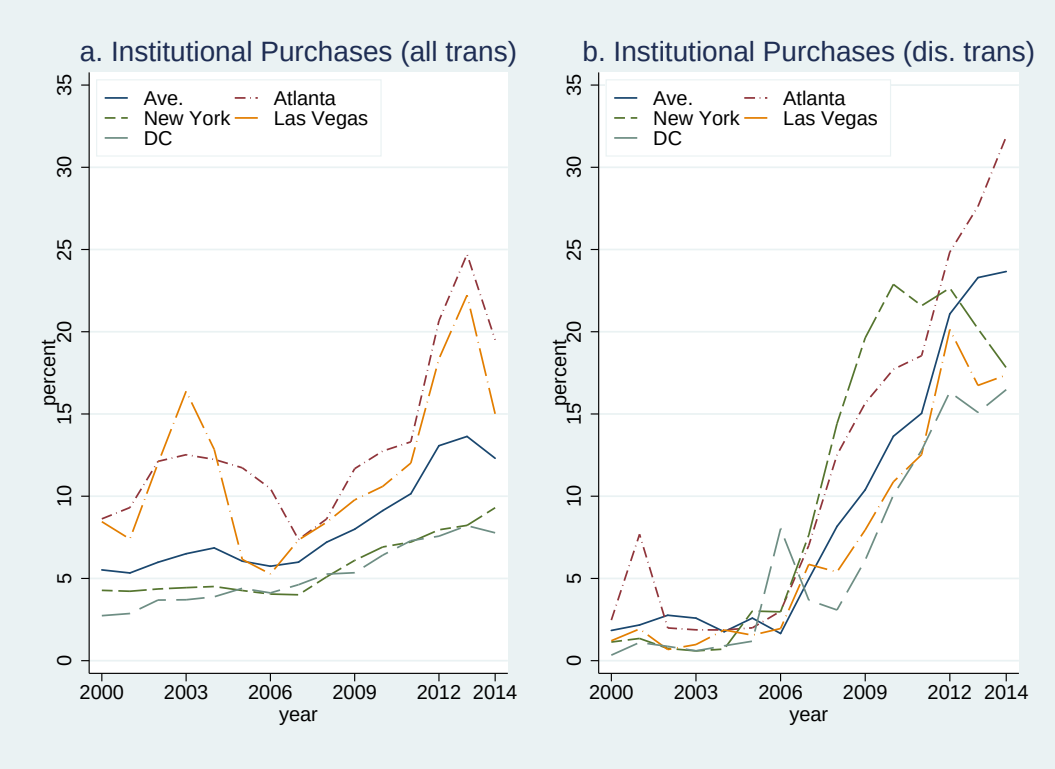

Figure 4: **Institutional Investor Purchase Activities.** This figure depicts institutional investor buying of single family homes in the 20 MSAs covered by S&P CoreLogic Case-Shiller 20-City Home Price Index on average and for four selected MSAs. Distressed transactions refer to foreclosure sales. We omit the chart for regular nondistressed sales because the shares resemble closely those in panel a.

