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Waking up from the American dream: on the experience of young Americans during the housing boom of the 2000s

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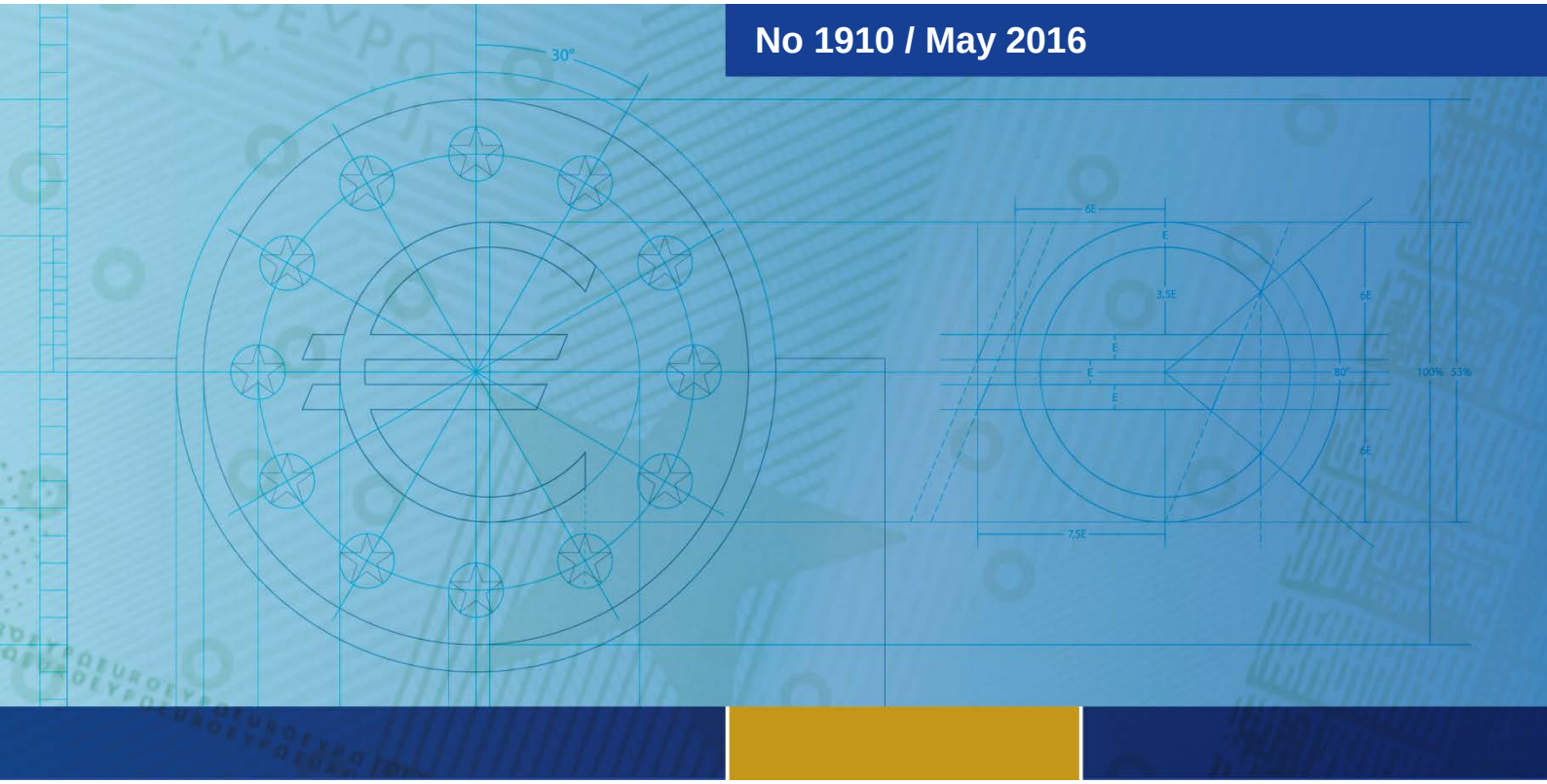

Abstract

We exploit regional variations in house price fluctuations in the United States during the early to mid-2000s to study the impact of the housing boom on young Americans' choices related to home ownership, household formation, and fertility. We also introduce a novel instrument for changes in house prices based on the predetermined industrial structure of the local economy. We find that in MSAs which experienced large increases in house prices between 2001 and 2006, the youngest households were substantially less likely to purchase residential property, to be married, and to have a child, both in 2006 and in 2011.

