The Economic Effects of Real Estate Investors*

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Abstract

We show five new results about small and medium-sized real estate investors (SMREI) who participate through legal entities in U.S. housing markets. First, SMREI have the largest growth across all cities post Great Recession, in contrast to Wall Street Landlords who concentrate in superstar cities. Second, SMREI increase house price growth and price-to-income ratio, especially in the bottom price-tier. Third, this effect is reversed as investors trigger a medium-run supply response. Fourth, in areas with a high supply elasticity, SMREI affect rents more than prices. Finally, SMREI change the composition of the housing stock in favor of multi-family units.

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1 Introduction

Real estate investors have attracted a lot of attention recently from academia, policy and media circles. In this paper we study a comprehensive database covering all U.S. housing transaction records during the period 2000-2017. Our contribution is to uncover two sets of results. First, we classify and document characteristics of real estate investors. Second, we use a novel identification strategy to study the effects of small and medium-sized real estate investors (SMREI) on housing markets. Our findings contribute to the growing literature that studies legal entities (LLCs, LPs, Trusts, REITs, etc.), referred to as institutional or corporate investors, in the housing markets after the Great Recession.[1] While the majority of the literature has studied economic effects of large-scale institutional investors, or the combined effects of investors of any size, our paper deviates from this path by showing the importance and impact of SMREI. Moreover, our paper is one of the first in this literature to study the multi-family market in addition to the single-family and show differential effects of investors in those markets.

We show that the group of investors that had the largest growth in terms of housing purchases post Great Recession were the SMREI. Compared to the early 2000s, the increase in the number and value of purchases by SMREI in the U.S. housing market was inversely proportional to the investors' size. These investors are mainly local as their purchases are in the same MSA of their mailing address, and they are located throughout the U.S. geography. In contrast, large institutional investors are geographically concentrated in large metropolitan areas, away from their mailing address. The large investors, so-called Wall Street Landlords (WSL), account for less than 2% of the share of housing purchases across the U.S. in the post-Great Recession period.

The growth of institutional investors in housing markets takes place in a period characterized by a dramatic drop of risk-free rates. Low and stable interest rates can lead to significantly higher demand for income-generating assets like housing.[2] At the same time, house prices across the U.S. suffered a substantial bust. Thus, both these forces made housing an attractive investment opportunity. This motivated us to utilize the pre-crisis "local propensity to invest" as our identification strategy.

We show that one standard deviation higher purchases by SMREI leads to 1.37 percentage points higher housing price growth for the median house, consistent with the findings of Allen

[1] See for example Allen et al. (2018), Mills, Molloy and Zarutskie (2019), Brunson and Buttimer (2020), Gurun et al. (2022), Lambie-Hanson, Li and Slonkosky (2022), and Ganduri, Xiao and Xiao (2022).

[2] This is consistent with the portfolio channel documented by Daniel, Garlappi and Xiao (2021) for stock investments.

et al. (2018), Mills, Molloy and Zarutskie (2019) and Lambie-Hanson, Li and Slonkosky (2022). Contrary to what is common belief, the impact in most areas is entirely driven by small and medium-sized and local investors. Moreover, we show that prices grew significantly faster than income. The market segment that is more sensitive to purchases by SMREI is the bottom price-tier. As first-time buyers tend to purchase housing from the bottom price-tier, it is apparent that investors have large effects on affordability especially for this group.

Our cross-sectional analysis shows strong effects on the overall supply of housing with clear compositional effects in the characteristics of the newly constructed stock. One percentage point increase in the share of SMREI increases the number of new construction permits for single-unit buildings by 4.5% on average, and for buildings of 5 or more units by 15.7% on average. In light of these findings, we apply the projection method developed by Jordà (2005) to separate the short-run impact of investors, in which the housing supply is more inelastic, from the long-run, in which housing supply can adjust.

We show that much of the cross-sectional results are driven by a powerful short-run response of price increases, but also by a reduction in the number of vacant units. The impact on prices weakens over time as new residential units are added to the stock of housing units. Consistent with the theory, the effects on price-to-income and price-to-rent ratio differ once we split the sample by the housing supply elasticity in each MSA based on Saiz (2010). In areas with a highly elastic supply of housing, the purchases of SMREI affect rents more than house prices. In other words, the increasing number of investors participating in this market searching for yield reduces their short-term rate of return. However, in the medium term the economy recovers and the yield growth increases with the income of tenants. In areas with a low housing supply elasticity, SMREI have the opposite effect as prices increase more than rents.

Our identification strategy utilizes the fact that most investors are small and local. As post-Great Recession house prices were collapsed and the yields from risk-free assets decreased due to quantitative easing and were expected to remain low due to forward guidance policy, relatively low prices and high rental yields made local properties an attractive alternative investment. The extent to which SMREI participated in the local real estate markets depended on the pre-crisis propensity for investments among the local high-income population.

We capture such pre-crisis "local propensity to invest" with the share of the top earners' business income over total income in each MSA in 2007, which we calculate using detailed data from individual tax filings. High-income households who consistently receive business income are a great proxy for sophisticated investors who are likely to invest in real estate through legal entities. The validity of our identification strategy requires that even after conditioning for

multiple controls, the geographical distribution of top earners claiming business income in 2007 must be uncorrelated with the factors that moved house price-to-income dynamics between 2008-2017. In other words, it is unlikely that these SMREI picked geographical locations anticipating a decline in house values in 2008 and a future appreciation between 2009-15. The group of high earners plays a more significant role than other groups in the local distribution.[3] This variable can be interpreted as the reverse housing net worth channel of Mian and Sufi (2014) that exposes certain areas to larger macro effects from declines in housing prices due to their housing leverage. Our strategy exposes the investment-prone areas to an attractive alternative investment.

Two features of our specification allow us to overcome the main identification concern of omitted variables: 1) In the main specifications we use many fixed effects and control variables that make it unlikely that the error term reflects common movers of both investors and housing market variables. Then, as robustness, we exhaust the list of possible drivers of housing markets as controls (income, local economic activity, credit conditions, population, composition of labor markets, foreclosures, other type of housing investors etc.). None changes the main results. 2) Predicting the instrument is as hard as it is in the entrepreneurship literature explaining which cities become hubs for entrepreneurship (e.g. Davidsson 1991; Rocha and Sternberg 2005). Most of the cross-sectional differences are driven by random historical factors. Thus, most of the variation in the instrument is random, especially unrelated to other drivers of housing markets. We show that in fact it is very hard to predict the instrument.

We perform a battery of tests that suggest that the identification is valid. For example, areas with the highest or lowest levels of the instrument exhibit parallel pre-trends. Placebo tests confirm the parallel pre-trends. This is strong support for the plausibility of the exogeneity assumption according to Goldsmith-Pinkham, Sorkin and Swift (2020). We also run tests based on Altonji, Elder and Taber (2005) and Oster (2019) that suggest no concerns of omitted variable bias. In addition, we show robustness to multiple alternative specifications and definitions of SMREI' purchases.

Policy implications: The post-Great Recession period has been characterized by severe issues concerning housing affordability across most cities in the world. This affordability crisis differs from the housing boom of the 2000s in the fact that the number of homeowners has been declining with the rise of residential housing investors. Officials in several cities have enacted or are discussing policies to block investors in housing markets.[4] The implications

[3]The individuals identified in the bottom of the distribution are individuals with low income and likely to rent, whereas the individuals in the middle of the distribution are typical homeowners, but do not receive business income.

[4]This has been the case of large states in the U.S. For example New York and California, where the pres-

from our analysis is that the presence of investors worsens the affordability of buying a house by increasing the price-to-income ratio in areas with high supply restrictions. In those areas the prices increase more than income after the investors enter the market. The SMREI affect especially the bottom-tier of the market. In areas with high restrictions on housing supply the investors caused short-term declines in the rent-to-price ratios, and zero short-term effects in rent-to-income ratios. On the other hand, in areas with low restrictions on housing supply, the investors had minimal effects on prices and price-to-income ratios, and they contributed to increased housing supply, especially in favor of multi-family units. In those areas the investors did not affect the price affordability. However, our analysis shows that in those areas the investors caused short-term increases to the rent-to-income and rent-to prices ratios.

Literature: The paper contributes to two seemingly disconnected literatures. The first one analyzes the recent emergence of corporate investors post-financial crisis. Allen et al. (2018), Mills, Molloy and Zarutskie (2019) and Brunson and Buttimer (2020) highlight the increasing importance of corporate investors (also referred to as legal entity or business or institutional investors) in housing markets and describe this new class of investors. Ganduri, Xiao and Xiao (2022), Smith and Liu (2020), Gurun et al. (2022) and An (2022) focus on large institutional investors. Graham (2020) studies implications of the investors during the housing bust of the 2000s, and Lambie-Hanson, Li and Slonkosky (2022) during the recovery from the Great Recession. Garriga, Gete and Tsouderou (2021) show that a significant part of these investors followed a buy-and-hold strategy, which might suggest searching for rental income. Moreover, Agarwal et al. (2019); Albanesi, De Giorgi and Nosal (2017), Bayer, Mangum and Roberts (2021) and Ben-David (2011) study short-term investors (commonly known as flippers). Chinco and Mayer (2016), Cvijanovic and Spaenjers (2021), Davids and Georg (2020) and Favilukis and Van Nieuwerburgh (2021) analyze foreign and out-of-town investors. We move forward this literature by highlighting the overwhelming increase in the small and medium-sized and local investors who buy through legal entities, and studying their real effects.

The second contribution is to bring a finance perspective to the housing affordability literature. Traditionally, this literature emphasizes the role of housing supply constraints as a central issue leading to affordability problems (see for example Gyourko, Mayer and Sinai 2013, or Molloy, Nathanson and Paciorek 2022. Ben-Shahar, Gabriel and Oliner 2020 provide a survey). After classifying investors according to different types (i.e., by size, location, etc.), our analysis highlights that the purchases by some types that actively participate in real estate markets have

ence of investors has reached unprecedented highs, approved statewide rent controls (Business Insider 2019). Internationally, cities like Amsterdam have discussed banning investors from purchasing and renting properties (Bloomberg 2018), Berlin is considering expropriating private profit-seeking landlords (The Wall Street Journal 2019), and Spain imposed measures to penalize investors (Bloomberg 2019).

a significant impact on house prices, rents, and affordability. The impact of investors interacts with housing supply elasticities, making the effect of purchases be large on prices in markets with low housing supply elasticity, and on rents in markets with high housing supply elasticity.

The rest of the paper is organized as follows: Section 2 describes the data and the new class of investors. Section 3 presents the cross-sectional analysis. Section 4 presents the dynamic analysis. Section 5 assesses the validity of the instrument and the robustness of the results. Section 6 concludes.

2 Investors in Real Estate Markets

2.1 Data

The core data we use in the analysis comes from the Zillow Transaction and Assessment Dataset (ZTRAX, Zillow 2017).[5] The database covers all ownership transfers as recorded by the counties' deeds in the United States. The unit of account is based on individual ownership transfers of residential properties, including multi-family and single-family, from January 1st, 2000 to December 31st, 2017. The sample period allows assessing the differences between the pre and post-financial crisis housing booms based on the participation of real estate investors. The final sample consists of about 85 million transactions.

The universe of deeds is characterized by buyers/owners of residential housing with different legal identities. We classify real estate investors based on the buyer name. Investors are legal entities who purchase homes using an LLC, LP, Trust, REIT, etc. in the purchase deed. We filter out from this category the buyers who are broadly defined as intermediaries, including relocation companies, non-profit organizations, construction companies and national and regional authorities, as well as banks, Ginnie Mae, Fannie Mae, Freddie Mac and other mortgage loan companies and credit unions, and the state taking ownership of foreclosed properties. The remaining buyers are households who either own one house or might own multiple properties under a personal name.[6] We use the same coding for the seller names in the deeds, to classify the entities the investors buy properties from.

To classify the large institutional investors we collect from industry reports and news reports

[5] We include a detailed description of the data sources in the Appendix *A*.

[6] In supplementary analysis we classify the households (using personal name in the deeds) who bought two or more properties in the same MSA within any two-year period as individual investors. The purchases by institutional investors were more than double in dollar value the purchases by individual investors post-Great Recession.

the names of the top institutional investors in the single-family and multi-family markets. For example Amherst Capital (2018) provides a comprehensive list of the top 20 single-family rental institutions and the number of homes they own. We also collect the names of the residential real estate companies that belong to the S&P 500 Real Estate Index, most of which are apartment REITs. We then search for the names of these top investors and their subsidiaries in the ZTRAX database and ensure they are classified as large investors. We use public SEC filings and other business websites to track down the names of the subsidiaries of these large investors. This procedure results in calculating the exact holdings of the top single-family and multi-family investors.

The key information we use in the analysis relates to different measurements of the volume and share of purchases by SMREI and WSL. The key variable we construct measures the total dollar value of investors' purchases in real terms over all the purchases at the MSA-year level.[7]

To construct our instrumental variable we use zip code level information on the pre-crisis investment attitudes in different areas identified by individual tax returns from the Statistics of Income of the Internal Revenue Services (IRS). The data contains information of all the individuals filing income taxes by income group and by zip code, such as the number of individuals and total earnings. Our instrument is the average share of business income over total income of high earners (annual adjusted gross income above $100K) in each MSA in 2007. We weigh by the total income of high-earners to aggregate to the MSA level in 2007. The choice of the year is to specify their attitude towards investment before the Great Recession, and this avoids the share to move with house prices. As a robustness check, we have performed the analysis using previous years. To assess the shift of investments over time, we construct the panel version of the instrument by interacting with the average rate of one-year certificate of deposits (CD) rate from the consumer financial services company Bankrate.

For consistency with the transaction data, we use the Zillow Home Value indices for all homes, the bottom and the top-tier homes at the MSA level. The bottom-tier segment of the market is the bottom third of the housing price distribution in each MSA, and captures the typical rental unit that is attractive for real estate investors searching for cash-flow yield. The middle-tier captures the typical owner-occupied housing unit, whereas the top-tier captures the luxury market for owner and rental-occupied housing (i.e., including high-end vacation homes). For each group, the price captures the median value within each segment (i.e., for the bottom

[7]The number of purchases would underestimate presence in the apartment market. For example the number of purchases would equate a purchase of one condominium to the purchase of one apartment building of 100 apartments. For robustness checks we use alternative measures of the presence of investors based on the number of properties purchased.

tier the median price represents the 17th percentile of the prices of the total market).[8] Similarly, housing rents come from the Zillow Rent Index for all homes. For our comprehensive list of control variables we use population data from the Census, the unemployment rate from the Bureau of Labor Statistics, and income from the Statistics of Income of the IRS and Zillow. We calculate the 17th, 50th and 83rd percentiles of individual income from the IRS to get the price-to-income and the rent-to-price ratios for the corresponding tiers.

To explore the effects of investors' purchases in the supply side, we collect the number of new construction permits from the Census Bureau's annual Building Permits Survey available at the zip code level.

The data allows the inclusion of 341 MSAs with complete information on housing variables, investors' activity, control variables, and the instrumental variable. Table 1, Panel A summarizes the key statistics of the cross-sectional sample between 2009 and 2017. According to the data, SMREI purchase on average 12.22% of the market annually. The average house price growth (mid-tier) is 0.47% annually, and that includes some MSAs with house prices declines and other areas with nearly 6% growth annually. Table 1, Panel B summarizes the key variables in the panel analysis.

2.2 Trends of Real Estate Investors: A New Class of Investors

Figure 1 summarizes the trend of real estate purchases by SMREI for the period 2000-17. In 2006 these investors represented about 8% of the purchases whereas by 2015 they represented over 16%. Their participation changed right after the dramatic drop of risk-free rates (top panel) and ahead of the recovery of the stock market (bottom panel).[9]

Location of investment properties. We further separate the SMREI by their origins relative to the location of the investment. This creates three distinct groups with local, out-of-town domestic and foreign investors. Local investors have a mailing address in the purchase deed in the same MSA as the property purchased. Out-of-town domestic investors have their mailing address in the U.S., but outside the MSA of the property they purchase. Finally, foreign investors have a mailing address outside the U.S. Figure 2 plots the share of each category of investors for the period 2000-17. After 2009, the purchases by local SMREI constituted about two-thirds of the total purchases by SMREI, if we exclude the purchases with missing addresses.

[8] In a symmetrical way, the top-tier segment of the market is the top third of the price distribution in each MSA, and the top-tier price is the top 83rd percentile of prices within an MSA.

[9] These patterns suggest a portfolio channel as what Daniel, Garlappi and Xiao (2021) show for stock investments.

The typical examples are business professionals, not necessarily real estate professionals, who purchase additional homes in the MSA where they also live.

For the transacted units with a complete address for the buyer, it appears that the market share for small and medium-sized foreign investors is very small. This could be due to the fact that total foreign housing investment is not that large, or because foreign legal entities use a U.S. mailing address, in which case we classify them as domestic investors but most likely out-of-town investors. Overall, the SMREI are about two-thirds local and one-third out-of-town. This fact is useful for our identification strategy, which focuses on local investors as we discuss later.

Size of investors. How does the growth of small investors compare to the large ones? Did existing investors become bigger, or new investors entered the market? The transaction microdata allows us to answer these questions by calculating the changes in the distribution of purchases by size of investors between 2006 and 2015. Figure $A1$ shows the distribution of the total purchases of each investor by size (total real dollar value of purchases) in the years 2006 and 2015.[10] The top panel of Figure 3 shows that at the intensive margin (dollar amount) the small investors, below the 30th percentile of the size distribution, and, to a lesser extend, the very large investors, mostly the 99th percentile, had the largest growth in their purchases. The bottom panel of Figure 3 shows that at the extensive margin (number of investors) the increase is driven by the small and medium-sized investors who flocked in mass to the housing market in the aftermath of the financial crisis.

The largest investors are WSL, that is, private equity-backed investors (e.g., Blackstone Invitation Homes and American Homes 4 Rent). They are also the Apartment REITs (e.g., Equity Residential and AvalonBay Communities) that are part of the Real Estate Sector of the Standard and Poor 500 index. The purchases of these top institutional investors are geographically concentrated. According to our calculations, 75% of the purchases by the top investors in single-family rentals and the public apartment REITs over the period 2009-17 are concentrated in 19 MSAs (6% of all MSAs) and 90% of the purchases of these top investors are concentrated in 36 MSAs (11% of all MSAs). The top institutional investors usually diversify in a few superstar cities. This investment strategy differs from the smaller investors who hold a large share in their respective location, and this pattern is observed across all MSAs.

