Economic Consequences of Housing Speculation

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ABSTRACT

By exploiting variation in state capital gains taxation as an instrument, we find that housing speculation, measured by the fraction of non-owner-occupied home purchases, helps explain the severity of both the housing price bust and the economic recession in 2007-2009. Housing speculation, anchored, in part, on extrapolation of past housing price changes, led to more housing construction across zip codes during the boom in 2004-2006, and more severe declines in employment, per capita income, real payroll, and business establishments during the bust. Our analysis identifies supply overhang and local household demand as two key channels for transmitting these adverse effects.

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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 Shiller (2009), Haughwout et al. (2011), Mayer (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 market 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. Housing speculation is a phenomenon that is largely orthogonal to the credit expansion to subprime households that occurred during the housing boom, which is widely regarded, for instance in Mian and Sufi (2009) and Keys et al. (2009), as a key driver of the housing boom. As we will demonstrate, there is a negligible correlation across zip codes between the fraction of non-owner-occupied home purchases during the boom period of 2004 to 2006 and the fraction of subprime mortgages originated.

An intuitive hypothesis posits that speculation in the housing market can have important economic consequences. When speculators purchase more non-owner-occupied homes in an area during a housing boom, this speculation can amplify the boom and contribute to not only a greater price drop, but also to a more severe economic contraction during the subsequent housing bust. However, despite its intuitive appeal, this hypothesis remains elusive to test because of the well-recognized endogeneity issue with identification. Because housing speculation may reflect local housing demand or other unobservable economic conditions, rather than be a cause of housing and economic cycles, it is difficult to measure its causal impact on these outcomes.

In this paper, we undertake 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 U.S. states in their taxation of capital gains. While homeowners can exclude capital gains from the sale of their primary residence from their

[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.

income taxes, 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: one is a tax dummy indicating whether a state has capital gains taxes, and the other 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 these 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 housing price contractions during the bust, but also experienced greater declines in employment, payroll, per capital income, and the number of establishments. The economic magnitude 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 21.4% and drops of 8.5% in real payroll, 8.4% in employment, 6.9% in income per capita, and 4.8% in the number of establishments in 2007 to 2009. These results establish a causal link between housing speculation and different aspects of local housing and economic cycles, and are robust to excluding the so-called "sand states" of Arizona, California, Florida, and Nevada that saw particularly phenomenal housing 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 instrumental variable approach, we find that areas with more intensive housing speculation during the boom also had a greater increase in housing construction in the same period, which, in turn, contributed to the subsequent 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 6.1% in building permits in 2004 to 2006 relative to the number of housing units in 2000, as well as decreases of 18.7% in construction-sector employment and 6.9% in 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 non-tradable sectors—and the retail and restaurant sectors more narrowly— which primarily rely on local consumption demand. We find significant real effects through this channel. An increase of one standard deviation in instrumented housing speculation in 2004 to 2006 led to a decrease of 9.5% in non-tradable sectors' employment in 2007 to 2009, and a decline of 9.4% in the retail and restaurant sectors, specifically. In contrast, housing speculation had more moderate effects on employment in tradable sectors and in industries other than retail and the restaurant business.

We also examine two other channels. The first is the housing collateral channel studied in Adelino, Schoar, and Severino (2015) and Schmalz, 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 second 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.

Housing speculation is likely an amplification of local economic conditions. We also make use of our tax variables to investigate extrapolative expectations of past housing price appreciation as a potential explanation for the cross-sectional variation we observe 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 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 past housing price change is significantly weaker. This result supports extrapolative expectations as a key driver of 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 establishments, payroll, 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. It is also related to that of Charles, Hurst, and Notowidigdo (2016a, 2016b), which explore how the housing boom led to distortions in the employment and educational attainment decisions predominantly among low-skilled, prime-aged laborers by temporarily expanding the construction and services sectors. Consistent with their results, we find that construction and local retail and service sectors contracted during the housing bust.

This paper is organized as follows. Section I discusses the empirical hypothesis and methodology, 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 and Methodology

Motivated by the literature referenced in the introduction on housing speculation, we investigate 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 a more severe economic contraction during the subsequent housing bust.

There are several channels through which the more intensive housing speculation during the boom may have led to the more severe housing price declines and economic recession during the subsequent housing bust. First, through a supply overhang channel, the increase in housing supply stimulated by purchases of non-owner-occupied homes during the boom might overhang 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 may affect household consumption and the 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 might affect firms' access to credit and thereby their capacity to invest during the housing bust, as studied in Adelino, Schoar, and Severino (2015) and Schmalz, Sraer, and Thesmar (2015). Finally, through the intermediary balance sheet channel, more intense speculation during the boom might lead to a more severe impairment of the balance sheets of local banks during the bust, which, in turn, prevented them from intermediating the investments of local firms, as examined in Gan (2007) and He and Krishnamurthy (2013). We intend to not only test the housing speculation hypothesis, but also separately examine these channels in our analysis. [2]

We face the typical issue of endogeneity in testing the housing speculation 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

[2] While we focus on these four channels as candidates for how speculation spilled over to the real economy during the bust, we would also acknowledge another possible channel. Charles, Hurst, and Notowidigdo (2016a, 2016b) show that the housing boom masked a secular decline in manufacturing employment, and distorted the choice to attend college for prime-aged workers, by expanding employment in residential construction and related FIRE (Finance, Insurance, and Real Estate) industries. This labor misallocation can have pernicious long-term consequences beyond exacerbating the economic contraction during the bust by distorting the composition of the workforce. While data limitation prevents us from explicitly analyzing this channel in this paper, our results from analyzing employment changes in construction and non-construction sectors, in tradable and non-tradable industries, and in service and non-service industries during the housing bust nevertheless reinforce their results.

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 per couple) of capital gains from the sale of 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. There is no capital gains exclusion for sales of non-owner-occupied homes however, and thus buyers of non-owner-occupied homes are subject to capital gains taxation. Different states impose different capital gains tax rates, and nine states (i.e., Alaska, Florida, Nevada, New Hampshire, South Dakota, Tennessee, Texas, Washington, and Wyoming) impose no capital gains taxes at all. Furthermore, the choice of capital gains tax rates are not driven by shocks to housing markets. In fact, during the boom period of 2004 to 2006, all of these nine states remained without capital gains taxes and only the District of Columbia and Ohio slightly changed their capital gains tax rates. As 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 taxes. 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, supporting the relevance requirement of our instrument.

For robustness, we also use an alternative variable—a continuous tax variable that further expands on the tax dummy variable to incorporate the marginal tax rate in states with capital gains taxes. This variable is equal to zero in states with no capital gains taxes and the marginal tax rate for a median income household in states with capital gains taxes. In using this variable as an

instrument, we make an additional assumption that the marginal buyer of non-owner-occupied homes has a median income in the state. [3]

For our instruments to be valid, they need to satisfy the exclusion restriction for causality with respect to the bust in local housing prices and the subsequent economic contraction. While economic activity in a state might be related to its treatment of state-level personal taxation, our analysis requires only that the relative decline in housing prices and real outcomes during the Great Recession were not directly driven by variation in state-level personal taxation during the boom period. We believe that this is the case for several reasons. First, several studies, such as Walden (2014) and Gale, Krupkin, and Reuben (2015), find little evidence that the relative size of the public sector (state and local taxes as a percentage of personal income) had any influence on the cross-sectional difference in economic growth during the recent recovery. Second, given that asset investments tended to experience losses during the economic contraction of 2008 to 2009 and capital losses are tax deductible, state capital gains tax rates were not a relevant margin for household consumption and savings decisions during the Great Recession. Third, thirty-three states changed their personal tax policies in 2008 and 2009 to raise revenues in response to the recession, including nine that altered their treatment of capital gains. Consequently, the tax rates we use reflect historical differences in personal tax incidence that may not have prevailed during the recession. Finally, personal capital gains tax treatment is not correlated with state public spending during our sample period, which suggests that the variation that we find across states in local economic outcomes during the bust does not reflect differences in public sector fiscal support.[4]

In a related paper, Charles, Hurst, and Notowidigdo (2016a, 2016b) estimate structural breaks in housing demand at the MSA-level, which they define as the sum of changes in both housing price and supply, in the spirit of Ferreira and Gyourko (2011). Their identification scheme relies on a discontinuous jump in housing demand in a MSA that is not anchored to changes in local

[3] Our results are robust to using the top marginal capital gains tax rate.