JEL classification: E32, G21, J10, R21.

Keywords: Credit constraints, house prices, home ownership, household formation, fertility.

Non-technical summary

The promotion of home ownership has for decades been one of the most popular political objectives in the United States. Collins (2002) lists 19 home ownership promotion programs enacted during the post-Depression years, with ten of those still in place in 2002. Mirroring this policy push, home ownership rates rose to 69% in 2005, from below 60% in the 1950s.

However, while the objective of public policy is to promote home ownership, episodes of rapid increases in house prices that sometimes occur can have the exact opposite effect on young individuals who are the marginal first-time buyers. With a concave age-earnings profile, the life cycle of home ownership can be distorted by capital market imperfections which restrict the ability of young households to borrow. Even in the deepest and most liquid mortgage markets, a substantial down-payment up front is required which limits the ability of some households to purchase a home. Therefore, rapid swings in house prices can have two separate negative effects on young households. First, rising house prices tighten credit constraints, which could price the marginal first-time buyers out of the market. Second, by erasing home equity gains, a housing bust can result in a substantial increase in debt overhang for those young households who purchased a (first) home at the height of the boom in order to live the American Dream.

In this paper, we study the economic and social consequences of the recent U.S. housing boom and bust for the cohort of young Americans. We first look at how past changes in local house prices (or more precisely, house prices growing faster than income) affect the propensity of young households to purchase a home. Rising house prices tighten credit constraints for first-time buyers by increasing the amount of the down-payment, which is usually a fixed percentage of the value of the home, making it more difficult for younger households to buy residential property. We next examine the economic and social consequences of home ownership in the presence of credit constraints. Specifically, we study the effect of past changes in house prices on the housing debt, home size, and household formation, both in the short-run and during the subsequent housing bust.

Our evidence suggests that, controling for changes in income and in rent levels, in 2006 younger individuals were considerably less likely to purchase a home in MSAs where house prices increased substantially between 2001 and 2006. The effect is long-lasting, in that young households residing in areas that experienced a large-scale house price boom between 2001 and 2006 were relatively

more likely to be deterred from purchasing residential property as late as 2011 (the trough of the housing boom-bust cycle). We also find that young households that decided to acquire a home at the peak of the housing boom in areas with rapidly increasing house prices ended up with higher mortgage debt per unit of housing, but not with a larger property. Finally, young households in general were considerably less likely be married and to have a child in MSAs where house prices increase substantially between 2001 and 2006. This is consistent with a mechanism whereby when house prices go up, families that don't yet own a home experience an adverse wealth shock, and so with lower wealth, they consume both less housing and fewer kids.

The second contribution of our paper is that we introduce a novel instrument for house prices changes based on the predetermined local industrial structure. In particular, we use the beginning-of-period local share of manufacturing employment to extract the exogenous component of subsequent local changes in house prices. We argue that the U.S.-wide increase in the demand for housing, which coincided with the manufacturing decline of the 2000s, was likely to result in a higher increase in local house prices in MSAs where a smaller share of the working population was employed in manufacturing in the early stages of the boom, i.e., where a smaller share of the workforce was at the risk of becoming unemployed due to the decline in manufacturing. We use this instrument together with the MSA's topological elasticity of housing supply from Saiz (2010). Our main results survive all tests where we use an Instrumental Variables procedure to account for the endogeneity of changes in local house prices.

The evidence in this paper suggests that housing booms tend to distort the life cycle of home ownership by pricing out young households from the housing market. By making it difficult to transition from renting to owning, house price booms also distort young individuals' household formation and fertility choices. Finally, the young households with the highest willingness to purchase a home end up with substantially higher debt during the bust phase of housing cycles. Given the crucial role public policy and financial sector imperfections play in determining individual home ownership incentives, our results point to the need for a more systematic analysis of the macroeconomic implications of housing boom-bust episodes. They also suggest that macro-pridential policy which can affect the house price dynamics by, for example, regulating loan-to-value ratios, can have significant economic, but also social, consequences for the marginal first-time buyers.