Who sells to investors? Using the ZTRAX microdata, we document the different types of sellers who sold their properties to SMREI. Figure 4 plots the share of homes the investors purchased by each seller category: individuals, investors and intermediaries. The individual

[10] We convert all prices to 2006 dollars using the monthly CPI index.

sellers include homeowners who sell their main residence or another property they own. The investors are legal entities and include small, medium and large investors. The intermediaries are entities who transact foreclosed properties, like federal government agencies, or states. The intermediaries also include non-profits and relocation companies who are market intermediaries, and construction companies that sell new homes. Regarding the single-family versus multi-family market, 75% of the investors' transactions were in the single-family market, from 2009 to 2017. The share of investors' single-family transactions, versus multi-family, was 82% in the years 2000 to 2008.

The top panel of Figure 4 shows that SMREI have been increasingly buying single-family homes from individuals. From 2003 to 2006 the share of purchases from individual sellers jumped from 28 to 48%, based on the number of transactions. This share stayed between 43 and 59% up to 2017. With the increase in foreclosures, the share of intermediaries selling properties to investors peaked to 37% in 2009, but had a decreasing trend and became 16% in 2017. The purchases from other investors were between 18 and 26% in the years 2009 to 2017. The shares based on the dollar value of the purchases show the same dynamics, with the share of purchases from other investors being about 10 percentage points higher. This is mostly because the value of single-family homes that the investors purchased from other investors was on average higher than the value of homes they purchased from intermediaries (likely foreclosed properties).

In the multi-family market the SMREI bought on average 45% of the time from individuals and 40% from other investors over the full period. The purchases from individuals were 26% of the total dollar value of investors' multi-family purchases and the purchases from other investors were 67% of the total value.

What is the connection between investment activity and housing affordability? For the period 2009-17, Figure 5 shows a strong correlation between an increase in SMREI' activity and a worsening in housing affordability. This is essentially stating that in areas in which prices increased more relative to income, investors were also more active purchasing housing. Figure *A*2 in the online Appendix shows the same correlation in a scatter plot highlighting the population of each MSA.

3 Small and Medium-Sized Real Estate Investors and Affordability in the Cross-Section

3.1 Basic Specification

The cross-sectional data showed that the MSAs that experienced the largest increase in the price-to-income ratio post-crisis also had the largest market share of housing purchases by SMREI. The objective of this section is to study the effect of SMREI on housing affordability exploiting the cross-sectional differences. The key regression is defined by

$$y_{m,09-17} = \beta_0 + \beta_1 Inv_{m,09-17} + \gamma C_m + \alpha_s + u_m, \tag{1}$$

where $y_{m,09-17}$ denotes the relevant housing variables for a given MSA indexed by m and for the period 2009-17. The relevant housing variables include the average annual real housing price growth rate and the price-to-income ratio for different price-to-income percentiles. To study the effects of investors on the supply of residential units we use the change in construction permits for different types of housing units (i.e., single-family, 2-units, 3-4 units, multiple units). $Inv_{m,09-17}$ is the average share of the SMREI' dollar value of purchases over the total purchases in MSA m over the same period. The term C_m summarizes traditional MSA-specific controls: population growth, income growth, changes in the unemployment rate, whether the location is sensitive to large house price movements measured by the average real housing price growth during the 2000-2006 boom and the 2006-2007 bust. We also include as a control the number of building permits in 2007, to account for new supply. The term α_s includes state dummies to account for the time-invariant state-specific influences.

One of the challenges of a direct estimation of specification (1) using OLS is that the parameter of interest could be biased downwards. That would downplay the role of real estate investors capturing "reverse causality" if the investors target MSAs where prices declined the most after the Great Recession and were slow to pick up. To overcome this potential problem, we use an instrument for the SMREI' market share of purchases.

3.2 The Instrumental Variable: Propensity to Invest

We use an instrumental variable that allows us to exploit variation in the geographical presence of investors and that is plausibly exogenous to the drivers of housing markets that we cannot control for through fixed effects and local economic variables. As we described in Section 2, this

instrument is the average propensity to invest in a given MSA as proxied by the average share of business income by the top earners in an MSA for the year 2007. Top earners are residents that file total income larger than $100,000 in their tax returns. Using the year 2007 assesses the likelihood to make investments in a period with relatively high returns on the risk free rate. With the decline in this rate during the financial crisis, and the collapse of house prices, these are the individuals who are most likely to create LLCs, LPs or Trusts to invest in housing and generate a regular cash-flow. In other words, the instrument measures knowledgeable investors with high earnings, prone to invest in real estate. Before the Great Recession, the areas with a higher share of business income earners were more prone to the search for yield and/or capital gains in real estate markers.

Consistent with this theory, De Stefani (2021) documents that the investment attitude towards housing increased significantly among the wealthy U.S. population following the financial crisis. There has been a similar increase of investors' activity during the pandemic. A related channel has been explored for financial investments (i.e., Martínez-Miera and Repullo 2017; Rodnyansky and Darmouni 2017; Campbell and Sigalov 2022; Daniel, Garlappi and Xiao 2021).

Even though this instrument applies to local investors, since it is concerned with the local tax returns and the local share of investors, it is still relevant for the share of all small and medium-sized investors. As we showed in Figure 2 about two-thirds of the SMREI are local. Moreover, the cross-sectional correlation between the share of local investors and the share of SMREI is 0.85. If we exclude the top 19 or 36 superstar MSAs, this correlation becomes 0.91. This high correlation makes the variables for SMREI and local investors roughly identical. That is, the out-of-town investors do not seem to be driving the share of SMREI, especially in the non-superstar MSAs. We show more robustness checks about local investors in Section 3.3.3.

Crucially for the validity of our identification strategy, conditional on multiple controls, the geographical distribution of these top earners claiming business income in 2007 is uncorrelated with other factors that drove the appreciation of house prices and price-to-income ratio during the period 2009-17. In other words, it is unlikely that these business entities picked geographical locations anticipating a decline in house values in 2008 and a future appreciation between 2009-15.

Section 5 contains multiple tests that suggest that the instrument is uncorrelated with other possible factors driving housing markets. One reason is that the baseline specification controls for the key variables that the literature discusses as key drivers of house prices. Another reason is that business income is closely linked to entrepreneurship decisions, and the existing

literature finds it extremely challenging to explain geographical differences in entrepreneurship, which seem related to random historical events (Davidsson 1991; Rocha and Sternberg 2005; Bosma and Kelley 2019). Thus, the evidence suggests that the instrument satisfies the exclusion restriction conditional on the multiple controls.

Table 2 assesses the relevance of the instrument, showing the results of the first stage of the 2-stage least squares (2SLS) regression based on (1). After controlling for the relevant MSA-level controls and state dummies, the instrument is significantly correlated with the SMREI' purchases. The Wald F statistic of 21.8, reported in 3, allows us to reject that the instrument is weak.

3.3 Results in the Cross-Section

The effects of SMREI' purchases over the period 2009-17 on price growth, price-to-income, and across price and income tiers are detailed in Table 3. The first column reports the OLS estimation of (1) for the median house price and median income. The smaller coefficient of the OLS estimation is consistent with the expected downward bias of the OLS, since the prices were falling significantly up to 2012, and investors were likely to select areas where prices collapsed.

The IV estimation in Table 3 shows that a one-percentage-point increase in the share of SMREI' purchases leads to a 0.23 percentage points (pp) increase in the mid-tier real house price growth. Moreover, we show that a one-percentage-point increase in the share of SMREI' purchases leads to a 0.29 pp increase in the bottom-tier real house price growth and a 0.17 pp increase in the top-tier real house price growth.[11]

Looking at the standardized estimates, an increase of one standard deviation in real estate purchases by SMREI (7.59% from Table 1, Panel A) causes 0.78 standard deviations, or 1.37 pp, higher housing price growth for the median house.[12] However, the largest effects are estimated for the housing units transacted from the bottom price-tier. In this market segment, an increase in purchases of one standard deviation causes 0.86 standard deviations, or 2.13 pp, higher housing price growth.[13]

[11] The results are robust to clustering the standard errors by state.

[12] The standardized estimates use the standardized share of SM investors and standardized dependent variables, for easier comparison and derivation of the economic significance of the results.We restrict the sample of the standardized variables to the MSAs for which we have Zillow housing prices for all price tiers, to facilitate comparison.

[13] The impact of purchases in the mid-tier market are calculated using 0.784 from Table 3 multiplied by 1.75 from Table 1. Similarly, for the button price-tier the value 0.859 also comes from Table 3 and it is multiplied by 2.48 from Table 1.

What are the effects on affordability? The results from Table 3 show that the purchases by SMREI increased price-to-income ratios in different price-tiers. Clearly, the investors had the largest effect in the bottom tier, but also drove prices in the top tier. For example, from Table 1 we know that the average price-to-income ratio in the bottom tier is 8.7. The estimates indicate that an increase in the level of SMREI' purchases of one standard deviation would make the price-income ratio increase to a value near 19. Clearly, the affordability impact of the SMREI is evident in the bottom price tier.

Recall from the summary statistics (Table 1, Panel A) the average growth in real housing prices between 2009 and 2017 was 0.47%. Our results show that over the period right after the Great Recession, SMREI purchases prevent large drops in housing prices. Then, later on, they cause positive growth. That is, right after the Great Recession there are strong forces pushing housing prices down that investors' purchases counteract. Once these forces recede, then investors' activity pushes prices up.

3.3.1 Investors in non-superstar MSAs

In the results in Table 3, both SMREI and WSL are active at the same time in some specific MSAs, and all regression models control for the purchases of WSL. To isolate even more the role of SMREI in the MSAs where they are the main investors purchasing houses, we remove from the analysis the specific MSAs in which the WSL dominate the share of purchases. This is an extra step to ensure that the effects we find are driven by the small, local investors. As we noted previously, the WSL purchase real estate mainly in 10% of the MSAs. Table 4 replicates the analysis from Table 3 for two different subsamples. The first one excludes the superstar cities (19 MSAs) in which 75% of the large institutional investors' purchases between 2009 and 2017 are located. The second subsample excludes the top 36 MSAs in which 90% of the purchases by large institutional investors are located.[14]

The results from Table 4 show that the estimated effect of SMREI' purchases remains very significant as we remove the top MSAs. The magnitude in the bottom-tier prices becomes even larger than in the full sample. Quantitatively, one percentage point increase in the share of investors' purchases increases bottom-tier price growth by 0.29 in the full sample, 0.30 in the sample without the top 19 superstar cities, and 0.32 in the sample without the top 36 superstar

[14]To classify the superstar cities, we rank the MSAs based on the dollar value of purchases by the WSL. The top MSAs are the superstars. We perform two robustness checks, ranking the MSAs by (a) the share of purchases by WSL over the total purchases by investors and (b) the share of purchases by WSL over the total purchases by investors and households. The alternative classifications have large overlaps with the first definition of superstar cities and they don't change the results.

cities.

To summarize, the baseline findings are enhanced when we exclude superstar MSAs, showing strong evidence of the positive impact of small and medium-sized, local investors on house price growth and the negative impact on affordability. To check the robustness of the results to the geographical unit, we perform the same analysis with counties instead of MSAs. Table $A2$ shows that the results remain unchanged when we use counties.

3.3.2 Investors and new construction: Single vs. multi-family

The stock of residential housing evolves very slowly over time. The type of units that are being demanded by the market are the units that developers will try to supply with a lag. During the boom in 2003-06, a large share of the demand came from individual homeowners that wanted to purchase single-family housing. The tightening of credit standards after the financial crisis coincided with a period of adjustment of the households' balance sheets (i.e., see Garriga and Hedlund 2020 for a detailed quantitative analysis using a model of household purchases and endogenous house prices). The declining demand of owner-occupied housing changed the type of newly constructed units. Table 5 summarizes the impact of SMREI on new construction over the period 2009-17. The first column of the top part of the table reports the IV estimation of (1) for the total number of construction permits for all houses, measured in logs. According to the estimates, a one percentage point increase in the share of SMREI increases the number of new construction permits by 4.8% on average ($e^{0.047} - 1$).

How do these purchases impact the characteristics of the stock of residential housing? The analysis that separates permits for single-family and multi-family units indicates that investors' purchases lead to an increase in permits of 4.5% ($e^{0.044} - 1$) for single-unit houses, and an average increase of 15.7% ($e^{0.146} - 1$) for buildings of 5 or more units. The middle and bottom part of Table 5 reiterates the results when the superstar cities are eliminated from the sample. This indicates that the composition of the demand has lasting effects in the type of newly constructed residential structures put in place. Depending on the degree of persistence of the shock that changes the composition of the housing demand (i.e., a transitory or a permanent change in the fraction of households desiring to enter in the owner-occupied market), the stock of housing might evolve in one direction or another. Since the characteristics of the stock of housing change very slowly, the type of unity newly constructed between 2009-17, mainly multi-family, can rationalize the lack of availability of single-family houses during the pandemic.

3.3.3 Local investors

We perform two additional analyses to show that our results are driven by local investors, shown in Table *A*1. First, using the ZTRAX microdata we calculated the share of purchases by local investors in each MSA. We regress the growth of house prices and price-to-income ratio on the share of local investors. The results show that the local investors have a significant effect on prices and affordability, with the coefficients being larger than our baseline regressions. Second, we re-estimate our baseline results of the effects of SMREI, excluding the MSAs that are in the top 5th percentile in terms of their share of out-of-town and foreign investors. Again, we find significant effects, larger in magnitude than our baseline regressions.

Overall, the local small and medium-sized investors are captured by our IV and are the ones driving the effects we find. Excluding MSAs in which out-of-town investors are more present, makes our results stronger.

4 Dynamic Real Effects of Investors

This section expands the analysis of Section 3 by studying the dynamic effects of the SMREI' purchases over time and across the geography. We follow Jordà (2005) and estimate sequential regressions of the dependent variable shifted forward.[15] The dynamic specification is defined by

$$y_{m,t+i} = \beta_0 + \beta_1^{(i)} Inv_{m,t-1} + \beta_2 y_{m,t-1} + \gamma C_{m,t-1} + \alpha_m + b_t + u_{m,t}, \tag{2}$$

where t indexes years and m MSAs, and $y_{m,t}$ denotes the housing variables: real housing price growth rate from year $t-1$ to year t, for all price tiers, the price-to-income and rent-to-income ratios, the price-to-rent ratio, and new construction permits. $Inv_{m,t-1}$ is the SMREI' share of dollar value of purchases over the total market value for the year $t-1$ in MSA m. The term $C_{m,t-1}$ captures time-varying MSA-specific controls (the population growth rate, the median income growth rate, and the change in the unemployment rate).[16] The location fixed effects α_m capture the time-invariant MSA-specific influences, and the time fixed effects b_t account for the time-varying factors common to all MSAs, like national mortgage rates. We include a lagged dependent variable $y_{m,t-1}$ to allow the growth response to be temporary.

The estimate of interest is the vector of $\{\beta_1^{(i)}\}$, where $i = 0, 1, ..., 6$ is the time horizon of

[15] Favara and Imbs (2015) also apply this method to study house prices, and Mian, Sufi and Verner (2017) to study GDP growth.

[16] Controlling for contemporaneous income and population growth, and unemployment rate change doesn't change the results.

the response, that is, the number of years after the investors' purchases. Each $\beta_1^{(i)}$ corresponds to the effect of SMREI' share of purchases at horizon i. Setting $i = 0$ gives the usual panel specification. We estimate (2) for the full panel data from 2009 to 2017. In the estimation we cluster standard errors by MSA to allow for within-MSA correlation throughout the sample period.[17]

The dynamic nature of the analysis requires adjusting the instrument. The notion of the propensity to invest is determined a priori using the cross-sectional information in 2007 before the financial crisis and the recovery of housing markets. For specification 2, we interact the previous instrument with the time path of certificate of deposits (CD) interest rate. The key idea is to exploit the national shock to the CD rate, which is equal for all locations and it is not driven by local factors.[18] The exposure (local propensity to invest) of each location to the national shock is unrelated to local factors affecting the housing markets, as we assess in Section 5. The exposure is also predetermined, fixed in 2007, which minimizes the possibility of reverse causality. Thus, this instrument captures which MSAs are more likely to have housing investors post-Great Recession. The rationale is analogous to the housing net worth channel of Mian and Sufi (2014) that exposes certain areas to larger macro effects from declines in housing prices due to their housing leverage. In our case, we expose investment-prone areas to housing becoming an attractive alternative investment. Table $A3$ shows that the relevance condition is satisfied.

Figures 6 and 7 display the baseline findings.[19] On impact, the purchases of real estate investors have a positive effect on price and rent growth. Over time, the investors de-accelerate the growth of prices and rents. For house prices this is around year 3, whereas for rents the momentum stops in year 4. The increase in prices makes the cap rates, the residential asset's unlevered (no mortgage) return, decline rationalizing the flattening in the growth of investors' purchases. The cumulative effects of SMREI on prices and rents are positive and large as Figure 6 shows.

Concerning why rents increase as a result of an increase in the purchase by SMREI, several channels can be at play. On one side, investors improve the quality or composition of the rental stock (i.e., they offer more single family homes for rent, or they offer newer multifamily units as the data indicates) and thus rents go up. These are more attractive than the typical rental unit of lower quality and old age. Another channel is that the marginal renter who sold her home

[17] The results remain unchanged when we alternatively allow for Newey-West standard errors that allow for heteroskedasticity and within-MSA serial autocorrelation of the error term.

[18] As robustness checks we use alternative rates, the 5-year CD rate and the shadow federal funds rate, and the results remain unchanged.

[19] Tables $A4$ to $A7$ have the results of the estimations.

is willing to pay more as a renter than the average renter because she is wealthier or because she attaches a premium to renting (e.g. ability to easily move). One also has to consider that SMREI have better pricing or bargaining technology as landlords to better negotiate rents.

Affordability and price elasticity of supply. What is the impact of investors on affordability? Figure 7 shows an average result across MSAs for the effects of SMREI' purchases on price-to-income and rent-to-income ratios. Clearly, most of the effects on affordability happened in the initial 3 to 4 years. The dynamic effects on prices and rents can be rationalized by the timing of the response of new construction. The bottom left panel of Figure 7 shows that new construction, measured by building permits, has a hump shape response with a peak around 2-3 years. The purchases of investors and the implied price growth motivates a supply response that partially mitigates the negative impact on affordability. Permits measure expectations about future growth, and construction developers respond to that incentive. The very short-run response of the supply can be assessed by analyzing the evolution of vacancies. The bottom right panel of Figure 7 highlights that as investors are attracted to the currently available housing units for sale the number of vacancies declines. Over time, as the cost of residential units increases, cap rates decrease, and vacancies increase as newly constructed units arrive to the market.[20] Overall, our affordability measures, price-to-income and rent-to-income ratios, worsen from the arrival of the SMREI.

