Economic Consequences of Housing Speculation

Zhenyu Gao[†], Michael Sockin[‡], Wei Xiong[§]

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ABSTRACT

By exploiting variation in capital gains taxation across U.S. states as an instrument, we provide novel evidence that housing speculation during the boom period of 2004 to 2006, measured by the fraction of non-owner-occupied home purchases, helps to explain not only the severity of the housing price bust in 2007 to 2009, but also the depth of the subsequent economic recession. Housing speculation, anchored, in part, on extrapolation of past housing price changes, was more pronounced in zip codes with low capital gains taxation. Zip codes that had greater speculation, in turn, experienced more new housing construction during the boom, and more severe declines in employment, per capita income, real payroll, and new business establishment growth during the bust. Our analysis also indicates that supply overhang and local household demand are two key channels for transmitting the adverse effects of housing speculation.

Economists have long been concerned with the economic consequences of speculation and the real effects of asset bubbles. A growing strand of the literature, including Haughwout et al. (2011), Case, Shiller, and Thompson (2015), Bayer et al. (2015), Nathanson and Zwick (2015), and Chinco and Mayer (2016), has highlighted the importance of housing speculation in driving the recent housing cycle.[1] Indeed, speculation in the housing markets became a national phenomenon in the low interest rate environment of the mid-2000s, with purchases of non-owner-occupied homes (second and investment homes) contributing up to 30% of all home purchases during the boom in cities such as Las Vegas. The economic consequences of housing speculation, however, remain elusive because of the well-recognized endogeneity issue with identification. The purchase of non-owner-occupied homes in one area may reflect local housing demand, or other unobservable economic conditions, rather than be a cause of housing and economic cycles.

In this paper, we take on this challenge to study how housing speculation during the boom period of 2004 to 2006 adversely affected economic activity during the bust period of 2007 to 2009. We measure housing speculation during the boom by the fraction of non-owner-occupied home purchases in a zip code. For identification, we construct a novel instrument for housing speculation that takes advantage of the variation across the U.S. states in their taxation of capital gains. While homeowners can exclude capital gains from the sale of their primary residence from their income tax, this exclusion does not cover capital gains from selling non-owner-occupied homes. As nine states have no capital gains taxes, and the others have significant variation in how they tax capital gains, housing speculation is more intensive in states with either no or low capital gains taxes. We construct two versions of the instrument: The first is a tax dummy indicating whether a state has capital gains taxes, and the second expands on the first by including the marginal tax rate for the median income household in states with capital gains taxes.

By instrumenting non-owner-occupied home purchases with the two tax variables, we find that zip codes with a greater share of non-owner-occupied home purchases during the boom had not only more pronounced price contractions during the bust, but also experienced greater

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[1] Glaeser (2013) provides an eloquent analysis of nine episodes of real estate speculation in American history, and highlights housing speculation as one of several recurring themes in these episodes.

declines in employment, payroll, per capital income, and the number of establishments. The economic magnitudes of these effects are substantial: an increase of 9.87% (one standard deviation across zip codes) in the share of non-owner occupied home purchases in 2004 to 2006 led to a housing price decline of 10.9% and drops of 7.0% in real payroll, 6.9% in employment, 5.9% in income per capita, and 4.5% in number of establishments in 2007 to 2009. These results establish a causal link between housing speculation and different aspects of housing and economic cycles.

We then examine several transmission mechanisms to understand how housing speculation during the boom propagated to the real economy during the bust. We first examine the supply overhang channel, explored, for instance, in Rognlie, Shleifer, and Simsek (2015). By again using the instrument variable approach, we find that areas with more intense housing speculation during the boom also had a greater increase in housing construction in the same period, which in turn contributed to the contraction of the construction sector. An increase of one standard deviation in the instrumented housing speculation in 2004 to 2006 led to an increase of 6.0% in the building permits in 2004 to 2006 relative to the number of housing units in 2000, as well as decreases of 13.3% in the construction sector employment and 5.93% in the non-construction sector employment in 2007 to 2009. These findings confirm the importance of the supply overhang channel, which, however, cannot fully explain the substantial downturn experienced by the non-construction sectors.

We further examine a second channel through local household demand, as suggested by Mian, Rao, and Sufi (2013) and Mian and Sufi (2014), by analyzing the impact of housing speculation on the retail and restaurant sector, which primarily relies on local consumption demand. We find significant effects. Specifically, an increase of one standard deviation in the instrumented housing speculation in 2004 to 2006 led to a decrease of 8.5% in the employment of the retail and restaurant sector in 2007 to 2009. Interestingly, the employment decrease experienced by large firms in this sector (with employment size above 50) was even greater than that experienced by small firms (with employment size below 50). As the financing of small firms is more vulnerable than large firms to local credit market conditions, this effect is not simply driven by the credit freeze during the recession period, and instead points to the local aggregate demand channel.

We also examine two other channels, one is the housing collateral channel studied in Adelino, Schoar, and Severino (2015) and Schmaltz, Sraer, and Thesmar (2015), through which the reduced housing collateral value might have affected firms' access to credit and thus their capacity to invest during the housing bust; the other is the intermediary balance sheet channel featured in Gan (2007) and He and Krishnamurthy (2013), through which the damaged balance sheet of local banks during the housing bust might have reduced their capacity to intermediate financing for investments by local firms. Our analysis finds little evidence supporting these channels in transmitting the adverse effects of housing speculation.

We also make use of our tax variables to investigate the relationship between housing speculation and extrapolative expectations as a potential explanation for the cross-sectional variation in housing speculation. The existing literature, including Case and Shiller (2003), Glaeser, Gyourko, and Saiz (2008), Piazzesi and Schneider (2009), and Glaeser and Nathanson (2015), has emphasized the importance of accounting for home buyers' expectations and, in particular, extrapolative expectations in understanding housing cycles. Our analysis shows that, among states without capital gains taxes, the share of non-owner-occupied home purchases responds strongly to the past housing price increases, even after controlling for past changes in local housing fundamentals, while in states with capital gains taxes, the response of the share of non-owner-occupied home purchases to the past housing price change is significantly weaker. This result strongly supports extrapolative expectations as an important factor in driving housing speculation.

Our study contributes to the quickly growing literature on housing speculation. By using credit-report data, Haughwout et al. (2011) document two important facts about housing speculation in the recent U.S. housing boom: 1) there were large increases in the share of housing purchases by real estate investors, especially in states that experienced the largest housing price booms and busts, and 2) by taking on more leverage, real estate investors had higher rates of default during the bust. Using micro-level data, Chinco and Mayer (2016) show that speculation by investment-home buyers played an important role in the dramatic house price boom and bust cycles in 21 cities, including Las Vegas, Miami, and Phoenix. Nathanson and Zwick (2015) turn to speculation in the land market, and investigate how land investment by homebuilders shapes the house price boom in areas with elastic housing supply. While most of

these studies have focused on the impact of speculation on housing market outcomes, such as house prices and default, we also explore its consequences for local economic activity, including employment and per capita income growth, during the housing bust. In this respect, our work is similar to that of Chen et al. (2016), which shows that firms responded to rising real estate prices in China by diverting resources from their core businesses to real estate investment.

Our paper is also related to the literature that studies how the housing cycle may affect the real economy. Consistent with the aggregate demand channel, in which shocks to household net worth impact real activity by depressing local demand, Mian, Rao, and Sufi (2013) show that the decline in household net worth during the recession from the collapse of the housing bubble had a particularly pernicious impact on the consumption patterns of low income and highly levered households. Mian and Sufi (2014) find that the fall in housing prices also transmitted to the pronounced decline in local employment in non-tradable sectors. Gan (2007) tests the intermediary balance sheet channel, in which housing prices propagate to the real economy through the balance sheets of intermediaries, by providing evidence that Japanese banks responded to the collapse of the Japanese housing bubble by reducing commercial lending that then depressed real investment. Bord, Ivashina, and Taliaferro (2015) and Huang and Stephens (2015) find that U.S. banks responded to the collapse of the U.S. housing bubble by reducing their lending to small businesses, while Cunat, Cvijanovic, and Yuan (2014) link local variation in exposure to real estate prices during the recent recession to contagion and distortion in the lending and financing policies of banks that suffered capital losses. Adelino, Schoar, and Severino (2015) and Schmaltz, Sraer, and Thesmar (2015), consistent with the housing collateral channel, demonstrate that housing price increases can impact entrepreneurs and small businesses by loosening borrowing constraints when housing is deployed as collateral.

This paper is organized as follows. Section I discusses the empirical hypothesis, and Section II describes the data used in our analysis. We investigate the effects of housing speculation on the housing price decline during the bust period, as well as its real economic consequences during the recent recession in Section III. Section IV examines several transmission mechanisms of the impact of housing speculation to the real economy. Section V provides evidence linking housing speculation to extrapolative expectations. Finally, Section VI concludes. We also provide an Internet Appendix that contains additional robustness analyses.

I. Empirical Hypothesis

We focus on the recent U.S. housing cycle of the 2000s since the data are more complete for this period than for earlier years, and also because the national housing cycle allows us to directly compare the cross-sectional variation in housing markets and local economic conditions. Such a cross-sectional analysis is not feasible for the earlier housing cycles of the 1980s and 1990s, since they were asynchronous and experienced only by a few cities.

Motivated by the literature referenced in the introduction on housing speculation, we examine the following hypothesis:

Housing Speculation Hypothesis: when home buyers purchased more non-owner-occupied homes in an area during the boom, either for investment or vacation purposes, the area suffered a greater price drop and more severe economic recession during the subsequent housing bust.

We face the typical issue of endogeneity in testing this hypothesis. A large fraction of non-owner-occupied home purchases in an area might be a reflection of the local economic conditions, rather than a cause of the housing and economic cycles. To resolve this challenging identification issue, we need an instrumental variable that exogenously affects housing speculation in the area. To construct such an instrument, we take advantage of the heterogeneous capital gains tax imposed by different states. The primary residence exclusion allows homeowners to exclude up to \$250,000 (\$500,000 for a couple) of capital gains from selling their primary residence, defined as a home they have owned for at least five years and lived in for at least two of those years. However, there is no capital gains exclusion for sales of non-owner-occupied homes and thus buyers of non-owner-occupied homes are subject to capital gains tax. It is useful to note that different states impose different capital gains tax rates, and nine states impose no capital gains taxes. Furthermore, the choices of capital gains tax rates are not driven by shocks to housing markets. In fact, during the boom period of 2004 to 2006, no states had changed its capital gains taxation rate. As it is intuitive to argue that buyers in states with either no or low capital gains tax are more likely to acquire non-owner-occupied homes, the state capital gains tax provides a source of exogenous variation in the fraction of non-owner-occupied home purchases across areas.

Specifically, we instrument the fraction of non-owner-occupied home purchases during the boom period of 2004 to 2006 with a tax dummy variable that records whether a state has capital gains tax. In using this instrument, we implicitly assume that the marginal buyer of non-owner-occupied homes is an in-state resident. This assumption is consistent with a recent survey by the National Association of Realtors (2015), according to which the typical investment property is 24 miles from the buyer's primary residence. This finding suggests that the typical investment home buyer is likely to be in-state.

For robustness, we also use an alternative variable, a continuous tax variable that further expands on the extensive margin of whether a state has capital gains tax to incorporate the marginal tax rate in states with capital gains taxes. This variable is equal to zero in states with no capital gains tax and the marginal tax rate for a median income household in states with capital gains tax. In using this variable as an instrument, we assume that the marginal buyer of non-owner-occupied homes that purchases their home with a mortgage has a median income in the state.

There are several channels for more intensive housing speculation during the boom to lead to more severe housing price decline and economic recession during the subsequent housing bust. First, through a supply overhang channel, the largely increased housing supply stimulated by intensive purchases of non-owner-occupied homes during the boom overhangs on the housing market and local economy during the bust, as explored in Rognlie, Shleifer, and Simsek (2015). Second, through the local demand channel, reduced housing wealth affects household consumption and local economy, as investigated in Mian, Rao, and Sufi (2013) and Mian and Sufi (2014). Third, through the housing collateral channel, the reduced housing collateral value affects firms' access to credit and thus capacity to invest during the housing bust, as studied in Adelino, Schoar, and Severino (2015) and Schmaltz, Sraer, and Thesmar (2015). Finally, through the intermediary balance sheet channel, more intense speculation during the boom might lead to a more severe damage to the balance sheet of local banks during the bust, which in turn prevent them from intermediating investments of local firms, as examined in Gan (2007) and He and Krishnamurthy (2013). We also separately examine these channels in our analysis.

With a number of economic variables recently becoming available at the zip code level, a rapidly growing strand of the housing literature employs micro-level analysis to take advantage of the within-Metropolitan Statistical Area (MSA) variation, and studies neighborhood effects at levels below MSAs. Such studies include, for example, Mian and Sufi (2009, 2011, 2015), Pool, Stoffman, and Yonker (2015), Griffin and Mantura (2015, 2016), and Adelino, Schoar, and Severino (2016). Following this literature, we also test the housing speculation hypothesis across different zip codes.

While our analysis is at the zip code level and our variable of interest, the fraction of non-owner occupied home purchases, is available at the zip code level, the variation that we exploit for our capital gains taxation instrument is at the state level. Though this mismatch does impact the standard errors of the estimates in our analysis by reducing the variation in the independent variable in our regressions, which we take into account, it nevertheless provides a rich cross-section to compare zip codes across states that differ in their capital gains taxation. Despite this additional uncertainty that our econometric approach introduces, we still find strong statistical significance in our main results, and are able to provide causal inference.

II.   Data Description

In this section, we describe the data used in our analysis and summarize the key variables. Table 1 provides summary statistics for a set of variables.