1 Introduction

The idea that home ownership is the fulfillment of the American Dream, and that the lasting value of family life is the exclusive privilege of the home owner, has a long tradition in U.S. political discourse, culminating in President George W. Bush's push for an "Ownership Society" during the 2000s.[1] Hardly any other social objective has so consistently been held under the aegis of public policy. Collins (2002) lists 19 home ownership promotion programs enacted during the post-Depression years, with ten of those still in place in 2002. Various authors have argued that such policies—coupled with low interest rates and with a decline in mortgage lending standards—may be among the root causes of the unprecedented housing boom that took place in the United States during the late 1990s and early-to-mid 2000s.[2]

We argue that while the objective of public policy is to promote home ownership, episodes of rapid increases in house prices and associated boom-bust cycles in housing can have the exact opposite effect on young individuals who are the marginal first-time buyers. The life cycle of the demand for housing is well-understood: individuals tend to rent while young, then purchase a starter home when they get a job and start a family, and finally upgrade to a larger, trade-up home when the number and age of children increases. With a concave age-earnings profile, implying that earnings potential grows with age (e.g., Ben-Porath, 1967; Heckman, 1976), the life cycle of home ownership can be distorted by rising property prices, for two reasons. First, even in the deepest and most liquid mortgage markets, a substantial down payment up front is required, especially from first-time buyers. Rising home prices will increase the absolute amount of the down payment, restricting the ability of the marginal first-time buyer to purchase residential property.[3] Second, even if lending standards are declining while home prices are increasing, keeping the absolute amount of the down payment constant,[4] rising property prices will increase the size

[1] Halfway through his first term, President Bush famously set a target of 5.5 million more homeowners that the U.S. government wanted by 2010 (Speech to HUD Employees on National Homeownership Month, June 18, 2002).

[2] See, e.g., Bhutta (2011, 2012) and Moulton (2014). In 2011, the authors of the "Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States" argued that "[T]he sine qua non of the financial crisis was U.S. government housing policy, which led to the creation of 27 million subprime and other risky loans – half of all mortgages in the United States – which were ready to default as soon as the massive 1997–2007 housing bubble began to deflate. If the U.S. government had not chosen this policy path – fostering the growth of a bubble of unprecedented size and an equally unprecedented number of weak and high risk residential mortgages – the great financial crisis of 2008 would never have occurred."

[3] This mechanism has important implications for the effect of income shocks on housing market fluctuations (Muellbauer and Murphy, 1997; Lamont and Stein, 1999; Malpezzi, 1999; Ortalo-Magne and Rady, 1999).

[4] Duca, Muellbauer, and Murphy (2011) and Geanakoplos and Pedersen (2012) provide evidence that down-

of the mortgage needed to finance the purchase, and consequently, increase life-time debt servicing costs. We expect that both mechanisms will price the marginal first-time buyers out of the market during a housing boom. At the same time, by erasing home equity gains, a housing bust can result in a substantial increase in debt overhang for those young households who purchased a (first) home at the height of the boom in order to live the American Dream.

In this paper, we study the economic and social consequences of the recent U.S. housing boom and bust for the cohort of young Americans. We exploit the enormous spatial heterogeneity in housing price growth during the housing boom. While nationally real home prices rose by more than 50% between 2001 and 2006 (Shiller, 2007), there were large regional variations: for example, over the same period house prices only increased by 8% in Kokomo, IN, but almost doubled in Miami-Hialeah, FL. We first look at how past changes in local house prices (or more precisely, house prices growing faster than income) affect the propensity of young households to purchase a home. Rising house prices should make it more difficult for younger households (who tend to be the marginal first-time buyers) to purchase residential property, while the overall effect for older households (who tend to already own residential property) is ambiguous. On the one hand, rising house prices increase home owners' housing wealth, making it easier for them to borrow more without increasing leverage, or to pay off their existing mortgage and move up the property ladder. On the other hand, rising house prices also raise the size of the required down payment on a trade-up home. We next examine the economic and social consequences of home ownership during housing booms. Specifically, we study the effect of past changes in house prices on housing debt, home size, and fertility and marital choices, both in the short-run and during the subsequent housing bust.