[4] While some states without capital gains taxes, such as New Hampshire and Tennessee, had the lowest per capita real public expenditure from 2000 to 2010 among U.S. states, others, such as Alaska, Nevada, Washington, and Wyoming, had amongst the highest (Fisher and Wassmer (2015)).

fundamentals, which they argue is related to speculative activity specific to the housing market.[5] While they instrument the overall increase in housing demand to investigate labor outcomes during the boom, we instead instrument investment home purchases to quantify the role of housing speculation during the bust. As such, we view our analysis as complementary to theirs. Furthermore, we also link housing speculation to extrapolative expectations, which may have gained traction during the boom period, and served as a source of non-fundamental housing demand.

II. Data Description

We focus on the recent U.S. housing cycle of the 2000s because 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, as they were asynchronous and experienced by only a few cities.

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 test the housing speculation hypothesis across different zip codes.

Table 1 provides summary statistics for a set of variables used in our analysis.

Housing speculation. The Home Mortgage Disclosure Act (HMDA) data set includes comprehensive individual mortgage application and origination data for the U.S. It discloses owner occupancy for each individual mortgage and indicates whether the mortgage is for a primary

[5] It is reassuring that 16 of the 25 MSAs they identify with the largest structural breaks are in states that do not tax capital gains, and that these breaks are identified in the 2004 to 2006 period we classify as the housing boom. Specifically, these MSAs are Flagstaff, Phoenix, Tucson, and Yuma AZ, Daytona Beach, Fort Walton Beach, Lakeland, Naples, Fort Myers, Ocala, Orlando, and Pensacola, FL, Las Vegas and Reno, NV, and Odessa and Wichita Falls, TX.

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.[6] We consider the fraction, as opposed to the level, to be the appropriate measure of speculation that is comparable across U.S. zip codes because it takes into account the relative sizes of the local housing markets and the housing booms that they experienced. 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 as the other two cities, remained below 7% during this period.

Capital gains instrument. We use the 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 based on the historical tax schedule in these states for 2004 to 2006. The first is a tax dummy variable for the extensive margin, which indicates the lack of state-level capital gains taxation in nine states: Alaska, Florida, Nevada, New Hampshire, South Dakota,

[6] 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 the HMDA data with which we are able to conduct a nationwide analysis of housing markets.

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 nine 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 had 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 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. As noted by Ferreira and Gyourko (2011), the start of the house price boom was not well synchronized

across the U.S. 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.[7]

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 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 interested in the construction industry as it is directly related to the supply side in housing markets. We also follow Mian and Sufi (2014) to identify non-tradable industries because they produce non-tradable goods and services, which reflect the strength of local demand. Alternatively, we examine the retail and restaurant industries, which rely on local consumption. We also compare the growth in employment in small (fewer than 50 employees) versus large (more than 50 employees) establishments. Finally, following Adelino, Schoar, and Severino (2016), we classify industries into those with high versus low start-up capital requirements.

New housing supply. To measure supply-side activities in local housing markets, 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, such as housing starts and

[7] 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.

housing completions, building permits are more detailed and available at the county level. In addition, building permits are issued before housing starts and can therefore predict price trends in a timely manner.[8] Nevertheless, a potential weakness of this measure is that 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 housing units in 2000.[9] 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, 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 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 on 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 ended 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 government sponsored entities (GSEs). We consequently can also control for the mortgage denial rate and the

[8] 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.

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

share of mortgages sold to GSEs in 2005 at the zip code level.[10] The mortgage denial rate has a mean of 13.9% and the fraction of GSE mortgages has a mean of 19.3%.[11]

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 to 2006 and the fraction of subprime mortgages in 2005 is only 0.004 and is insignificant. This suggests that housing speculation is a phenomenon largely independent of the credit expansion to subprime households. Instead, our measure of housing speculation captures the purchases of second homes by relatively wealthier households in booming areas.

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.[12]

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

In addition, we control for whether a state is one of the so-called "sand states" (Arizona, California, Florida, and Nevada), and whether the state has non-recourse mortgage laws. As highlighted, for instance, by Nathanson and Zwick (2015) and Choi et al. (2016), the sand states experienced phenomenal housing cycles in comparison to the rest of the U.S. in such outcomes as

[10] 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.

[11] 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.

[12] 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.

mortgage origination, defaults, and housing price fluctuations.[13] The nature of the mortgage laws in a given state has been found to be an important predictor of real outcomes by in the housing market (Dobbie and Goldsmith-Pinkham (2014)) and of speculative activity in the housing market (Nam and Oh (2016)).

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 an equal-weighting scheme instead. 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, 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 between more intensive housing speculation and subsequent greater housing price drops.

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

[13] In the Internet Appendix, we rerun all of our regressions excluding the four sand states for robustness. It is reassuring that our results are not affected by their exclusion.

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 44.34 provides reassurance that the tax dummy variable is a valid instrument, with regard to relevance, for the fraction of non-owner-occupied home purchases.

The coefficient of the 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, as highlighted, for instance, in Mian and Sufi (2009) and Keys et al. (2009). Interestingly, the dummy identifying the four sand states of Arizona, California, Florida, and Nevada is insignificant and is likely a result of the low level of speculation that California experienced during this period that was well below the national average.

We next analyze the causal effect of housing speculation on price contraction 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.

Column (2) shows the IV coefficient estimate 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 a 2.2% 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 21.4%. 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 Saiz's

elasticity measure, suggesting larger price reversals occurred in more inelastic areas. It is also significantly and positively correlated with 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 6.44, 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, the median household income in 2000, and the population change in 2003 to 2006. In addition, the sand states also experienced steeper price declines than the rest of the U.S., as found in Choi et al. (2016).

We also report two sets of robustness results in the Online Appendix. First, Table A2 reports similar results to Table 2 when using the continuous tax rate variable as an alternative instrument. For the analysis hereafter, we always report the results using the continuous tax rate variable as our instrument in the Online Appendix. A table in Appendix A of the Online Appendix corresponds to every table hereafter in the main paper that uses the alternative tax instrument.

Second, Table B2 reports similar results to Table 2 by excluding the four sand states. As two of the four sand states, Florida and Nevada, have no capital gains taxes, this raises a potential concern that the effect of housing speculation on the price decline might be driven by these two sand states. Table B2 invalidates this concern by using either the tax dummy instrument in Panel A or the continuous tax instrument in Panel B.

B. Economic Recession

Beyond the direct impact of housing speculation on housing price declines, we also explore its effects on local economic activities during the housing bust. Growing empirical literature, including Mian and Sufi (2011, 2014), Stumpner (2016), Hurst et al. (2016), has found severe real economic consequences of the U.S. housing cycle during the recent recession. Motivated by these studies, we examine to what extent housing market speculation contributed to the slowdown in local economic activities. After investigating its impact on real outcomes, we then explain how housing speculation propagated to the real economy by examining several potential transmission mechanisms highlighted in the literature.

We examine the economic consequences of housing speculation by again using the instrumental variable method. We 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, which is shown in column (3), is most heavily affected by local housing speculation during the boom: a decrease of 86.2 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 8.5% in real payroll.

Employment and income per capita also decrease to a large extent, with the coefficient estimates of -0.856 and -0.704 in columns (4) and (1), 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 8.4% and 6.9% in employment and income per capita, respectively. Finally, the change in the number of establishments, shown in column (2), is the most modest, although the effect is still economically meaningful: a one-percent increase in housing speculation implies a decrease of 48.5 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 4.8% 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. 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 and the median income of households in 2000, are statistically significant and

negatively correlated across economic outcomes during the bust. The growth in population and per capita income during the boom, with the exception of subsequent real per capita 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. Furthermore, states with non-recourse mortgage laws experienced a small decline in employment during the bust, and sand states experienced worse declines in payroll and employment than the rest of the U.S.

Table A3 in the Online Appendix shows that the results reported in Table 3 remain robust when using the continuous tax variable as the instrument, and Table B3 shows similar results when excluding the four sand states.

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 may have led not only to supply overhang from overbuilding that reduced residential construction during the bust, but also to greater housing price declines, which further depressed household consumption and the balance sheets 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, a collateral channel, and an intermediary balance sheet channel, respectively. In doing so with our instrumental variable approach, we are able to provide evidence on the relevance of several of these mechanisms in transmitting the housing speculation effect.