Housing speculation. The Home Mortgage Disclosure Act (HMDA) data set is a comprehensive individual mortgage application and origination data set for the U.S. It discloses the owner occupancy for each individual mortgage and indicates whether the mortgage is for a primary residence or a non-owner occupied home. We aggregate the HMDA data to the zip code level and calculate the fraction of mortgage originations for non-owner-occupied homes in the total mortgage origination as our measure of the share of non-owner-occupied home purchases.[2]

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[2] Haughwout et al. (2011) use the FRBNY Consumer Credit Panel to determine housing investors based on the number of first-lien mortgage accounts that appear on their credit reports. Their proprietary data are more reliable than the HMDA data. Chinco and Mayer (2016) identify out-of-town second home buyers by distinguishing between the property and tax bill mailing addresses in transaction deeds. These data, however, are not as comprehensive as HMDA data with which we are able to conduct a nationwide analysis of housing markets.

The fraction of non-owner-occupied home purchases in 2004 to 2006 has a mean of 13.6% and a standard deviation of 9.9% across zip codes.

Figure 1 depicts the fraction of non-owner-occupied home purchases for the U.S. and three cities, New York, Las Vegas, and Charlotte, from 2000 to 2010. Non-owner-occupied home purchases represent a sizable fraction of mortgage originations, comprising 15.31% of all new originations in the U.S. at its peak in 2005. While this measure of non-owner-occupied home purchases contains both second home and investment home purchases, both types of home purchases are at least partially influenced by the motive to speculate on housing price appreciation, which became a national phenomenon in the low interest rate environment of the mid-2000s. Among the three cities, Las Vegas had the highest fraction of non-owner-occupied home purchases, which rose from a level 17.77% in 2000 to 29.41% in 2005 and then dropped back down to 17.77% in 2008. New York had the lowest fraction, which, while having a synchronous rise and fall, remained below 7% during this period.

Capital gains instrument. We use state capital gains tax rate as a key instrument for our analysis of housing speculation. Specifically, we collect state capital gains tax data from the Tax Foundation and state median income data from the American Community Survey conducted by the Census Bureau. We construct two measures of the capital gains tax burden on housing speculation at the state level. The first is a tax dummy variable for the extensive margin, which indicates the lack of state-level capital gains taxation in the nine states of Alaska, Florida, Nevada, New Hampshire, South Dakota, Tennessee, Texas, Washington, and Wyoming. Our second measure also exploits variation in the intensive margin of state capital gains taxation by measuring the marginal capital gains tax burden for the median income residents within a state in 2005, which ranges from 2.1%, in states such as North Dakota, to 9% in states such as Oregon. The mean of the marginal tax burden on the intensive margin is 4.77% and the standard deviation is 1.27%.

Figure 2 displays two maps of the distribution of capital gains taxes at the state level. Panel A illustrates the extensive margin for capital gains taxes at the state level, and shows the 9 states without capital gains tax: Alaska, Florida, Nevada, New Hampshire, South Dakota, Tennessee,

Texas, Washington, and Wyoming. Panel B plots the marginal capital gains tax burden across states for the median income within the state in 2005.

House prices. We use zip code level house price data from the Case-Shiller Home Price indices, which are constructed from repeated home sales. We further deflate the Case-Shiller Home Price Indices with the Consumer Price Index (CPI) from the Bureau of Labor Statistics. The real house price change has a mean of 27.8% in 2004 to 2006 across the zip codes in our sample, and a mean of -41.3% in 2007 to 2009.

Figure 3 displays the Case-Shiller real house price indices for the U.S. and three cities, New York, Las Vegas, and Charlotte, from 2000 to 2010. The national housing market experienced a significant boom and bust cycle in the 2000s with the national home price index increasing over 60 percent from 2000 to 2006 and then falling back to the 2000 level in 2007 to 2009. New York had a real housing price appreciation of more than 80 percent during the boom, and then declined by over 25 percent during the bust. Charlotte had an almost flat real housing price level throughout this decade. Interestingly, Las Vegas, which has the most dramatic rise and fall in non-owner-occupied home purchases, also experienced the most pronounced price expansion—over 120 percent—during the boom and the most dramatic price drop—over 50 percent—during the bust.

We define 2004 to 2006 as the boom period for the housing cycle, and 2007 to 2009 as the bust period. This definition is consistent with the common convention in the literature. In particular, 2006 is widely recognized as the turning point of the cycle, as noted by Glaeser (2013). Haughwout et al. (2013) defines the boom period as 2000 to 2006, and the bust period as 2007 to 2010. Furthermore, the start of the house price boom was not well synchronized across the U.S., as argued by Ferreira and Gyourko (2011). We choose 2004 as the start of the boom period because non-owner-occupied home purchases, which are the focus of our analysis, occurred predominantly in the period of 2004 to 2006, as shown in Figure 1.[3]

Local economic performance. We collect data on economic performance at the zip code level from various sources. Annual population and annual per capita income at the zip code level

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[3] Our results are robust to using an alternative definition of the boom period from 2000 to 2006 and the bust period from 2007 to 2010.

are available from the Internal Revenue Service (IRS). The IRS does not, however, provide data for 2000 and 2003. We thus use the data for 2002 and 2006 to calculate the changes during the boom period and the changes from 2001 to 2002 for the pre-boom period. Annual total employment, annual payroll, and the number of establishments at the zip code level are from the Zip Code Business Patterns database. We include both resident income and annual payroll from employers because, as argued by Mian and Sufi (2009), residents in a certain area do not necessarily work in the same place that they live. The change in per capita income has a mean of -11.3% in 2007 to 2009, which is consistent with the severe economic recession during the bust period. Similarly, the employment change has a mean of -8.3%, the change in the number of establishments has a mean of -3.8%, and the real payroll change has a mean of -10.0% in 2007 to 2009.

Zip Code Business Patterns database also provides employment data by establishment size and by industry. For our analysis, we are particularly interested in construction industry as it is directly related to the supply side in housing markets, and retail and restaurant industries because they produce non-tradable goods and services, reflecting the strength of local demand. We also compare the growth in employment in small (fewer than 50 employees) versus large (more than 50 employees) establishments.

New housing supply. To measure supply-side activities in the housing market, we use building permits from the U.S. Census Bureau, which conducts a survey in permit-issuing places all over the U.S. Compared with other construction-related measures, including housing starts and housing completions, building permits have more detailed county-level information. In addition, building permits are issued before housing starts and can, therefore, predict price trends in a timely manner.[4] Unfortunately, the Census Bureau does not provide building permit data at the zip code level. Specifically, using 2000 U.S. census data, we measure new housing supply during the boom period by the building permits issued from 2004 to 2006 relative to the existing

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[4] Authorization to start is a largely irreversible process, with housing starts being only 2.5% lower than building permits at the aggregate level according to https://www.census.gov/construction/nrc/nrcdatarelationships.html, the website of the Census Bureau. Moreover, the delay between authorization and housing start is relatively short, on average less than one month, according to https://www.census.gov/construction/nrc/lengthoftime.html. These facts suggest that building permits are an appropriate measure of new housing supply.

housing units in 2000.[5] This measure has a mean of 5.6% across counties in our sample and a substantial standard deviation of 5.6%.

Figure 4 depicts the annual building permits granted in 2000 to 2010 relative to the number of housing units in 2000 for the U.S. and three cities, New York, Las Vegas, and Charlotte. At the national level, the annual building permits had a modest increase from 1.05% in 2000 to 1.45% in 2005 and then a substantial drop to 0.38% in 2009. New York saw very little increase in its housing supply, with the annual building permits staying at a flat level of less than 0.4% throughout this decade. Charlotte had a larger new supply than New York in the 2000s. Interestingly, Las Vegas, had the most dramatic rise and fall in annual building permits, rising from 2.03% in 2000 to a level above 5% in 2005 and 2006, and then dropping to 0.50% in 2009, roughly in sync with the rise and fall of non-owner-occupied home purchases as well as the housing price cycle.

Credit conditions. We include several variables on credit conditions at the zip code level to control for the credit expansion during the recent housing boom. We use mortgages originated for home purchases and link the lender institutions in the HUD subprime home lender list to the HMDA data to identify the mortgages issued to the subprime households. As the HUD subprime home lender list ends in 2005, we use the fraction of subprime mortgage originations in 2005 as the share of low quality loans in the zip code during the housing cycle. This fraction has a mean of 21.1% and a standard deviation of 13.8%. The HMDA data set also marks whether a mortgage application is denied by the lender, and whether the originated mortgage is sold to the government sponsored entities (GSEs). We consequently can also control for the mortgage denial rate, and the share of mortgages sold to GSEs in 2005 at the zip code level.[6] The mortgage denial rate has a mean of 13.9% and the fraction of GSE mortgages has a mean of 19.3%.[7]

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[5] Our results for new housing supply are robust instead to allocating new building permits at the county level to zip codes according to the fraction of employment in residential construction in 2000.

[6] We control these variables only in 2005 as we use the subprime mortgage fraction in 2005. The results also hold if we choose these controls in 2004 to 2006.

[7] We acknowledge that misreporting is common in mortgage data, e.g. Griffin and Maturana (2015 and 2016). For example, recent studies such as Avery et al. (2013), Blackburn and Vermilyea (2012), and Mian and Sufi (2015), cast doubt on the accuracy of HMDA data, and in particular, find that the income variable could be overstated by home buyers. For this reason, we use only mortgage variables that are less likely to be misreported, such as lender institutions, loans sold to GSEs, securitized mortgages, and owner occupancy. We use income data from the IRS.

Figure 5 shows little correlation between the distribution of housing speculation and that of subprime mortgages across zip codes. Statistically, the correlation coefficient between the fraction of non-owner-occupied home purchases in 2004-2006 and the fraction of subprime mortgages in 2015 is only 0.004 and insignificant. This suggests that housing speculation is a phenomenon largely independent of the credit expansion to subprime households.

Other controls. For housing supply elasticity, we employ the widely used elasticity measure constructed by Saiz (2010). This measure reflects geographic constraints in home building by defining undevelopable land for construction as terrain with a slope of 15 degrees or more as areas lost to bodies of water including seas, lakes, and wetlands. This measure has a lower value if an area is more geographically restricted.[8]

We also control for various economic fundamentals at zip code level. We use the information from the Census Bureau in 2000 including the zip-code-level population, the fraction of the college educated population, the fraction of workforce, the median household income, the poverty rate, the urban rate and the fraction of white people.

Regression analysis. To account for the relative importance of different zip codes in the recent U.S. housing cycle, we conduct all of our regression analyses by weighting observations by the number of households within the zip code in 2000. All of our results are robust to employing instead an equal-weighting scheme. We also include clustered standard errors at the MSA level in all regressions.

III.   Economic Consequences

In this section, we examine the cross-section of housing speculation during the boom period of 2004 to 2006 and the economic consequences during the bust period of 2007 to 2009. We employ as our measure of housing speculation for each zip code the fraction of non-owner-occupied home purchases made in that zip code during the boom period. By using this measure,

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[8] The Saiz (2010) measure is not, however, without its issues. Davidoff (2015), for instance, argues that the Saiz measure is a poor instrument for housing prices because it is correlated with many variables related to housing demand.

we show that housing speculation, instrumented by state capital gains taxes, can help explain not only the price contraction, but also local economic outcomes, during the bust period.

A. Housing Cycle

Figure 6 provides a scatter plot of the real housing price change during the bust period of 2007 to 2009 against the fraction of non-owner-occupied home purchases during the boom period of 2004 to 2006 at the zip code level. The plot displays a clear association of more intensive housing speculation with greater housing price drop subsequently.

Table 2 reports the two-stage instrumental variable approach to formally analyze this relationship by using the tax dummy variable that records whether a state has a capital gains tax as the instrument. Column (1) of Table 2 shows the first-stage result from regressing the fraction of non-owner-occupied home purchases during the boom period of 2004 to 2006 on the tax instrument, together with all of the control variables that we use. Column (1) shows that the tax instrument has a significant explanatory power for the fraction of non-owner-occupied home purchases. The F-statistic of 45.04 provides reassurance that the tax dummy variable is a valid instrument for the fraction of non-owner-occupied home purchases.

The coefficient of fraction of subprime mortgages in 2005 in this first-stage regression is significant and negative. This negative coefficient again confirms that housing speculation tends to concentrate in zip codes very different from those severely affected by subprime credit expansion and securitization, which has been identified as important drivers of the housing boom, e.g., Mian and Sufi (2009) and Keys et al. (2009).

We next analyze the causal effect of housing speculation on price contract during the bust period. Column (2) of Table 2 reports the IV results of regressing the housing price change in 2007 to 2009 on the fraction of non-owner-occupied home purchases during the boom period of 2004 to 2006, instrumented by the tax dummy variable, following the first-stage regressions in column (1). We also add the same control variables as used in column (1). We again weight observations by the total number of households in the zip code and cluster standard errors at the MSA level.

The IV coefficient estimate in column (2) of the impact of housing speculation during the boom is significantly negative, both statistically and in its economic magnitude: a one-percent increase in the fraction of non-owner-occupied home purchases is associated with 1.1% price contraction in 2007 to 2009. This coefficient, when multiplied by 0.0987—the standard deviation of the fraction of non-owner-occupied home purchases across zip codes, as reported in Table 1, gives a substantial price decline of 10.9%. Taken together, we are able to establish a causal link between housing speculation during the boom period of 2004 to 2006 and the house price contraction during the bust period of 2007 to 2009.

Several of the control variables for the regression in Column (2) of Table 2 are also significant. The price change during the bust period is significantly and positively correlated with the Saiz's elasticity measure, suggesting larger price reversals occurred in more inelastic areas, as well as the fraction of GSE mortgages in 2005, which were of higher credit quality than non-GSE mortgages. Furthermore, the price change in 2007 to 2009 is also negatively correlated with the fraction of subprime mortgages in 2005 with a t-statistic of 6.63, confirming a reversal of the price boom associated with the subprime credit expansion, as argued by Mian and Sufi (2009). The price change in 2007 to 2009 is also significantly and negatively correlated with various demographic measures, such as the log population, the fraction of white households, and the median household income in 2000, and the population change in 2003 to 2006.

Table A1 in the online appendix reports similar results to Table 2 from using the continuous tax rate variable as an alternative instrument. For the analysis hereafter, we always report the results from using the continuous tax rate variable as instrument in the online appendix. Without mentioning this again, there is a table in the online appendix that corresponds to every table hereafter in the main paper but uses the alternative tax instrument.