Our main findings are as follows. First, controlling for changes in income and in rent levels, in 2006 younger individuals were considerably less likely to purchase a home in MSAs where house prices increased substantially between 2001 and 2006. We show that this is due to both theoretical mechanisms outlined, a tightening of credit constraints as the required down payment increases, and a price effect whereby rising home prices increase debt servicing costs. Moreover, we also find that in such MSAs, younger individuals were still relatively more constrained in their ability to enter the housing market in 2011, at the trough of the housing boom-bust cycle.

Second, we find that younger individuals who did buy a home in MSAs with an above-average

payment constraints were indeed eased during the early to mid-2000s.

house price increase between 2001 and 2006 accumulated substantially higher housing debt per unit of housing, relative to young first-time buyers in MSAs with a below-average house price increase. When we compare these effects to the experience of households at later stages of the life cycle, we find that older home buyers were more likely to purchase a home, and this home was likely to be larger (in terms of number of bedrooms), in MSAs where house prices increased substantially between 2001 and 2006. This suggests that the increase in home equity driven by the increase in house prices relaxed credit constraints for individuals who were already home owners when the housing boom started and allowed them to move more easily up the property ladder.

Third, we find that an increase in house prices affects negatively marriage and fertility decisions for the majority of the youngest households. In particular, both in 2006 and in 2011, young households in general were considerably less likely to be married and to have a child in MSAs where house prices increased more over the sample period, while young home owners were more likely to have a child in such areas. This is consistent with two mechanisms. First, because children are a normal good, homeowners are more likely to have a child when house prices go up. Second, when house prices go up, families that don't yet own a home experience an adverse wealth shock—because it will be more expensive for them to buy one eventually—and so with lower wealth, they consume both less housing and fewer kids.

There are non-trivial endogeneity concerns related to the differential impact of credit constraints induced by rising house prices on home ownership across age groups. For example, the areas with the highest increase in house prices tend to also be the ones where the supply of housing is most inelastic, such as coastal cities, and so the housing supply adjusts on the price margin in response to a U.S.-wide shock to housing demand. Because new housing units are difficult to build, individuals in these areas will be less likely to purchase a home than similar individuals in areas with elastic housing supply. This effect will be stronger for younger households who are the marginal first-time buyers. A second source of endogeneity can be related to the fact that individuals in such areas may be different from the rest in ways that matter for the demand for housing. For example, if such areas also have booming economies, then the opportunity cost of having children for young individuals residing in those areas will be higher, weakening their incentives to buy a home. Selection bias can also arise from migration in response to differences in house prices, rents, and income prospects. While we control for current and expected income, as well as for a wide range of demographic

characteristics, such as gender, education, race, and marital status that may influence the demand for housing, controlling even for the most exhaustive set of demographic and income variables cannot fully rule out concerns related to omitted variable bias.

In order to deal with this issue, we employ a novel instrument, namely, the local industrial structure, to extract the exogenous component of locational differences in house price movements. In particular, we argue that the MSA's share of the working population employed in manufacturing at the start of the period is a good predictor of subsequent MSA-level changes in house prices. Between 1999 and 2007, the U.S. economy lost 4 million manufacturing jobs (Charles, Hurst, and Notowingo, 2013), an unprecedented decline in manufacturing driven by a rise of low-wage manufacturing in emerging markets (mostly in China). We argue that the U.S.-wide increase in the demand for housing, which coincided with the manufacturing decline, was likely to result in a higher increase in local house prices in MSAs where a smaller share of the working population was employed in manufacturing in the early stages of the boom, i.e., where a smaller share of the workforce was at the risk of becoming unemployed due to the decline in manufacturing. We use this instrument together with another instrument for house prices that is common in the literature, the MSA's topological elasticity of housing supply from Saiz (2010). The later is based on the idea that an increase in the economy-wide demand for housing will increase house prices, and this effect should be stronger in MSAs with less elastic housing supply where the adjustment in response to aggregate demand shocks takes place on the price margin. Each of these instruments explains about one-third of the variation in MSA-level house price changes between 2001 and 2006, and the two instruments together explain 51% of this variation. Crucially, our main results continue to obtain when we employ instrumental variable techniques.