A. Supply Overhang

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 resulted in a contraction

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. Given that the Census Bureau provides building permit data only 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 vividly 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 19.65 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 61.5 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 6.1% in the new housing supply between 2004 and 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, fewer 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. Interestingly, while sand states saw a larger increase in the fraction of non-owner occupied home purchases during the boom, they did not necessarily have larger increases in their housing supply.

Supply overhang can both exacerbate the subsequent housing price bust and reduce demand for new housing, leading to a large decline in construction activity 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 18.7% in construction-sector employment.

However, the drag on the construction sector cannot explain all of the economic impacts of speculation. In column (2), we also examine the change in employment in all industries except the construction sector. The result is still both statistically and economically significant. A one-percent increase in housing speculation during the housing boom decreases non-construction employment by 69.5 basis points during the housing bust, or equivalently, one standard deviation of the fraction of non-owner-occupied home purchases across zip codes is associated with a decrease of 6.9% 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. Those with higher mortgage denial rates during the boom also saw less of a decline in construction employment during the bust. 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 urban rate 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. In addition, while sand states did not, on average, have more new construction during the boom than the rest of the U.S., they did experience a greater contraction in construction employment during the bust.

B. Local Demand

To further examine the effects of housing speculation on the non-construction sectors, we now specifically focus on non-tradable industries. We use the classification of non-tradable and tradable industries from Mian and Sufi (2014),[14] who define these sectors based on the industry's geographical concentration. As non-tradable sectors serve local areas, their locations tend to be dispersed. As tradable sectors supply goods to meet national demand, however, they should be more concentrated in order to take advantage of economic scale and specific resources. Alternatively, we examine the restaurant and retail sectors, which mainly rely on local demand. By analyzing these sectors, we can test whether housing speculation affected 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 non-tradable sectors in column (1), and the retail and restaurant sectors in column (3), during the bust period using our IV method. The instrumented housing speculation is negatively associated with these employment changes at the 1% significance level: a one-percent increase in housing speculation during the housing boom is associated with a decrease of 96.1 basis points in the employment in non-tradable sectors during the housing bust, and 95.3 basis points in the retail and restaurant sectors. An increase of one standard deviation in the share of non-owner occupied home purchases in 2004 to 2006 led to a decrease of 9.5% in the employment of non-tradable sectors in 2007 to 2009, and of 9.4% in the employment of retail and restaurant sectors, specifically. These economic magnitudes are larger than that for overall employment change reported in column (4) of Table 3 and for non-construction employment change in column (2) of Table 5. This strong effect on the non-tradable

[14] For the detailed classification, refer to Appendix Table 1 of Mian and Sufi (2014).

sectors, whether broadly or narrowly defined, indicates that housing speculation during the housing boom has a substantially adverse effect on local demand during the housing bust.

For comparison, we also include the estimates for the employment change in tradable industries in column (2) and the employment change in industries other than retail and restaurant in column (4). Housing speculation has an insignificant effect on the employment of tradable industries and a moderate impact (52.9 basis points) on industries other than retail and the restaurant business. As employment in these sectors relies more on national demand, the adverse effects of local housing speculation are much weaker for these industries.

Several controls are also significant in explaining the decline in employment shown in Table 6. Interestingly, the negative impact of the subprime boom was felt mainly by firms in the non-tradable sectors. The increases in per capita income, population, real payroll, 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 for the non-tradable sectors and for sectors other than restaurant and retail. Local demographics, such as the log population, the fraction of white households, and the median household income in 2000 are also significantly, though negatively, correlated with the change in employment from 2007 to 2009 in the non-tradable sectors. In addition, the negative and significant coefficient on the employment change during the boom suggests a strong reversal occurred during the bust.

C. Collateral Channel

We now examine the impact of housing speculation on real activity through the collateral channel. Even firms 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.[15] Indeed, as highlighted by Schmalz, Sraer, and Thesmar (2015) and Adelino, Schoar, and Severino (2016), the decline in housing prices particularly

[15] 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 on smaller establishments.

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 hit harder by the housing bust as a consequence of housing speculation.

As the Zip Business Pattern provides a breakdown of the size of establishments, we regress the employment change in 2007 to 2009 for the small versus large establishments on the instrumented housing speculation in 2004 to 2006. Columns (1) and (2) of Table 7 report the regression results for establishments with less than 50 employees (small-sized firms) and those with more than 50 employees (large-sized firms), respectively.[16] Interestingly, the impact of housing speculation is greater on the large-sized firms (with the coefficient estimate of -0.885) than on the small-sized firms (with the coefficient estimate of -0.518). This contrast does not support the collateral channel as a central transmission mechanism for the adverse effect of housing speculation on real activity during the housing bust. That larger firms suffered more adverse real consequences from housing speculation further supports that the economic consequences of housing speculation were not simply a reflection of the widespread credit market freeze that occurred during the housing bust.

In addition to comparing small versus large establishments, we also classify industries into those with high versus low requirements for start-up capital, following Adelino, Schoar, and Severino (2016), who split the two-digit NAICS industry levels above and below the median amount of the start-up capital required by firms in the 2007 Survey of Business Owners (SBO) Public Use Microdata Sample (PUMS).[17] Consistent with our findings for small versus large firms, columns (3) and (4) of Table 7 reveal that firms with high start-up capital, which are unlikely to be funded with housing collateral, experienced worse economic outcomes than their low start-up capital counterparts. Again, we do not find evidence that housing speculation propagated to the real economy through the collateral channel.

[16] 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 the Family Medical & Leave Act (FMLA). Our results are robust to other size cutoffs between small and large firms.

[17] See Online Appendix Table 5 in Adelino, Schoar, and Severino (2016) for the amount of start-up capital by two-digit NAICS industry.

Many of our controls are significant across our 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 small firms and across start-up capital requirements. 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. The real payroll and employment changes during the boom have significant explanatory power for the change in employment at larger firms across start-up capital requirements during the bust, having positive and negative impacts, respectively.

D. Intermediary Channel

Another potential channel is through the balance sheets of financial intermediaries. Gan (2007) shows that Japanese banks responded to the collapse of the Japanese housing bubble by reducing commercial lending, which in turn 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 prices 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. 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.

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 in the top 25% in terms of the average fraction of bank deposits in our sample.[18] If the intermediary channel is important

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

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 variable indicating the local banking zip codes. We expect to observe a significantly negative coefficient on this interaction term, given that 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 can be seen in Table 3 of Section III, many controls are significant across the regressions, and these results mirror those presented in Table 3. Overall, this test thus provides little evidence in support of the intermediary channel as the mechanism by which speculation in the housing market propagated to the real economy.

For robustness, we also test the bank balance sheet channel by interacting our instrumented measure of housing speculation with two measures of the fragility of bank balance sheets. The first is the fraction of a bank's assets that are liquid (cash and marketable securities), and the second is its cost of deposits, defined as the total interest expense on deposits as a fraction of total deposits.[19] We define zip codes with low liquidity as those ranked in the bottom 25% of zip codes in their fraction of liquid assets, and similarly with high deposit cost zip codes. Table C1 in the Online Appendix reports the regression results. If the bank balance sheet channel caused housing speculation to have real economic consequences, we would expect zip codes with more illiquid and higher deposit cost banks to experience more severe economic contractions, as these are the banks for which balance sheet impairment from a housing price bust would limit their ability to lend to firms and households. We again see that none of the interaction terms in Panels A and B are significantly negative, inconsistent with the prediction by the intermediary channel. These findings confirm that housing speculation did not impact local economic outcomes by impairing the balance sheets of banks.

[19] These two measures are employed, for instance, in Loutskina and Strahan (2009) and Gilje, Loutskina, and Strahan (2016), and are constructed at the zip code level from "Call Report" Reports on Income and Condition for commercial banks for banks located in that zip code.

Taken together, our results suggest that housing speculation had real economic consequences during the recent recession primarily through the supply overhang channel and the local demand channel. Since employment in residential construction contributes to local demand, it is likely that these two channels are complementary, and it is reassuring that we find that both are significant in contributing to the severity of the local recession. In contrast, we find little evidence that speculation transmitted to the real economy by reducing the value of housing collateral available to small businesses to finance their operations or by impairing the balance sheets of intermediaries. While these other channels may have played a substantial role in magnifying the severity of the recent recession as a result of the bust of the U.S. housing cycle, as prior research has shown, our findings clarify that their impact did not arise as an adverse consequence of housing speculation during the boom.