Are there key differences in the cross-section once we consider the difficulties in certain areas to rapidly expand the supply? There are some striking differences in the response of price-to-income and price-to-rent once we split the sample of MSAs by the housing supply elasticity as Figure $A4$ shows. In highly inelastic areas, the short-run price response and the implied worsening of affordability are much larger than in MSAs with high supply elasticity. In other words, in areas with low supply elasticity, investors drive prices and don't seem to move rents in the short-run. As a result the price-to-rent ratio increases, the price-to-income ratio also increases, and the rent-to-income ratio is constant. In areas with high supply elasticity the opposite effect is true. The price-to-rent ratio decreases in the short run and most of the effect on affordability comes from rents and not prices. The distributional effects are very different from the average effects depicted in Figure 7. There is a clear separation in the response of prices and rents across elasticities.

The final part of the analysis explores the impact across housing market segments and housing characteristics. Consistent with the cross-sectional evidence, the analysis indicates that investors have larger effects on the bottom-tier of the market. Figure $A3$ depicts the

[20] Ben-David, Towbin and Weber (2019) argue that one way to identify housing booms is to look at the response of vacancies for owner-occupied and rental houses.

differences in the estimated impulse responses for the top and bottom price tier. While multi-family can be important for the supply of new units, it is important to highlight the role of the single-family segment of the housing market. We redo the analysis separating these units from the rest of the market. The top panel of Table $A8$ uses single-family prices with only single-family purchases by investors, and the bottom panel prices for all homes, from Zillow with single-unit purchases by investors. The findings indicate that the response of prices to investors is exactly as statistically significant in the single-family segment as in the total market.[21]

5 Validity of the Instrument

In this section we assess the validity of the instrumental variable and the robustness of the previous results. We examine at length the exclusion restriction. Section 3.2 already discussed the relevance of the instrument. Figures $A5$ and $A6$ confirm that the instrument is strongly correlated with the investors' share of purchases.

Our instrumental variable measures the exposure of each MSA to the propensity to invest. The identification concern is whether differences across MSAs in the share of income reported as business income in 2007 by high-earners leads to differential changes in the outcome variables through channels other than investors and for which our fixed effects and control variables cannot control for.

We follow different strategies to test the exclusion restriction: 1) Our empirical design satisfies the parallel pre-trends. Placebo tests confirm the parallel pre-trends. This is strong support for the plausibility of the exogeneity assumption according to Goldsmith-Pinkham, Sorkin and Swift (2020). 2) We control exhaustively for all the usual drivers of housing markets (income, local economy activity, credit conditions, population, composition of labor markets etc.) through different variables. We include these controls even if they can be "bad control variables" that should not be in the main specification because they are part of the transmission channel of investors' purchases. None changes the main results. Thus, it does not seem that the usual drivers of housing markets are driving our main results as omitted variables. We were not able to think on extra omitted variables driving both housing markets and the cross-sectional differences in our instrument. 3) Altonji, Elder and Taber (2005) and Oster (2019) omitted variable tests suggest that there is no omitted variable bias. 4) We show that it is very hard to predict the instrument, which indicates that a large part of the variation in it is random,

[21] Ninety percent of the properties in the Zillow Home Value Index are single-family and the rest are condominiums and cooperatives.

especially unrelated to other drivers of housing markets. 5) We show the robustness of the results to alternative specifications and definitions of the investors' share.

5.1 Parallel pre-trends

The use of a shift-share instrument and the availability of pre-period trends, make our empirical strategy analogous to difference-in-differences. In a difference-in-differences setting the MSAs with the largest exposure to business income of top earners in 2007 is the treated group, and the MSAs with the smallest exposure is the control group. The year 2008 is the "treatment" year, when the Fed implemented the first wave of unconventional monetary policy which led to a large drop in interest rates.

Figure 8 plots the annual log number of building permits and the annual real price growth of bottom-tier homes for MSAs ranking in the top and bottom 25% of exposure to top earners' business income in 2007. Figure 8 shows that, prior to the shock, the high and low exposure groups have parallel dynamics. The divergence starts post-2008. That is, the MSAs behave similarly in the period before the Great Recession. We only see differences after 2008 when the MSAs more exposed to potential investors see those investors move to the housing market. Thus, the parallel pre-trends suggest that the instrument is driving construction and prices only in the post-crisis period. In other words, the instrument is not capturing other factors that could make housing prices to have permanently different dynamics across locations. Goldsmith-Pinkham, Sorkin and Swift (2020) recommend this test to assess whether the exclusion restriction is valid.

5.2 Placebo tests

Another way to implement the parallel trends test recommended by Goldsmith-Pinkham, Sorkin and Swift (2020) is to do a placebo analysis. Figure *A*7 does such a placebo test with the pre-crisis housing boom period 2000-06 and the housing bust period 2006-09. The scatterplots control for the same variables as specification (1). The MSAs are binned by percentiles so that each point represents around 15 MSAs. The bottom panel of the figure demonstrates strong positive correlation between the instrument and housing price growth over 2009–17. This correlation is absent in the pre-crisis housing boom and bust placebo samples that are in the top and middle panels. This evidence suggests that the instrument is not contaminated by pre-crisis price dynamics.

To confirm the message from Figure *A*7, we conduct various placebo tests over the 2000–06,

2001–06, and 2000–05 periods in Table 6.[22] We ask if, when using a specification analogous to (1), the exposure to the top earners' business income can explain housing price growth over any of these periods. The placebo point estimates are insignificant across periods. That is, the instrument is only capturing post-crisis positive shocks in housing investment. None of the factors operating pre-crisis are correlated with the instrument.

Table *A*9 contains the results of placebo tests for the panel analysis, for pre-crisis periods. Figure *A*8 plots a placebo experiment linking the instrument to prices, and Figure *A*9 to new construction. The instrument does not contribute to changes in prices or number of construction permits in time periods pre-crisis.

5.3 Controls for the local economy

To rule out the possibility that local economic conditions drive the results, Table 7 re-estimates the baseline specification controlling for a wide range of variables that capture contemporaneous local economic activity: average annual unemployment rate change, labor force participation growth, real GDP per capita growth, and median hourly wage per capita growth from 2009 to 2017. Table 7 displays results very similar to Table 3. Importantly, the estimated coefficients are in a close range of the baseline coefficient of 0.234 from Table 3. A large change in the coefficient would hint at omitted variables biasing the estimation. These results suggest that the local economic activity and the investors are both important for housing price growth, but investors also affect housing markets even when keeping local economic activity constant.

5.4 Controls for credit conditions

Credit conditions are another potential driver of housing prices that we want to rule out. Table 8 reestimates the baseline specification including controls for credit supply. The first column controls for the mortgage denial rate over 2009-2017 in each MSA. The second column controls for the share of lenders, in terms of their deposit holdings, that underwent stress-testing due to the Dodd-Frank Act. This control is inspired by Gete and Reher (2018) who use this variable as an instrument for denial rates to study housing rents. After including those controls, the coefficient of the investors' share moves between 2% and 8%, and remains strongly significant.

[22]The selection of placebo periods is restricted by a lower bound of the year 2000, since this is when our investors' data begin. The upper bound is 2006, since we want to avoid an overlap and potential co-determination of the investors' share and our instrumental variable that is constructed using 2007 data.

5.5 Controls for shifts in the composition of labor demand

Although we include several controls for economic conditions, an alternative concern could be that the instrument is correlated with the industrial composition of the local labor market, and therefore related to shifts in the composition of labor demand during the post-crisis period.[23] To address this concern we reestimate the baseline specification controlling for changes in employment in the largest industry sectors within the MSAs (Table 9). The changes are accounted for, starting from the base year of the instrumental variable, that is, from the annual change from 2007 to 2008, up to the annual change from 2016 to 2017. Employment changes in some industries, such as Real Estate, Rental and Leasing could be considered bad controls, as they are likely part of the transmission channel of investors on prices. Even with this prudent analysis, after controlling for employment growth of up to ten industries, the estimated effect of investors holds, and it is close to the baseline effect.

Moreover, Table $A10$ re-estimates the dynamic results accounting for the lagged annual shifts in the composition of labor demand. The dynamic patterns of housing price growth remain unchanged when we include the employment growth controls for the largest industries in the MSAs. The shifts in the composition of labor demand do not seem to be driving the results.

5.6 Oster (2019) omitted variable bias test

We conduct omitted variable bias tests based on the work of Altonji, Elder and Taber (2005) and Oster (2019), which we outline in the online Appendix C. This test confirms that, while our multiple controls do not change our coefficient of interest in a significant way, they do increase significantly the R-squared of the estimation.

Table $A11$ shows the results of the omitted variable bias test for four different specifications: (1) our baseline specification in Table 3, (2) the specification with additional controls for economic drivers in Table 7, (3) the specification with additional controls for credit conditions in Table 8 and (4) the specification with additional controls for changes in industry employment in Table 9. The results strongly reject that the effect of the share of investors on housing prices is driven by omitted variables. Thus, these tests alleviate concerns of omitted variable bias.

[23] For example, Monte, Redding and Rossi-Hansberg (2018) study the importance of spatial spillovers due to local labor demand shocks through changes in commuting patterns.

5.7 Unpredictable instrumental variable

Here, we show that it is very difficult to predict the share of business income. In the introduction we discuss papers showing that most of the cross-regional differences in investment attitude are as good as random. It is very hard to predict the investment or entrepreneurship attitude of an MSA. We confirm this result in Table 10. We regress the share of the top earners' business income in each MSA in 2007 on several factors that may explain investment or entrepreneurship activity. These factors are demographic (median age and share of immigrants), regulatory (tax rate for high earners), geographical (natural amenity index) and the ranking of MSAs in the ease of doing business. While some of these factors are correlated with the top earners' business income, their explanatory power is low. The demographic and regulatory factors explain 11% of the variation in the top earners' business income share, as we see by the R-squared of the first column of Table 10. Including the geographical factor the R-squared becomes 22%.

Moreover, in Table *A*12 we study whether the standard drivers of the housing market are correlated with the instrument, given our controls. We regress the local share of top earners' business income on the pre-crisis trends of homeownership and median age within each MSA. To better gauge the magnitude of these partial correlations, the table normalizes all variables to have a mean of zero and a variance of one. This allows us to assess both the magnitude and statistical significance of any correlations. Importantly, there is no relevant correlation between the common drivers of housing variables and the MSA share of top earners' business income, given our baseline controls.

5.8 Robustness to other specifications

We check robustness to changes in the specifications. First, we use additional controls for total demand for housing or demand for housing by investors. These controls are the total dollar value of purchases in the market or the total dollar value of purchases by investors. Controlling for either of these levels of demand does not change any of the results.[24] Our baseline controls (population, income, unemployment, MSA and year fixed effects) already capture a large part of the variation in housing demand. Second, we use an additional control for the share of purchases by individual investors in the housing market of each MSA. We identify individual investors as individuals (having their personal name in the deeds) who purchase two or more houses in the same MSA within two years. Table *A*13 shows that the main effects we study remain unchanged after the inclusion of this control. The share of purchases by individual investors

[24] We do not report the tables of these results, as they are similar to the previous ones. Available upon request.

shows correlation with price growth, and this is in addition to the effects of the investors who purchase houses as legal entities. Third, we control for the change in the share of foreclosures in each MSA. Foreclosed properties are likely to attract investors because of lower prices, and at the same time they might restrict access to investors in some areas through the Fannie Mae and Freddie Mac First Look programs (Lambie-Hanson, Li and Slonkosky 2022). This analysis uses a restricted sample of 84 MSAs for which we have foreclosure data from Zillow for the years 2008 to 2017. Even with this restricted sample, the effects of investors on house price growth remain significant for all price tiers, as Table $A14$ shows. Finally, Table $A15$ shows that our results are robust to using an alternative measure of investors' share based on number of purchases.

6 Conclusions

In this paper we analyze the contribution of small and medium-sized real estate investors to the U.S. residential housing markets post Great Recession. Using a large database covering the whole U.S. we document the emergence of a new type of real estate investors that buys properties through legal entities. These investors are local, relatively small in size, and present in MSAs all across the U.S. Instead, large investors, as those referred to as Wall Street Landlords, are geographically concentrated in "superstar cities". The growth of small and local investors in both extensive (number of investors) and intensive (dollar purchases) margins in the post-financial crisis period is substantial.

Then, we analyze how the small and medium-sized real estate investors affect housing affordability. Cities around the world are designing policies to deal with these new investors. Investors drove most of the recovery in housing prices, and housing affordability worsened. Especially affected were the single-family homes at the bottom of the price distribution. These are usually starter homes that otherwise would be purchased by young households. The presence of investors triggered an equilibrium response of supply, which slowed down the acceleration of house prices, but did not reverse the effects. The investors affected differently the price-to-income and rent-to-income ratios, depending on the supply restrictions of each area. Prices increased more than income and more than rents in areas with high supply restrictions. Price increases were small in MSAs where there are loose supply restrictions. In those areas the investors caused increases to the rent-to-income and rent-to prices ratios.

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Figures

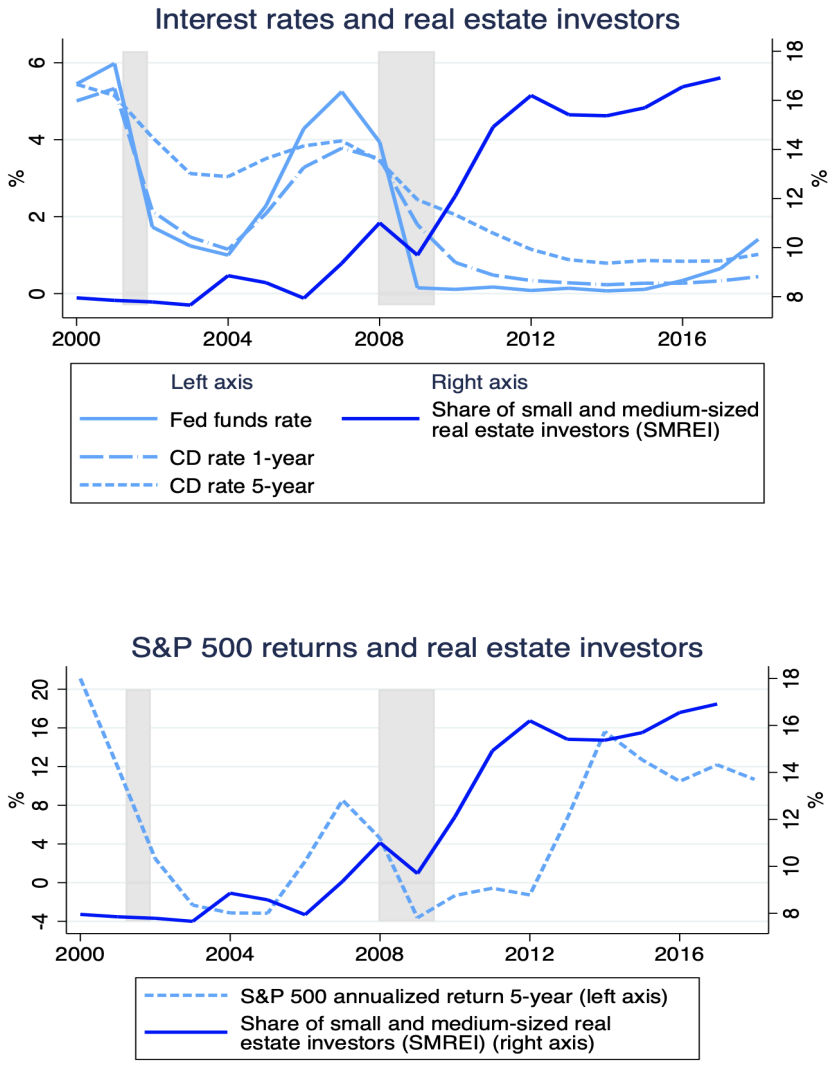

Figure 1. Rates of return and real estate investors. The top figure plots the federal funds rate and the average CD rates for 1-year and 5-year CDs. The bottom figure plots the 5-year annualized past returns of the S&P 500 index. Both figures also plot the share of dollar purchases that corresponds to the small and medium-sized real estate investors (SMREI) in the U.S. housing market. The gray areas illustrate the U.S. Recessions.

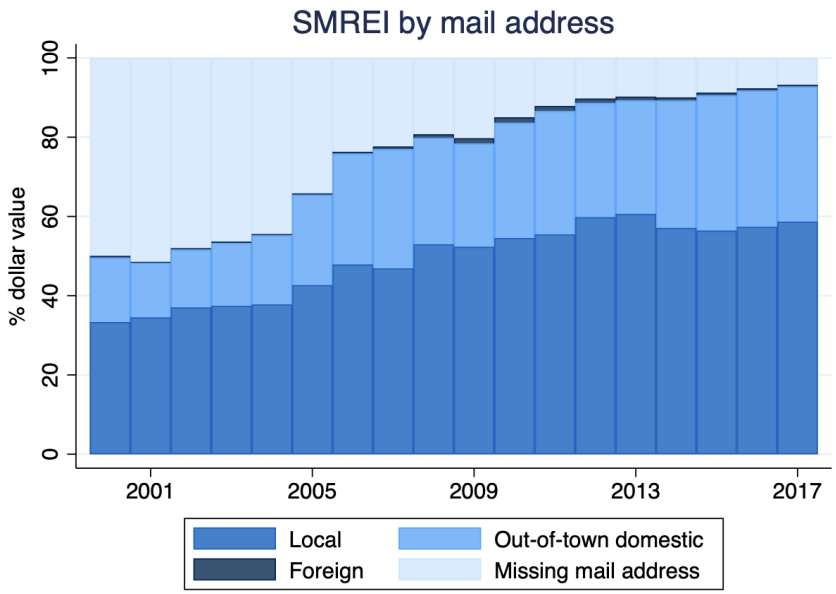

Figure 2. Local and out-of-town small and medium-sized investors. The figure plots the dollar purchases by SMREI in the U.S. housing market split into local, out-of-town domestic and foreign investors. Local investors have their mailing address in the same MSA as the property they purchase. Out-of-town domestic investors have their mailing address in the U.S., but outside the MSA of the property they purchase. Foreign investors have a mail address outside the U.S. The data come from ZTRAX.