Our results are consistent with theoretical mechanisms highlighting the role that credit market imperfections play in housing market dynamics. An early example of this line of research is Stein (1995) who demonstrates how extreme credit distress, captured by very high housing debt, can result in lower house prices and fewer transactions because negative equity prevents some households from moving. With many households burdened by too much debt to meet the down payment requirement on their current homes, equilibrium house prices and the number of transactions in housing markets are low. Our results have their closest theoretical counterpart in the model in Ortalo-Magne and Rady (2006) who link the credit constraints faced by first-time buyers to housing price dynamics.

Their model argues that by affecting the ability of potential first-time buyers to enter the housing market, credit constraints can have a strong effect on housing market dynamics. In particular, the down payment constraint can affect the transmission of income shocks to housing transaction. Our main results provide evidence on the link between credit constraints and the propensity of first-time buyers to purchase residential property, and we also detect in the data a pattern whereby a rise in existing home owners' housing wealth can affect their propensity to move up the property ladder.

Our work complements and expands along a number of dimensions existing empirical studies on the economic and social effects of fluctuations in housing markets. One strand of this literature has linked the U.S. housing boom of the late 1990s and early-to-mid 2000s to household portfolio and labor choices and to changes in the U.S. industrial structure. Mian and Sufi (2011) provide evidence on how home equity-based borrowing during the U.S. housing boom of the 1990s and 2000s was responsible for the large observed increase in housing debt among U.S. households. Chetty and Szeidl (2012) show that increases in home equity wealth tend to raise share holdings by U.S. households. Charles, Hurst, and Notowidigdo (2013) show that the housing boom allowed for a reallocation of unskilled workers from manufacturing to construction sectors, masking the overall unemployment effect of the U.S. manufacturing decline. Corradin and Popov (2015) show that the rise in home owners' home equity brought about by the housing boom increased the rate of creation of business start-ups. We extend this literature by demonstrating the effect of changes in credit constraints driven by increases in house prices on home ownership choices. We furthermore show how this effect varies over the life cycle.

Another strand of the literature has studied the effect of home ownership and house prices on a range of individual choices, ranging from schooling (Lovenheim, 2011; Laeven and Popov, 2016) to fertility and martial stability (Farnham, Schmidt, and Sevak, 2011; Lovenheim and Mumford, 2013; Detling and Kearney, 2014; Milosch, 2014). Relative to the latter papers, we show how fertility choices vary with credit constraints over the life cycle. Our results also relate to the literature on the economic effects of changes in lending standards. This literature has generally found that the substantial rise in mortgage lending which fuelled the housing boom was preceded by a large decline in lending standards and by a dramatic increase in securitization (e.g., Mian and Sufi, 2009; Demyanyk and Van Hemert, 2011; Dell'Ariccia, Igan, and Laeven, 2012), although there is little evidence that individual financiers were aware of the macroeconomic consequences of their

actions (Cheng, Raina, and Xiong, 2014). More generally, our results on young households ending up with more mortgage debt in boom areas speak to the literature on the role of overoptimism in (housing market) boom-bust cycles (see e.g. Burnside, Eichenbaum, and Rebelo, 2011; Barron and Xiong, 2013). Finally, by incorporating home ownership in the analysis, we contribute to the recent literature that has attempted to link demography to business cycle fluctuations and wealth inequality (Jaimovic and Siu, 2009; Beaudry, Green, and Sand, 2014; Liang, Wang, and Lazear, 2014; Wolff, 2014).

2 Data

The main part of the empirical analysis uses individual-level data for 2006, which coincides with the peak of the U.S. housing boom of the late 1990s and early to mid-2000s. In addition, we use data on 2011, which coincides with the trough of the housing boom-bust cycle. We use data from the American Community Survey (ACS) individual-level and household-level extracts from the Integrated Public Use Microsamples (IPUMS) database (Ruggles et al., 2004). We restrict our attention to households residing in MSAs which can also be uniquely matched to MSA-level data on house prices. This yields a total of 3,109,818 households in 254 MSAs.[5]

In terms of individual housing choices, we use the survey question on whether the household bought residential property in the previous year. We also use the provided information on the value of the purchased home, on the size of the monthly mortgage payment, and on the number of rooms and bedrooms in the newly acquired housing unit.[6] In terms of demographics, we use data on age, gender, marital status, education, and race. We also use data on whether the household had a child in the past year. The latter is only available during the bust phase of the housing market. In terms of financials, we use data on the household's total labor income, employment status, and sector of employment. These variables have been shown in previous studies to matter for home ownership choices in the US.[7] Regarding employment, we focus on whether the household head is employed as