B. Economic Recession

Beyond the direct impact of housing speculation on the housing price decline, it is also important to explore its potential real effects on local economic activities during the housing bust. The growing empirical literature, including Mian and Sufi (2011, 2014), Stumpner (2014), Hurst, Keys, Seru, and Vavra (2016), has found severe real economic consequences of the U.S. housing cycle during the recent recession. We also examine to what extent housing market

speculation contributed to the slowdown in local economic activities. After investigating its impact on real outcomes, we then try to explain how speculation propagated to the real economy by testing several potential transmission mechanisms highlighted in the literature.

We examine whether speculation causally leads to economic consequences using the instrumental variable method. Testing the real economic consequences of speculation is elusive without an instrument for identification, since speculative activity is not only difficult to identify, but also endogenous to local housing market conditions. We specifically measure economic performance at zip code level in different aspects, including per capita income change, change in the number of establishments, real payroll change, and employment change, during the bust period of 2007 to 2009.

Table 3 reports the results of regressing the aforementioned measures of economic activity in 2007 to 2009 on the fraction of non-owner-occupied home purchases in 2004 to 2006, instrumented by our tax dummy variable. Housing speculation is negatively associated with all of the measures of economic consequences at the 1% significance level. Among our measures of economic activity, real payroll is most heavily affected by local housing speculation during the boom: a decrease of 70.9 basis points is associated with a one-percent increase in the fraction of non-owner-occupied home purchases. This coefficient, when multiplied by 0.0987 the standard deviation of the faction of non-owner-occupied home purchases across zip codes, gives a substantial drop of 7.0% in real payroll.

Employment and income per capita also decrease to a large extent, with the coefficient estimates of -0.695 and -0.593, respectively. These coefficients, when multiplied by the standard deviation of the faction of non-owner-occupied home purchases across zip codes, give a substantial drop of 6.9% and 5.9% in employment and income per capita. Finally, the change in the number of establishments is the most modest, although the effect is still economically meaningful: a one-percent increase in housing speculation implies a decrease of 45.9 basis points in the number of establishments. When multiplied by the standard deviation of the faction of non-owner-occupied home purchases across zip codes, this effect translates to a substantial decline of 4.5% in the number of establishments. The variation across zip codes in their economic responses reflects not only differences in firm adjustment costs of employment, wages, and establishments, but also differences in exposure to housing speculation during the boom.

Many of the controls for the regressions in Table 3 are also significant across economic outcomes, and we discuss several here. Consistent with Mian and Sufi (2009), the fraction of subprime mortgages in 2005 is negative and statistically significant at the 1% percent level in all four regressions. Similar to the housing price decline in 2007 to 2009 in Table 2, population demographics, such as the log population, the fraction of white households, and the median income of households in 2000, are all statistically significant and negatively correlated across economic outcomes during the bust. The growth in population and per capital income during the boom, with the exception of subsequent real per capital income growth, are positively and significantly correlated across economic outcomes in 2007 to 2009. In addition, the growth in the number of establishments during the boom is positive and statistically significant in all four regressions, suggesting areas that saw more new businesses during the boom period also experienced a milder recession.

IV.   Transmission Mechanisms

Having demonstrated a causal relationship between housing speculation during the boom period and the decline in local economic activity during the bust, we now investigate potential transmission mechanisms by which housing speculation propagated to the real economy. Housing speculation may have had real consequences by contributing a source of non-fundamental housing demand to housing markets, which put upward pressure on housing prices. This, in turn, may have led not only to supply overhang from overbuilding that reduced residential construction during the bust, but also a greater housing price decline, which further depressed household consumption and the balance sheet of local banks during the recession. We test several potential transmission mechanisms of this speculation effect to real economic activities through supply overhang, local demand, collateral channel, and intermediary balance sheet channel, respectively. In doing so with our instrumental variable approach, we are able to provide some causal evidence on the relevance of some of these mechanisms in transmitting the housing speculation effect.

A. Supply Overhang

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We first examine how housing speculation may have impacted the supply side of the housing market in the recent recession. New housing supply stimulated by speculation during the boom period could have led to a supply overhang problem during the bust, which, in turn, resulted in a decline in construction sector activity. This channel is explored, for instance, in Rognlie, Shleifer and Simsek (2015), who demonstrate that, in addition to a decline in construction sector employment, supply overhang in the housing market can transmit to the rest of the economy in the presence of nominal rigidities.

We first examine the impact of housing speculation on housing supply. Since the Census Bureau only provides building permit data at the county level, we carry out the analysis by aggregating non-owner-occupied home purchases and all other controls into the county level. Figure 7 provides a scatter plot of the building permits in 2004 to 2006 relative to the number of housing units in 2000, a measure of the new housing supply, against the fraction of non-owner-occupied home purchases in the same period. The plot illustrates a positive relationship between housing speculation and new housing supply.

Table 4 then demonstrates the causal link by regressing the new housing supply measure on the fraction of non-owner-occupied home purchases in 2004 to 2006, instrumented by the state tax dummy variable. We report the two stage results in Columns (1) and (2), respectively. We weight observations by the total number of households at the county level and cluster standard errors at the MSA level. As shown in Column (1), the tax instrument also has significant explanatory power for the fraction of non-owner-occupied home purchases at the county level. The F-statistic of 24.00 of the first stage suggests that the instrument is statistically strong for this county-level test. Column (2) reports the second stage result. The IV coefficient estimate of the impact of housing speculation on the new supply during the boom is significantly positive, establishing a causal link between them. Specifically, a one-percent increase in the fraction of non-owner-occupied home purchases during the boom period is associated with an expansion of 60.6 basis points in the new housing supply, or equivalently, one standard deviation of the faction of non-owner-occupied home purchases across zip codes implies a substantial increase of 6.0% in the new housing supply of 2004 to 2006.

Several of the controls in Table 4 are significant as well. Saiz's elasticity measure positively and significantly predicts the growth in building permits during boom, as more elastic areas have fewer constraints on new construction. In addition, less building permits were issued in more urban areas, as measured by the urban rate in 2000, and in areas where a larger fraction of households in 2000 were college educated. In addition, the median household income in a zip code and the poverty rate in 2000 are positively and significantly correlated with new building permits.

Supply overhang can both exacerbate the subsequent housing price bust and reduce demand for new housing, leading to a large decline in construction activities during the recession. Column (1) of Table 5 reports the results of zip-code level regressions on how housing speculation leads to a severe reduction in employment in the construction sector. Consistent with the supply overhang story, the IV coefficient estimate shows that the impact of housing speculation on the construction sector is almost twice as great as that on total employment (reported in Table 3) — one standard deviation of the faction of non-owner-occupied home purchases across zip codes is associated with a decrease of 13.3% in the construction sector employment.

The drag on the construction sector, however, cannot explain all of the economic impact of speculation. In Column (2), we also examine the change in employment in all industries but the construction sector. The result is still both statistically and economically significant as a one-percent increase in housing speculation during the housing boom had led to a decrease of 60.1 basis points in the non-construction employment during the housing bust, or equivalently, one standard deviation of the faction of non-owner-occupied home purchases across zip codes is associated with a decrease of 5.93% in the non-construction sector employment. This result suggests that the economic effects of housing speculation are not restricted to the housing sector.

Several of the controls in column (1) of Table 5 are also statistically significant and warrant discussion. Areas that issued more subprime mortgages during the boom experienced greater declines in construction employment during the bust, consistent with Mian and Sufi (2009), as did areas with larger increases in employment during the boom. In addition, several measures of local demographics, such as the median household income and fraction of white households in

2000, are negatively and significantly correlated with the change in construction employment in 2007 to 2009, while the fraction of college educated households is positively correlated. Interestingly, Saiz's elasticity measure is not statistically significant in explaining the fall in construction employment during the bust, which suggests that supply overhang from building during the boom, rather than supply constraints, led to the decline.

B. Local Demand

To further examine the effects of housing speculation on the non-construction sectors, we now specifically focus on the industries in restaurant and retail sectors. Following Mian and Sufi (2014), we define restaurant and retail sectors as non-tradable sectors, which mainly rely on local demand. By analyzing these sectors, we can whether housing speculation can affect the local economy through the local demand channel.

Table 6 reports the coefficient estimates of the fraction of non-owner-occupied home purchases during the boom period on the change in employment in the retail and restaurant sectors during the bust period using our IV method. The instrumented housing speculation is negatively associated with their employment change at the 1% significance level and the economic magnitude is larger than that for overall employment change reported in Table 3: a one-percent increase in housing speculation during the housing boom is associated with a decrease of 86.5 basis points in the employment of the retail and restaurant sectors during the housing bust versus a decrease of 69.5 basis points in the overall employment. An increase of one standard deviation in the share of non-owner occupied home purchases in 2004 to 2006 led to a decrease of 8.5% in the employment of retail and restaurant sectors in 2007 to 2009. This strong effect on the retail and restaurant sectors indicates that housing speculation during the housing boom has a substantially adverse effect on local demand during the housing bust.

We further examine the effects of housing speculation on small versus large firms in the retail and restaurant sectors, measured by establishments with less or more than 50 employees. As the financing of small firms are more vulnerable than large firms to credit market conditions. By comparing the effects on large and small firms, we can further isolate the impact of housing speculation through the local demand channel from that through the credit market channel. Table

6 finds both significant and negative impacts on the employment of both small and large firms. The effect, however, is much stronger for large retail and restaurant firms (with a coefficient estimate of -1.545) than for small ones (with a coefficient estimate of -0.435). This result shows that the effect of housing speculation on the retail and restaurant sectors is not simply a result of the credit market freeze during the housing bust, lending further support to the local demand channel.

Several controls are also significant in explaining the decline in employment in Table 6. Interestingly, it is mainly large firms that were impacted by the subprime boom. The increases in per capita income, population, and number of establishments during the boom period, which are measures of local economic strength, are all positively and significantly correlated with the change in employment during the bust. Local demographics, such as the log population, the fraction of households employed, the fraction of white households, and the median household income in 2000 are significantly and negatively with the change in employment from 2007 to 2009 across small and large firms, while the fraction of college educated households and the fraction of the workforce in 2000 is positively correlated.

C. Collateral Channel

We now examine the impact of housing speculation on real activity through the collateral channel. Firms even without direct exposure to real estate industries may reduce their business and downsize their employment during the housing bust as a result of their dependence on real estate collateral for financing. In contrast to larger firms, which can borrow against their commercial real estate and have access to capital markets, entrepreneurs and smaller firms tend to rely more on housing as collateral to secure financing.[9] Indeed, as highlighted by Schmaltz, Sraer, and Thesmar (2015) and Adelino, Schoar, and Severino (2016), the decline in housing prices particularly constrained the financing of smaller firms. If this channel plays an important role with the collapse of the housing market, then we expect small firms, rather than large firms, to be harder hit by the housing bust as a consequence of housing speculation.

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[9] Chaney, Sraer, and Thesmar (2012) explore the role of commercial real estate as collateral in securing financing for larger firms. Our focus is on the adverse impact on businesses activity from the decline in housing prices, which through the collateral channel is more concentrated in smaller establishments.

As the Zip Business Pattern provides a breakdown in the size of establishment, we regress the employment change in 2007 to 2009 for the small versus large establishments on the instrumented housing speculation in 2004 to 2006. Table 7 reports the regression results for establishments with less than 50 employees (small-sized firms) and those with more than 50 employees (large-sized firms), respectively.[10] Interestingly, consistent with our earlier result on the impact of housing speculation on small and large firms in retail and restaurant sectors, the impact of housing speculation is also greater on the large-sized firms overall (with the coefficient estimate of -0.862) than that on the small-sized firms (with the coefficient estimate of -0.522). This result shows that the collateral channel is not the main transmission mechanism for the adverse effect of housing speculation on real activity during the housing bust.

Many of our controls are significant across our three regression specifications in Table 7. The fraction of subprime mortgages has significant negative explanatory power for the change in retail employment during the bust across firms of all sizes. In contrast, measures of local housing fundamentals during the boom period, including the increase in per capita income, population, and the number of establishments are significantly and positively correlated with the change in retail employment. The real payroll and employment changes during the boom only have significant explanatory power for the change in employment at larger firms during the bust, having positive and negative impacts, respectively.

D. Intermediary Channel

Another potential channel is through the balance sheets of financial intermediaries, as explored, for instance, in Gan (2007). If an area is primarily serviced by local banks, the negative shock to the banks' balance sheets caused by the housing price drop during the housing bust directly propagates to the local economy, and leads to an economic contraction in a devastating amplification cycle, e.g., He and Krishnamurthy (2013). In contrast, national banks can diversify their exposure to local housing conditions, and can consequently mitigate the impact of local shocks induced by local housing speculation.

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[10] We classify establishments with 50 or more employees as large-sized firms because those firms are generally affected by several provisions including the Affordable Care Act (ACA) and Family Medical & Leave Act (FMLA). Our results are robust to other size cutoffs between small and large firms.

Based on the definition in Mian and Sufi (2014), we identify areas primarily served by local banks using the summary of deposits data from the FDIC. We first calculate the fraction of deposits of every bank in each zip code. Then by weighting the deposits of the bank, we obtain the average fraction of bank deposits in each zip code. Areas primarily served by local banks should have a higher average fraction. We define local banking zip codes as those ranked top 25% in terms of the average fraction of bank deposits in our sample.[11] If the intermediary channel is important for transmitting the adverse effect of housing speculation, we expect areas mainly serviced by local banks to be more exposed to such effects.

To examine this channel, we interact the instrumented housing speculation with the dummy indicating the local banking zip codes. We expect to observe a significantly negative coefficient on this interaction term, since local banks are more exposed to the negative impact from local housing speculation. As shown in Table 8, however, this interaction term is insignificant in explaining the declines in per capita income, real payroll, employment, and the number of establishments in 2007 to 2009. As in Table 3 of Section III, many controls are significant across the regressions, and these results mirror those presented in Section III. Our test thus provides little evidence in support of the intermediary channel.