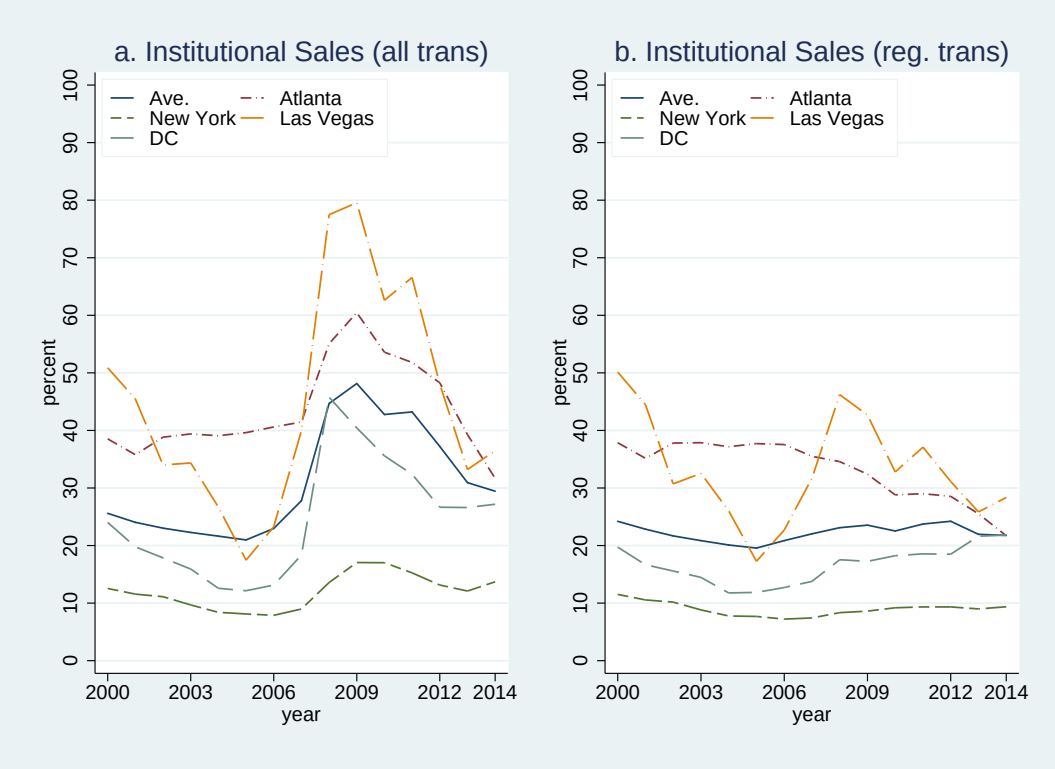

Figure 5: **Institutional Investor Sale Activities.** This figure depicts institutional investors' selling of single family homes in the 20 MSAs covered by S&P CoreLogic Case-Shiller 20-City Home Price Index on average and for selected MSAs. Regular refers to nonforeclosure sales. We omit the chart for distressed foreclosure sales because by definition all foreclosure sales have institutions as sellers.