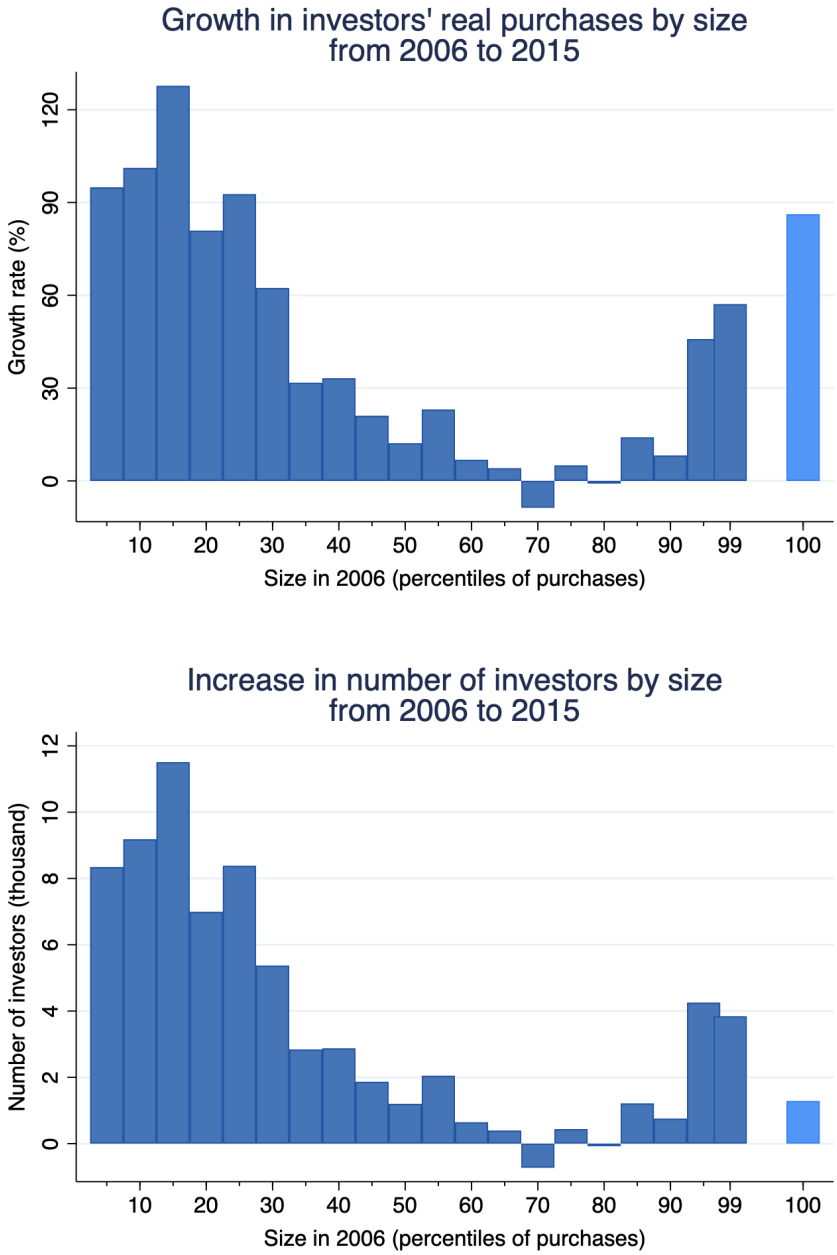

Figure 3. Growth of investors by size. The top figure plots the growth in dollar purchases by investors from 2006 to 2015 in each percentile segment of dollar purchases (intensive margin). The percentile cutoffs are the dollar value cutoffs in 2006. All dollar values are in 2006 dollars. The bottom figure shows the change in the number of investors (extensive margin) over the same period.

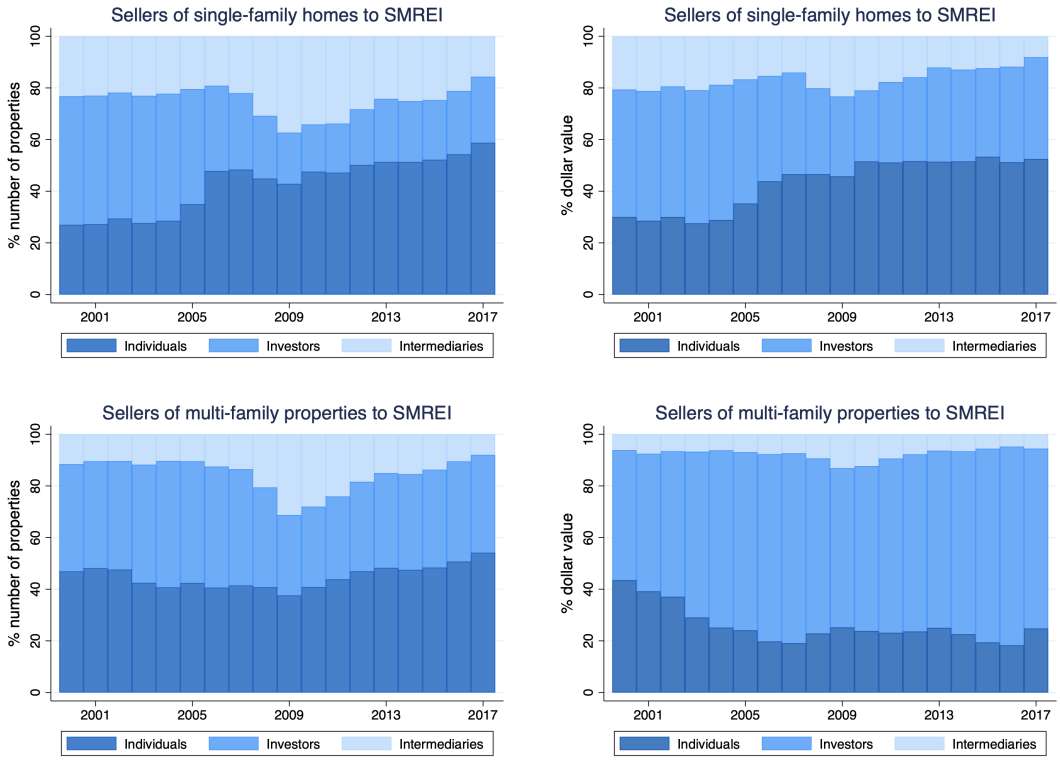

Figure 4. Who do investors buy from? The figures show the SMREI purchases from 2000 to 2017 split by the type of seller. The types of sellers are: (i) homeowners, who are identified in the ZTRAX microdata as the ones who use a personal seller name in the deeds, (ii) investors, who are identified as the ones who use a legal entity seller name in the deeds, and (iii) intermediaries, for which we group together the sellers who are relocation companies, non-profit organizations, construction companies, national and regional authorities, banks, Ginnie Mae, Fannie Mae, Freddie Mac and other mortgage loan companies and credit unions, and states, counties, cities or municipalities. The top two panels show the share of the seller type of single-family homes by number of homes and dollar value, and the bottom two panels show the same for multi-family homes.

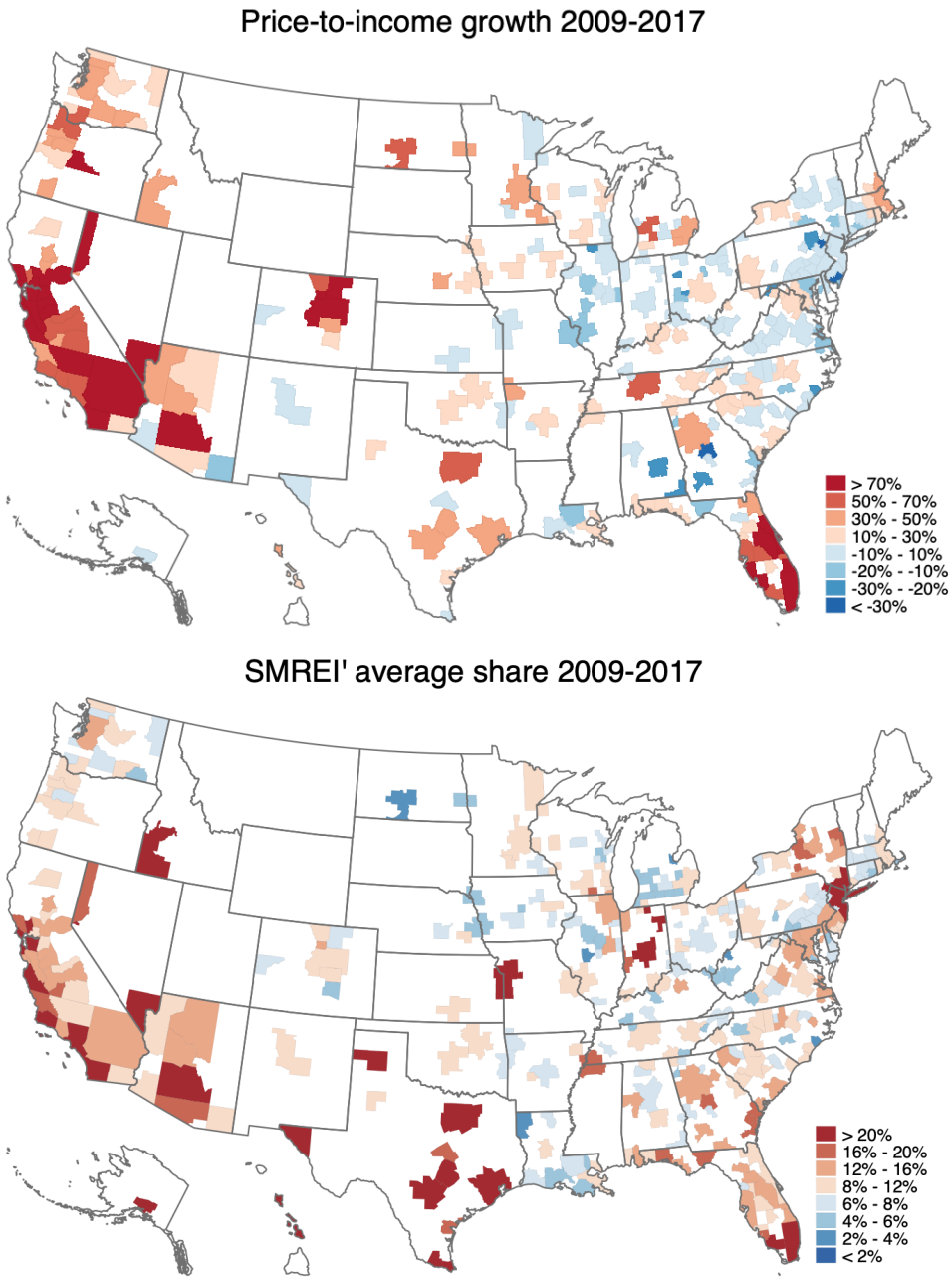

Figure 5. Affordability and real estate investors. The top map shows the percentage growth of price-to-income ratio from 2009 to 2017 in each MSA for bottom tier houses. The bottom map shows the average share of dollar purchases by SMREI from 2009 to 2017 in each MSA. Figure A2 shows the correlation of the raw data in a scatter plot.

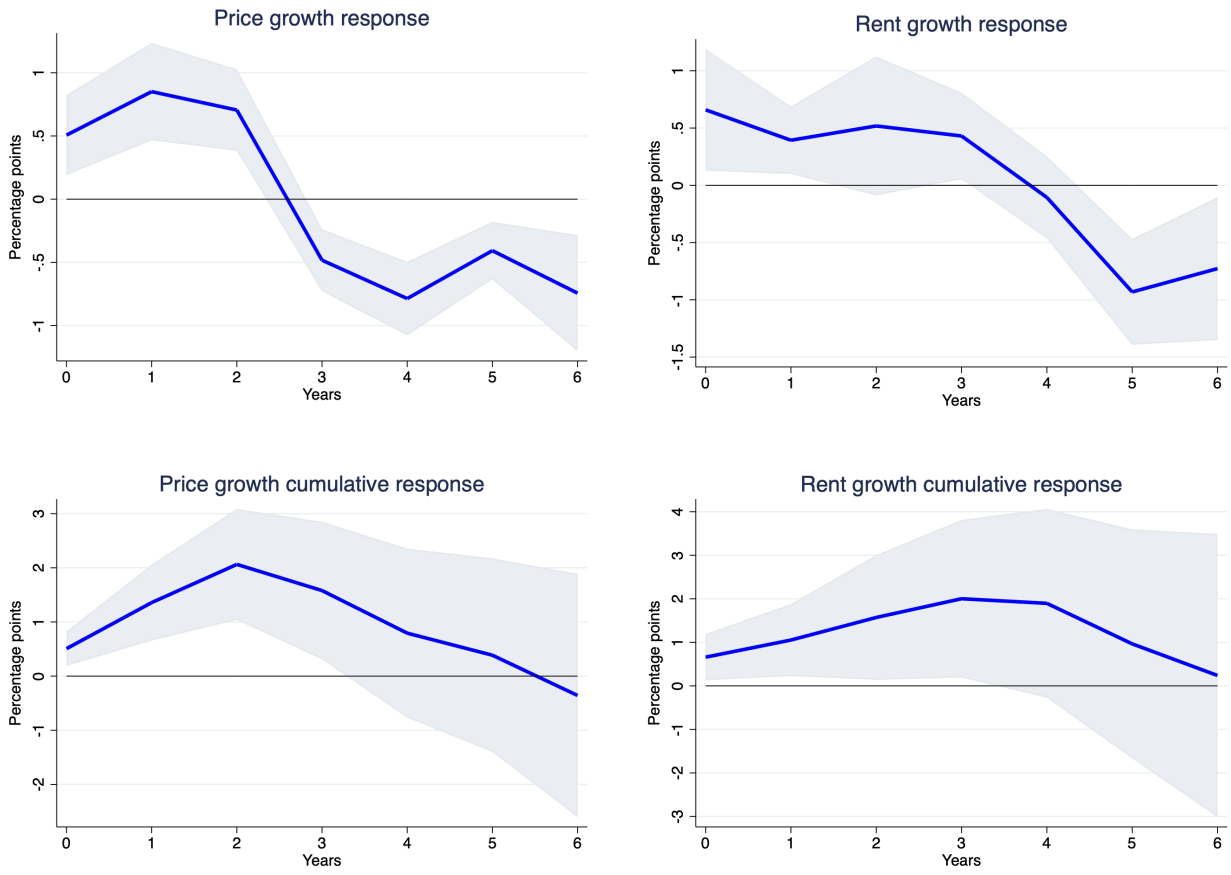

Figure 6. Dynamics of housing prices and rents after investors' purchases. The top figures plot the estimates from sequential regressions of the price growth and rent growth on the instrumented past SMREI share. The bottom figures plot the cumulative effects, calculated as the cumulative sum of the previous coefficients. Prices and rents are adjusted for inflation. Section 4 discusses the methodology that follows Jordà (2005). We estimate the impulse responses for the full panel data from 2009 to 2017. The shaded areas show the 90% confidence interval.

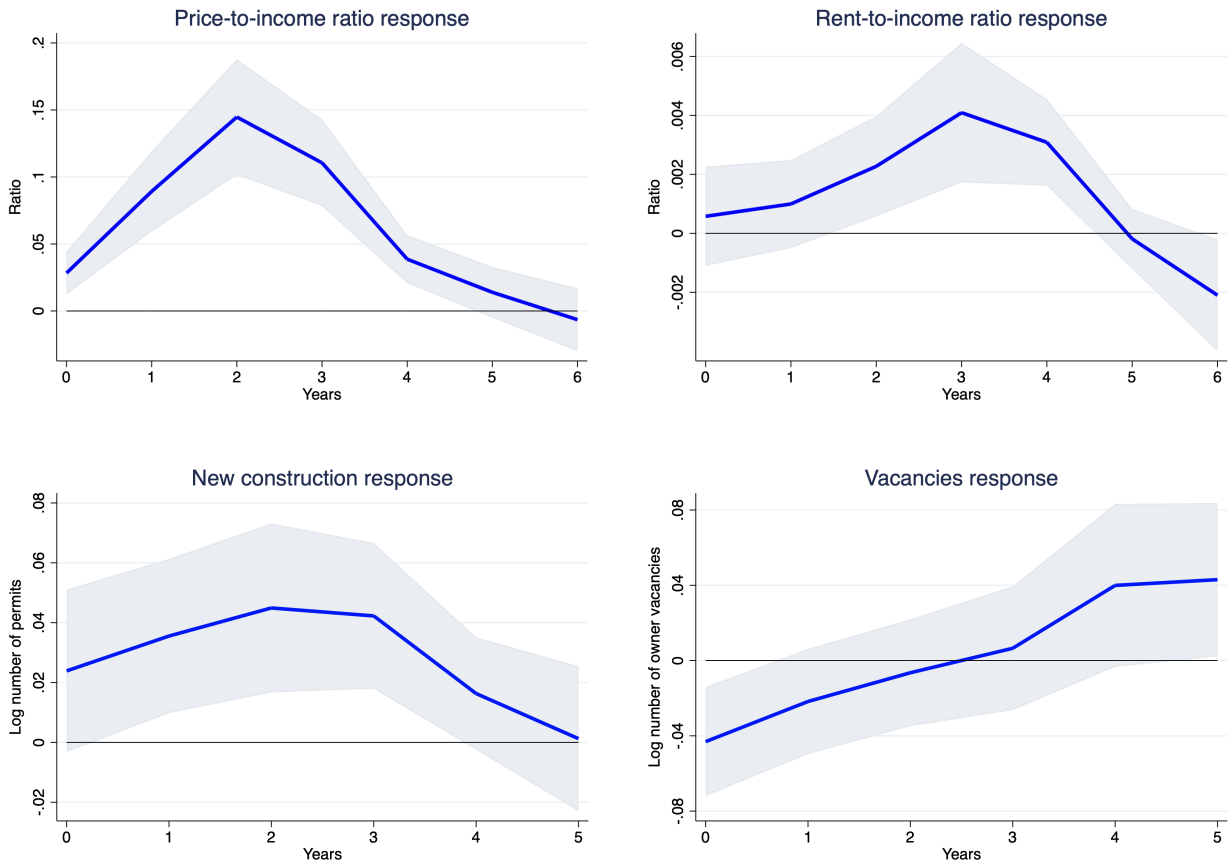

Figure 7. Dynamics of housing affordability and supply after investors' purchases. The figures plot the estimates from sequential regressions of (a) the price-to-income ratio, (b) the rent-to-income ratio, (c) the log number of building permits, and (d) the log number of homeowner vacant units on the instrumented past SMREI share. The price-to-income ratio is the median housing price over the median annual household income in an MSA. The rent-to-income ratio is the median annual housing rent over the median annual household income in an MSA. We estimate the impulse responses for the full panel data from 2009 to 2017. The shaded areas show the 90% confidence interval.