V. Extrapolation and Speculation

While we have explored many of the consequences of housing speculation during the bust, it remains to be addressed what drove housing speculation during the boom period. Glaeser (2013) highlights that speculation has been a common and natural feature of real estate markets historically. Rational speculators may, for instance, participate in housing markets when they have superior 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. Wheaton and Nechayev (2008) show that a regression forecasting housing price appreciation systematically underestimates the realized housing price growth between 1998 and 2005, and that these forecast errors are positively correlated with the percentage of home sales attributed to investors and second home buyers within a MSA. Gao, Sockin and Xiong (2015) develop a theoretical model to show that supply elasticity may affect the information aggregation in the housing market when home builders, buyers, and speculators possess private information about the quality of a neighborhood. 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) conclude 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) suggest 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 markets 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 one-year-lagged housing price changes from 2000 to 2006, as well as a host of controls including the year fixed effect. We expect that states without capital gains taxation would be more susceptible to housing speculation, given that speculators can benefit more from capital gains from investing in housing. Table 9 shows that past housing price increases significantly predict a higher fraction of non-owner-occupied home purchases, providing evidence of extrapolation, while our capital gains tax predicts a lower fraction. More important, the coefficient of their interaction terms is both strongly negative and statistically significant at the 1% level, suggesting that housing speculation at the zip code level in states without capital gains taxes reacted more strongly to past housing price changes. Given that we control for local economic fundamentals known to drive housing price growth, 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 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 estimate is negative, which supports the analysis of Haughwout et al. (2011) that speculators tended to be non-prime borrowers buying secondary homes.

For robustness, in Table C2 of the Online Appendix we also report results from an alternative 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. In addition, in Table A9 we instead use the continuous tax variable as the instrument. The results are very similar to those reported in Table 9.[20] Overall, our analysis highlights one potential channel that can help explain the cross-sectional variation in speculation in housing markets during the recent U.S. housing cycle.

VI. Conclusion

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 local household demand. We find little evidence that speculation impaired local economic conditions by reducing the value of housing collateral deployed by small businesses to finance their operations or by tarnishing the balance sheets of local intermediaries. Finally, we provide evidence linking housing speculation to extrapolation by speculators of past housing price changes, identifying a channel by which this behavioral bias may have impacted the real economy during the recent recession.

[20] Our results on extrapolation are also similar if we interact one minus the tax rate with the lagged price change, which captures the benefit from speculation. We display the results for the tax burden for consistency with our previous use of our tax instruments.

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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.

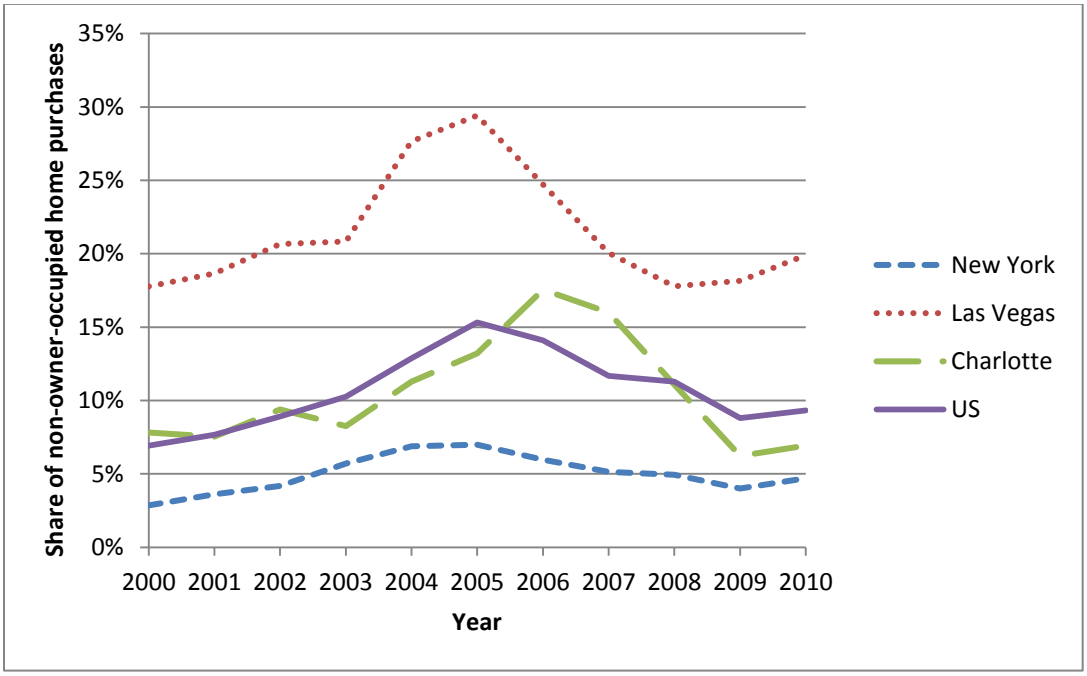
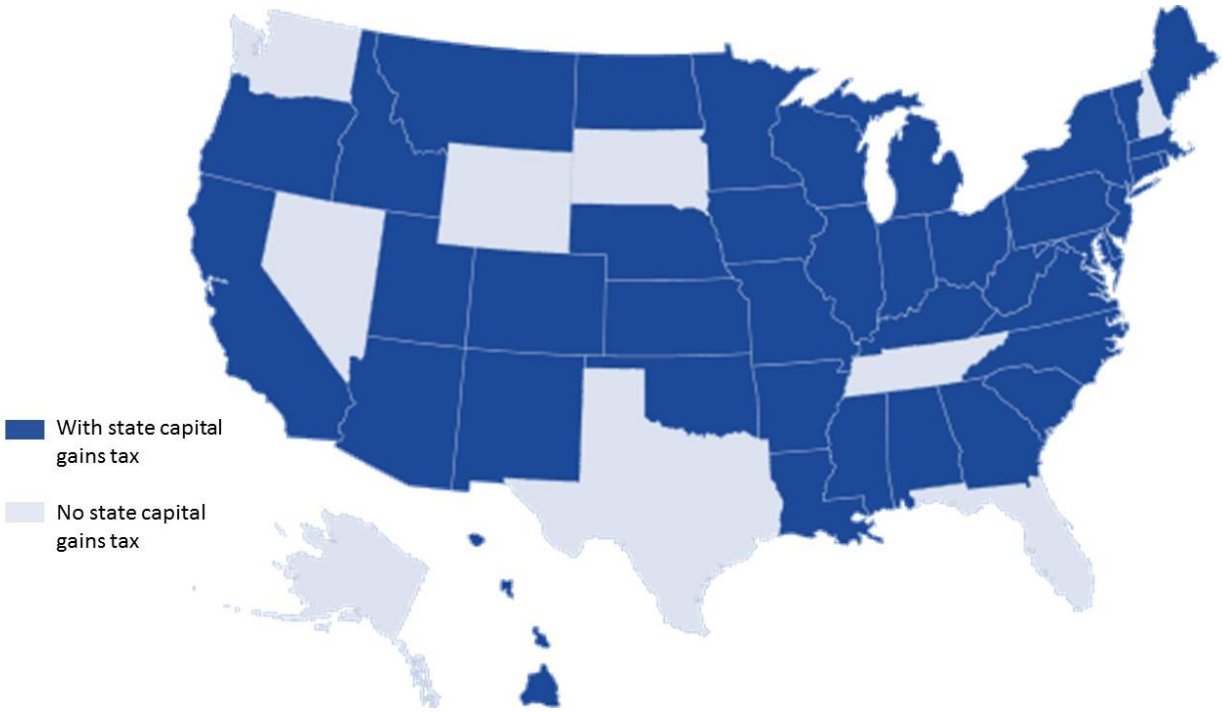


Figure 2: Distribution of Capital Gains Tax across U.S. States

Panel A: State capital gains tax



Panel B: Marginal state tax rates on capital gains for state median income in 2005