Our results suggest that housing speculation had real economic consequences during the recent recession primarily by the supply overhang channel and the household demand channel. In contrast, we find little evidence that speculation transmitted to the real economy by impairing the balance sheets of intermediaries or by reducing the value of housing collateral available to small businesses to finance their operations. In the next section, we study to what extent housing speculation during the boom was driven by speculative investors extrapolating past housing price changes when choosing their housing demand.

V.   Extrapolation and Speculation

What drove housing speculation during the boom period? Glaeser (2013) highlights that speculation has been a natural and common feature of real estate markets historically. Rational speculators may, for instance, participate in housing markets when they have superior

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[11] Our results are robust to other cutoffs including the median and the tercile.

information, as in Kurlat and Stroebel (2015). Malpezzi and Wachter (2005), for instance, find that supply elasticity is an important driver of speculation, leading speculation to be most intensive in inelastic areas. Bayer et al. (2015) argues that speculation in Los Angeles during the boom period was driven by uninformed, amateur investors who flipped houses in response to past housing price increases. Chinco and Mayer (2016) concludes that "out-of-town" speculators were misinformed, in that they timed the housing market poorly and earned lower returns than "in-town" speculators. In contrast, Haughwout et al. (2011) suggests that the relaxation of borrowing constraints, in the form of down payment and documentation standards, from increased housing prices led more optimistic buyers to enter housing markets as short-term speculators.

In this section, we explicitly test one theory of housing speculation during the boom—extrapolation of past housing prices contributed a source of non-fundamental demand to housing market in areas with lower capital gains taxes, which are more prone to speculation. A strand of the housing literature, including Case and Shiller (2003), Glaeser, Gyourko, and Saiz (2008), Piazzesi and Schneider (2009), and Glaeser and Nathanson (2015), has long emphasized the importance of accounting for home buyer expectations in understanding housing cycles, and, in particular, extrapolative expectations. In this section, we investigate the relationship between housing market speculation in the recent U.S. housing cycle and this behavioral explanation of housing price booms and busts. A central empirical prediction of extrapolative expectations is that home buyers react more strongly to recent past price changes when forecasting future housing price changes, a phenomenon that gives rise to housing price momentum in housing markets. If housing speculation is linked to extrapolative expectations, then we would expect that non-owner occupied home purchases in areas more prone to speculation would anchor more strongly on lagged housing price changes.

Table 9 displays the regression results of regressing the fraction of non-owner occupied home purchases on our capital gains tax instrument and lagged housing price changes, as well as a host of controls. Specifically, Panel A reports the results of regressing housing speculation on one-year-lagged housing price changes and Panel B presents the regression of housing speculation during the boom period of 2004 to 2006 on housing price changes during the pre-boom period of 2001 to 2003. Again, we expect that states without capital gains taxation would

be more susceptible to housing speculation, since speculators can more easily recognize a capital gain from investing in housing. Since other economic outcomes during the boom period of 2004 to 2006, such as housing price increases, changes in per capita income, and changes in credit conditions are endogenous to the boom, we exclude them from the regressions in Panel B. Such factors would confound interpretation of the results.

From Table 9, past housing price increases significantly predict a higher fraction of non-owner occupied home purchases during the boom, providing evidence of extrapolation, while our capital gains tax predicts a lower fraction. While past housing price increases raise non-owner occupied home purchases, and higher capital gains taxes dampen them, our focus is on the interaction of these two forces. The coefficients on the interaction terms in both Panel A and Panel B are both strongly negative and statistically significant at the 5% level, suggesting that our measure of housing speculation at the zip code level in states without capital gains taxes reacted more strongly to past housing price changes. Since the coefficients on the capital gains tax dummies are insignificant in most specifications, this further suggests that the power of our instrument for explaining speculation is driven by those zip codes that exhibited extrapolative behavior. In addition, since we control for local economic fundamentals known to drive housing price growth in both panels, our results indicate that the speculation, anchored on past house price changes, contributes a non-fundamental source of housing demand.

Several of our controls in column (4) of Table 9 are also significant. The lagged mortgage denial rate and per capita income change are significant and positively correlated with the fraction of non-owner occupied home purchases in 2004 to 2006. In contrast, the lagged population change has a significant but negative explanatory power. Interestingly, the fraction of subprime mortgages does not appear to be a driver of housing speculation as its coefficient estimates are negative in all specifications. This supports the analysis of Haughwout et al. (2011) that speculators tended to be non-prime borrowers buying secondary homes for speculation.

Our analysis, consequently, highlights one potential channel that can help explain the cross-sectional variation in speculation in housing markets during the recent U.S. housing cycle. By distorting home buyer expectations, extrapolation may have contributed a non-fundamental source of housing demand to areas in which speculators could more easily act on their views for

profit, the economic consequences of which we turn to in the next section. Such a view is consistent with that of Haughwout et al. (2011), who postulate that optimistic speculators took leveraged bets on future housing price increases.

VI.   Conclusions

In this paper, we document how housing speculation during the boom period of 2004 to 2006, as measured by the fraction of non-owner occupied home purchases, had adverse economic consequences during the bust period of 2007 to 2009. We exhibit this causal relationship by taking advantage of an instrument based on variation in state capital gains taxes. Our results suggest that housing speculation had real economic consequences during the recession primarily through depressing residential construction employment, as a result of a supply overhang, and household aggregate demand. We find little evidence that speculation impaired local economic conditions by tarnishing the balance sheets of local intermediaries, or by reducing the value of housing collateral deployed by small businesses to finance their operations. Finally, we provide evidence linking housing speculation during the boom to extrapolation by speculations of past housing price changes, identifying a channel by which this behavioral bias, often employed to explain housing cycles, impacted the real economy during the recent recession.

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Figure 1: Fraction of Non-Owner-Occupied Home Purchases

This figure plots the share of non-owner-occupied home purchases for the U.S. and three cities, New York, Las Vegas, and Charlotte. The fraction of non-owner-occupied home purchases in each city is computed from the "Home Mortgage Disclosure Act" data set.
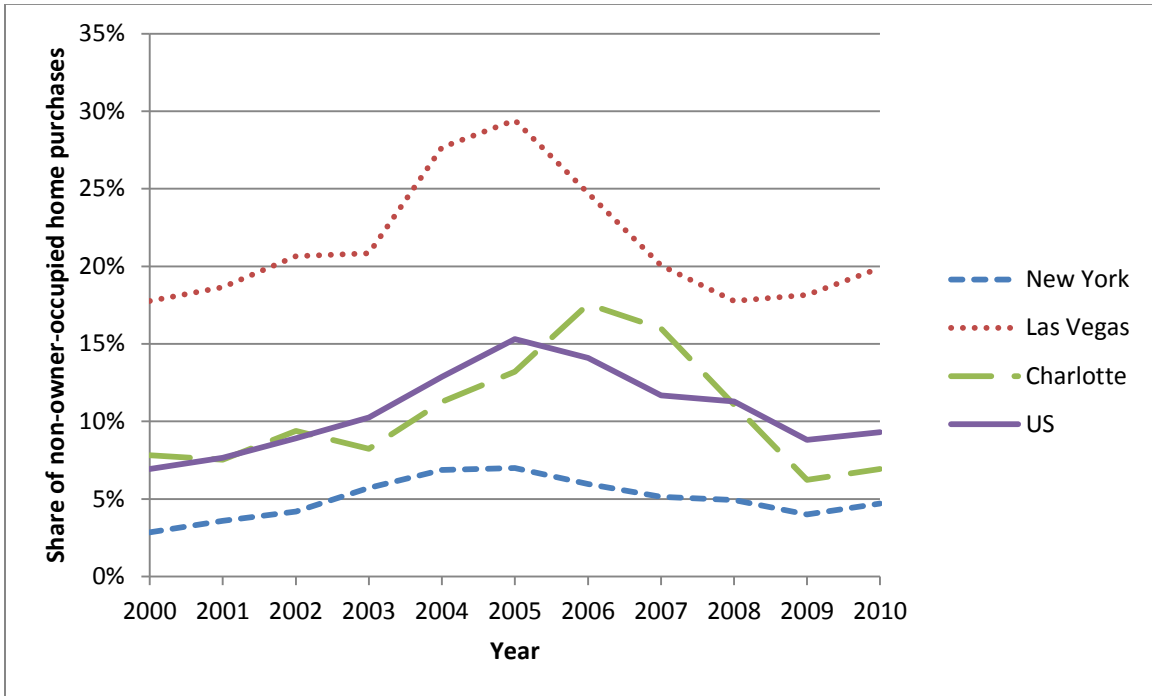
Figure 2: Distribution of Capital Gains Tax across U.S. States

Panel A: State capital gains tax
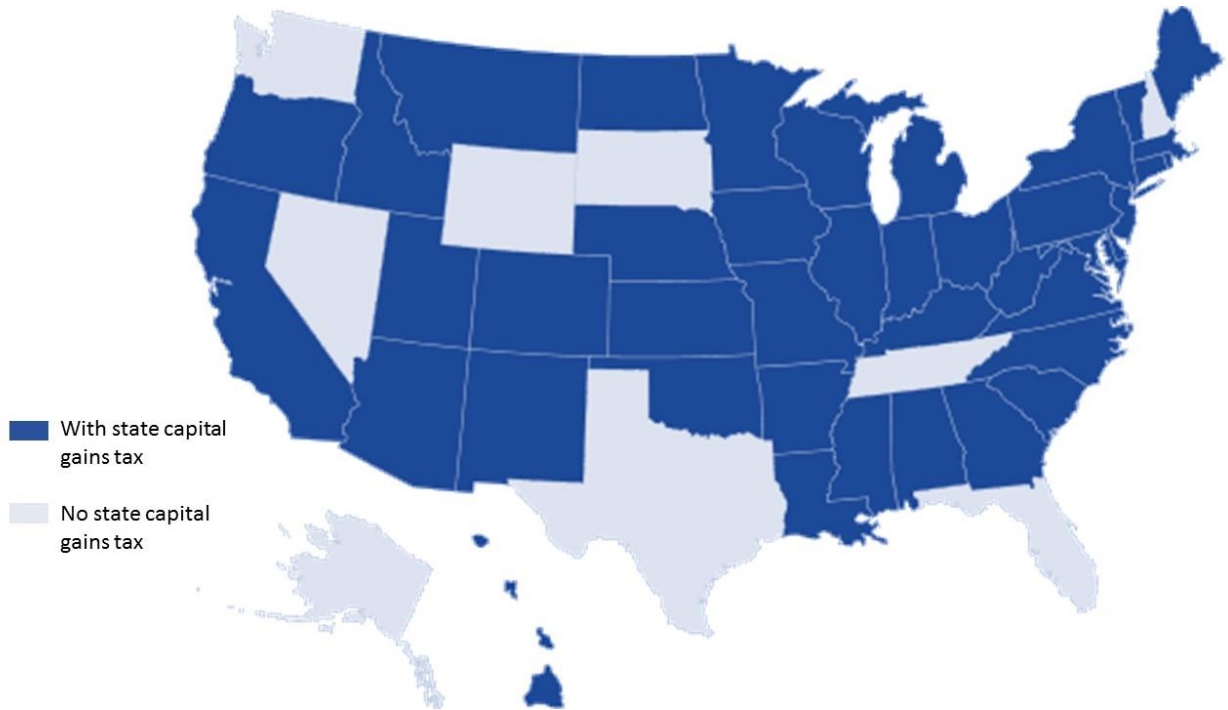
Panel B: Marginal state tax rates on capital gains for state median income in 2005
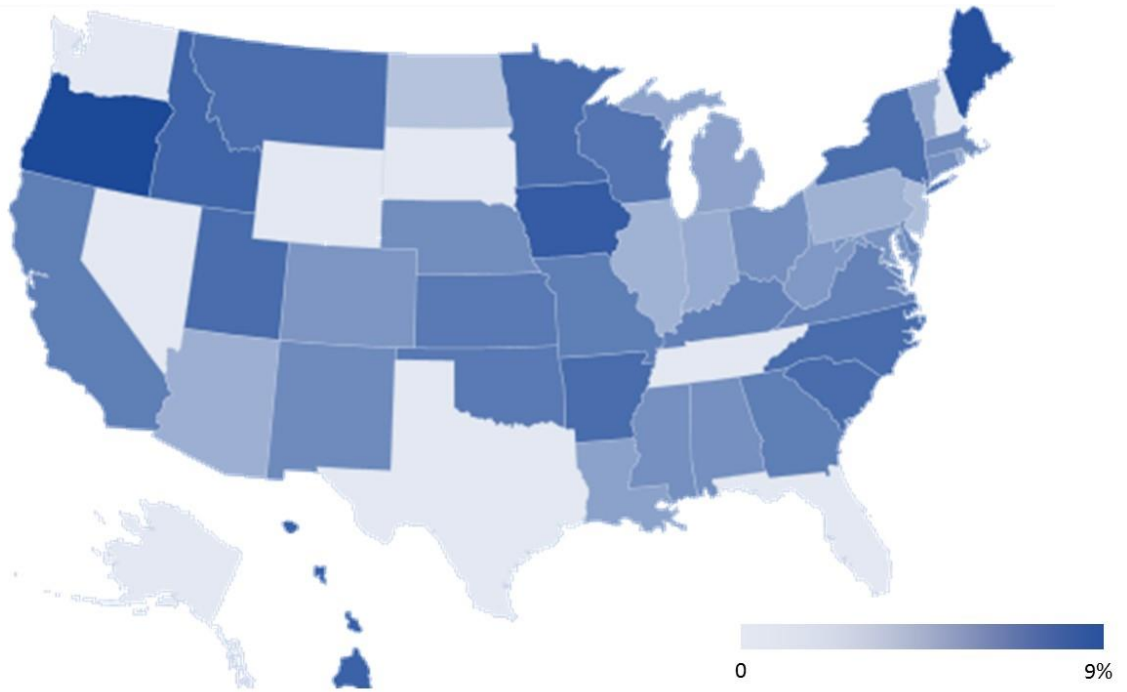
Figure 3: Case-Shiller Home Price Index