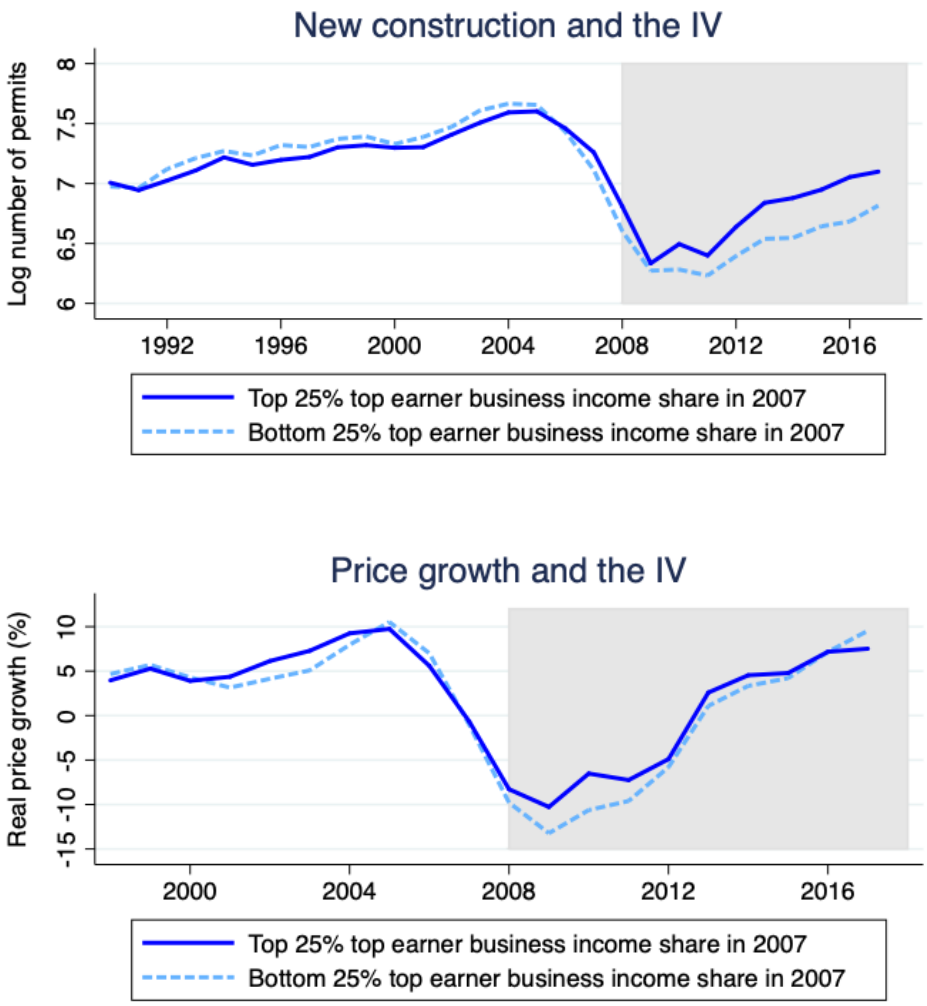

Figure 8. Parallel trends. The top figure plots the time series of the log number of new building permits for MSAs ranking in the top and bottom 25% of exposure to the instrumental variable (that is 2007 top earners' average share of business income over total income in a MSA). The bottom figure plots the same MSAs but for the bottom-tier real price growth The gray shaded area shows the period from 2008 onwards.

Tables

Table 1. Summary statistics

Panel A - MSA level

	Obs	Mean	SD	Min	Max
Small and medium-sized investors' (SMREI) share (%)	341	12.22	7.59	3.10	40.69
Wall Street Landlords' (WSL) share (%)	341	0.31	1.08	0.00	11.87
Top tier price growth (%)	337	0.43	1.54	-4.26	6.45
Mid-tier price growth (%)	341	0.47	1.75	-5.15	5.96
Bottom tier price growth (%)	306	0.17	2.48	-8.97	7.04
Top tier price-to-income ratio	337	3.11	1.23	1.40	9.50
Mid tier price-to-income ratio	341	4.85	2.45	1.50	16.98
Bottom tier price-to-income ratio	306	8.70	5.55	1.05	38.68
Log number of building permits all properties	341	6.49	1.27	2.33	10.33
Log number of building permits single-unit	341	6.44	1.28	2.24	10.31
Log number of building permits 2–4 units	339	2.25	1.23	0	6.73
Log number of building permits 5+ units	337	2.42	1.26	0	6.43
Top earner business income share$_{2007}$(%)	341	2.78	0.93	1.03	9.09

Panel B - Panel data MSA-annual (2009-2017)

Small and medium-sized investors' (SMREI) share (%)	2,997	11.27	8.17	0.65	75.95
Wall Street Landlords' (WSL) share (%)	2,997	0.30	1.58	0.00	28.18
Top tier price growth (%)	2,853	0.46	5.61	-24.92	28.41
Mid tier price growth (%)	2,901	0.47	6.67	-25.51	36.47
Bottom tier price growth (%)	2,610	0.13	9.87	-53.03	34.09
Rent growth (%)	2,583	0.52	6.12	-35.07	49.65
Price-to-income ratio of median household	2,849	3.24	1.27	1.12	9.97
Rent-to-income ratio of median household	2,583	0.29	0.05	0.14	0.61
Log number of building permits all properties	2,997	6.46	1.36	1.10	10.58
Log number of homeowner vacancies	2,554	7.57	1.13	3.14	10.96
Lagged population growth (%)	2,994	0.71	0.90	-4.45	7.99
Lagged median household income growth (%)	2,853	1.41	2.61	-7.98	11.01
Lagged unemployment rate change (pp)	2,997	0.04	1.56	-4.54	9.29
Top earner business income share$_{07}$(%)×CD rate growth$_{t-1}$	2,997	-0.57	0.76	-4.98	1.58

Detailed descriptions of the variables and data sources are in Appendix A.

Table 2. First stage: SMREI share and the instrumental variable

	SMREI share of purchases$_{m,09-17}$		
	All MSAs	Excl. top 19 MSAs	Excl. top 36 MSAs
Top earner business income share$_{m,07}$	1.539***	1.442***	1.499***
	(0.329)	(0.334)	(0.344)
MSA-level controls	Yes	Yes	Yes
State dummies	Yes	Yes	Yes
R-squared	0.698	0.706	0.713
Observations	341	322	305

Heteroskedasticity robust standard errors are in parentheses. The controls are the population growth, income growth, unemployment rate change and real housing price growth over the periods 2000-2006 and 2006-2007, the log number of building permits in 2007 and the large investors' share. Each observation is an MSA. ***significant at the 1% level.

Table 3. Housing price growth and affordability by price tier

All MSAs	Price growth$_{m,09-17}$			
	Mid Tier		Bottom Tier	Top Tier
SMREI share$_{m,09-17}$	0.033**	0.233***	0.290***	0.174***
	(0.016)	(0.070)	(0.085)	(0.060)
Estimation	OLS	IV	IV	IV
1st stage F-test excluded instruments		21.830	21.210	22.382
Underidentification test p-value		0.000	0.000	0.000
Observations	341	341	306	337
		Standardized		
SMREI share$_{m,09-17}$		0.784***	0.859***	0.727**
		(0.260)	(0.252)	(0.284)
Observations		303	303	303
	Price-to-income ratio$_{m,09-17}$			
SMREI share$_{m,09-17}$	0.117***	0.502***	1.434***	0.286***
	(0.021)	(0.131)	(0.306)	(0.079)
Estimation	OLS	IV	IV	IV
Observations	341	341	306	337
		Standardized		
SMREI share$_{m,09-17}$		1.531***	1.931***	1.730***
		(0.392)	(0.407)	(0.472)
Observations		303	303	303

Heteroskedasticity robust standard errors are in parentheses. Prices are inflation adjusted. Bottom tier refers to the 17th percentile, and top tier to the 83rd percentile of the housing prices and individual income in each MSA. The standardized results show the estimated effects of the standardized independent variable on the standardized dependent variables, for the sample of MSAs for which we have price series for all price tiers. All models include state dummies and MSA-level controls: population growth, income growth, unemployment rate change and real housing price growth over the periods 2000-2006 and 2006-2007, the log number of building permits in 2007 and the large investors' share. Table 2 contains the first stage of the IV regression. The instrument for the SMREI share is the average share of business income over total income of the top earners in MSA m in the year 2007. The weak identification F statistic is the Kleibergen and Paap Wald F statistic. The underidentification test is from Kleibergen and Paap (2006). Each observation is an MSA. ***significant at the 1% level; **significant at the 5% level.

Table 4. Price and affordability results excluding top MSAs

	Price growth$_{m,09-17}$			Price-to-income ratio$_{m,09-17}$		
	Bottom Tier	Mid Tier	Top Tier	Bottom Tier	Mid Tier	Top Tier
Sample without top 19 MSAs						
SMREI share$_{m,09-17}$	0.301***	0.245***	0.185***	1.614***	0.535***	0.323***
	(0.096)	(0.077)	(0.067)	(0.354)	(0.144)	(0.084)
F-test of excluded instruments	17.637	18.655	19.198	17.637	18.655	19.198
Underidentification p-value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	287	322	318	287	322	318
Sample without top 36 MSAs						
SMREI share$_{m,09-17}$	0.319***	0.243***	0.171**	1.620***	0.547***	0.317***
	(0.091)	(0.075)	(0.068)	(0.357)	(0.137)	(0.076)
F-test of excluding instruments	17.726	19.019	19.598	17.726	19.019	19.598
Underidentification test p-value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	270	305	301	270	305	301

Heteroskedasticity robust standard errors are in parentheses. Top MSAs are the ones with the highest dollar purchases by WSL. These include the largest institutional investors in single-family rentals, and the apartment REITs in the S&P 500 Real Estate Sector. Prices are inflation adjusted. All models include state dummies, MSA-level controls and the instrumental variable as in Table 3. The weak identification F statistic is the Kleibergen and Paap Wald F statistic. The underidentification test is from Kleibergen and Paap (2006). Each observation is an MSA. ***significant at the 1% level; **significant at the 5% level.

Table 5. Housing construction by property type

	Log number of permits$_{m,09-17}$			
	All	Single-unit	2-4 units	5+ units
All MSAs				
SMREI share$_{m,09-17}$	0.047***	0.044***	0.100**	0.146***
	(0.017)	(0.016)	(0.047)	(0.039)
Estimation	IV	IV	IV	IV
1st stage F-test excluded instruments	21.370	21.370	21.587	21.003
Underidentification test p-value	0.000	0.000	0.000	0.000
Observations	341	341	339	337
Sample without top 19 MSAs				
SMREI share$_{m,09-17}$	0.052***	0.049***	0.106**	0.153***
	(0.018)	(0.018)	(0.052)	(0.044)
Observations	322	322	320	318
Sample without top 36 MSAs				
SMREI share$_{m,09-17}$	0.056***	0.054***	0.092**	0.139***
	(0.017)	(0.017)	(0.045)	(0.042)
Observations	305	305	303	301

Heteroskedasticity robust standard errors are in parentheses. Top MSAs are the ones with the highest dollar purchases by WSL. These include the largest institutional investors in single-family rentals, and the apartment REITs in the S&P 500 Real Estate Sector. Single-unit refers to permits for the construction of single-unit properties, 2-4 units refers to permits for the construction of properties that have between 2 and 4 units, and 5+ units refers to permits for the construction of properties of 5 units or more. All models include state dummies, MSA-level controls and the instrumental variable as in Table 3. The weak identification F statistic is the Kleibergen and Paap Wald F statistic. The underidentification test is from Kleibergen and Paap (2006). Each observation is an MSA. ***significant at the 1% level; **significant at the 5% level.

Table 6. Placebo: Housing price growth and investors' share pre-crisis

	Price growth$_{m,[t_1,t_2]}$		
$[t_1, t_2]$	2000-2006	2001-2006	2000-2005
SMREI share$_{m,[t_1,t_2]}$	0.062	0.915	-0.046
	(0.881)	(1.680)	(2.638)
Estimation	IV	IV	IV
MSA-level controls	Yes	Yes	Yes
State dummies	Yes	Yes	Yes
Observations	314	310	313

Heteroskedasticity robust standard errors are in parentheses. Prices are inflation adjusted. The controls are the population growth, income growth, unemployment rate change and real housing price growth over the periods 1991-1997 and 1997-1998, the log number of construction unit permits in 1998 and the share of large investors. The instrument for the SMREI share is the average share of business income over total income of the top earners in MSA m in the year 2007. Each observation is an MSA.

Table 7. Estimation including additional local economic drivers

	Price growth$_{m,09-17}$				
SMREI share$_{m,09-17}$	0.244***	0.237***	0.211***	0.233***	0.229***
	(0.071)	(0.072)	(0.071)	(0.071)	(0.075)
Unempl. rate change$_{m,09-17}$	-3.063***				-2.585**
	(1.156)				(1.271)
Labor force partic. growth$_{m,09-17}$		-0.004			-0.100
		(0.193)			(0.208)
Real per cap. GDP growth$_{m,09-17}$			0.196*		0.188
			(0.118)		(0.136)
Per cap. wage growth$_{m,09-17}$				-0.021	-0.195
				(0.177)	(0.192)
First stage F-test	21.320	21.666	20.170	22.001	19.407
Underidentification test p-value	0.000	0.000	0.000	0.000	0.000
Observations	341	340	341	341	340

Heteroskedasticity robust standard errors are in parentheses. Unemployment rate change$_{m,09-17}$ denotes the average unemployment rate change in MSA m over 2009-2017. Labor force participation growth$_{m,09-17}$, real per capita GDP growth$_{m,09-17}$ and per capita wage growth$_{m,09-17}$ denote the average annual growth rate of those variables in MSA m over 2009-2017. Prices are inflation adjusted. The specifications include MSA-level controls, state dummies and the instrumental variable as in Table 3. The underidentification test is that of Kleibergen and Paap (2006) and the F statistic is the Kleibergen and Paap Wald F statistic. Each observation is an MSA. ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table 8. Estimation including credit condition controls

	Price growth$_{m,09-17}$	
SMREI share$_{m,09-17}$	0.216***	0.227***
	(0.065)	(0.068)
Mortgage application denial rate$_{m,09-17}$	-0.040	
	(0.043)	
Tested lenders' share$_{m,2008}$		-0.006
		(0.007)
First stage F-test	22.111	22.150
Underidentification test p-value	0.000	0.000
Observations	341	341

Heteroskedasticity robust standard errors are in parentheses. Mortgage application denial rate$_{m,09-17}$ is the average share of mortgage applications that were denied annually in MSA m over 2009-2017. Tested lenders' share$_{m,2008}$ is the 2008 deposit share of lenders in MSA m that underwent a stress test between 2011 and 2017. Prices are inflation adjusted. The specifications include MSA-level controls, state dummies and the instrumental variable as in Table 3. The underidentification test is that of Kleibergen and Paap (2006) and the F statistic is the Kleibergen and Paap Wald F statistic. Each observation is an MSA. ***significant at the 1% level.

Table 9. Estimation controlling for labor demand shifts by industry

	Price growth$_{m,09-17}$					
	coef.	s.e.	coef.	s.e.	coef.	s.e.
SMREI share$_{m,09-17}$	0.225***	(0.071)	0.212***	(0.068)	0.214***	(0.070)
Employment growth by industry$_{m,08-17}$						
Health Care & Social Assistance	-0.001	(0.003)	-0.004	(0.004)	-0.004	(0.004)
Retail Trade	0.310**	(0.122)	0.285**	(0.116)	0.288**	(0.119)
Accommodation & Food Services	0.031	(0.082)	0.020	(0.080)	0.012	(0.082)
Manufacturing	-0.001	(0.005)	-0.008**	(0.004)	-0.009*	(0.004)
Professional, Scientific, Tech. Services	0.003	(0.002)	0.002	(0.002)	0.002	(0.002)
Administrative, Support, Waste Mgmt.	-0.001**	(0.000)	-0.001**	(0.000)	-0.001**	(0.000)
Finance & Insurance	0.002	(0.001)	0.002	(0.001)	0.002	(0.002)
Wholesale Trade			0.030	(0.030)	0.029	(0.031)
Other Services			0.094**	(0.037)	0.092**	(0.037)
Transportation & Warehousing			0.023**	(0.010)	0.021**	(0.010)
Information			0.004	(0.003)	0.004	(0.003)
Educational Services					-0.000	(0.001)
Management of Companies					-0.001	(0.001)
Real Estate, Rental & Leasing					0.003	(0.002)
Arts, Entertainment & Recreation					-0.000	(0.001)
1st stage F-test of excluded instruments	19.643		20.751		19.674	
Underidentification test p-value	0.000		0.000		0.000	
Observations	341		341		339	

Heteroskedasticity robust standard errors are in parentheses. The specifications control for the average annual growth in the number of employees in various industries, based on the North American Industry Classification System (NAICS) 2 digit sector codes, that predominate the labor market of MSAs over 2008-2017. Prices are inflation adjusted. The specifications include MSA-level controls, state dummies and the instrumental variable as in Table 3. The underidentification test is that of Kleibergen and Paap (2006) and the F statistic is the Kleibergen and Paap Wald F statistic. Each observation is an MSA. ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table 10. The instrumental variable and its predictors

	Top earner business income share$_{m,07}$	
Median age$_{m,07}$	0.030*	0.011
	(0.016)	(0.017)
Immigrants as % of population$_{m,07}$	0.032***	-0.001
	(0.008)	(0.010)
Income tax rate for top earners$_{m,07}$	0.055***	0.053***
	(0.018)	(0.016)
Entrepreneurship rank$_{m,07}$	-0.0001	0.001
	(0.003)	(0.003)
Natural amenity index$_{m,07}$		0.121***
		(0.022)
R-squared	0.113	0.223
Observations	280	277

Heteroskedasticity robust standard errors are in parentheses. The outcome variable is our instrument for the SMREI share of purchases: the average share of business income over total income of the top earners in MSA m in the year 2007. Each observation is an MSA.

Online Appendix (NOT FOR PUBLICATION)

A Detailed Description of Database

In this appendix we describe our data sources, how we cleaned the data, and the key variables used in our analysis.

Investors' purchases

The investors' data come from the Zillow Transaction and Assessment Dataset (ZTRAX), a large raw database of U.S. deeds data. The transactions database of ZTRAX contains all property ownership transfers that are documented in the County deeds. Each record contains the date of the transfer, the address of the property, the type of the property, the sale price, and the names of the buyer and seller. We keep transactions between January 1^{st}, 2000 and December 31^{st}, 2017. We restrict the data to ownership transfers, dropping observations that refer exclusively to mortgages or foreclosures.[25] We drop transactions with deed type "Life Estate", since this is not an immediate transfer of ownership. We also drop transactions that had "Cancellation" in the deed type. We restrict the data to residential property transfers based on the ZTRAX property land use standard codes, which include both single-family and multi-family properties. Table A16 contains the classification of the property land use standard codes in single-family and multi-family from ZTRAX. This amounts to 139 million transactions nationally. We then drop transactions with purchase price missing or smaller than \$10,000, a common practice with deeds data (Bernstein, Gustafson and Lewis 2019; Stroebel 2016). This leaves 85 million transactions. Table A17 describes step by step the construction of the database of transactions with the investors' classification.

With the previous cleaning criterion, most of the transactions are dropped in the non-disclosure states. These states or counties do not require that the sale price is submitted to the county office. Specifically, all transactions are dropped in five non-disclosure states: Mississippi, Missouri, Montana, Utah and Wyoming. We keep in our data seven non-disclosure states, with a total of 28 MSAs, in which some of the transactions record sales price. We drop from our final dataset MSA-years that have fewer than 200 transactions, to avoid large outlier values, due to very few observations. The final dataset contains the following MSAs in non-disclosure states: Anchorage, Alaska; Boise City, Idaho; Alexandria, Baton Rouge, Hammond, Houma-Thibodaux, Lafayette, Lake Charles, Monroe, New Orleans-Metairie and Shreveport-

[25] The mortgage and foreclosure deeds have a separate corresponding deed for the ownership transfer.