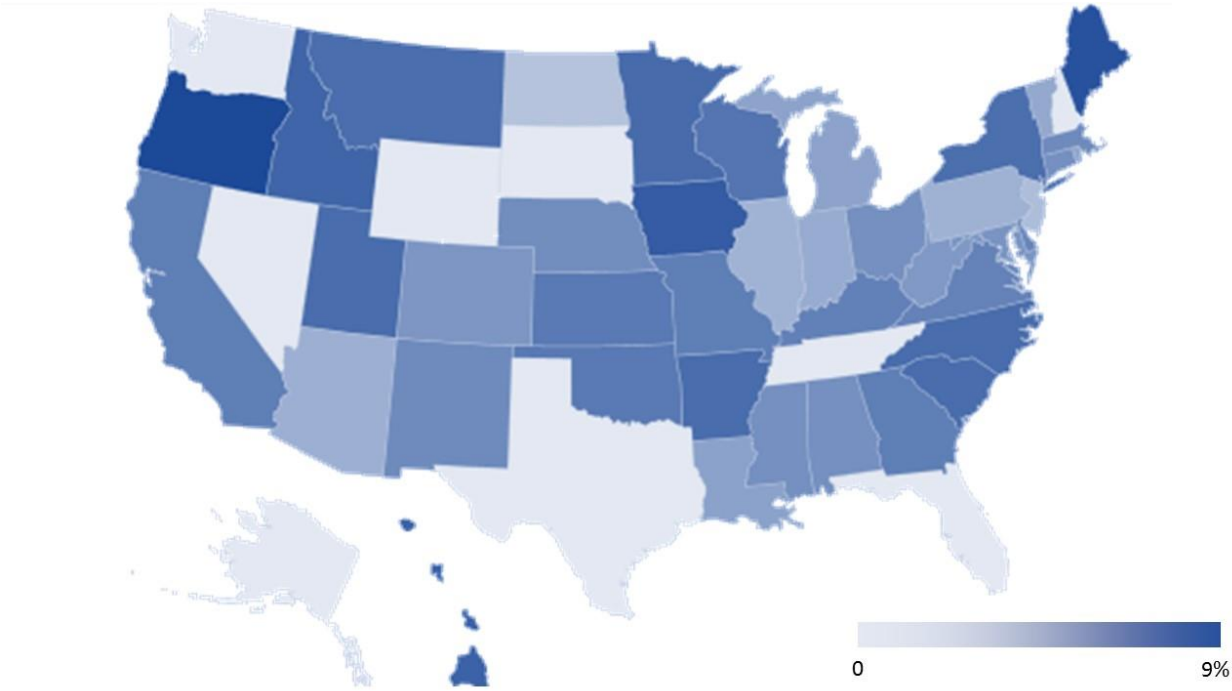


Figure 3: Case-Shiller Home Price Index

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.

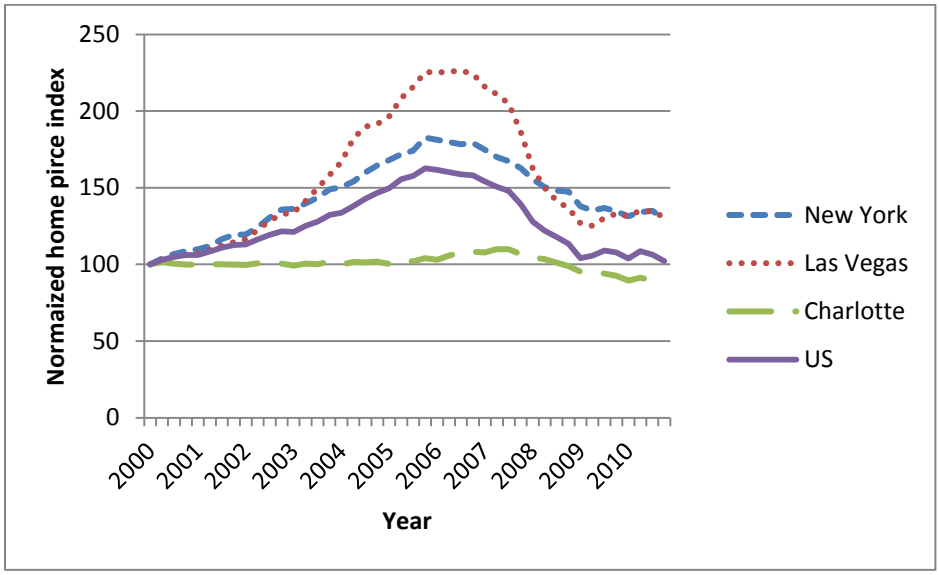


Figure 4: New Housing Supply

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.

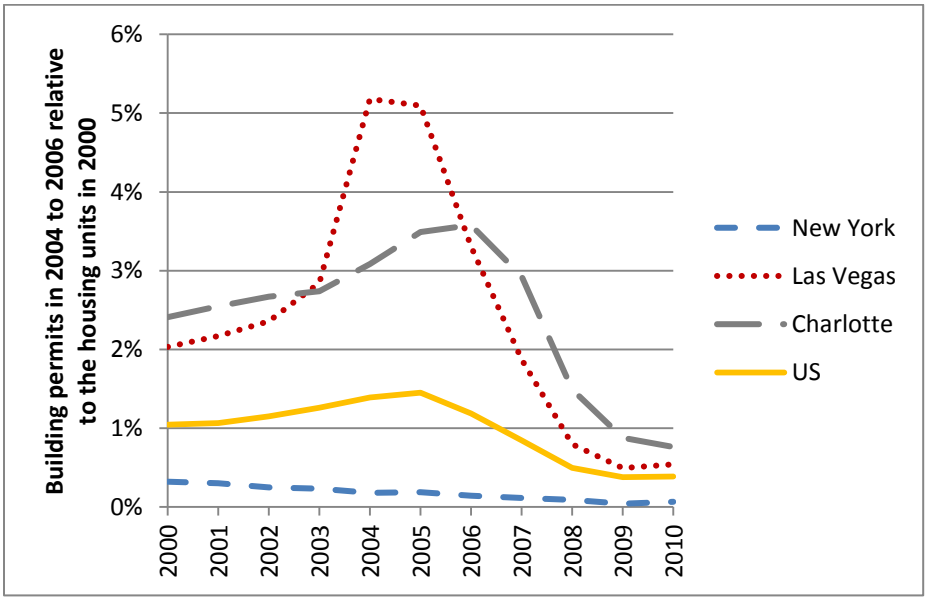


Figure 5: Speculation and Subprime Households

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.

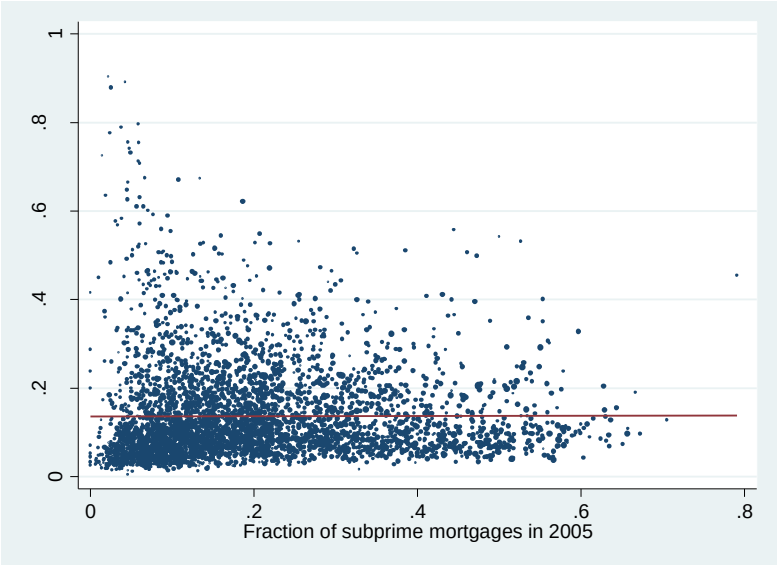


Figure 6: Speculation and Housing Price Decline

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.