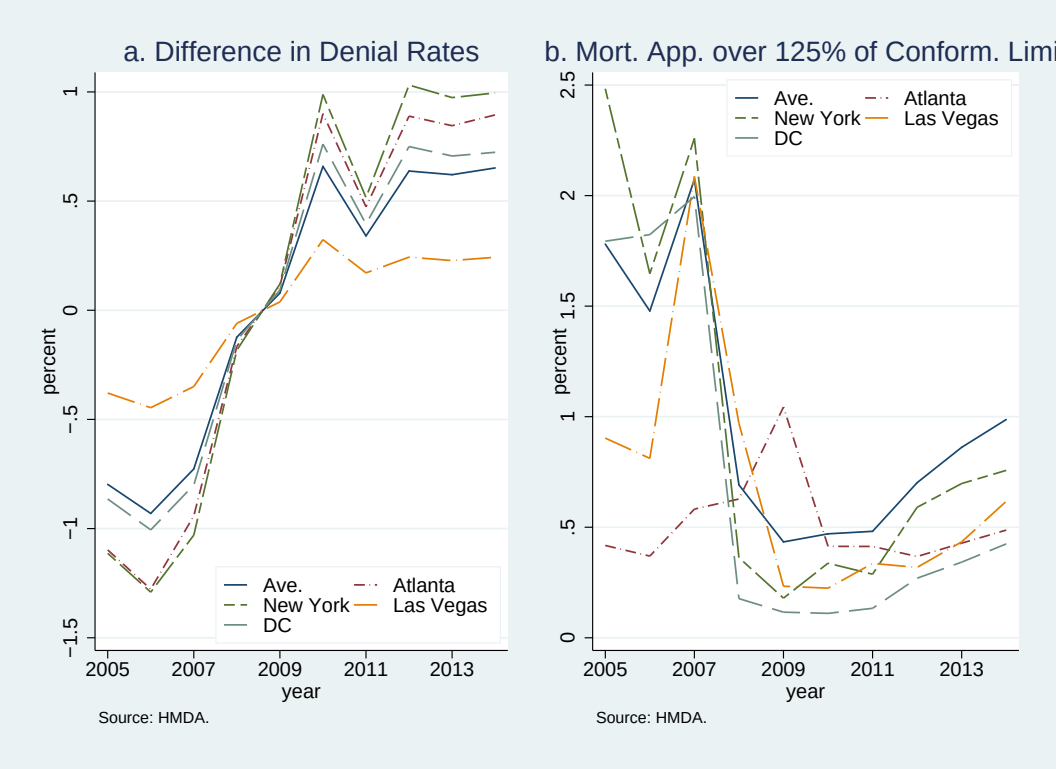

Figure 6: **Lending Conditions over Time.** This figure depicts in panel a the denital rates of single family mortgage applications by lenders subject to distress tests relative to lenders not subject to distress tests weighted by their 2005 application shares in the 20 MSAs covered by S&P CoreLogic Case-Shiller 20-City Home Price Index on average and for selected MSAs. Panel b depicts the share of single mortgage applications with mortgage amount exceeding 1.25 times the conforming mortgage limit for the county.

Table 1: **Housing Conditions by MSA**

	Real HPI Gr. Rates (%)			Homeownership (%)			Transactions (000s)			Forecl. Share (%)		
City	2005	2009	2014	2005	2009	2014	2005	2009	2014	2005	2009	2014
Atlanta	2.41	-11.30	8.13	66.4	67.7	61.1	67.7	61.6	75	3.00	41.29	12.71
Boston	3.78	-3.27	4.67	63.0	65.5	62.8	65.5	62.8	33	0.21	8.76	3.98
Charlotte	2.05	-6.66	3.57	65.8	66.1	58.1	40	17	30	3.14	14.13	6.27
Chicago	5.57	-11.97	5.37	70.0	69.2	66.3	108	51	83	1.17	28.34	18.43
Cleveland	-0.66	-5.29	3.43	74.4	70.9	69.2	30	21	23	4.86	25.92	10.81
Dallas	2.07	-3.57	6.44	62.3	61.6	57.7	91	56	72	6.73	17.28	4.57
Denver	-0.17	-1.25	7.08	70.7	65.3	61.9	48	36	48	6.93	23.97	3.54
Detroit	-1.83	-19.86	10.45	75.1	73.9	71.2	54	53	61	7.22	55.47	26.96
Las Vegas	18.19	-26.51	10.01	61.4	59.0	53.2	53	46	35	0.25	63.73	11.03
Los Angeles	17.61	-13.62	8.81	54.6	50.4	49.0	116	78	73	0.23	35.06	4.61
Miami	22.22	-24.24	8.38	69.2	67.1	58.8	69	33	48	0.36	27.51	15.05
Minneapolis	3.56	-9.43	4.21	74.9	70.9	69.7	48	35	40	1.31	30.21	7.67
New York	9.99	-9.03	5.07	54.6	51.7	50.7	165	82	97	0.46	9.19	4.76
Phoenix	30.93	-22.77	5.39	71.2	69.8	61.9	122	88	78	0.38	50.62	6.25
Portland	12.06	-10.04	6.72	68.3	64.0	59.8	49	22	32	1.30	17.61	4.73
San Diego	9.66	-9.92	7.21	60.5	56.4	57.4	30	24	24	0.27	36.91	4.93
San Fran.	11.62	-10.66	11.85	57.8	57.3	54.6	55	38	36	0.24	36.40	3.58
Seattle	10.81	-11.29	11.85	64.5	61.2	61.3	68	30	44	0.68	17.66	8.20
Tampa	20.52	-17.30	5.27	71.7	68.3	64.9	79	34	49	0.95	24.14	21.52
Wash. D.C.	20.58	-6.79	2.56	68.4	67.2	65.0	107	58	62	0.32	27.48	6.79

This table reports the housing market conditions of the 20 MSAs included in our study as characterized by real house price growth rate, homeownership rate, total transactions, and the foreclosure shares. The real house price growth rate is constructed using CoreLogic Solutions MSA level house price index for detached single family homes deflated by headline CPI (consumer price index) from U.S. Census/Haver Analytics.