Bossier City, Louisiana; Kansas City and Wichita, Kansas; Albuquerque, New Mexico; Bismarck and Fargo, North Dakota; Amarillo, Austin-Round Rock, Brownsville-Harlingen, Corpus Christi, Dallas-Plano-Irving, El Paso, Fort Worth-Arlington, Houston-The Woodlands-Sugar Land, Killeen-Temple, Lubbock, McAllen-Edinburg-Mission and San Antonio-New Braunfels, Texas. Additional results, not reported here, contain our baseline cross-sectional and dynamic analyses, dropping completely all non-disclosure MSAs. The results of both analyses hold with the same significance and even stronger results for the relevance tests for our instrumental variable.

To identify *institutional* or *corporate investors*, we first use the ZTRAX classification of buyer names into individual and non-individual names. The non-individual names frequently end with the words "LLC," "LP," "INC," "TRUST," "CORPORATION," "PARTNERS," "PARTNERSHIP," "LIMITED LIABILITY," "LTD," but they also contain entity names without the description in the end of the name.[26] Thorough inspection of the data confirms that the classification by ZTRAX of individual and non-individual names is as expected, with very minimal (human) errors. Our investors' identifier contains the deeds where the buyer has a non-individual name. From these names we filter out names of relocation companies, non profit organizations, construction companies, national and regional authorities, banks, Ginnie Mae, Fannie Mae, Freddie Mac and other mortgage loan companies and credit unions, homeowner associations, hospitals, universities (not when is university housing), churches, airports, and the state, names of the county, city and municipality. To identify relocation companies, non profit organizations and construction companies we use public data of lists of the top relocation companies, non profit organizations and construction companies in the U.S. We also manually check the names of the 200 largest non-individual buyers in each state using online search engines to classify them in the right category, and iterate this procedure several times to ensure the largest buyers are correctly classified.

To further increase the accuracy of the largest investors' classification we collect from industry reports and news reports the names of the top institutional investors in the single-family and multi-family markets. For example Amherst Capital's market commentary report (2018) provides a comprehensive list of the top 20 single-family rental institutions and the number of homes they own based on their calculations. We also collect the names of the residential real estate companies that belong to the S&P 500 Real Estate Index, most of which are apartment REITs. We then search for the names of these top investors and their subsidiaries in the ZTRAX database and ensure they are classified as investors. We use public SEC filings and other business websites to track down the names of the subsidiaries of these large investors.

[26]For example "Invitation Homes" and "Invitation Homes LP" are both included as non-individual names.

This procedure results in calculating the exact holdings of the top single-family and multi-family investors.

We calculate the market share of investors as the *dollar value* of investors' purchases divided by the dollar value of all purchases. Using the dollar value, accounts correctly for purchases of buildings with multiple units. Alternatively, we use the *number of purchases*, instead of the dollar value, and our results remain unchanged.

Finally, we use the crosswalk file from Census Bureau to match the County FIPS codes in ZTRAX to the Census Bureau MSA's 2017 core based statistical area (CBSA) code. For submetro areas of the largest MSAs, we use the CBSA division code. In total we match 411 CBSAs and divisions in the data.

Housing prices, rents and supply elasticity

Our price and rent data at MSA-level from 1999 through 2017 come from Zillow. To measure housing prices, we use the Metro Zillow Home Value Index (ZHVI). The ZHVI measures the median monthly price for each MSA and has units of nominal dollars per month. Zillow imputes this price based on a proprietary machine learning model taking into account the specific characteristics of each home and recent sale listings for homes with similar characteristics. The median price is computed across all homes in an MSA, not only those that are currently for sale. Thus, unlike pure repeat-listing indices, the ZHVI is not biased by the current composition of for-sale properties. To measure housing prices specifically for single-family homes, we use the ZHVI Single-Family Homes Time Series. To measure the price of top tier and bottom tier homes we use the Zillow's Top Tier Index and Bottom Tier Index, which measure the median house price among homes in the top third and bottom third of the price distribution within an MSA respectively. To measure rents, we use the Metro Zillow Rent Index (ZRI). The ZRI measures the median quarterly rent for each MSA and has units of nominal dollars per month. Zillow imputes this rent using an analogous methodology to ZHVI. Importantly, the ZRI does not impute a property's rent from its price. To convert the prices and rents to annual, we take the last value of each year. Housing price growth is the percentage growth of housing prices from year $t-1$ to year t. Housing rent growth is the percentage growth of housing rents from year $t-1$ to year t.

The housing supply elasticities were originally estimated by Saiz (2010). The elasticities are based on the amount of developable land in the U.S. MSAs, which is calculated based on satellite-generated geographical data. We use the dataset provided by Favara and Imbs (2015)

as our source of elasticity data.[27] The original data are at the MSA level (CBSA 2003 codes), and cover 275 MSAs. We crosswalk these to our 2017 CBSA and CBSA division codes.

Construction and vacancy data

Data on construction permits come from the Census Bureau's annual Residential Building Permits Survey. Statistics on construction authorized by building permits are based upon reports submitted by local building permit officials in response to a mail survey. When a report is not received, missing residential data are either obtained from the Survey of Use of Permits (SUP) or imputed. The SUP is used to collect information on housing starts. All other missing data are imputed. The imputations are based on the assumption that the ratio of current year authorizations to those of a year ago should be the same for both respondents and nonrespondents.

Our construction data cover the years 2000 to 2017 and they are collected initially at the county level. We then use the crosswalk file from Census Bureau to match the County FIPS codes to the Census Bureau 2017 core based statistical area (CBSA) and CBSA division codes. Then we aggregate the number of construction permits at the CBSA level. The permits are split into 1-unit, 2-units, 3-4 units and 5+ units, and they count the number of new buildings authorized. For our main construction variable we add up all the permits together, since our analysis includes the total housing market. The MSA-level data cover all the 411 CBSA codes.

Vacancy data come from the American Community Survey One-Year Estimates. Data are available annually and they cover 311 MSAs over the 2005-2017 period. We start from the original data at the county level: number of vacant housing units for homeowners and number of total units for homeowners. We then crosswalk to the 2017 CBSA codes and CBSA division codes and sum the number of households in the counties within the MSAs. Starting from county-level data results in more accurate MSA values for the most recent CBSA codes. Owner vacancy rate is the share of the number of vacant housing units for homeowners over the total housing units for homeowners.

Tax report data

The main data source to construct our instruments comes from the Internal Revenue Services (IRS), in particular, the Statistics of Income (SOI). This dataset provides zip code data on

[27] The AER site from which we obtained the data is: https://www.aeaweb.org/articles?id=10.1257/aer.20121416, and the specific dataset is "hp_dereg_controls".

administrative records of individual tax returns. The data excludes zip codes with less than 100 returns. Detailed description of the instruments is included in Appendix B.

Control variables

We also rely on the following data sources to get data at the county-year level and then aggregate to MSA-year level using the 2017 CBSA and CBSA division codes:

- Population: U.S. Census Bureau, from 1990 to 2017.
- Median Income: Zillow Median Household Income dataset, from 1990 to 2017.
- Unemployment and labor force participation: Bureau of Labor Statistics, from 1990 to 2017.
- Median age: American Community Survey One-Year Estimates, Census Bureau. The data only cover the 2005-2017 period. The data come in discrete age intervals that are 5 years apart. Based on the number of people in each age interval we find the interval that contains the median age, and take as the median age the midpoint of this interval.
- Employment by industry: County Business Patterns (CBP) dataset, from 2007 to 2017.
- Gross Domestic Product and wages: U.S. Department of Commerce's Bureau of Economic Analysis (BEA), from 2008 to 2017.
- Natural Amenities Scale: U.S. Department of Agriculture. The scale is constructed by combining six measures of climate, topography, and water area that reflect environmental qualities. These measures are warm winter, winter sun, temperate summer, low summer humidity, topographic variation, and water area.

  These additional controls come from the following data sources:

- Migration: American Community Survey 5-year estimates, Census Bureau, MSA-level in 2007.
- Income tax rate: Tax Foundation, the top marginal tax rate for an individual, State-level in 2007.
- Entrepreneurship rank: CNBC America's top states for business in 2007. This index provides a ranking of 50 States based on 40 different measures of competitiveness from publicly available data.

To summarize, there are 341 MSAs with the full set of average housing variables and investors' market share for the years 2009-17, control variables beginning in 2000, and tax-returns for the year 2007.

B Detailed Description of the Instrumental Variable

Our instrument approximates the average individual's tax returns by the zip code returns of a specific adjusted gross income (AGI) group. Since the Statistics of Income (SOI) dataset from the IRS does not provide returns at the individual level, the zip code AGI group level is the closest approximation to the average individual of each group within the zip code. AGI is defined as the total income minus adjustments to the income, which might be subject to change each year. The dataset splits the returns into six income groups. We specifically focus on the returns of the top two high earnings groups, which include people with annual AGI above $100,000.

Our instrument is the share of business income which measures the local attitude towards investment. Next, we describe in detail how we construct this instrument.

Share of business income

The share of business income instrument is concerned with the component of earnings associated with net business income. Post-Great Recession housing becomes an attractive investment. High earners with high business income in each MSA are likely to be more knowledgeable about investments. They are more likely to pursue investments in general, and investments in residential real estate in particular.

To construct the instrument we calculate the average share of net business income of top earners in 2007 at zip code level as:

$$b_{z,2007} = \sum_{g=5}^{6} \mu_g \frac{\text{Net business income } (\$)_g}{\text{Adjusted gross income } (\$)_g},$$

where z denotes the zip code and $g \in \{5, 6\}$, denotes the AGI group. Group 5 consists of returns with AGI between $100,000 and $200,000, and group 6 consists of returns with AGI above $200,000. The weight μ_g weights by the number of returns of each group. $\mu_g = N_g/(N_5 + N_6)$, where N represents the number of returns. All values refer to the 2007 returns.

We calculate the average share of business income of top earners in 2007 at the MSA level as:

$$b_{m,2007} = \sum_{z \in m} \omega_z k_z b_z,$$

where m denotes the MSA. k_z is the share of the zip code population that belongs to the MSA. This share comes from the Department of Housing and Urban Development (HUD) zip-CBSA and zip-CBSA division crosswalk files. k_z is one for most of the zip codes. ω_z weights by the number of returns of each zip code within the MSA: $\mu_z = N_z / \sum_{z \in m} N_z$.Our instrument $b_{m,2007}$ is used in the cross-sectional regression (1) to instrument for the average share of investors in MSA m, using a 2-stage least square estimation methodology.

For our dynamic analysis that uses a panel specification, we use the panel version of the instrument. The time-varying instrument captures the local exposure of an MSA to the national shock to CD rates. We construct the time-varying instrument as follows:

$$b^p_{m,t} = b_{m,2007} \times CD_{t-1},$$

where CD_t is the growth in the one-year certificate of deposits rate from year $t-1$ to t. In our panel data t ranges from 2009 to 2017. The investors' share is used with one year lag in the panel specification (2) .

Having the business income share fixed in 2007, ensures that the exposure is predetermined, and not affected by the housing market variables post 2008. Figure 1 plots the time series of an average one-year CD rate. CD_t is a national shock that is also unrelated to each of the local housing markets. This methodology constructs instruments that are likely to satisfy the exclusion restriction. Our multiple tests in Section 5 provide strong evidence in this direction.

C Altonji, Elder and Taber (2005) and Oster (2019) Test of Omitted Variable Bias

Altonji, Elder and Taber (2005) and Oster (2019) propose a test for omitted variable bias that uses the values of the coefficient of interest and R-squared in two different regressions: with and without control variables. We estimate an interval for the coefficient of interest and confirm that this interval does not contain zero. Note that this methodology is applied to OLS regressions, since the fundamental principle is obtaining the best model fit, as measured by the R-squared (see Mian and Sufi 2014 and Jenwittayaroje and Jiraporn 2019 for applications).

We compute the identified interval for the coefficient of the investors' share $[\beta, \beta^*]$, where β is the coefficient of the fully controlled model, and $\beta^* = \beta - (\beta_{uncontrolled} - \beta)\frac{R_{\max} - \tilde{R}}{\tilde{R} - R_{uncontrolled}}$. $\tilde{R}$ is the R-squared of the fully controlled model. $\beta_{uncontrolled}$ and $R_{uncontrolled}$ are the coefficient and R-squared of the basic model without controls, respectively. For $R_{\max}$ we use both definitions suggested by Oster (2019), $R_{\max} = 1.3\tilde{R}$ or $R_{\max} = 2.2\tilde{R}$.

We perform this test for four different specifications: (1) our baseline specification in Table 3, (2) the specification with additional controls for economic drivers in Table 7, (3) the specification with additional controls for credit supply in Table 8 and (4) the specification that includes additional controls for changes in industry employment in Table 9.

Table A11 shows the results of these tests. For $R_{\max} = 1.3\tilde{R}$, the identified intervals are: $[0.030, 0.033]$, $[0.020, 0.025]$, $[0.030, 0.033]$ and $[0.022, 0.026]$, for the above models. The identified intervals safely exclude zero. Thus, we can reject that the effect of the share of investors on housing prices is driven by omitted variables.

Extra Figures (NOT FOR PUBLICATION)

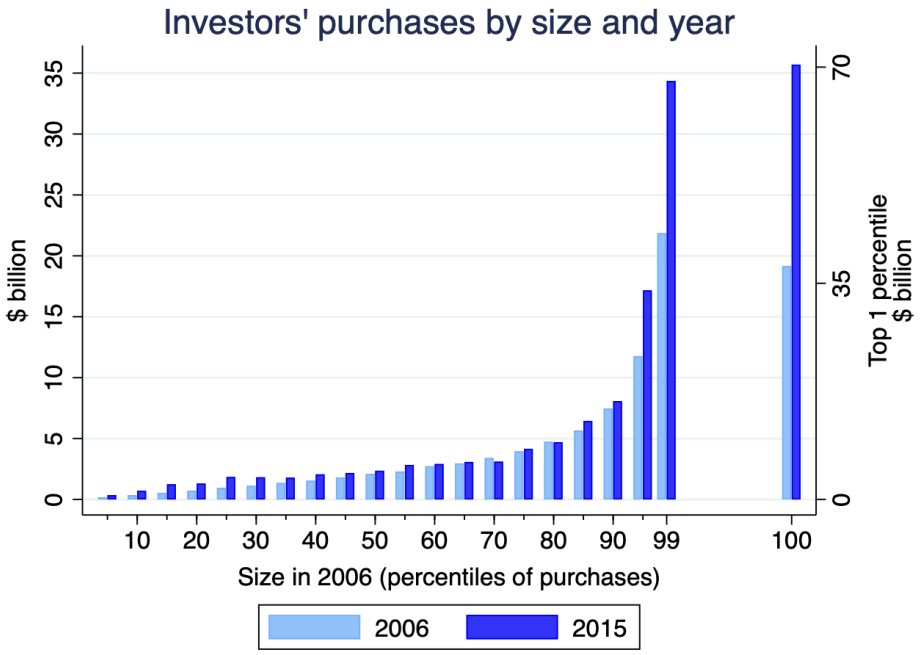

Figure A1. Size distribution of real estate investors. The figure plots the total dollar purchases by real estate investors in the U.S. housing markets in the years 2006 and 2015, in each percentile segment of purchase value. The percentile cutoffs are the dollar value cutoffs in 2006. All dollar values are in 2006 dollars.

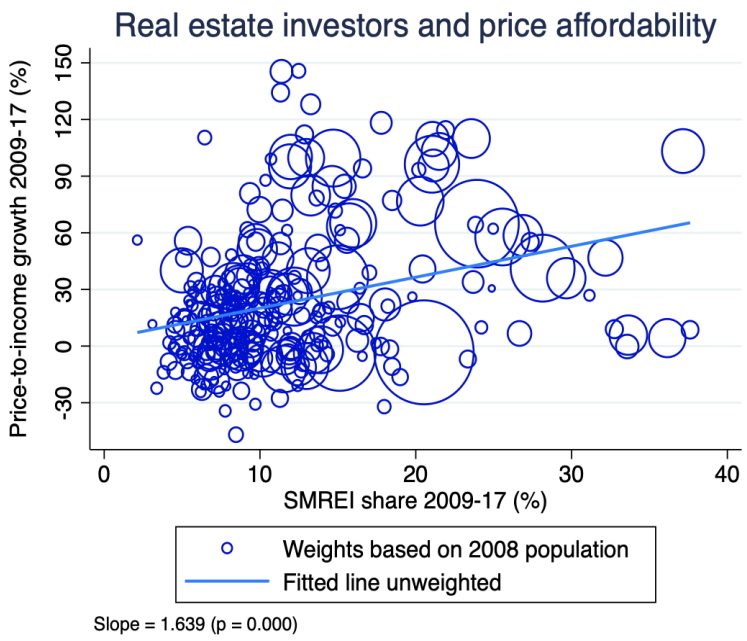

Figure A2. Price-to-income ratio and real estate investors. The figure plots the average share of SMREI purchases in the years 2009 to 2017 against the growth of the bottom tier price-to-income ratio from 2009 to 2017 in the U.S. MSAs. Each circle represents an MSA, and the size of the circle is analogous to the MSA population in 2008.

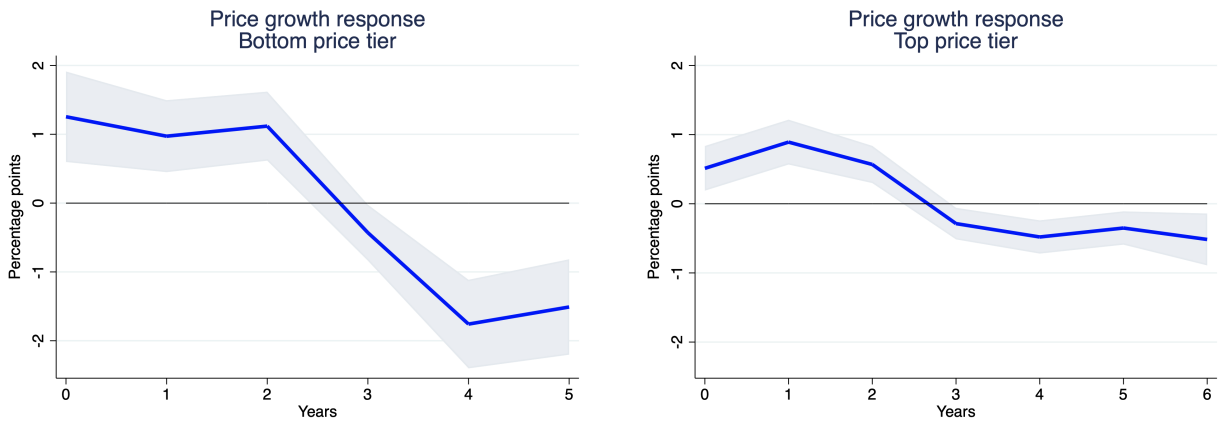

Figure A3. Dynamics of housing prices after investors' purchases by tier. The figure plots the estimates from sequential regressions of the real housing price growth on the instrumented past investors' share of purchases for top and bottom price-tier houses. Top tier houses are houses in the top third, and bottom tier houses are houses in the bottom third of the house value distribution within an MSA. We estimate the impulse responses for the full panel data from 2009 to 2017. The shaded areas show the 90% confidence interval.