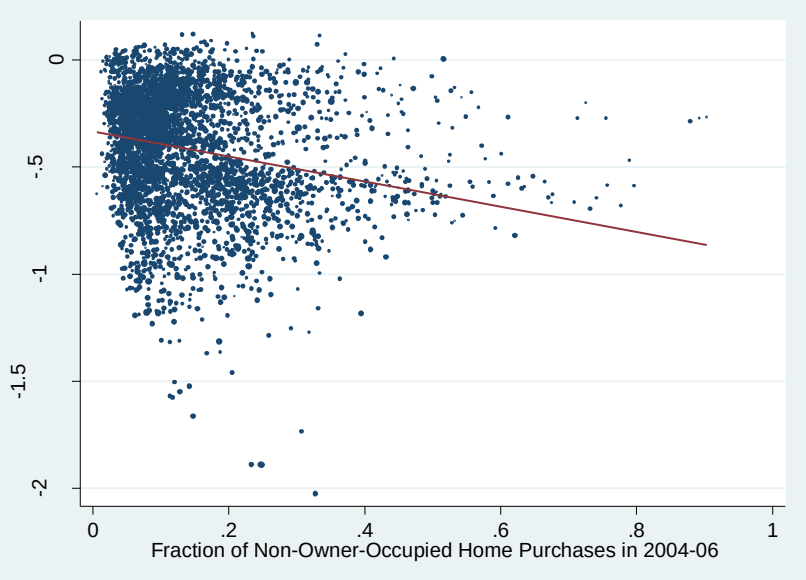


Figure 7: Speculation and New Housing Supply

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.

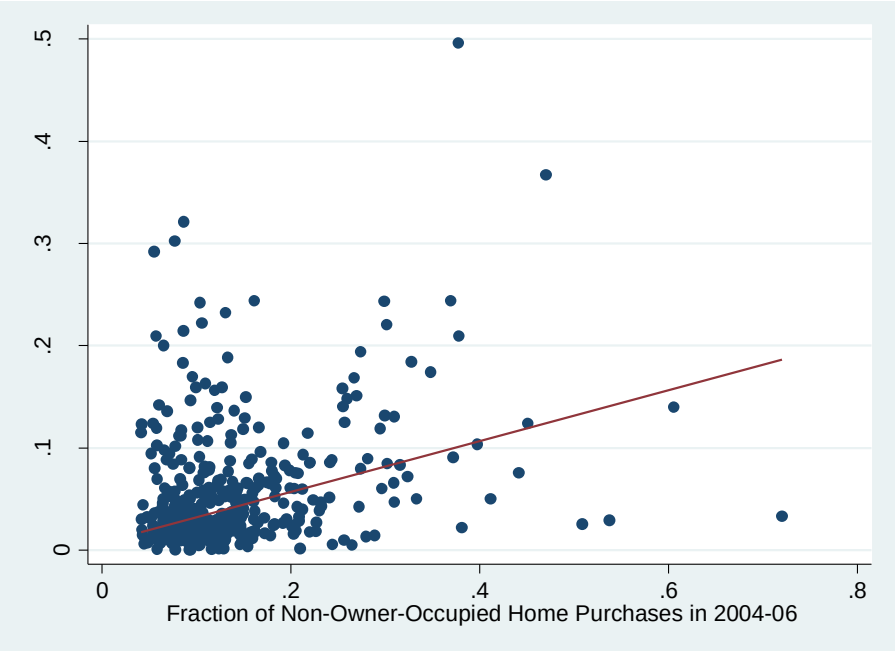


Table 1 Summary Statistics

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 gains 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 gains 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	-0.0820***	
gains tax	(0.0153)	
Fraction of Non-Owner-Occupied		-2.176***
Home Purchases in 2004-06		(0.410)
Saiz's elasticity	0.0308***	0.0866***
	(0.00814)	(0.0151)
Fraction of subprime mortgages in	-0.247***	-1.455***
2005	(0.0631)	(0.226)
Mortgage denial rate in 2005	0.322***	-0.0717
	(0.0917)	(0.659)
Fraction of GSE mortgages in 2005	-0.224***	-0.498**
	(0.0429)	(0.223)
Per capita income change in 2003-06	0.0841**	0.244*
	(0.0320)	(0.135)
Population change in 2003-06	-0.0555***	-0.298***
	(0.0158)	(0.0778)
Change in no. of establishments in	0.113***	0.237**
2004-06	(0.0298)	(0.114)
Real payroll change in 2004-06	0.0244**	0.0627*
	(0.0106)	(0.0381)
Employment change in 2004-06	0.00217	-0.0596
	(0.0115)	(0.0374)
Ln of population in 2000	-0.0206***	-0.0453**
	(0.00581)	(0.0181)
Fraction of the college educated in	0.000483	0.00142
2000	(0.000301)	(0.000945)
Fraction of the employed in 2000	0.000717	-0.000575
	(0.00233)	(0.00885)
Fraction of workforce in 2000	-0.00271	-0.000929
	(0.00231)	(0.00854)
Median household Income in 2000	-0.00000196***	-0.00000547***

	(0.000000254)	(0.00000112)
Poverty rate in 2000	0.00195***	0.00390
	(0.000686)	(0.00243)
Urban rate in 2000	0.000804***	0.00128*
	(0.000154)	(0.000674)
Fraction of the white in 2000	-0.0000663	-0.00254***
	(0.000209)	(0.000938)
Dummy for states with non-recourse	-0.0187	0.0669
mortgage law	(0.0141)	(0.0414)
Sand states	0.0121	-0.296***
	(0.0196)	(0.0481)
Constant	0.538***	1.032***
	(0.0936)	(0.276)
Observations	3941	3941
R-squared	0.509	0.440

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 gains 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	-0.704***	-0.485***	-0.862***	-0.856***
Home Purchases in 2004-06	(0.165)	(0.0645)	(0.142)	(0.133)
Saiz's elasticity	-0.00651	0.00216	0.0211***	0.0188***
	(0.00605)	(0.00336)	(0.00707)	(0.00584)
Fraction of subprime mortgages	-0.239***	-0.161***	-0.227***	-0.245***
in 2005	(0.0575)	(0.0308)	(0.0729)	(0.0577)
Mortgage denial rate in 2005	-0.0887	0.0461	0.214	0.268***
	(0.124)	(0.0520)	(0.138)	(0.101)
Fraction of GSE mortgages in	-0.0895*	-0.0386	-0.112	-0.0994*
2005	(0.0492)	(0.0353)	(0.0686)	(0.0561)
Per capita income change in	-0.187***	0.101***	0.199***	0.146***
2003-06	(0.0680)	(0.0223)	(0.0447)	(0.0481)
Population change in 2003-06	-0.168***	0.171***	0.128***	0.122***
	(0.0530)	(0.0216)	(0.0410)	(0.0359)
Change in no. of establishments	0.196***	0.186***	0.486***	0.535***
in 2004-06	(0.0502)	(0.0315)	(0.0958)	(0.0773)
Real payroll change in 2004-06	0.0258	0.0239*	-0.122***	0.151***
	(0.0168)	(0.0129)	(0.0458)	(0.0373)
Employment change in 2004-06	-0.00842	-0.00776	-0.00348	-0.300***
	(0.0129)	(0.0129)	(0.0344)	(0.0358)
Ln of population in 2000	-0.0244***	-0.0101***	-0.0198**	-0.0230***
	(0.00566)	(0.00381)	(0.00809)	(0.00585)
Fraction of the college educated	-0.00114***	0.000432**	0.00217***	0.00137***
in 2000	(0.000356)	(0.000169)	(0.000440)	(0.000319)
Fraction of the employed in 2000	-0.00321	-0.00433***	-0.0106***	-0.00722***
	(0.00255)	(0.00151)	(0.00335)	(0.00257)
Fraction of workforce in 2000	0.00284	0.00357**	0.00874***	0.00573**
	(0.00262)	(0.00154)	(0.00315)	(0.00256)
Median household Income in	-0.00000187***	-0.000000860***	-0.00000259***	-0.00000196***
2000	(0.000000401)	(0.000000216)	(0.000000551)	(0.000000465)
Poverty rate in 2000	0.000729	0.000875*	0.000987	0.00136

	(0.000831)	(0.000486)	(0.00121)	(0.000934)
Urban rate in 2000	-0.0000229	0.000517***	0.00130***	0.001000***
	(0.000208)	(0.000118)	(0.000278)	(0.000250)
Fraction of the white in 2000	-0.00124***	-0.000431***	-0.000462	-0.000395*
	(0.000234)	(0.000129)	(0.000349)	(0.000224)
Dummy for states with non-	-0.00513	0.00290	0.0187*	0.0192**
recourse mortgage law	(0.0102)	(0.00563)	(0.0111)	(0.00969)
Sand states	-0.0224	-0.00807	-0.0484***	-0.0508***
	(0.0139)	(0.00811)	(0.0129)	(0.0115)
Constant	0.557***	0.174***	0.253**	0.294***
	(0.0990)	(0.0614)	(0.117)	(0.102)
Observations	3940	3910	3910	3910
R-squared	0.262	0.134	0.035	0.045