This figure plots the Case-Shiller home price index for the U.S. and three cities, New York, Las Vegas, and Charlotte. The price index is deflated by the CPI and normalized to 100 in 2000.
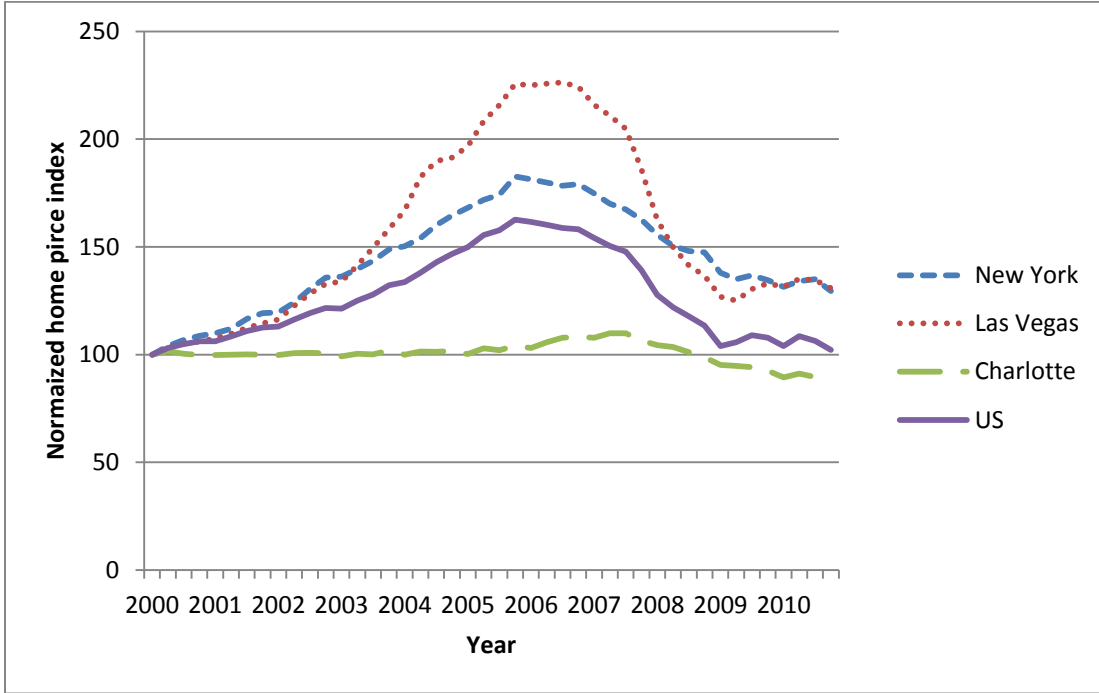
Figure 4: New Housing Supply

This figure depicts building permits in 2000 to 2010 relative to the housing units in 2000 for the U.S. and three cities, New York, Las Vegas, and Charlotte.
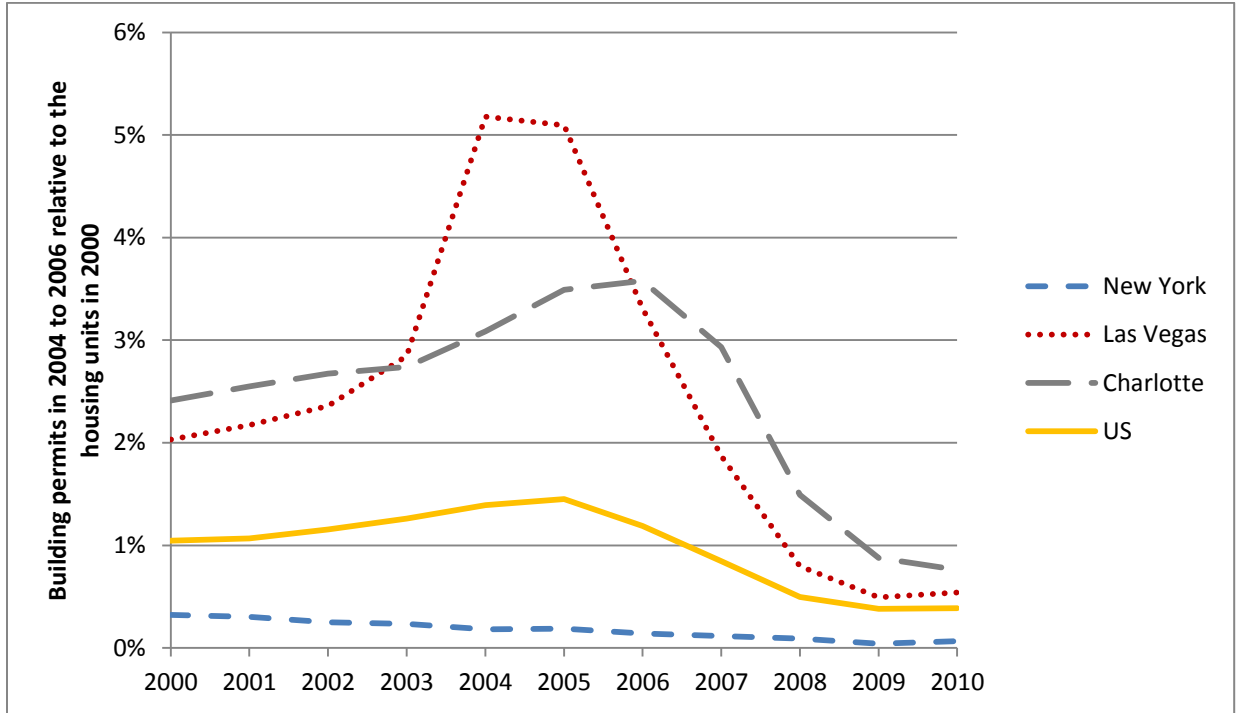
Figure 5: Speculation and Subprime Households

This figure plots the fraction of non-owner-occupied home purchases in 2004-2006 against the fraction of subprime mortgages in 2005 at zip code level.
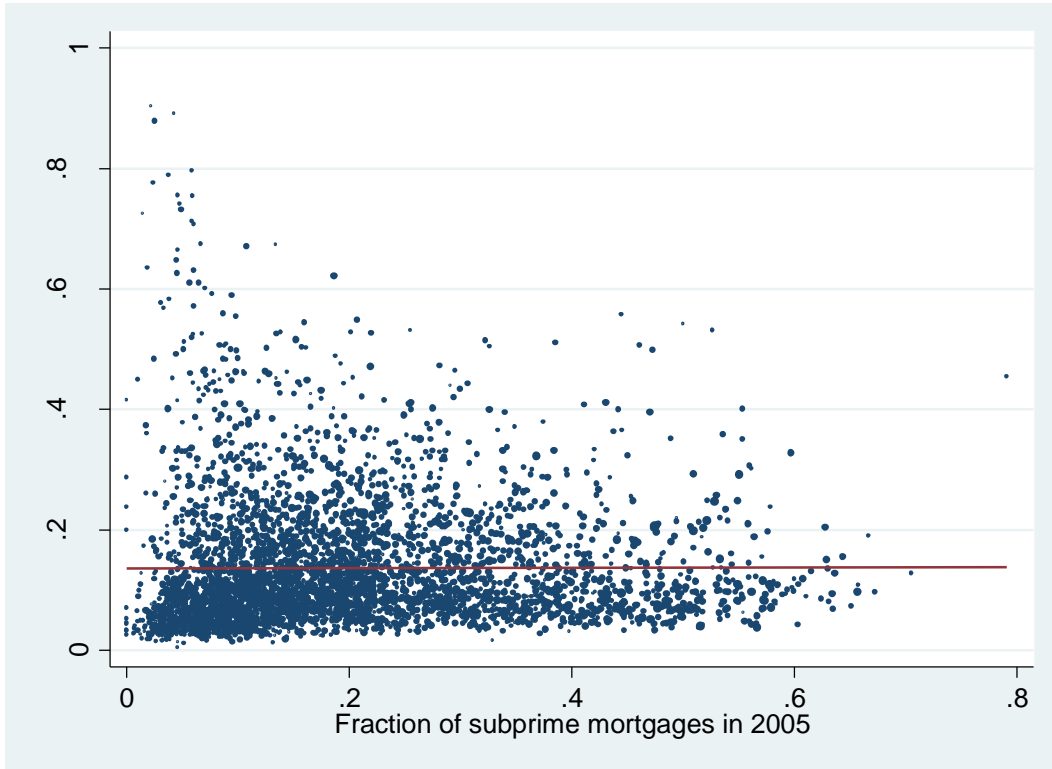
Figure 6: Speculation and Housing Price Decline

This figure plots the real housing price change during the boom period of 2007-2009 against the fraction of non-owner-occupied home purchases in 2004-2006 at zip code level.

Figure 7: Speculation and New Housing Supply

This figure plots building permits in 2004 to 2006 relative to the number of housing units in 2000 against the fraction of non-owner-occupied home purchases in 2004-2006 at the county level.
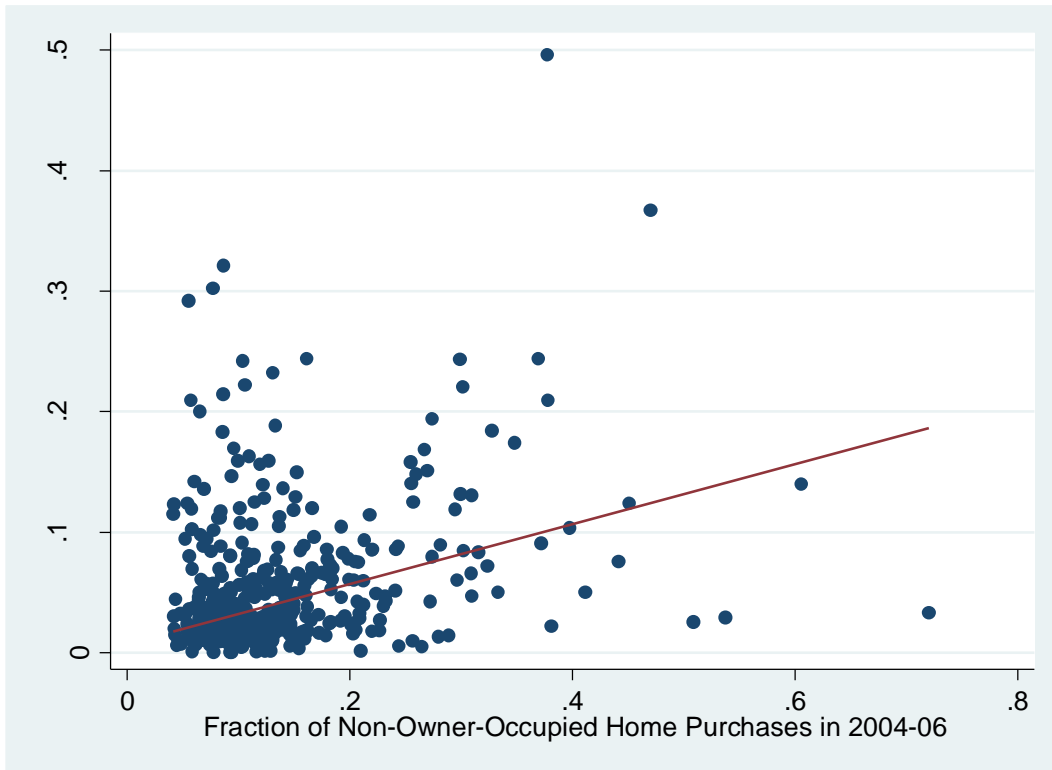
Table 1 Summary Statistics

VARIABLES	(1) N	(2) Mean	(3) Sd
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	3,975	0.136	0.0987
Real house price change in 2001-03	4,027	0.191	0.135
Real house price change in 2004-06	4,027	0.278	0.191
Real house price change in 2007-09	4,027	-0.413	0.278
Per capita income change in 2003-06	4,027	0.0521	0.125
Per capita income change in 2007-09	4,026	-0.113	0.0957
Change in no. of establishments in 2004-06	3,942	0.0638	0.0870
Change in no. of establishments in 2007-09	3,924	-0.0382	0.0706
Real payroll change in 2004-06	3,942	0.0866	0.179
Real payroll change in 2007-09	3,924	-0.0998	0.191
Employment change in 2004-06	3,942	0.0707	0.158
Employment change in 2007-09	3,924	-0.0831	0.148
Saiz's elasticity	4,027	1.376	0.715
Fraction of subprime mortgages in 2002	3,468	0.0896	0.0725
Fraction of subprime mortgages in 2005	3,975	0.211	0.138
Mortgage denial rate in 2002	3,468	0.111	0.0573
Mortgage denial rate in 2005	3,975	0.139	0.0507
Fraction of GSE mortgages in 2002	3,468	0.376	0.113
Fraction of GSE mortgages in 2005	3,975	0.193	0.103
Ln of population in 2000	4,027	10.32	0.572
Fraction of the college educated in 2000	4,027	28.12	15.63
Fraction of the employed in 2000	4,027	61.14	8.782
Fraction of workforce in 2000	4,027	64.70	8.106
Median household Income in 2000	4,027	49,524	17,274
Poverty rate in 2000	4,027	10.77	7.713
Urban rate in 2000	4,027	94.30	14.21
Fraction of the white in 2000	4,027	71.89	23.05
Number of households in 2000	4,027	12,935	6,235