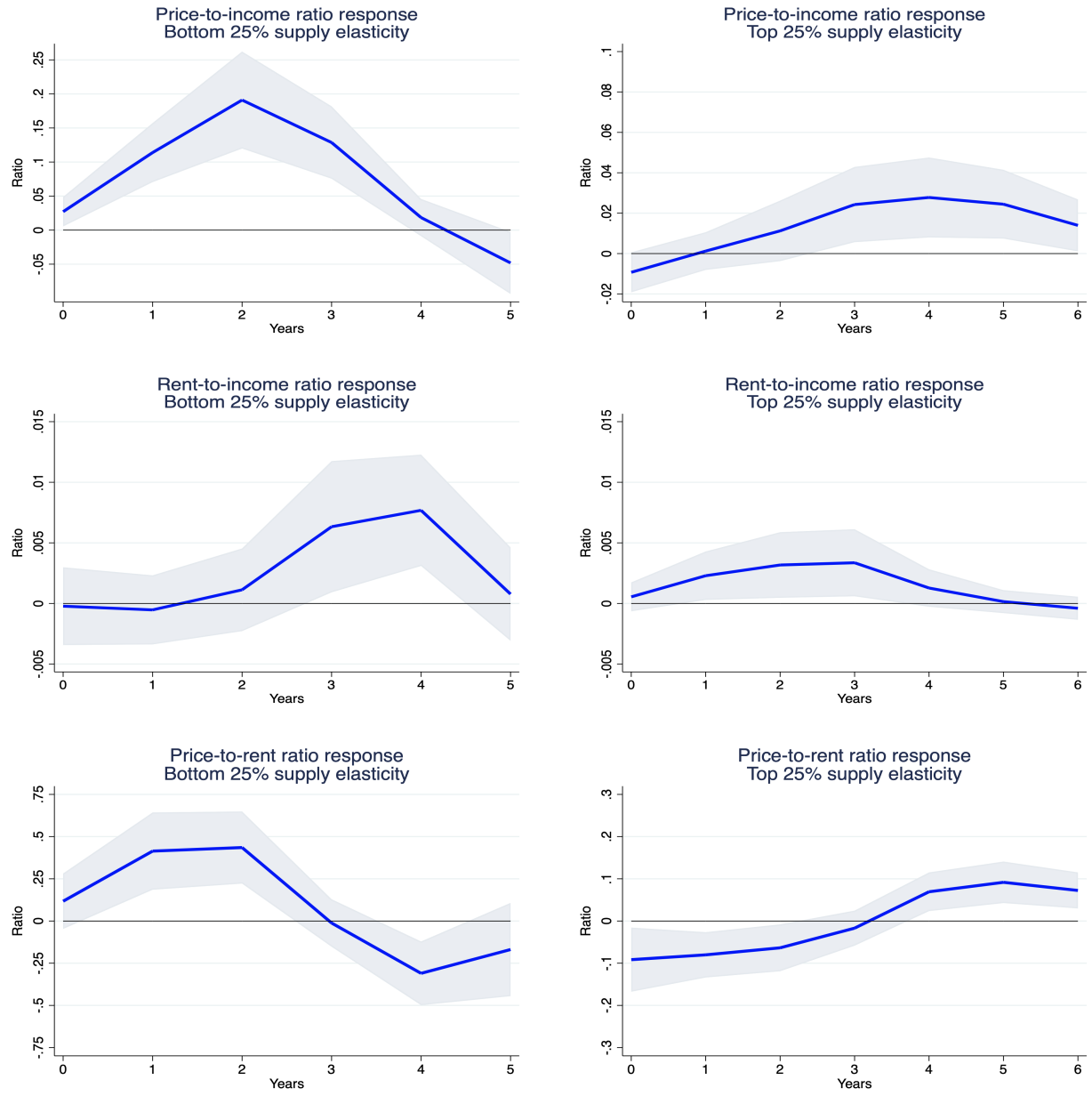

Figure A4. Dynamics of housing affordability after investors' purchases and supply elasticity. The figure plots the estimates from sequential regressions of (a) price-to-income, (b) rent-to-income, and (c) price-to-rent ratio for MSAs at the bottom and top quartiles of the supply elasticity distribution. Housing supply elasticity comes from Saiz (2010). The bottom quartile of the supply elasticity is 1.56, and the top quartile is 2.89 in our sample. The bottom quartile has on average 4.2 price-to-income, 0.33 rent-to-income and 13.0 price-to-rent ratio, over 2009-2017. The top quartile has on average 2.5 price-to-income, 0.27 rent-to-income and 9.4 price-to-rent ratio, over the same period. The shaded areas show the 90% confidence interval.

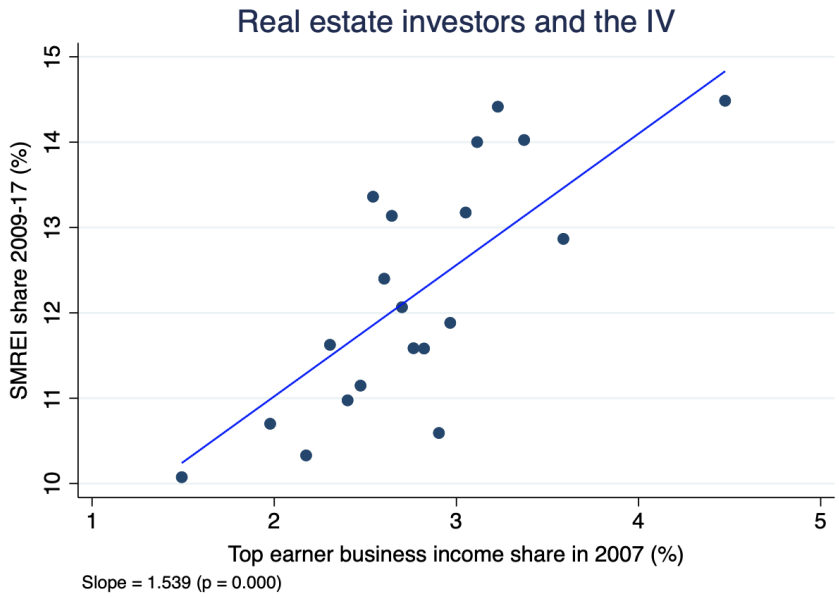

Figure A5. Investors' market share and the instrumental variable. This figure plots the average share of value of business income over total income of top earners in an MSA in 2007, against the 2009-2017 average market share of investors' purchases in each MSA. The top earners are the ones who reported adjusted gross income of 100,000 U.S. dollars or higher in their tax returns. The MSAs are binned by percentiles so that each point represents around 15 MSAs. The figure controls for the controls in the baseline specification in Table 3.

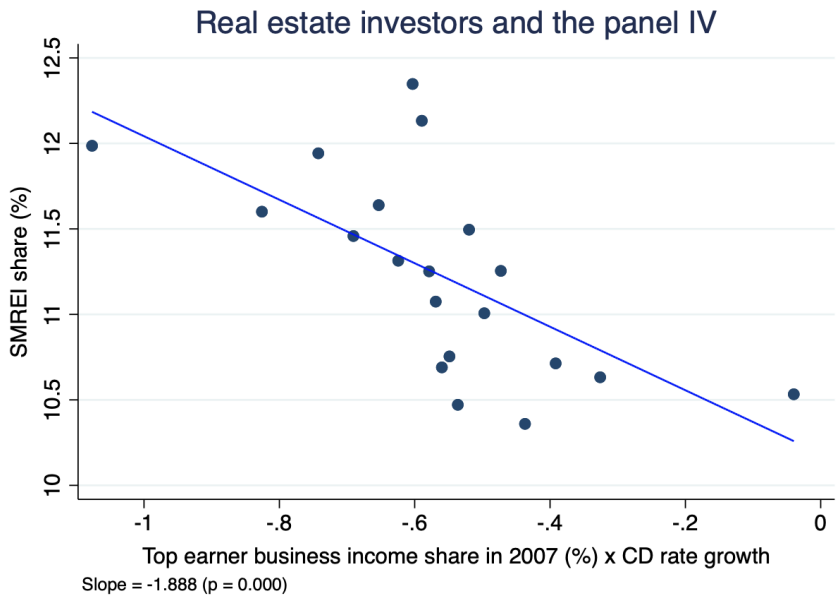

Figure A6. Investors' market share and the instrumental variable. This figure plots the share of value of business income over total income of top earners in an MSA in 2007 multiplied by the CD rate growth, against the market share of investors' purchases each year in each MSA. The top earners are the ones who reported adjusted gross income of 100,000 U.S. dollars or higher in their tax returns. The MSAs are binned by percentiles so that each point represents around 15 MSAs. The figure controls for the controls in the panel specification in Table A4.

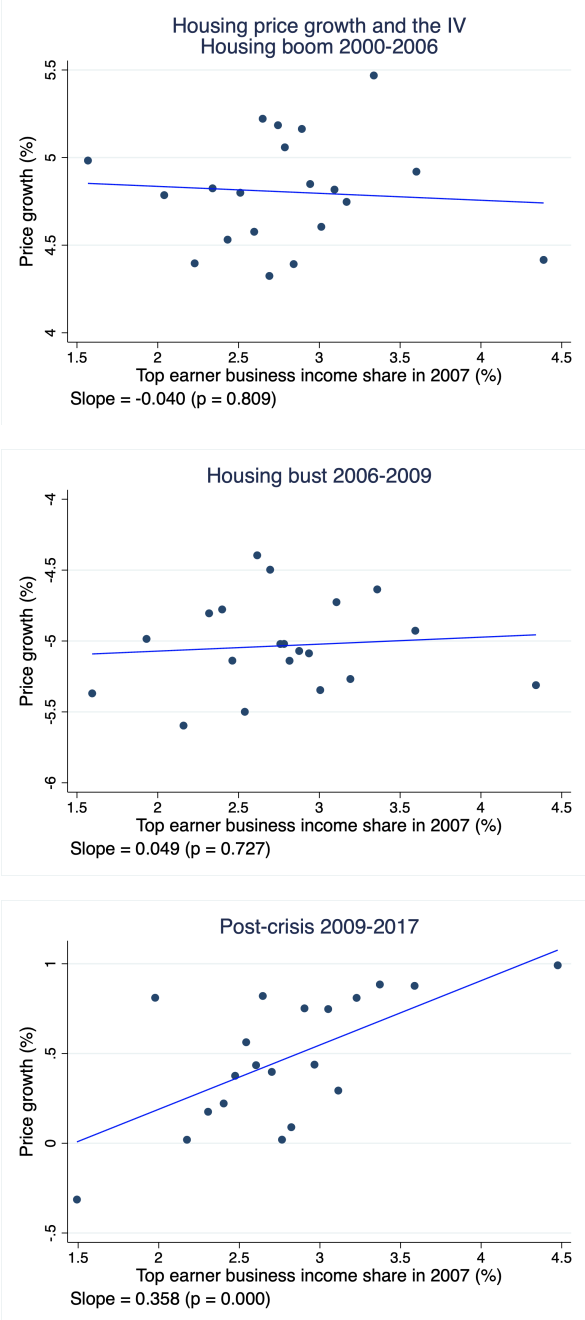

Figure A7. Housing price growth and the instrument for SMREI. The figures plot the average annual real housing price growth over three different periods: 2000-06, 2006-09 and 2009-17, against the average share of business income of top earners in each MSA in 2007. The controls are as in Table 6 for the top two figures and as in Table 3 for the bottom figure.

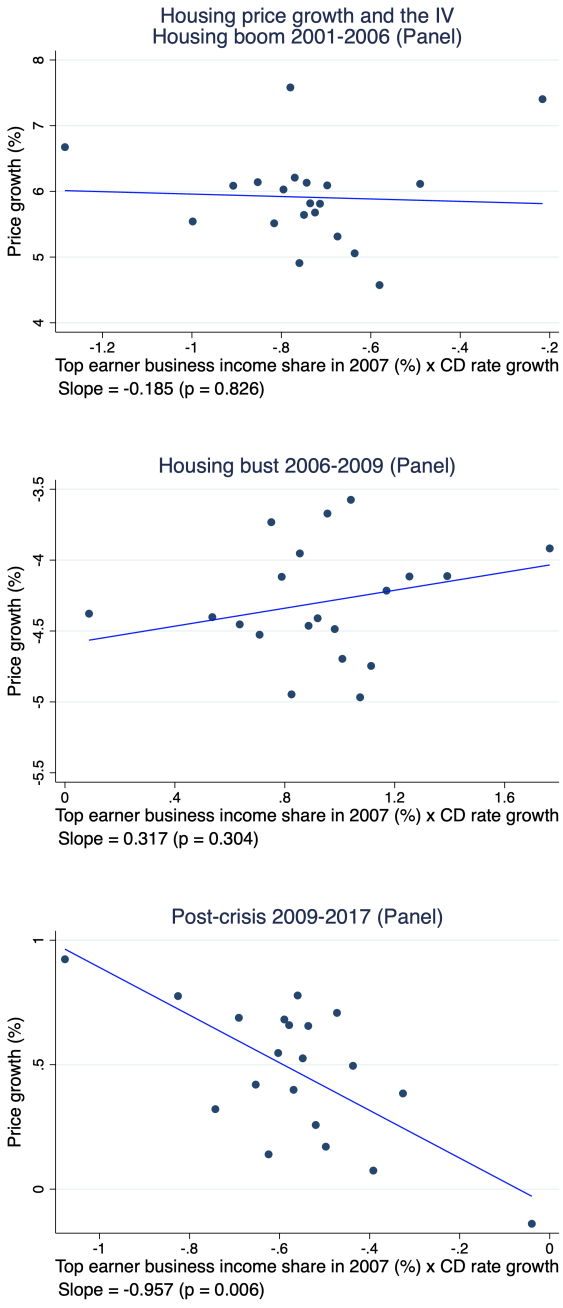

Figure A8. Housing price growth and the panel instrument for SMREI. The figures plot the annual real price growth over three different periods: 2000-06, 2006-09 and 2009-17, against the average share of business income of top earners in each MSA in 2007 times the lagged CD rate growth. The controls are as in Table A9 for the top two figures and as in Table A4 for the bottom figure.

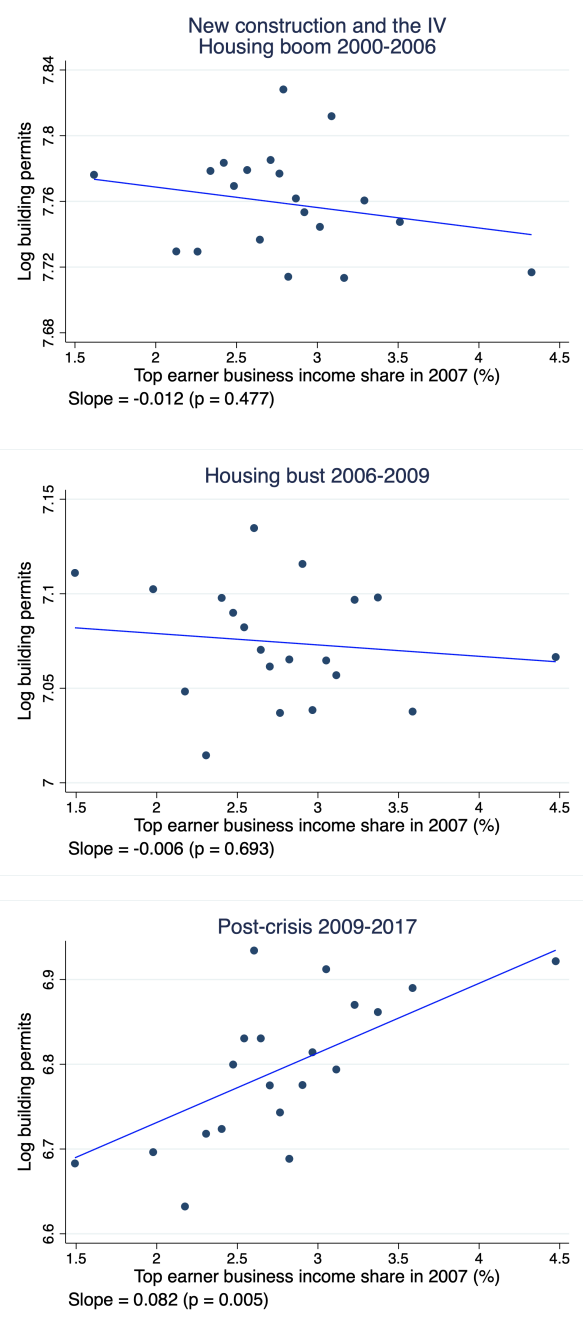

Figure A9. Building permits and the panel instrument for SMREI. The figures plot the log number of building permits over three different periods: 2000-06, 2006-09 and 2009-17, against the average share of business income of top earners in each MSA in 2007 times the lagged CD rate growth. The controls are as in Table A9 for the top two figures and as in Table A4 for the bottom figure.

Extra Tables (NOT FOR PUBLICATION)

Table A1. Robustness test: Local investors' share

	Price growth$_{m,09-17}$			Price-to-income ratio$_{m,09-17}$		
	Bottom Tier	Mid Tier	Top Tier	Bottom Tier	Mid Tier	Top Tier
All MSAs						
Local investors' share$_{m,09-17}$	0.436***	0.377***	0.279***	2.154***	0.812***	0.459***
	(0.127)	(0.125)	(0.104)	(0.526)	(0.269)	(0.162)
Observations	306	341	337	306	341	337
			Standardized			
Local investors' share$_{m,09-17}$	0.972***	0.887***	0.823***	2.185***	1.732***	1.958***
	(0.283)	(0.270)	(0.316)	(0.529)	(0.512)	(0.623)
Observations	303	303	303	303	303	303
Sample without top 5% of MSAs with highest share of out-of-town investors						
SMREI share$_{m,09-17}$	0.378***	0.317***	0.223***	1.716***	0.575***	0.324***
	(0.111)	(0.097)	(0.076)	(0.381)	(0.183)	(0.111)
Observations	288	323	319	288	323	319
			Standardized			
SMREI share$_{m,09-17}$	1.112***	1.070***	0.937***	2.309***	1.717***	1.911***
	(0.325)	(0.325)	(0.340)	(0.505)	(0.528)	(0.635)
Observations	285	285	285	285	285	285

Heteroskedasticity robust standard errors are in parentheses. The top part of table uses the local investors' share as a dependent variable. Local investors buy homes within the MSA of their mailing address. The bottom part of the table uses the SMREI share as a dependent variable and excludes 18 MSAs: the top 5th percentile in terms of share of out-of-town and foreign investors. These investors have mailing addresses outside of the MSA where the transacted homes are located. The standardized results show the estimated effects of the standardized independent variables on the standardized dependent variables, for the MSAs for which we have price series for all tiers. All models include state dummies, MSA-level controls and the IV as in Table 3. Each observation is an MSA. ***significant at the 1% level.