Table 2: **Summary Statistics**

	2007-2014				
variable	mean	median	s.d.	min	max
Share of institutional buyers (%)	10.220	7.500	8.955	0	100
Share of institutional sellers (%)	37.756	35.814	19.715	0	100
Share of insti. sellers not counting REO sales (%)[1]	24.168	21.339	14.097	0	100
Real house price growth rate (%)	-2.844	-2.569	10.263	-36.275	30.437
Homeownership rate (%)	63.638	63.069	10.068	18.152	90.688
Changes in homeownership rate (%)	-0.719	-0.677	1.635	-26.449	32.096
Growth rate in building permits (units) (%)	-0.146	-2.137	38.827	-99.275	522.059
Growth rate in building permits (value) (%)	1.207	-0.114	35.861	-93.859	255.419
Population (thousands)	17.144	16.173	7.384	0.381	98.117
Unemployment rate (county level) (%)	7.373	7.233	2.707	1.950	17.700
Changes in unemp. rate (county level) (%)	0.135	-0.342	1.682	-3.308	7.975
Real average household income (thousands, 1982 $)	32.243	27.036	21.454	11.032	463.858
Growth rate of real average hh income (%)	-0.160	-0.198	7.263	-16.449	19.182
Instruments					
Weighted diff. in denial rates by stress lenders (%)[2]	0.261	0.148	0.593	-3.305	3.340
Mort. app. with loans over 125% of loan limit (%)[3]	0.761	0.00	3.356	0	100
Capital gains tax at mean income (%)	4.486	4.750	3.085	0	12.300
Number of observations	22,825 (4,776 zip codes)				

This table presents summary statistics for variables used in the empirical analysis. 1. Don't count REO sales as institutional sales. 2. Weighted difference in deny rates by stress lenders measures the difference in mortgage application denial rates for single family homes by lenders subject to stress tests and by lenders not subject to stress tests. The difference is then weighted by the zip code's single family mortgage application share to lenders subject to stress tests in 2005. The main text of the paper describes the logic and procedure in more details. 3. The share of single family mortgage applications with mortgages exceeding 1.25 times of the conforming mortgage limit.

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Table 3: **Benchmark Estimation**

	OLS		2SLS	
Dependent variable: Real HPI gr. rate (%)	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	0.118***	0.005	0.206***	0.055
Share of institutional sellers (%)	-0.056***	0.003	-0.561***	0.088
Lagged real hpi growth rate (%)	0.297***	0.006	0.241***	0.012
Lagged growth rate in population (%)	-0.002***	0.001	0.159***	0.027
Lagged changes in foreclosure rate (%)	-14.632***	0.389	-9.037***	1.196
Lagged changes in unemployment rate (%)	-1.646***	0.048	-1.559***	0.090
Lagged growth rate of real average hh income (%)	0.055***	0.005	0.057***	0.008
MSA and year dummies	yes		yes	
Instruments			yes	
Adjusted R-squared	0.813		0.599	
Under identification test (P-value)			0.000	
J-statistics (P-value)			0.000	
	OLS		2SLS	
Depend. variable: changes in homeownership rate (%)	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.005***	0.002	-0.026***	0.012
Share of institutional sellers (%)	0.001	0.001	0.036*	0.020
Lagged changes in homeownership rate (%)	-0.128***	0.004	-0.144***	0.004
Lagged real hpi growth rate (%)	0.018***	0.002	0.022***	0.003
Lagged growth rate in zip code population (%)	0.001*	0.000	-0.013***	0.006
Lagged changes in foreclosure rate (%)	0.106	0.131	-0.284	0.268
Lagged changes in unemployment rate (%)	0.047***	0.016	0.037	0.021
Lagged growth rate of real average hh income (%)	0.002	0.002	-0.001	0.002
MSA and year dummies	yes		yes	
Instruments			yes	
Adjusted R-squared	0.126		0.255	
Under identification test of the equation (P-value)			0.000	
Weak identification test of the equation (P-value)			0.000	
Number of observations	22,825 (4,776 zip codes)			