[5] We considered using alternative sources of household surveys with information on household finances and expenditures, including the Amercian Housing Survey (AHS), the Survey of Income and Program Participation (SIPP), and the Panel Study of Income Dynamics (PSID) database, but these all have drawbacks compared to the ACS. The AHS covers too few MSAs (only 47), the SIPP data does not cover the post-boom period (no data for the year 2011), and the PSID covers too few households (only 6,000).

[6] We are naturally limited here by the information contained in the ACS survey. For example, there is no information on the amount of mortgage debt but there is information on the monthly mortgage payment.

[7] See, for example, Gyourko and Linneman (1996) and Gyourko, Linneman, and Wachter (1999).

real estate agent or mortgage broker. Such professional occupation signals both inside knowledge of the housing market and high expected wealth in booming areas. Moreover, owning a home may be a viewed as a must for such individuals to signal success to prospective clients. Finally, we drop 881 households that reported negative monthly labor income.

We compute local house prices using data from the Federal Housing Finance Agency (FHFA), which is a repeat-sales housing price index with data for most metropolitan areas.[8] We map the FHFA metro areas to the Census/ACS metro areas by hand. To mirror the Census and the ACS data, we construct house price growth as the change in MSA-level house prices between 2001 and the average of house price in the first quarter in 2006.

Turning to our instruments, we use the IPUMS to calculate the share of the workforce employed in manufacturing in 2001. We take the sample of households who reported their industry of employment, and we calculate the proportion of those who reported their industry of employment to be between 1997 NAICS codes 3111 and 3399, which span the universe of manufacturing industries. Next, in order to compute estimates of elasticity-adjusted changes in house prices, we use information on housing supply elasticities from the extant literature. The MSA specific housing supply elasticity measures are from Saiz (2010), who constructs them using detailed information on the topography of the MSA. The MSA-level topological elasticity of the housing supply has emerged as the instrument of choice when extracting the exogenous component of house price increases, for two reasons. First, being computed at the MSA level, this variable exhibits substantial variation. Second, it is conceptually appealing to argue that the effect an increase in the economy-wide demand for housing has on house prices is stronger in MSAs with less elastic housing supply where the adjustment in response to aggregate demand shocks takes place on the price margin.

Table 1 reports summary statistics of housing choices, demographics, fertility choices, financials, and MSA-wide changes in house prices. It also summarizes data on the beginning-of-period share of the workforce employed in manufacturing and on the topological elasticity of housing supply, both of which we later use as instruments for changes in house prices. Data are for the 254 MSAs with non-missing data on individual characteristics, house prices, industrial occupations, and topological elasticities. It shows that on average, over the period 2001-2006, house prices in our sample of MSAs increased by 50%, which is consistent with the US-wide developments reported in Shiller (2007). In

[8] We compute house prices at the MSA level because our instruments for house prices are at the MSA level.

addition to that, there are vast regional variations: for example, over the same period house prices only increased by 8% in Kokomo, IN, but almost doubled in Miami-Hialeah, FL. However, the overall increase is not driven by a few outlier MSAs: In 121 MSAs, house prices increased by more than 50% between 2001 and 2006, and in 40 MSAs they increased by more than 75%. Moreover the increases in house prices tended to significantly outpace increases in income: MSA-level average income growth (defined as the change in average household income at the MSA level between 2001 and 2006, from the IPUMS) averaged only 21% over the same period.

About 5% of the households in the sample purchased a home in 2006. The average new home in the sample had 6 rooms and 3 bedrooms and cost $310,000. The distribution of residential home prices is very skewed, however, with a median price at $220,000. New home owners on average paid $735 in mortgage payments monthly, which constitutes about 11% of disposable income. The table also reports that the average person interviewed in the sample is female, married, white, and has at most a high school degree. Only 2% of the population is employed as real estate agents and mortgage brokers, and 4% of household heads are on average unemployed.