Table A2. County level results

	Bottom Tier	Mid Tier	Top Tier
	Price growth$_{c,09-17}$		
SMREI share$_{c,09-17}$	0.362***	0.238**	0.139*
	(0.114)	(0.099)	(0.078)
Observations	609	699	682
	Price-to-income ratio$_{c,09-17}$		
SMREI share$_{c,09-17}$	1.876***	0.560***	0.476***
	(0.500)	(0.170)	(0.147)
Observations	609	699	682

Heteroskedasticity robust standard errors are in parentheses. Bottom tier houses are houses in the bottom third, and top tier in the top third of the house value distribution within a county. SMREI share is the average annual share of purchases by medium and small investors in county c over 2009-2017. All models include state dummies and county-level controls: population growth, income growth, unemployment rate change and real housing price growth over the periods 2000-2006 and 2006-2007, the log number of construction unit permits in 2007 and share of large investors. Price growth is inflation adjusted. The instrument for the SMREI share of purchases is the average share of business income over total income of the top earners in county c in 2007. Each observation is a county. ***significant at the 1% level; **significant at the 5% level.

Table A3. First stage panel: SMREI share and the instrumental variable

	SMREI share$_{m,t-1}$		
	All MSAs	Excl. top 19 MSAs	Excl. top 36 MSAs
Top earner business income share$_{m,07}$×CD rate growth$_{t-2}$	-1.888***	-1.974***	-1.986***
	(0.384)	(0.399)	(0.412)
MSA-year controls	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
R-squared	0.674	0.656	0.651
Observations	2,842	2,671	2,518

Standard errors clustered by MSA are in parentheses. The controls are the housing price growth, population growth, median income growth, unemployment rate change and share of large investors, all lagged by one year. The sample period is 2009-2017. Each observation is an MSA-year. ***significant at the 1% level.

Table A4. Housing price growth in response to investors' purchases

	Price growth$_{m,t+i}$						
	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
Top price-tier							
SMREI share$_{m,t-1}$	0.51***	0.89***	0.57***	-0.29**	-0.48***	-0.35**	-0.52**
	(0.20)	(0.20)	(0.16)	(0.14)	(0.15)	(0.15)	(0.23)
Observations	2,804	2,492	2,180	1,868	1,556	1,244	932
Mid price-tier							
SMREI share$_{m,t-1}$	0.51***	0.85***	0.71***	-0.48***	-0.79***	-0.41***	-0.74***
	(0.19)	(0.23)	(0.20)	(0.15)	(0.18)	(0.14)	(0.28)
Observations	2,842	2,525	2,208	1,891	1,575	1,259	943
Bottom price-tier							
SMREI share$_{m,t-1}$	1.26***	0.97***	1.12***	-0.43*	-1.76***	-1.51***	-2.68***
	(0.40)	(0.32)	(0.31)	(0.25)	(0.39)	(0.42)	(1.04)
Observations	2,547	2,261	1,975	1,690	1,406	1,122	838

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. All models include location and time fixed effects and controls: the lagged dependent variable, and population growth, median household income growth, unemployment rate change and share of large investors, all lagged by one year. Prices are inflation adjusted. The IV is the average share of business income over total income of the top earners in MSA m in 2007 multiplied by the lagged CD rate growth. The sample period is 2009-2017. Each observation is an MSA-year. Table A3 contains the first stage of the IV regression. Table A15 contains the dynamic results using alternative measures of the investors' presence. ***significant at 1%; **significant at 5%; *significant at 10%.

Table A5. Dynamic results for prices excluding top 36 MSAs

	Price growth$_{m,t+i}$						
	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
Top price-tier							
SMREI share$_{m,t-1}$	0.61***	0.92***	0.59***	-0.27*	-0.50***	-0.32**	-0.52**
	(0.21)	(0.20)	(0.17)	(0.15)	(0.15)	(0.15)	(0.23)
Observations	2,480	2,204	1,928	1,652	1,376	1,100	824
Mid price-tier							
SMREI share$_{m,t-1}$	0.64***	0.91***	0.79***	-0.44***	-0.83***	-0.43***	-0.70***
	(0.20)	(0.24)	(0.21)	(0.15)	(0.18)	(0.15)	(0.26)
Observations	2,518	2,237	1,956	1,675	1,395	1,115	835
Bottom price-tier							
SMREI share$_{m,t-1}$	1.43***	1.04***	1.20***	-0.34	-1.62***	-1.34***	-2.27***
	(0.41)	(0.31)	(0.30)	(0.24)	(0.37)	(0.39)	(0.83)
Observations	2,223	1,973	1,723	1,474	1,226	978	730

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The fixed effects, controls and instrumental variable are as in Table A4. The sample period is 2009-2017. Each observation is an MSA-year. The Kleibergen and Paap (2006) underidentification test has p-value of 0.001, and the Kleibergen and Paap Wald F statistic is 25.475 for the mid-tier market panel regression ($i = 0$). Table A3 contains the first stage of the IV regression. Table A15 contains the dynamic results using alternative measures of the investors' presence. ***significant at 1%; **significant at 5%; *significant at 10%.

Table A6. Affordability measures in response to investors' purchases

	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
	Price-to-income ratio$_{m,t+i}$						
SMREI share$_{m,t-1}$	0.03***	0.09***	0.14***	0.11***	0.04***	0.01	-0.01
	(0.01)	(0.02)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	2,844	2,527	2,210	1,893	1,576	1,260	944
	Rent-to-income ratio$_{m,t+i}$						
SMREI share$_{m,t-1}$	0.06	0.10	0.23**	0.41***	0.31***	-0.02	-0.21*
	(0.10)	(0.09)	(0.10)	(0.14)	(0.09)	(0.06)	(0.12)
Observations	2,580	2,293	2,006	1,719	1,432	1,145	858

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The fixed effects, controls and instrumental variable are as in Table A4. The sample period is 2009-2017. Each observation is an MSA-year. The SMREI share is divided by 100 in the regressions of rent-to-income to adjust the coefficients. ***significant at 1%; **significant at 5%; *significant at 10%.

Table A7. Dynamic results for affordability excluding top 36 MSAs

	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
	Price-to-income ratio$_{m,t+i}$						
SMREI share$_{m,t-1}$	0.03***	0.09***	0.14***	0.11***	0.04***	0.01	-0.01
	(0.01)	(0.02)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	2,520	2,239	1,958	1,677	1,396	1,116	836
	Rent-to-income ratio$_{m,t+i}$						
SMREI share$_{m,t-1}$	0.06	0.11	0.22**	0.37**	0.28***	-0.02	-0.17
	(0.11)	(0.10)	(0.11)	(0.16)	(0.10)	(0.07)	(0.11)
Observations	2,256	2,005	1,754	1,503	1,252	1,001	750

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The fixed effects, controls and instrumental variable are as in Table A4. The sample period is 2009-2017. Each observation is an MSA-year. The SMREI share is divided by 100 in the regressions of rent-to-income to adjust the coefficients. ***significant at 1%; **significant at 5%; *significant at 10%.

Table A8. Single-family properties

	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
	Single-family price growth$_{m,t+i}$						
SMREI single-family share$_{m,t-1}$	0.59***	1.04***	0.83***	-0.62***	-0.95***	-0.47***	-1.12**
	(0.21)	(0.27)	(0.23)	(0.18)	(0.21)	(0.17)	(0.48)
Observations	2,830	2,514	2,198	1,882	1,567	1,252	937
	Price growth$_{m,t+i}$						
SMREI single-unit share$_{m,t-1}$	0.58***	1.05***	0.88***	-0.61***	-1.00***	-0.51***	-1.08**
	(0.21)	(0.27)	(0.24)	(0.18)	(0.22)	(0.17)	(0.44)
Observations	2,842	2,525	2,208	1,891	1,575	1,259	943

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The fixed effects, controls and instrumental variable are as in Table A4. The top panel uses single-family prices and the bottom panel prices for all homes, from Zillow. The sample period is 2009-2017. Each observation is an MSA-year. ***significant at the 1% level; **significant at the 5% level.

Table A9. Placebo panel: Housing price growth and investors' share pre-crisis

	Price growth$_{m,t}$			
Panel period	2001-2005	2001-2006	2001-2005	2001-2006
SMREI share$_{m,t-1}$	-1.308	-1.585	-0.046	-0.892
	(0.855)	(1.035)	(0.754)	(0.941)
Estimation	IV	IV	IV	IV
Instrumental variable period	2001-2005	2001-2006	2009-2013	2009-2014
Observations	1,639	1,981	1,638	1,980

Standard errors clustered by MSA are in parentheses. The specifications include location and time fixed effects and MSA-year level controls: the real housing price growth, population growth, median income growth and unemployment rate change from time $t-2$ to $t-1$, and the share of large investors in $t-1$. Prices are for the median house and are inflation adjusted. The instrument for the SMREI share of purchases is the average share of business income over total income of the top earners in MSA m in the year 2007 multiplied by the lagged CD rate growth. In the first two columns the instruments are constructed using CD rate growth$_{m,t-1}$, so the CD rate is contemporaneous to the panel variables. In the last two columns the instruments are constructed using CD rate growth$_{m,t+7}$, so the instrument is identical to the baseline panel specification, which begins in the year 2009. Each observation is an MSA-year.

Table A10. Dynamic results controlling for labor demand shifts by industry

	Price growth$_{m,t+i}$						
	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
SMREI share$_{m,t-1}$	0.49***	0.82***	0.69***	-0.40***	-0.74***	-0.36***	-0.71***
	(0.19)	(0.23)	(0.19)	(0.14)	(0.18)	(0.13)	(0.27)
Observations	2,758	2,442	2,138	1,836	1,532	1,227	919

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The specification includes location and time fixed effects, controls and the IV as in Table A4. Additional controls are the lagged growth rate of employment in the main industries, based on the NAICS 2 digit sector codes, within the MSAs: Health Care & Social Assistance, Retail Trade, Accommodation & Food Services, Manufacturing, Professional, Scientific and Technical Services, Administrative and Support and Waste Management, Finance and Insurance, Wholesale Trade, Other Services, and Transportation and Warehousing. Prices are for mid-tier houses and are inflation adjusted. The sample period is 2009-2017. Each observation is an MSA-year. ***significant at 1%.

Table A11. Omitted variable bias test: Oster (2019) bounds

	β ($\delta = 0$)	β^* ($\delta = 1$)	
		$R_{\max} = 1.3\tilde{R}$	$R_{\max} = 2.2\tilde{R}$
Table 3	0.033	0.030	0.023
Table 7	0.025	0.020	0.005
Table 8	0.033	0.030	0.023
Table 9	0.026	0.022	0.008

This table shows the identified intervals for the coefficient of the investors' share, based on the Oster (2019) methodology. The first omitted variable bias test is for the baseline specification (Table 3, first column), the second is for our specification with additional controls for economic drivers (Table 7, last column), the third for the specification that controls for credit denials (Table 8, first column) and the fourth for our robustness check using controls for changes in industry employment (Table 9, last column). β is the estimated coefficient in the fully controlled models. For detailed description of the methodology and the symbols check our online Appendix C and Oster (2019).

Table A12. The instrumental variable and drivers of housing markets

	Top earner business income share$_{m,07}$	
	Coefficient	Standard error
Avg. median age change$_{m,00-06}$	0.019	(0.049)
Avg. homeownership rate change$_{m,00-06}$	-0.002	(0.056)
Median age change$_{m,07}$	-0.014	(0.052)
Homeownership rate change$_{m,07}$	-0.024	(0.067)
Baseline controls		
Avg. house price growth$_{m,00-06}$	-0.103	(0.113)
Avg. population growth$_{m,00-06}$	-0.074	(0.097)
Avg. income growth$_{m,00-06}$	0.137**	(0.067)
Avg. unemployment rate change$_{m,00-06}$	-0.026	(0.095)
House price growth$_{m,07}$	0.053	(0.086)
Population growth$_{m,07}$	-0.025	(0.072)
Income growth$_{m,07}$	0.050	(0.061)
Unemployment rate change$_{m,07}$	-0.001	(0.094)
Log construction permits$_{m,07}$	-0.031	(0.054)
Large investors' share$_{m,09-17}$	-0.022	(0.039)
State dummies	Yes	
R-squared	0.534	
Observations	297	

Heteroskedasticity robust standard errors are in parentheses. All variables are normalized to have zero mean and standard deviation of one. The outcome variable is our instrument for the SMREI share: the average share of business income over total income of the top earners in MSA m in 2007. The baseline controls are as in Table 3 and are included in all specifications. Each observation is an MSA.

Table A13. Robustness: Control for individual investors

	Price growth$_{m,t+i}$						
	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
SMREI share$_{m,t-1}$							
(instrumented)	0.54***	0.87***	0.72***	-0.49***	-0.80***	-0.41***	-0.69**
	(0.20)	(0.24)	(0.20)	(0.15)	(0.18)	(0.14)	(0.27)
Individual investors' share$_{m,t-1}$							
(not instrumented)	0.05**	0.06*	0.05*	-0.02	-0.06*	-0.03	-0.10
	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.09)
WSL share$_{m,t-1}$							
(not instrumented)	-0.08	-0.22	-0.21	0.21	0.17	0.14	0.25
	(0.12)	(0.17)	(0.14)	(0.13)	(0.25)	(0.12)	(0.37)
Observations	2,842	2,525	2,207	1,891	1,575	1,258	942

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The small and medium-sized legal entity investors' share is the usual definition of SMREI used throughout the paper. The individual investors' share is the MSA share of housing purchases in dollar value by individuals who purchase two or more properties in the same MSA within two years. The fixed effects, controls and instrumental variable for the legal entity investors' share are as in Table A4. The individual investors' share is not instrumented. The sample period is 2009-2017. Each observation is an MSA-year. ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Table A14. Robustness: Control for foreclosures

	Bottom Tier	Mid Tier	Top Tier
All MSAs	Price growth$_{m,t+1}$		
SMREI share$_{m,t-1}$	2.200**	1.111**	0.861**
	(0.894)	(0.549)	(0.409)
Number of MSAs	93	95	95
Observations	514	523	523
Sample without top 19 MSAs	Price growth$_{m,t+1}$		
SMREI share$_{m,t-1}$	2.259**	1.330**	1.041**
	(0.921)	(0.536)	(0.405)
Number of MSAs	77	79	79
Observations	424	433	433

Standard errors clustered by MSA are in parentheses. These panel regressions are estimated at the 1-year horizon. The fixed effects, controls and instrumental variable are as in Table A4. In addition, all models control for the lagged increase in the foreclosure rate. The sample period is 2009-2017. Each observation is an MSA-year. **significant at the 5% level.

Table A15. Alternative measure of investors

	Price growth$_{m,t+i}$						
	$i=0$	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$
Share of number of							
SMREI' purchases$_{m,t-1}$	0.79***	1.59***	1.42***	-1.05***	-1.78***	-0.87***	-2.34*
	(0.28)	(0.45)	(0.40)	(0.34)	(0.46)	(0.32)	(1.21)
Observations	2,842	2,525	2,208	1,891	1,575	1,259	943

Standard errors clustered by MSA are in parentheses. i indicates the number of years forward for which the effect is estimated. The SMREI share of number of purchases denotes the share of the count of properties that investors bought. Each property counts as one purchase, independent of the type of property, that is, one single-family detached home, one apartment building, etc. The fixed effects, controls and instrumental variable are as in Table A4. The sample period is 2009-2017. Each observation is an MSA-year. ***significant at the 1% level; *significant at the 10% level.

Table A16. Land use and buildings' classification

Single-family: single family residential, townhouse, row house, mobile home, cluster home, seasonal, cabin, vacation residence, bungalow, zero lot line, patio home, manufactured, modular, prefabricated homes, garden home, planned unit development, rural residence, residential general, inferred single family residential.
Multi-family: condominium, cooperative, landominium, duplex (2 units, any combination), triplex (3 units, any combination), quadruplex (4 units, any combination), apartment building (5+ units), apartment building (100+ units), high-rise apartment, garden apartment, court apartment (5+ units), mobile home park, trailer park, dormitory, group quarters (residential), fraternity house, sorority house, apartment (generic), multifamily dwelling (generic any combination 2+), boarding house rooming house apt hotel transient lodging, residential condominium development (association assessment), residential income general (multi family).

This table shows the classification of homes into single-family and multi-family based on the ZTRAX land use standard codes.[28]

[28] We excluded from the data the following land use standard codes that do not refer to homes: "residential common area", "timeshare", "residential parking garage" and "miscellaneous improvement".

Table A17. Investors database construction

Action to clean database	Number of observations	Percentage dropped	Explanation
Database: All transactions with buyer names	226,645,766		This is the full database of deeds up to 31st December 2017, after we merged it with the buyer names based on a unique deed identifier.
Remove missing transaction dates	226,643,278	0.001%	The transaction date is the date the deed for the transfer of the property was signed.
Keep dates from 1st January 2000 to 31st December 2017	188,006,472	17.05%	The date each county begins reporting data varies. Some report from 1980, while most from the 1990s. We keep transactions from 1st January 2000.
Keep only residential properties	142,727,896	24.08%	Each property has a land use classification code. We keep the codes for single- and multi-family homes as we show in Table A16.
Remove life estate deeds	142,713,308	0.01%	This type of deed transfers the house in the future at death of the owner. Date of transfer is unknown.
Remove deeds with cancel indicator	142,608,773	0.07%	These deeds cancel previous deeds. They don't transfer ownership.
Merge 2017 MSA and MSA division codes using FIPS county codes	131,856,802	7.54%	The dropped counties are outside the Metropolitan Statistical Areas. We keep MSAs to focus on urban areas.
Merge with seller	131,687,294	0.13%	We drop incomplete records that miss the seller name.
Remove transactions with price<$10,000	85,398,628	35.15%	This is common practice with deeds data (Stroebel 2016; Bernstein, Gustafson and Lewis 2019). Most of the dropped data are from non-disclosure states.

This table describes step-by-step the cleaning of the transaction-level database. Each observation is a transaction to transfer the ownership of a property, as recorded in the official deed. The percentage dropped shows the percentage of observations that are removed from the database in each step. The cleaned database contains the dollar value of purchases by either investors or other buyers, which is used to calculate their share of purchases.