Table 2: Speculation and Housing Price Decline

This table reports the two stage least squares regressions of the real house price change in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax. Column 1 shows the coefficients of the first stage regression of the fraction of non-owner-occupied home purchases in 2004-2006 on the dummy variable of the state capital gain tax. Column 2 shows the coefficients of the second stage regression of the real house price change in 2007-2009 on the instrumented fraction of non-owner-occupied home purchases in 2004-2006. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Fraction of Non-Owner-Occupied Home Purchases in 2004-06	(2) Real house price change in 2007-09
Dummy with state capital gain tax	-0.0823***	
	(0.0173)	
Instrumented fraction of Non-Owner-Occupied Home Purchases in 2004-06		-1.101**
		(0.466)
Saiz's elasticity	0.0313***	0.0588***
	(0.00812)	(0.0221)
Fraction of subprime mortgages in 2005	-0.251***	-1.187***
	(0.0633)	(0.179)
Mortgage denial rate in 2005	0.362***	-0.359
	(0.0987)	(0.640)
Fraction of GSE mortgages in 2005	-0.211***	0.402**
	(0.0554)	(0.180)
Per capita income change in 2003-06	0.0856**	0.0504
	(0.0364)	(0.129)
Population change in 2003-06	-0.0588***	-0.189***
	(0.0174)	(0.0600)
Change in no. of establishments in 2004-06	0.117***	-0.0699
	(0.0355)	(0.141)
Real payroll change in 2004-06	0.0221*	-0.00144
	(0.0113)	(0.0497)
Employment change in 2004-06	0.00286	-0.0610
	(0.0116)	(0.0419)
Ln of population in 2000	-0.0200***	-0.0385**
	(0.00574)	(0.0178)
Fraction of the college educated in 2000	0.000448	0.00127
	(0.000317)	(0.00101)
Fraction of the employed in 2000	0.000945	-0.00357
	(0.00240)	(0.0103)
Fraction of workforce in 2000	-0.00308	0.00668

	(0.00245)	(0.0101)
Median household Income in 2000	-0.00000189***	-0.00000335***
	(0.000000261)	(0.00000123)
Poverty rate in 2000	0.00192***	0.000444
	(0.000717)	(0.00294)
Urban rate in 2000	0.000851***	0.000297
	(0.000157)	(0.000784)
Fraction of the white in 2000	-0.0000654	-0.00317***
	(0.000208)	(0.000871)
Constant	0.524***	0.403
	(0.0940)	(0.267)
Observations	3941	3941
R-squared	0.505	0.513

Table 3: Real Effects of Housing Speculation

This table reports the two stage least squares regressions of the economic outcomes in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Per capita income change in 2007-09	(2) Change in no. of establishments in 2007-09	(3) Real payroll change in 2007-09	(4) Employment change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.593***	-0.459***	-0.709***	-0.695***
	(0.145)	(0.0531)	(0.158)	(0.143)
Saiz's elasticity	-0.00910	0.00145	0.0169**	0.0144***
	(0.00569)	(0.00324)	(0.00670)	(0.00549)
Fraction of subprime mortgages in 2005	-0.213***	-0.154***	-0.187***	-0.203***
	(0.0537)	(0.0299)	(0.0726)	(0.0590)
Mortgage denial rate in 2005	-0.0931	0.0365	0.154	0.206*
	(0.114)	(0.0489)	(0.157)	(0.116)
Fraction of GSE mortgages in 2005	0.0110	-0.0176	0.0107	0.0302
	(0.0349)	(0.0244)	(0.0517)	(0.0446)
Per capita income change in 2003-06	-0.206***	0.0960***	0.171***	0.116**
	(0.0639)	(0.0225)	(0.0476)	(0.0501)
Population change in 2003-06	-0.159***	0.174***	0.145***	0.140***
	(0.0490)	(0.0220)	(0.0423)	(0.0378)
Change in no. of establishments in 2004-06	0.167***	0.179***	0.441***	0.487***
	(0.0441)	(0.0311)	(0.0940)	(0.0747)
Real payroll change in 2004-06	0.0177	0.0225*	-0.130***	0.142***
	(0.0164)	(0.0128)	(0.0453)	(0.0365)
Employment change in 2004-06	-0.00812	-0.00787	-0.00423	-0.300***
	(0.0126)	(0.0129)	(0.0343)	(0.0360)
Ln of population in 2000	-0.0233***	-0.00997***	-0.0191**	-0.0223***
	(0.00599)	(0.00383)	(0.00873)	(0.00660)
Fraction of the college educated in 2000	-0.00118***	0.000431***	0.00217***	0.00136***
	(0.000353)	(0.000163)	(0.000441)	(0.000297)
Fraction of the employed in 2000	-0.00337	-0.00441***	-0.0112***	-0.00778***
	(0.00265)	(0.00150)	(0.00339)	(0.00255)
Fraction of workforce in 2000	0.00338	0.00378**	0.01000***	0.00705***
	(0.00264)	(0.00152)	(0.00318)	(0.00251)
Median household Income in 2000	-0.00000161***	-0.000000812***	-0.00000232***	-0.00000167***
	(0.000000399)	(0.000000210)	(0.000000588)	(0.000000483)

Poverty rate in 2000	0.000355	0.000794	0.000513	0.000858
	(0.000742)	(0.000484)	(0.00118)	(0.000908)
Urban rate in 2000	-0.0000948	0.000490***	0.00114***	0.000829***
	(0.000196)	(0.000110)	(0.000281)	(0.000250)
Fraction of the white in	-0.00130***	-0.000446***	-0.000553	-0.000491**
2000	(0.000244)	(0.000123)	(0.000351)	(0.000218)
Constant	0.483***	0.160***	0.171	0.207**
	(0.0903)	(0.0584)	(0.119)	(0.101)
Observations	3940	3910	3910	3910
R-squared	0.300	0.152	0.054	0.080

Table 4: Speculation and New Housing Supply

This table reports the two stage least squares regressions of building permits in 2004-06 relative to the housing units in 2000 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax at the county level. Column 1 shows the coefficients of the first stage regression of the fraction of non-owner-occupied home purchases in 2004-2006 on the dummy variable of the state capital gain tax. Column 2 shows the coefficients of the second stage regression of building permits in 2004-06 relative to the housing units in 2000 on the instrumented fraction of non-owner-occupied home purchases in 2004-2006. Observations are weighted by the number of households at the county level. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Fraction of Non-Owner-Occupied Home Purchases in 2004-06	(2) Building permits in 2004-06 relative to the housing units in 2000
Dummy with state capital gain tax	-0.0606***	
	(0.0154)	
Instrumented fraction of Non-Owner-Occupied Home Purchases in 2004-06		0.596***
		(0.107)
Saiz's elasticity	-0.0000710	0.00882**
	(0.00785)	(0.00348)
Ln of population in 2000	-0.0113	0.00321
	(0.00853)	(0.00400)
Fraction of the college educated in 2000	0.00113*	-0.00282***
	(0.000673)	(0.000525)
Fraction of the employed in 2000	0.00666	0.00506
	(0.00830)	(0.00376)
Fraction of workforce in 2000	-0.0106	-0.00169
	(0.00833)	(0.00377)
Median household Income in 2000	-0.00000395***	0.00000392***
	(0.000000671)	(0.000000773)
Poverty rate in 2000	-0.00432**	0.00441***
	(0.00209)	(0.00131)
Urban rate in 2000	0.000902*	-0.000968***
	(0.000464)	(0.000342)
Fraction of the white in 2000	-0.000450	0.0000815
	(0.000470)	(0.000214)
Constant	0.757***	-0.363***
	(0.175)	(0.125)
Observations	323	323
R-squared	0.445	0.326

Table 5: Effects of Housing Speculation on Construction and Non-construction Sectors

This table reports the two stage least squares regressions of the employment change in the construction (Column 1) and non-construction sectors (Column 2) in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Construction employment change in 2007-09	(2) Non-construction employment change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-1.348***	-0.601***
	(0.368)	(0.149)
Saiz's elasticity	-0.0252	0.0154**
	(0.0202)	(0.00628)
Fraction of subprime mortgages in 2005	-0.638***	-0.166***
	(0.172)	(0.0575)
Mortgage denial rate in 2005	0.577	0.109
	(0.361)	(0.113)
Fraction of GSE mortgages in 2005	0.186	-0.00512
	(0.151)	(0.0453)
Per capita income change in 2003-06	0.202	0.111**
	(0.134)	(0.0486)
Population change in 2003-06	0.220*	0.134***
	(0.124)	(0.0346)
Change in no. of establishments in 2004-06	-0.288	0.627***
	(0.178)	(0.0792)
Real payroll change in 2004-06	0.00116	0.147***
	(0.0868)	(0.0372)
Employment change in 2004-06	-0.217**	-0.278***
	(0.0932)	(0.0359)
Ln of population in 2000	-0.0228	-0.0242***
	(0.0177)	(0.00678)
Fraction of the college educated in 2000	0.00165**	0.000534*
	(0.000839)	(0.000275)
Fraction of the employed in 2000	-0.0104	-0.00744***
	(0.00802)	(0.00278)
Fraction of workforce in 2000	0.0119	0.00704**
	(0.00818)	(0.00284)
Median household Income in 2000	-0.00000291***	-0.00000112**
	(0.00000111)	(0.000000503)

Poverty rate in 2000	0.00273	0.00110
	(0.00227)	(0.000956)
Urban rate in 2000	0.00124*	0.000407
	(0.000685)	(0.000282)
Fraction of the white in 2000	-0.00221***	-0.000234
	(0.000684)	(0.000231)
Constant	0.152	0.233**
	(0.246)	(0.106)
Observations	3939	3908
R-squared	0.104	0.095

Table 6: Effect of Housing Speculation on Employment in Retail and Restaurant Industries

This table reports the two stage least squares regressions of the employment change in retail and restaurant sectors in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax. Column 1 presents the coefficients for the sample of retail and restaurant establishments with fewer than 50 employees, and Column 2 presents the coefficients for the sample of retail and restaurant establishments with more than 50 employees. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Retail and restaurant employment change in 2007-09	(2) Retail and restaurant employment (size under 50) change in 2007-09	(3) Retail and restaurant employment (size above 50) change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.865***	-0.435***	-1.545***
	(0.135)	(0.104)	(0.278)
Saiz's elasticity	0.00991	-0.00203	0.0228
	(0.00695)	(0.00510)	(0.0146)
Fraction of subprime mortgages in 2005	-0.270***	-0.0997***	-0.392**
	(0.0583)	(0.0377)	(0.158)
Mortgage denial rate in 2005	0.105	0.0591	0.0821
	(0.122)	(0.0951)	(0.304)
Fraction of GSE mortgages in 2005	-0.0374	0.0192	-0.109
	(0.0571)	(0.0399)	(0.114)
Per capita income change in 2003-06	0.175***	0.0876**	0.347***
	(0.0600)	(0.0354)	(0.125)
Population change in 2003-06	0.193***	0.165***	0.217***
	(0.0399)	(0.0344)	(0.0785)
Change in no. of establishments in 2004-06	0.513***	0.471***	0.633***
	(0.0593)	(0.0559)	(0.125)
Real payroll change in 2004-06	0.110***	0.00352	0.258***
	(0.0417)	(0.0274)	(0.0789)
Employment change in 2004-06	-0.139***	0.0218	-0.309***
	(0.0451)	(0.0341)	(0.0854)
Ln of population in 2000	-0.0218***	-0.00750	-0.0463***
	(0.00774)	(0.00674)	(0.0125)
Fraction of the college educated in 2000	-0.000412	0.000569	-0.000991
	(0.000507)	(0.000370)	(0.00113)
Fraction of the employed in 2000	-0.00714**	-0.00714***	-0.00579
	(0.00348)	(0.00229)	(0.00704)
Fraction of workforce in	0.00624*	0.00674***	0.00423

2000	(0.00354)	(0.00221)	(0.00714)
Median household Income	-0.00000125**	-0.000000936*	-0.00000297***
in 2000	(0.000000513)	(0.000000543)	(0.000000981)
Poverty rate in 2000	0.00141	0.000138	0.00152
	(0.00107)	(0.000705)	(0.00245)
Urban rate in 2000	0.000554*	0.000822***	-0.000720
	(0.000323)	(0.000217)	(0.000728)
Fraction of the white in	-0.000719***	-0.000176	-0.000879*
2000	(0.000218)	(0.000184)	(0.000527)
Constant	0.356***	0.0589	0.921***
	(0.115)	(0.102)	(0.184)
Observations	3941	3941	3519
R-squared	0.013	0.093	.

Table 7: Effect of Housing Speculation on Employment of Small and Large Firms

This table reports the two stage least squares regressions of the employment change in the establishments with fewer than 50 employees (Column 1) and in those with more than 50 employees (Column 2) in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Employment (size under 50) change in 2007-09	(2) Employment (size above 50) change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.522*** (0.0632)	-0.862** (0.336)
Saiz's elasticity	0.00282 (0.00364)	0.0370*** (0.0125)
Fraction of subprime mortgages in 2005	-0.140*** (0.0286)	-0.178 (0.164)
Mortgage denial rate in 2005	0.0751 (0.0586)	0.234 (0.306)
Fraction of GSE mortgages in 2005	0.0183 (0.0280)	0.157 (0.140)
Per capita income change in 2003-06	0.0974*** (0.0271)	0.179* (0.0935)
Population change in 2003-06	0.187*** (0.0286)	0.179** (0.0792)
Change in no. of establishments in 2004-06	0.249*** (0.0390)	0.597*** (0.175)
Real payroll change in 2004-06	0.0215 (0.0177)	0.295*** (0.0753)
Employment change in 2004-06	0.00299 (0.0178)	-0.663*** (0.0904)
Ln of population in 2000	-0.0107** (0.00443)	-0.0329** (0.0159)
Fraction of the college educated in 2000	0.000691*** (0.000183)	0.00252*** (0.000702)
Fraction of the employed in 2000	-0.00514*** (0.00170)	-0.0114** (0.00559)
Fraction of workforce in 2000	0.00454*** (0.00168)	0.0115** (0.00565)
Median household Income in 2000	-0.00000102*** (0.000000241)	-0.00000227** (0.00000115)

Poverty rate in 2000	0.000898*	0.000324
	(0.000535)	(0.00185)
Urban rate in 2000	0.000961***	-0.000126
	(0.000142)	(0.000846)
Fraction of the white in 2000	-0.000419***	-0.000995**
	(0.000135)	(0.000393)
Constant	0.0970	0.276
	(0.0672)	(0.243)
Observations	3941	3665
R-squared	0.142	0.037