This table presents the Ordinary Least Squares and Two-Stage Least Squares estimation results for the benchmark model. The sample includes all regular and foreclosure sales. The dependent variables are the real house price growth rate and the percentage point changes in homeownership rate. The instruments used in the 2SLS estimation are: (1) lagged weighted difference between denial rates for loans made to lenders subject to stress test and to lenders not subject to stress test; (2) the lagged fraction of mortgage applications with loan amount exceeding 1.25 times of the conforming limit; and (3) the caital gains tax rate evaluated at the zip code average household income. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level. For our instruments, the underidentificaiton test rejects the hypothesis that the model is underidentified with a P-value of 0.000. The model also rejects the weak identification test at 5 percent critical level. The overidentification test gives a Sargan statistic that has a P-value of 0.04.

Table 4: **Benchmark Estimation: First Stage**

	Institutional Purchases (%)		Institutional Sales (%)	
variable	coeff.	s.e.	coeff.	s.e.
Lagged real house price growth rate (%)	-0.064***	0.010	-0.107***	0.015
Lagged growth in zip code population (%)	-0.192***	0.013	0.169***	0.019
Lagged changes in foreclosure rate (%)	-1.228*	0.653	11.067***	0.929
Lagged changes in unemployment rate (%)	-0.871***	0.081	0.170***	0.019
Lagged grow rate of real average hh income (%)	-0.055***	0.009	0.077	0.116
MSA and year dummies	yes		yes	
Weighted diff. in denial rates by stress lenders (%)	28.409***	11.275	65.824***	16.046
Mort. exceeding 1.25 times of conforming limit (%)	24.609***	1.435	15.159***	2.044
Capital gains tax at mean income (%)	-63.614**	5.271	-39.176***	7.501
Number of observations	22,825 (4,776 zip codes)			

This table presents the first stage of the Two-Stage Least Squares estimation results for the benchmark model. The dependent variables are percentage purchases and sales by institutions, respectively. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level.

Table 5: **Robustness Tests**

	Alternative Instruments					
Dependent variable:	1 and 2		1 and 3		2 and 3	
Real HPI Growth Rate (%)	coeff.	s.e.	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	0.1979***	0.059	0.130***	0.074	0.136***	0.045
Share of institutional sellers (%)	-0.575***	0.093	-0.655***	0.117	-0.304***	0.081
Other controls	yes		yes		yes	
MSA and year dummies	yes		yes		yes	
Dependent variable:	1 and 2		1 and 3		2 and 3	
Changes in Homeownership Rate (%)	coeff.	s.e.	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.030***	0.013	-0.016*	0.010	-0.020**	0.012
Share of institutional sellers (%)	0.030***	0.019	0.058***	0.024	0.018	0.022
Other controls	yes		res		yes	
MSA and year dummies	yes		yes		yes	
Number of observations	22,825					

This table presents some alternative Two-Stage Least Squares estimation results. The dependent variable is the real house price growth rate for the top panel and changes in homeownership rate for the bottom panel. Instrument 1: the weighted difference in denial rates between banks subject to stress test and banks not subject to stress test; instrument 2: percentage of mortgage applications with loan amount exceeding 1.25 times of the county's conforming loan limit; instrument 3: the income tax rate for a household with mean income of the zip code. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level.

Table 6: **Robustness Tests (continued)**

Dependent variable:	Without Weights		Including Bank REO Sales as Inst. Sales	
Real HPI growth rate (%)	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	0.144***	0.061	0.139***	0.029
Share of institutional sellers (%)	-0.301***	0.086	-0.504***	0.042
Other controls	yes		yes	
MSA and year dummies			yes	
Dependent variable:	Without Weights		Including Bank REO Sales as Inst. Sales	
Changes in homeownership rate (%)	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.068***	0.020	-0.018**	0.008
Share of institutional sellers (%)	0.089***	0.028	0.035***	0.011
Other controls	yes		yes	
MSA and year dummies	yes		yes	
Number of observations	22,825		22,825	

This table presents some alternative Two-Stage Least Squares estimation results. The dependent variable is the real house price growth rate for the top panel and changes in homeownership rate in the bottom panel. Cities with medium elasticities refers to areas with housing elasticity ranked within the middle 50 percent of the sample and they include Boston, Chicago, Cleveland, Denver, Detroit, Las Vegas, Minneapolis, New York City, Portland, Seattle, Tampa, and Washington D.C. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level.