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 gains 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 gains 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 gains tax	-0.0648***	
	(0.0137)	
Fraction of Non-Owner-Occupied Home Purchases in 2004-06		0.615***
		(0.103)
Saiz's elasticity	-0.00000697	0.00890**
	(0.00717)	(0.00366)
Ln of population in 2000	-0.0170**	0.00185
	(0.00770)	(0.00418)
Fraction of the college educated in 2000	0.00155**	-0.00273***
	(0.000630)	(0.000516)
Fraction of the employed in 2000	0.00470	0.00451
	(0.00761)	(0.00384)
Fraction of workforce in 2000	-0.00799	-0.000943
	(0.00760)	(0.00388)
Median household Income in 2000	-0.00000473***	0.00000379***
	(0.000000751)	(0.000000814)
Poverty rate in 2000	-0.00525***	0.00426***
	(0.00194)	(0.00138)
Urban rate in 2000	0.00117**	-0.000907**
	(0.000514)	(0.000354)
Fraction of the white in 2000	-0.000381	0.000105
	(0.000451)	(0.000239)
Dummy for states with non-recourse mortgage law	-0.00845	-0.000463
	(0.0121)	(0.00662)
Sand states	0.0405**	0.00944
	(0.0202)	(0.0105)
Constant	0.791***	-0.366***

	(0.151)	(0.129)
Observations	323	323
R-squared	0.473	0.314

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 gains 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	-1.898***	-0.695***
Home Purchases in 2004-06	(0.255)	(0.138)
Saiz's elasticity	-0.0109	0.0181***
	(0.0154)	(0.00663)
Fraction of subprime mortgages in	-0.775***	-0.190***
2005	(0.141)	(0.0572)
Mortgage denial rate in 2005	0.727**	0.150
	(0.288)	(0.108)
Fraction of GSE mortgages in 2005	-0.274*	-0.0796
	(0.153)	(0.0542)
Per capita income change in 2003-06	0.301**	0.128***
	(0.120)	(0.0467)
Population change in 2003-06	0.164	0.123***
	(0.119)	(0.0329)
Change in no. of establishments in	-0.130	0.656***
2004-06	(0.160)	(0.0796)
Real payroll change in 2004-06	0.0339	0.152***
	(0.0925)	(0.0379)
Employment change in 2004-06	-0.216**	-0.278***
	(0.0910)	(0.0360)
Ln of population in 2000	-0.0262	-0.0245***
	(0.0166)	(0.00626)
Fraction of the college educated in	0.00172*	0.000532*
2000	(0.000940)	(0.000290)
Fraction of the employed in 2000	-0.00886	-0.00708**
	(0.00742)	(0.00285)
Fraction of workforce in 2000	0.00792	0.00621**
	(0.00736)	(0.00290)
Median household Income in 2000	-0.00000399***	-0.00000127***
	(0.00000111)	(0.000000477)
Poverty rate in 2000	0.00450**	0.00139
	(0.00210)	(0.000963)

Urban rate in 2000	0.00175***	0.000513*
	(0.000564)	(0.000282)
Fraction of the white in 2000	-0.00189***	-0.000177
	(0.000726)	(0.000234)
Dummy for states with non-recourse	0.0359*	0.0138
mortgage law	(0.0215)	(0.00939)
Sand states	-0.153***	-0.0316***
	(0.0289)	(0.0116)
Constant	0.473*	0.282***
	(0.267)	(0.100)
Observations	3939	3908
R-squared	0.090	0.076

Table 6: Effect of Housing Speculation: Demand Channel

This table reports the two stage least squares regressions of the employment change in non-tradable and tradable 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 gains tax. Columns 1 and 2 present the coefficients for non-tradable and tradable industries respectively defined by Mian and Sufi (2014). Columns 3 and 4 present the results for retail and restaurant sectors and industries other than these two sectors, respectively. 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 change in non-tradable industries in 2007-09	(2) Employment change in tradable industries in 2007-09	(3) Retail and restaurant employment change in 2007-09	(4) Employment change in industries other than retail and restaurant in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.961***	0.148	-0.953***	-0.529***
	(0.149)	(0.418)	(0.137)	(0.187)
Saiz's elasticity	0.0130**	0.00466	0.0118	0.0188**
	(0.00645)	(0.0155)	(0.00733)	(0.00809)
Fraction of subprime mortgages in 2005	-0.304***	0.122	-0.289***	-0.131
	(0.0611)	(0.152)	(0.0622)	(0.0826)
Mortgage denial rate in 2005	0.0582	-0.122	0.0957	0.146
	(0.125)	(0.363)	(0.125)	(0.156)
Fraction of GSE mortgages in 2005	-0.122*	0.0576	-0.121*	-0.0249
	(0.0708)	(0.194)	(0.0709)	(0.0667)
Per capita income change in 2003-06	0.200***	0.0535	0.189***	0.0932*
	(0.0524)	(0.134)	(0.0578)	(0.0544)
Population change in 2003-06	0.178***	0.193**	0.187***	0.120**
	(0.0419)	(0.0968)	(0.0385)	(0.0554)
Change in no. of establishments in 2004-06	0.538***	-0.0590	0.534***	0.680***
	(0.0607)	(0.202)	(0.0572)	(0.131)
Real payroll change in 2004-06	0.114***	0.0833	0.117***	0.150***
	(0.0438)	(0.122)	(0.0424)	(0.0407)
Employment change in 2004-06	-0.130***	-0.133	-0.140***	-0.326***
	(0.0470)	(0.122)	(0.0448)	(0.0457)
Ln of population in 2000	-0.0205***	0.0222	-0.0228***	-0.0222***
	(0.00762)	(0.0225)	(0.00769)	(0.00806)
Fraction of the college educated in 2000	-0.000456	0.00142	-0.000369	0.000904***
	(0.000544)	(0.00109)	(0.000521)	(0.000347)
Fraction of the employed in 2000	-0.00552*	-0.00744	-0.00709**	-0.00507
	(0.00297)	(0.00827)	(0.00348)	(0.00381)
Fraction of workforce in	0.00431	0.0122	0.00594*	0.00441

2000	(0.00310)	(0.00811)	(0.00358)	(0.00383)
Median household Income	-0.00000131**	-0.000000614	-0.00000148***	-0.000000987
in 2000	(0.000000544)	(0.00000157)	(0.000000514)	(0.000000606)
Poverty rate in 2000	0.00264**	-0.00163	0.00171	0.00121
	(0.00104)	(0.00248)	(0.00107)	(0.00125)
Urban rate in 2000	0.000445	-0.00120	0.000595*	0.000417
	(0.000327)	(0.000868)	(0.000331)	(0.000377)
Fraction of the white in	-0.000730***	0.000231	-0.000670***	-0.0000692
2000	(0.000240)	(0.000673)	(0.000236)	(0.000290)
Dummy for states with non-	-0.0122	0.0107	-0.0104	0.0268**
recourse mortgage law	(0.0105)	(0.0262)	(0.00928)	(0.0115)
Sand states	-0.0110	0.0140	-0.0134	-0.0366***
	(0.0175)	(0.0352)	(0.0150)	(0.0132)
Constant	0.416***	-0.695*	0.420***	0.186
	(0.129)	(0.364)	(0.120)	(0.120)
Observations	3940	3856	3941	3905
R-squared	0.155	0.008	0.132	0.070