Table 8: Real Effects of Housing Speculation in Areas with More Local Banks

This table reports the two stage least squares regressions of the economic outcomes in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the dummy variable of the state capital gain tax, the dummy variable indicating local banking areas, and their interactions. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Per capita income change in 2007-09	(2) Change in no. of establishments in 2007-09	(3) Real payroll change in 2007-09	(4) Employment change in 2007-09
Fraction of Non-Owner-Occupied Home	-0.557***	-0.463***	-0.674***	-0.682***
Purchases in 2004-06	(0.133)	(0.0504)	(0.163)	(0.148)
Dummy for areas with	0.0181	-0.00184	0.0256	0.0125
more local banks	(0.0174)	(0.00821)	(0.0206)	(0.0139)
Interaction	-0.150	0.0180	-0.139	-0.0457
	(0.119)	(0.0583)	(0.137)	(0.0965)
Saiz's elasticity	-0.00910	0.00145	0.0169**	0.0144***
	(0.00578)	(0.00325)	(0.00685)	(0.00555)
Fraction of subprime	-0.214***	-0.154***	-0.189***	-0.204***
mortgages in 2005	(0.0532)	(0.0300)	(0.0725)	(0.0591)
Mortgage denial rate in	-0.0923	0.0364	0.155	0.206*
2005	(0.114)	(0.0490)	(0.159)	(0.117)
Fraction of GSE	0.00750	-0.0173	0.00341	0.0259
mortgages in 2005	(0.0350)	(0.0250)	(0.0508)	(0.0441)
Per capita income	-0.200***	0.0952***	0.174***	0.116**
change in 2003-06	(0.0678)	(0.0229)	(0.0483)	(0.0499)
Population change in	-0.161***	0.174***	0.143***	0.139***
2003-06	(0.0511)	(0.0223)	(0.0429)	(0.0380)
Change in no. of	0.168***	0.179***	0.443***	0.489***
est. in 2004-06	(0.0441)	(0.0313)	(0.0934)	(0.0745)
Real payroll change in	0.0162	0.0227*	-0.132***	0.142***
2004-06	(0.0167)	(0.0128)	(0.0456)	(0.0367)
Employment change in	-0.00676	-0.00804	-0.00256	-0.300***
2004-06	(0.0130)	(0.0128)	(0.0344)	(0.0359)
Ln of population in 2000	-0.0231***	-0.0100***	-0.0198**	-0.0229***
	(0.00607)	(0.00384)	(0.00896)	(0.00687)
Fraction of the college	-0.00118***	0.000430***	0.00216***	0.00136***
educated in 2000	(0.000358)	(0.000162)	(0.000432)	(0.000293)
Fraction of the	-0.00356	-0.00439***	-0.0113***	-0.00783***
employed in 2000	(0.00259)	(0.00149)	(0.00339)	(0.00253)

Fraction of workforce in 2000	0.00355	0.00376**	0.0101***	0.00707***
	(0.00257)	(0.00151)	(0.00318)	(0.00250)
Median household Income in 2000	-0.00000163***	-0.000000809***	-0.00000233***	-0.00000167***
	(0.000000404)	(0.000000212)	(0.000000581)	(0.000000478)
Poverty rate in 2000	0.000289	0.000802*	0.000444	0.000831
	(0.000727)	(0.000480)	(0.00120)	(0.000908)
Urban rate in 2000	-0.0000912	0.000490***	0.00116***	0.000843***
	(0.000200)	(0.000111)	(0.000281)	(0.000250)
Fraction of the white in 2000	-0.00130***	-0.000447***	-0.000572	-0.000506**
	(0.000248)	(0.000124)	(0.000353)	(0.000216)
Constant	0.479***	0.161***	0.176	0.212**
	(0.0892)	(0.0584)	(0.121)	(0.104)
Observations	3940	3910	3910	3910
R-squared	0.295	0.153	0.054	0.080

Table 9 Extrapolation and Housing Speculation

Panel A reports coefficient estimates from regressing the fraction of non-owner-occupied home purchases on the lagged house price change (Columns 1 and 2), and the dummy variable of the state capital gain tax and their interaction (Columns 3 and 4). Panel B reports coefficient estimates from regressing the fraction of non-owner-occupied home purchases in 2004-2006 on the house price change in 2001-2003 (Columns 1 and 2), and the dummy variable of the state capital gain tax and their interaction (Columns 3 and 4). Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

Panel A:

	(1)	(2)	(3)	(4)
	Fraction of Non-Owner-Occupied Home Purchases			
Lagged Real house price change	0.195**	0.193***	0.576***	0.560***
	(0.0830)	(0.0686)	(0.129)	(0.111)
Dummy with state capital gain tax			-0.0345*	-0.0251
			(0.0200)	(0.0172)
Interaction			-0.510***	-0.497***
			(0.133)	(0.121)
Lagged Fraction of subprime mortgages		-0.0863		-0.101**
		(0.0539)		(0.0495)
Lagged Mortgage denial rate		0.524***		0.450***
		(0.0622)		(0.0614)
Lagged Fraction of GSE mortgages		0.104***		0.0163
		(0.0335)		(0.0271)
Lagged Per capita income change		0.260***		0.161***
		(0.0466)		(0.0354)
Lagged Population change		-0.0706***		-0.0647***
		(0.0238)		(0.0225)
Lagged Change in no. of establishments		0.0584		-0.0365
		(0.0353)		(0.0301)
Lagged Real payroll change		0.0259***		0.0147**
		(0.00753)		(0.00582)
Lagged Employment change		-0.0231***		-0.0107*
		(0.00811)		(0.00600)
Constant	0.0589***	-0.0302**	0.0996***	0.0365
	(0.00499)	(0.0130)	(0.0190)	(0.0256)
Observations	26304	21478	22837	21478
R-squared	0.103	0.195	0.224	0.294

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Panel B:

	(1)	(2)	(3)	(4)
	Fraction of Non-Owner-Occupied Home Purchases in 2004-06			
Real house price change in 2001-03	0.0220	0.0159	0.366**	0.358***
	(0.0547)	(0.0452)	(0.159)	(0.115)
Dummy with state capital gain tax			-0.0312	-0.00901
			(0.0336)	(0.0242)
Interaction			-0.393**	-0.396***
			(0.163)	(0.126)
Fraction of subprime mortgages in 2002		-0.0469		-0.0630
		(0.109)		(0.0956)
Mortgage denial rate in 2002		0.654***		0.532***
		(0.0870)		(0.0789)
Fraction of GSE mortgages in 2002		0.0664		-0.0376
		(0.0424)		(0.0357)
Per capita income change in 2002		0.210***		0.199***
		(0.0722)		(0.0608)
Population change in 2002		-0.378***		-0.233***
		(0.0765)		(0.0589)
Change in no. of establishments in 2001-03		0.163***		0.0665*
		(0.0406)		(0.0380)
Real payroll change in 2001-03		-0.000191		-0.00225
		(0.0121)		(0.0105)
Employment change in 2001-03		-0.0141		-0.00280
		(0.0144)		(0.0123)
Constant	0.132***	-0.0156	0.151***	0.0605**
	(0.0110)	(0.0206)	(0.0319)	(0.0271)
Observations	3975	3431	3975	3431
R-squared	0.001	0.212	0.218	0.332

Economic Consequences of Housing Speculation

Internet Appendix

Zhenyu Gao, Michael Sockin, Wei Xiong

We start the first table with number A2 so that it corresponds to Table 2 in the main paper. Table A3 corresponds to Table 3, and so on.

Table A2: Speculation and Housing Price Decline

This table reports the two stage least squares regressions of the real house price change in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income. Column 1 shows the coefficients of the first stage regression of the fraction of non-owner-occupied home purchases in 2004-2006 on the state capital gain tax rate for the median income. Column 2 shows the coefficients of the second stage regression of the real house price change in 2007-2009 on the instrumented fraction of non-owner-occupied home purchases in 2004-2006. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Fraction of Non-Owner-Occupied Home Purchases in 2004-06	(2) Real house price change in 2007-09
State capital gain tax rate for median income	-1.238*** (0.249)	
Instrumented fraction of Non-Owner-Occupied Home Purchases in 2004-06		-1.617*** (0.540)
Saiz's elasticity	0.0296*** (0.00717)	0.0692*** (0.0223)
Fraction of subprime mortgages in 2005	-0.245*** (0.0506)	-1.283*** (0.196)
Mortgage denial rate in 2005	0.375*** (0.0937)	-0.120 (0.542)
Fraction of GSE mortgages in 2005	-0.215*** (0.0408)	0.348** (0.169)
Per capita income change in 2003-06	0.103*** (0.0337)	0.131 (0.183)
Population change in 2003-06	-0.0555*** (0.0177)	-0.226*** (0.0750)
Change in no. of establishments in 2004-06	0.154*** (0.0307)	0.0450 (0.193)
Real payroll change in 2004-06	0.0313*** (0.0105)	0.0226 (0.0617)
Employment change in 2004-06	-0.00585 (0.0113)	-0.0693 (0.0479)
Ln of population in 2000	-0.0205*** (0.00544)	-0.0516** (0.0213)
Fraction of the college educated in 2000	0.000551* (0.000286)	0.00152 (0.00101)
Fraction of the employed in 2000	0.00187 (0.00198)	-0.00197 (0.0106)
Fraction of workforce in 2000	-0.00392*	0.00393

	(0.00205)	(0.0102)
Median household Income in 2000	-0.00000215***	-0.00000461***
	(0.000000274)	(0.00000174)
Poverty rate in 2000	0.00210***	0.00139
	(0.000680)	(0.00302)
Urban rate in 2000	0.000740***	0.000816
	(0.000147)	(0.000610)
Fraction of the white in 2000	-0.0000516	-0.00311***
	(0.000199)	(0.000865)
Constant	0.527***	0.652*
	(0.0873)	(0.367)
Observations	3941	3941
R-squared	0.506	0.458

Table A3: Real Effects of Housing Speculation

This table reports the two stage least squares regressions of the economic outcomes in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Per capita income change in 2007-09	(2) Change in no. of establishments in 2007-09	(3) Real payroll change in 2007-09	(4) Employment change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.543***	-0.526***	-0.857***	-0.813***
	(0.130)	(0.0748)	(0.180)	(0.160)
Saiz's elasticity	-0.0101*	0.00282	0.0199***	0.0168***
	(0.00572)	(0.00363)	(0.00720)	(0.00564)
Fraction of subprime mortgages in 2005	-0.204***	-0.167***	-0.214***	-0.225***
	(0.0489)	(0.0338)	(0.0698)	(0.0565)
Mortgage denial rate in 2005	-0.116	0.0675	0.222	0.260**
	(0.108)	(0.0538)	(0.151)	(0.114)
Fraction of GSE mortgages in 2005	0.0162	-0.0247	-0.00491	0.0177
	(0.0370)	(0.0285)	(0.0584)	(0.0490)
Per capita income change in 2003-06	-0.214***	0.106***	0.194***	0.135**
	(0.0622)	(0.0270)	(0.0554)	(0.0539)
Population change in 2003-06	-0.155***	0.169***	0.135***	0.131***
	(0.0473)	(0.0221)	(0.0423)	(0.0382)
Change in no. of establishments in 2004-06	0.156***	0.193***	0.473***	0.513***
	(0.0452)	(0.0354)	(0.0997)	(0.0788)
Real payroll change in 2004-06	0.0154	0.0256*	-0.124***	0.147***
	(0.0166)	(0.0137)	(0.0460)	(0.0369)
Employment change in 2004-06	-0.00732	-0.00888	-0.00643	-0.302***
	(0.0128)	(0.0131)	(0.0345)	(0.0362)
Ln of population in 2000	-0.0220***	-0.0117***	-0.0229**	-0.0253***
	(0.00539)	(0.00394)	(0.00927)	(0.00672)
Fraction of the college educated in 2000	-0.00120***	0.000464***	0.00224***	0.00142***
	(0.000374)	(0.000180)	(0.000469)	(0.000314)
Fraction of the employed in 2000	-0.00353	-0.00421**	-0.0107***	-0.00741***
	(0.00262)	(0.00166)	(0.00361)	(0.00272)
Fraction of workforce in 2000	0.00365	0.00342**	0.00921***	0.00642**
	(0.00260)	(0.00173)	(0.00346)	(0.00273)
Median household Income in 2000	-0.00000149***	-0.000000977***	-0.00000268***	-0.00000196***
	(0.000000436)	(0.000000295)	(0.000000680)	(0.000000540)
Poverty rate in 2000	0.000264	0.000915*	0.000780	0.00107

	(0.000691)	(0.000553)	(0.00126)	(0.000984)
Urban rate in 2000	-0.000145	0.000558***	0.00128***	0.000948***
	(0.000151)	(0.000121)	(0.000294)	(0.000257)
Fraction of the white in 2000	-0.00130***	-0.000438***	-0.000535	-0.000477**
	(0.000243)	(0.000130)	(0.000356)	(0.000224)
Constant	0.459***	0.192***	0.243*	0.264**
	(0.0841)	(0.0662)	(0.132)	(0.108)
Observations	3940	3910	3910	3910
R-squared	0.316	0.101	0.032	0.049

Table A4: Speculation and New Housing Supply

This table reports the two stage least squares regressions of building permits in 2004-06 relative to the housing units in 2000 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income. Column 1 shows the coefficients of the first stage regression of the fraction of non-owner-occupied home purchases in 2004-2006 on the state capital gain tax rate for the median income. Column 2 shows the coefficients of the second stage regression of building permits in 2004-06 relative to the housing units in 2000 on the instrumented fraction of non-owner-occupied home purchases in 2004-2006. Observations are weighted by the number of households at the county level. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Fraction of Non-Owner-Occupied Home Purchases in 2004-06	(2) Building permits in 2004-06 relative to the housing units in 2000
State capital gain tax rate for median income	-0.883*** (0.209)	
Instrumented fraction of Non-Owner-Occupied Home Purchases in 2004-06		0.425*** (0.105)
Saiz's elasticity	-0.00604 (0.00775)	0.00742** (0.00340)
Ln of population in 2000	-0.0153** (0.00749)	0.000569 (0.00330)
Fraction of the college educated in 2000	0.00138** (0.000701)	-0.00264*** (0.000487)
Fraction of the employed in 2000	0.0103 (0.00749)	0.00737** (0.00355)
Fraction of workforce in 2000	-0.0139* (0.00744)	-0.00476 (0.00370)
Median household Income in 2000	-0.00000440*** (0.000000711)	0.00000309*** (0.000000675)
Poverty rate in 2000	-0.00340* (0.00198)	0.00371*** (0.00110)
Urban rate in 2000	0.000781* (0.000466)	-0.000753** (0.000298)
Fraction of the white in 2000	-0.000601 (0.000447)	0.0000428 (0.000172)
Constant	0.823*** (0.160)	-0.222** (0.108)
Observations	323	323
R-squared	0.435	0.423