Table 7: **Robustness Tests (continued)**

Dependent variable:	Medium Supply Elasticity		High Foreclosure Areas	
Real HPI growth rate (%)	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	0.422***	0.093	0.489***	0.128
Share of institutional sellers (%)	-0.555***	0.077	-0.779***	0.223
Other controls	yes		yes	
MSA and year dummies	yes		yes	
Dependent variable:	Med. Supply Elasticity		High Foreclosure	
Changes in homeownership rate (%)	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.054**	0.027	-0.063***	0.030
Share of institutional sellers (%)	0.071	0.005	0.127***	0.052
Other controls	yes		yes	
MSA and year dummies	yes		yes	
Number of observations	13,880		6,100	

This table presents some alternative Two-Stage Least Squares estimation results. The dependent variable is the real house price growth rate for the top panel and changes in homeownership rate in the bottom panel. Cities with medium elasticities refers to areas with housing elasticity ranked within the middle 50 percent of the sample and they include Boston, Chicago, Cleveland, Denver, Detroit, Las Vegas, Minneapolis, New York City, Portland, Seattle, Tampa, and Washington D.C. Foreclosure areas are zip codes that ranked at the top 25 percentile of the sampel in terms of foreclosure rates. All 20 cities are repsented in this subsample. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level.

Table 8: **Transmitting Mechanisms**

Dependent variable:	Building Permit Unit		Building Permit ($)	
	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	0.876*	0.229	0.926***	0.214
Share of institutional sellers (%)	-1.648***	0.364	-1.623***	0.341
Other controls	yes		yes	
MSA and year dummies	yes		yes	
	Changes in Unemp. Rate (%)		Growth of Mean HH Income (%)	
	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.011*	0.006	-0.040	0.080
Share of institutional sellers (%)	0.026***	0.009	-0.102	0.115
Other controls	yes		yes	
MSA and year dummies				
Number of observations	22,825			

This table presents some alternative Two-Stage Least Squares estimation results. The dependent variable is the growth rate in building permits in units and in real value for the top panel, and changes in local unemployment rate and growth rate of average household income for the bottom panel. The permit and unemployment data are at the county level, while the household income data are at the zip code level. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level.

Table 9: **Impact on the Rental Market**

Dependent variable:	% Changes in Rent-Price Ratio					
	Total Sample		Med. Supply Elasticity		High Foreclosure	
	coeff.	s.e.	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.230***	0.064	-0.483***	0.112	-0.127	0.105
Share of institutional sellers (%)	0.620***	0.100	0.615***	0.091	0.170	0.187
Other controls	yes		yes		yes	
MSA and year dummies	yes		yes		yes	
	Changes in Eviction Rate (%)					
	Total Sample		Med. Supply Elasticity		High Foreclosure	
	coeff.	s.e.	coeff.	s.e.	coeff.	s.e.
Share of institutional buyers (%)	-0.018	0.012	0.019*	0.010	0.043***	0.019
Share of institutional sellers (%)	0.007*	0.004	-0.004	0.010	-0.036*	0.020
Other controls	yes		yes		yes	
MSA and year dummies	yes		yes		yes	
Number of observations	22,825		13,880		6,100	

This table presents some alternative Two-Stage Least Squares estimation results. The dependent variable is the growth rate in the rent-price index for the top panel and changes in eviction rates for the bottom panel. The rent index is the county level rent index from Zillow Research between 2010 to 2014. Before 2010, we use the MSA level rent index also from Zillow as there exists no county level rental index before 2010. The House price index is at the zip code level and the same as in the benchmark analysis. Both indexes are deflated by the headline CPI before computing the growth rates. County eviction rates come from the Eviction Lab at Princeton University for the bottom panel. * indicates statistical significance at 10 percent level; ** at 5 percent level; and *** at 1 percent level.