Table 7: Effect of Housing Speculation: Collateral Channel

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 gains tax. Columns 3 and 4 report the results for the industries with low versus high start-up capital amount. 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	(3) Employment (with low start-up capital) change in 2007-09	(4) Employment (with high start-up capital) change in 2007-09
Fraction of Non-Owner-Occupied Home Purchases in 2004-06	-0.518***	-0.885***	-0.593***	-0.761***
	(0.0669)	(0.321)	(0.153)	(0.127)
Saiz's elasticity	0.00476	0.0422***	0.00954	0.0131*
	(0.00394)	(0.0128)	(0.00683)	(0.00692)
Fraction of subprime mortgages in 2005	-0.127***	-0.143	-0.169***	-0.193***
	(0.0267)	(0.156)	(0.0606)	(0.0580)
Mortgage denial rate in 2005	0.0512	0.141	0.267**	0.0108
	(0.0608)	(0.290)	(0.127)	(0.0888)
Fraction of GSE mortgages in 2005	-0.0194	-0.00558	0.0525	-0.128**
	(0.0375)	(0.147)	(0.0659)	(0.0635)
Per capita income change in 2003-06	0.107***	0.188*	0.0927**	0.170***
	(0.0240)	(0.0978)	(0.0445)	(0.0399)
Population change in 2003-06	0.180***	0.105	0.171***	0.161***
	(0.0274)	(0.0641)	(0.0537)	(0.0300)
Change in no. of establishments in 2004-06	0.342***	0.886***	0.457***	0.455***
	(0.0389)	(0.176)	(0.0906)	(0.0593)
Real payroll change in 2004-06	0.0242	0.336***	0.131***	0.0747**
	(0.0199)	(0.0833)	(0.0320)	(0.0357)
Employment change in 2004-06	0.0171	-0.637***	-0.213***	-0.0830**
	(0.0209)	(0.0928)	(0.0329)	(0.0396)
Ln of population in 2000	-0.0110**	-0.0407**	-0.0232***	-0.0180***
	(0.00444)	(0.0171)	(0.00809)	(0.00618)
Fraction of the college educated in 2000	0.000226	0.00132*	0.000207	0.000755**
	(0.000190)	(0.000719)	(0.000348)	(0.000366)
Fraction of the employed in 2000	-0.00412**	-0.0109*	-0.00258	-0.00659**
	(0.00169)	(0.00650)	(0.00276)	(0.00327)
Fraction of workforce in 2000	0.00355**	0.0103	0.00151	0.00610*
	(0.00169)	(0.00659)	(0.00273)	(0.00342)

Median household Income	-0.000000869***	-0.00000169	-0.000000720	-0.00000180***
in 2000	(0.000000249)	(0.00000126)	(0.000000566)	(0.000000411)
Poverty rate in 2000	0.000988*	0.000640	0.00158*	0.000485
	(0.000512)	(0.00208)	(0.000824)	(0.00107)
Urban rate in 2000	0.000553***	-0.000248	0.000252	0.000728***
	(0.000145)	(0.000830)	(0.000317)	(0.000256)
Fraction of the white in	-0.000212	-0.000619	-0.000148	-0.000646***
2000	(0.000129)	(0.000427)	(0.000225)	(0.000210)
Dummy for states with	0.00683	0.0407*	0.0211**	-0.00207
non-recourse mortgage law	(0.00562)	(0.0222)	(0.00944)	(0.00964)
Sand states	-0.0186**	-0.0422	-0.0202	-0.0254*
	(0.00839)	(0.0275)	(0.0125)	(0.0139)
Constant	0.146**	0.435*	0.272**	0.263***
	(0.0684)	(0.248)	(0.113)	(0.101)
Observations	3939	3615	3941	3941
R-squared	0.167	0.027	0.069	0.017

Table 8: Real Effects of Housing Speculation: Banking Balance Sheet Channel

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 gains 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 Purchases in 2004-06	-0.676***	-0.491***	-0.829***	-0.851***
	(0.156)	(0.0623)	(0.151)	(0.140)
Interaction	-0.115	0.0264	-0.0936	0.00380
	(0.116)	(0.0616)	(0.143)	(0.104)
Dummy for areas with more local banks	0.0118	-0.00307	0.0191	0.00541
	(0.0171)	(0.00868)	(0.0219)	(0.0149)
Saiz's elasticity	-0.00655	0.00217	0.0209***	0.0187***
	(0.00605)	(0.00336)	(0.00720)	(0.00588)
Fraction of subprime mortgages in 2005	-0.239***	-0.161***	-0.226***	-0.244***
	(0.0568)	(0.0309)	(0.0730)	(0.0578)
Mortgage denial rate in 2005	-0.0895	0.0463	0.214	0.268***
	(0.124)	(0.0521)	(0.139)	(0.101)
Fraction of GSE mortgages in 2005	-0.0909*	-0.0384	-0.109	-0.0973*
	(0.0484)	(0.0352)	(0.0685)	(0.0554)
Per capita income change in 2003-06	-0.183***	0.0999***	0.200***	0.144***
	(0.0705)	(0.0228)	(0.0447)	(0.0471)
Population change in 2003-06	-0.169***	0.172***	0.127***	0.122***
	(0.0542)	(0.0219)	(0.0413)	(0.0358)
Change in no. of establishments in 2004-06	0.195***	0.186***	0.486***	0.535***
	(0.0495)	(0.0317)	(0.0952)	(0.0773)
Real payroll change in 2004-06	0.0246	0.0242*	-0.124***	0.150***
	(0.0170)	(0.0129)	(0.0464)	(0.0376)
Employment change in 2004-06	-0.00745	-0.00800	-0.00229	-0.299***
	(0.0132)	(0.0128)	(0.0345)	(0.0357)
Ln of population in 2000	-0.0241***	-0.0101***	-0.0203**	-0.0235***
	(0.00575)	(0.00382)	(0.00832)	(0.00608)
Fraction of the college educated in 2000	-0.00114***	0.000432**	0.00216***	0.00136***
	(0.000361)	(0.000168)	(0.000433)	(0.000316)
Fraction of the employed in 2000	-0.00337	-0.00429***	-0.0108***	-0.00721***
	(0.00250)	(0.00149)	(0.00333)	(0.00253)

Fraction of workforce in 2000	0.00300	0.00354**	0.00886***	0.00572**
	(0.00254)	(0.00152)	(0.00314)	(0.00253)
Median household Income in 2000	-0.00000189***	-0.000000856***	-0.00000257***	-0.00000194***
	(0.000000399)	(0.000000217)	(0.000000544)	(0.000000461)
Poverty rate in 2000	0.000678	0.000888*	0.000910	0.00134
	(0.000807)	(0.000479)	(0.00122)	(0.000927)
Urban rate in 2000	-0.0000258	0.000517***	0.00131***	0.00101***
	(0.000209)	(0.000118)	(0.000276)	(0.000250)
Fraction of the white in 2000	-0.00123***	-0.000431***	-0.000484	-0.000411*
	(0.000237)	(0.000130)	(0.000349)	(0.000221)
Dummy for states with non-recourse mortgage law	-0.00578	0.00302	0.0191*	0.0198**
	(0.00996)	(0.00558)	(0.0110)	(0.00943)
Sand states	-0.0217*	-0.00826	-0.0467***	-0.0501***
	(0.0131)	(0.00809)	(0.0132)	(0.0115)
Constant	0.552***	0.175***	0.252**	0.296***
	(0.0963)	(0.0607)	(0.118)	(0.102)
Observations	3940	3910	3910	3910
R-squared	0.258	0.135	0.036	0.047

Table 9: Extrapolation and Housing Speculation

This table 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 gains 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.

	(1)	(2)	(3)	(4)
	Fraction of Non-Owner-Occupied Home Purchases			
Lagged Real house price change	0.195**	0.206**	0.576***	0.527***
	(0.0830)	(0.0795)	(0.129)	(0.102)
Dummy with state capital gains tax			-0.0345*	-0.0284**
			(0.0200)	(0.0141)
Interaction			-0.510***	-0.516***
			(0.133)	(0.111)
Lagged Fraction of subprime mortgages		-0.0822		-0.107**
		(0.0520)		(0.0481)
Lagged Mortgage denial rate		0.512***		0.452***
		(0.0611)		(0.0564)
Lagged Fraction of GSE mortgages		0.0843*		0.0484
		(0.0446)		(0.0377)
Lagged Per capita income change in 2007-09		0.260***		0.152***
		(0.0459)		(0.0324)
Lagged Population change		-0.0688***		-0.0659***
		(0.0228)		(0.0220)
Lagged Change in no. of establishments		0.0597*		-0.0456*
		(0.0349)		(0.0271)
Lagged Real payroll change		0.0266***		0.0140**
		(0.00763)		(0.00568)
Lagged Employment change		-0.0222***		-0.0119**
		(0.00826)		(0.00596)
Dummy for states with non-recourse		-0.0123		-0.00922
mortgage law		(0.0109)		(0.0116)
Sand states		0.000191		0.0267
		(0.0204)		(0.0187)
Constant	0.0589***	-0.0178	0.0996***	0.0276
	(0.00499)	(0.0200)	(0.0190)	(0.0235)
Year fixed effect	Yes	Yes	Yes	Yes
Observations	26304	21478	22837	21478
R-squared	0.103	0.199	0.224	0.299