Table A5: Effects of Housing Speculation on Construction and Non-construction Sectors

This table reports the two stage least squares regressions of the employment change in the construction (Column 1) and non-construction sectors (Column 2) in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Construction employment change in 2007-09	(2) Non-construction employment change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-1.989***	-0.673***
	(0.344)	(0.161)
Saiz's elasticity	-0.0123	0.0169***
	(0.0200)	(0.00647)
Fraction of subprime mortgages in 2005	-0.756***	-0.179***
	(0.150)	(0.0550)
Mortgage denial rate in 2005	0.874***	0.142
	(0.332)	(0.116)
Fraction of GSE mortgages in 2005	0.119	-0.0127
	(0.138)	(0.0479)
Per capita income change in 2003-06	0.302**	0.122**
	(0.129)	(0.0521)
Population change in 2003-06	0.174	0.129***
	(0.124)	(0.0343)
Change in no. of establishments in 2004-06	-0.145	0.643***
	(0.177)	(0.0806)
Real payroll change in 2004-06	0.0310	0.150***
	(0.0895)	(0.0370)
Employment change in 2004-06	-0.227**	-0.279***
	(0.0963)	(0.0359)
Ln of population in 2000	-0.0391**	-0.0260***
	(0.0181)	(0.00674)
Fraction of the college educated in 2000	0.00196**	0.000569*
	(0.000955)	(0.000291)
Fraction of the employed in 2000	-0.00843	-0.00721**
	(0.00750)	(0.00294)
Fraction of workforce in 2000	0.00845	0.00665**
	(0.00748)	(0.00305)
Median household Income in 2000	-0.00000448***	-0.00000129**
	(0.00000115)	(0.000000538)

Poverty rate in 2000	0.00390*	0.00122
	(0.00228)	(0.00102)
Urban rate in 2000	0.00189***	0.000479*
	(0.000620)	(0.000290)
Fraction of the white in 2000	-0.00213***	-0.000225
	(0.000721)	(0.000233)
Constant	0.461*	0.268**
	(0.266)	(0.107)
Observations	3939	3908
R-squared	0.072	0.079

Table A6: Effect of Housing Speculation on Employment in Retail and Restaurant Industries

This table reports the two stage least squares regressions of the employment change in retail and restaurant sectors in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income. Column 1 presents the coefficients for the sample of retail and restaurant establishments with fewer than 50 employees, and Column 2 presents the coefficients for the sample of retail and restaurant establishments with more than 50 employees. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Retail employment change in 2007-09	(2) Retail employment (size under 50) change in 2007-09	(3) Retail employment (size above 50) change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.763***	-0.450***	-1.215***
	(0.140)	(0.106)	(0.316)
Saiz's elasticity	0.00787	-0.00172	0.0161
	(0.00700)	(0.00531)	(0.0136)
Fraction of subprime mortgages in 2005	-0.251***	-0.103***	-0.333**
	(0.0579)	(0.0382)	(0.152)
Mortgage denial rate in 2005	0.0583	0.0663	-0.0759
	(0.129)	(0.0964)	(0.325)
Fraction of GSE mortgages in 2005	-0.0268	0.0176	-0.0737
	(0.0540)	(0.0404)	(0.106)
Per capita income change in 2003-06	0.159**	0.0900***	0.293**
	(0.0624)	(0.0347)	(0.132)
Population change in 2003-06	0.200***	0.164***	0.240***
	(0.0375)	(0.0342)	(0.0737)
Change in no. of establishments in 2004-06	0.491***	0.475***	0.559***
	(0.0571)	(0.0570)	(0.123)
Real payroll change in 2004-06	0.105**	0.00425	0.243***
	(0.0418)	(0.0276)	(0.0769)
Employment change in 2004-06	-0.138***	0.0216	-0.304***
	(0.0449)	(0.0340)	(0.0839)
Ln of population in 2000	-0.0192**	-0.00790	-0.0375***
	(0.00814)	(0.00639)	(0.0128)
Fraction of the college educated in 2000	-0.000462	0.000577	-0.00116
	(0.000488)	(0.000376)	(0.00110)
Fraction of the employed in 2000	-0.00745**	-0.00709***	-0.00681
	(0.00340)	(0.00229)	(0.00674)
Fraction of workforce in 2000	0.00678*	0.00665***	0.00598
	(0.00347)	(0.00221)	(0.00686)
Median household Income in	-0.00000101**	-0.000000974*	-0.00000216**

2000	(0.000000500)	(0.000000536)	(0.00000103)
Poverty rate in 2000	0.00122	0.000167	0.000987
	(0.00103)	(0.000709)	(0.00229)
Urban rate in 2000	0.000452	0.000838***	-0.00104
	(0.000330)	(0.000216)	(0.000696)
Fraction of the white in 2000	-0.000731***	-0.000174	-0.000933*
	(0.000215)	(0.000182)	(0.000501)
Constant	0.308***	0.0664	0.757***
	(0.114)	(0.0984)	(0.197)
Observations	3941	3941	3519
R-squared	0.033	0.091	0.009

Table A7: Effect of Housing Speculation on Employment of Small and Large Firms

This table reports the two stage least squares regressions of the employment change in the establishments with fewer than 50 employees (Column 1) and in those with more than 50 employees (Column 2) in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Employment (size under 50) change in 2007-09	(2) Employment (size above 50) change in 2007-09
Fraction of Non-Owner-Occupied	-0.595***	-1.035***
Home Purchases in 2004-06	(0.0854)	(0.349)
Saiz's elasticity	0.00430	0.0406***
	(0.00387)	(0.0119)
Fraction of subprime mortgages in	-0.154***	-0.210
2005	(0.0328)	(0.157)
Mortgage denial rate in 2005	0.109*	0.320
	(0.0656)	(0.295)
Fraction of GSE mortgages in	0.0107	0.140
2005	(0.0315)	(0.143)
Per capita income change in	0.109***	0.206**
2003-06	(0.0302)	(0.101)
Population change in 2003-06	0.182***	0.167**
	(0.0288)	(0.0781)
Change in no. of establishments in	0.265***	0.636***
2004-06	(0.0423)	(0.181)
Real payroll change in 2004-06	0.0249	0.303***
	(0.0184)	(0.0748)
Employment change in 2004-06	0.00180	-0.665***
	(0.0179)	(0.0910)
Ln of population in 2000	-0.0126***	-0.0371**
	(0.00456)	(0.0167)
Fraction of the college educated in	0.000727***	0.00260***
2000	(0.000205)	(0.000714)
Fraction of the employed in 2000	-0.00491***	-0.0109*
	(0.00182)	(0.00588)
Fraction of workforce in 2000	0.00415**	0.0106*
	(0.00183)	(0.00603)
Median household Income in 2000	-0.00000119***	-0.00000269**
	(0.000000309)	(0.00000118)
Poverty rate in 2000	0.00103*	0.000645
	(0.000592)	(0.00199)
Urban rate in 2000	0.00104***	0.0000552

	(0.000148)	(0.000836)
Fraction of the white in 2000	-0.000409***	-0.000972**
	(0.000139)	(0.000404)
Constant	0.132*	0.355
	(0.0753)	(0.257)
Observations	3941	3665
R-squared	0.107	0.030

Table A8: Real Effects of Housing Speculation in Areas with More Local Banks

This table reports the two stage least squares regressions of the economic outcomes in 2007-2009 on the fraction of non-owner-occupied home purchases in 2004-2006 instrumented with the state capital gain tax rate for the median income, the dummy variable indicating local banking areas, and their interactions. Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

	(1) Per capita income change in 2007-09	(2) Change in no. of establishments in 2007-09	(3) Real payroll change in 2007-09	(4) Employment change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.512***	-0.539***	-0.853***	-0.819***
	(0.123)	(0.0759)	(0.189)	(0.168)
Dummy for areas with more	0.0163	-0.00665	0.0188	0.0105
local banks	(0.0191)	(0.0115)	(0.0258)	(0.0176)
Interaction	-0.143	0.0592	-0.0742	-0.0177
	(0.136)	(0.0808)	(0.179)	(0.125)
Saiz's elasticity	-0.0100*	0.00280	0.0203***	0.0171***
	(0.00585)	(0.00368)	(0.00721)	(0.00562)
Fraction of subprime	-0.205***	-0.166***	-0.219***	-0.228***
mortgages in 2005	(0.0489)	(0.0342)	(0.0682)	(0.0555)
Mortgage denial rate in	-0.114	0.0668	0.230	0.266**
2005	(0.108)	(0.0541)	(0.151)	(0.113)
Fraction of GSE mortgages	0.0130	-0.0234	-0.0128	0.0122
in 2005	(0.0370)	(0.0291)	(0.0571)	(0.0482)
Per capita income change in	-0.208***	0.104***	0.197***	0.135**
2003-06	(0.0661)	(0.0271)	(0.0551)	(0.0528)
Population change in	-0.158***	0.170***	0.132***	0.130***
2003-06	(0.0489)	(0.0226)	(0.0431)	(0.0387)
Change in no. of	0.157***	0.193***	0.479***	0.517***
establishments in 2004-06	(0.0455)	(0.0359)	(0.0996)	(0.0789)
Real payroll change in	0.0141	0.0262*	-0.124***	0.148***
2004-06	(0.0169)	(0.0138)	(0.0466)	(0.0372)
Employment change in	-0.00609	-0.00941	-0.00558	-0.302***
2004-06	(0.0131)	(0.0131)	(0.0346)	(0.0360)
Ln of population in 2000	-0.0218***	-0.0118***	-0.0241**	-0.0264***
	(0.00551)	(0.00394)	(0.00948)	(0.00700)
Fraction of the college	-0.00120***	0.000462***	0.00224***	0.00142***
educated in 2000	(0.000379)	(0.000179)	(0.000466)	(0.000313)
Fraction of the employed in	-0.00370	-0.00413**	-0.0107***	-0.00739***
2000	(0.00256)	(0.00164)	(0.00361)	(0.00272)

Fraction of workforce in 2000	0.00380	0.00336**	0.00917***	0.00634**
	(0.00253)	(0.00171)	(0.00345)	(0.00274)
Median household Income in 2000	-0.00000152***	-0.000000965***	-0.00000272***	-0.00000198***
	(0.000000450)	(0.000000299)	(0.000000673)	(0.000000531)
Poverty rate in 2000	0.000207	0.000940*	0.000766	0.00108
	(0.000683)	(0.000544)	(0.00126)	(0.000991)
Urban rate in 2000	-0.000140	0.000556***	0.00132***	0.000976***
	(0.000152)	(0.000121)	(0.000290)	(0.000254)
Fraction of the white in 2000	-0.00130***	-0.000440***	-0.000555	-0.000494**
	(0.000247)	(0.000131)	(0.000356)	(0.000223)
Constant	0.456***	0.194***	0.257*	0.277**
	(0.0849)	(0.0666)	(0.136)	(0.112)
Observations	3940	3910	3910	3910
R-squared	0.311	0.103	0.029	0.047

Table A9 Extrapolation and Housing Speculation

Panel A reports coefficient estimates from regressing the fraction of non-owner-occupied home purchases on the lagged house price change (Columns 1 and 2), and the state capital gain tax rate for the median income and their interaction (Columns 3 and 4). Panel B reports coefficient estimates from regressing the fraction of non-owner-occupied home purchases in 2004-2006 on the house price change in 2001-2003 (Columns 1 and 2), and the state capital gain tax rate for the median income and their interaction (Columns 3 and 4). Observations are weighted by the number of households. Standard errors are clustered at MSA level. ***, **, * indicate coefficient estimates statistically distinct from 0 at the 1%, 5%, and 10% levels, respectively.

Panel A:

	(1)	(2)
	Fraction of Non-Owner-Occupied Home Purchases	
Lagged real house price change	0.651***	0.594***
	(0.115)	(0.101)
State capital gain tax rate for	-0.224	-0.172
median income	(0.272)	(0.230)
Interaction	-10.44***	-9.911***
	(1.958)	(1.910)
Lagged fraction of subprime mortgages		-0.0915**
		(0.0455)
Lagged mortgage denial rate		0.465***
		(0.0597)
Lagged fraction of GSE mortgages		-0.00327
		(0.0276)
Lagged Per capita income change		0.186***
		(0.0339)
Lagged population change		-0.0636***
		(0.0225)
Lagged change in no. of establishments		-0.00765
		(0.0298)
Lagged real payroll change		0.0215***
		(0.00635)
Lagged employment change		-0.0154**
		(0.00606)
Constant	0.0792***	0.0276
	(0.0161)	(0.0212)
Observations	22837	21478
R-squared	0.211	0.291

Panel B:

	(1)	(2)
	Fraction of Non-Owner-Occupied Home Purchases in 2004-06	
Real house price change in 2001-03	0.307**	0.276***
	(0.125)	(0.0992)
State capital gain tax rate for	-0.455	-0.237
median income	(0.449)	(0.341)
Interaction	-5.564***	-5.342***
	(2.073)	(1.768)
Fraction of subprime mortgages		-0.0464
in 2002		(0.0870)
Mortgage denial rate in 2002		0.567***
		(0.0775)
Fraction of GSE mortgages in 2002		-0.0543
		(0.0379)
Per capita income change in 2002		0.204***
		(0.0644)
Population change in 2002		-0.276***
		(0.0581)
Change in no. of establishments		0.113***
in 2001-03		(0.0371)
Real payroll change in 2001-03		0.00292
		(0.0106)
Employment change in 2001-03		-0.00671
		(0.0136)
Constant	0.142***	0.0560**
	(0.0270)	(0.0255)
Observations	3975	3431
R-squared	0.174	0.314