Turning to our two instrumental variables, we find that on average 10% of the workforce is employed in manufacturing over the sample period. Once again, there are large regional differences: only 2% of the workforce is employed in the manufacturing industry in Anchorage, AK, while 35% is in Elkhart-Goshen, IN. The topological elasticity of the housing supply varies enormously across geographical regions, too, with a value of 0.6 in Miami-Hialeah, FL (very inelastic housing supply) and a value of 12.15 in Pine Bluff, AR (very elastic supply).

3 Empirical model

Our goal is to explore how changes in house prices affect the probability of purchasing a home for young individuals, the majority of whom do not already own residential property, relative to older individuals who are substantially more likely to already be home owners. We expect changes in house prices to affect differentially households in earlier and in later stages of the life-cycle. The young (marginal first-time buyers) will be affected negatively by an increase in house prices because with constant loan-to-value ratios, the down payment constraint will tighten. In addition, even if lending standards decline so that loan-to-value ratios rise to keep the absolute amount of the down

payment unchanged, an increase in house prices will increase debt servicing costs for potential first-time buyers. At the same time, an increase in house prices raises housing wealth for existing home owners who tend to be older.

We model the probability of household i in MSA m purchasing a home in 2006 as follows:

$$Home\ purchase_{im} = \sum_{j=1}^{4} \beta_{1j} Age_{imj} + \sum_{j=1}^{4} \beta_{2j} Age_{imj} \times \Delta Home\ prices_{m}^{2001-2006} + \beta_3 X_{im} + \beta_4 \Psi_m + \varepsilon_{im} \quad (1)$$

where $Age_{im1} = 1$ if the head of household i in MSA m is between 18 and 35 years old, $Age_{im2} = 1$ if the head of household i in MSA m is between 36 and 45 years old, $Age_{im3} = 1$ if the head of household i in MSA m is between 46 and 55 years old, and $Age_{im4} = 1$ if the head of household i in MSA m is between 56 and 65 years old. We use individuals older than 65 years as the control group. $\Delta Home\ prices_{m}^{2001-2006}$ denotes the change in average MSA-level house prices between 2001 and 2006, for each individual MSA m. We focus on this period because it captures the sharpest and largest increase in house prices during the most recent U.S. housing boom (see Shiller, 2007). X_{im} is a vector of individual control variables; Ψ_m is a matrix of MSA-level fixed effects; and ε_{im} is an idiosyncratic error term. We do not include $\Delta Home\ prices_{m}^{2001-2006}$ on its own in the regression because its effect on the probability of household i in MSA m purchasing a home in 2006 is subsumed in Ψ_m. However, we do report regressions without MSA fixed effects which include $\Delta Home\ prices_{m}^{2001-2006}$. We employ a linear probability model with robust standard errors clustered at the MSA level.[9]

A negative coefficient β_{1j} implies that individuals in age category j are systematically less likely to purchase a home, relative to the control group of individuals older than 65 years. Our main coefficient of interest is β_{21}. A negative coefficient β_{21} implies that households in age category 18-35 are systematically less likely to purchase a home if they reside in an MSA that experienced a larger increase in house prices between 2001 and 2006. In robustness tests, we also interact the level of the average MSA-specific down payment with the age dummies. This allows us to better distinguish whether rising home prices reduce the young Americans' propensity to purchase residential property through tightening credit constraints (an increase in the down payment) or

[9] The results are robust to employing non-linear probability models instead.

through a plain price effect. Because these households are the ones that are the most likely to not own a home yet, a negative coefficient β_{21} suggests that housing booms tend to shut them out of the housing market, distorting the life cycle of home ownership.

The propensity of home ownership is of course affected by a number of other factors besides credit constraints and age. Therefore, we make sure that we include an exhaustive set of personal characteristics in the vector X_{im}. In particular, X_{im} includes proxies for gender, marital status, education, and race. We also include proxies for both current and expected income, such as labor income, employment status, and whether the person works in real estate. In this way, our results are not contaminated by the fact that married individuals and individuals with high expected non-housing wealth are more likely to purchase a home. Finally, we also include MSA fixed effects. This enables us to control for systematic differences across geographic regions related to tastes for home ownership vs. renting, or to local changes in house prices.

While a negative coefficient β_{21} is consistent with the idea that credit constraints negatively affect the ability of young renters to purchase a home, it could also be driven by other forces. For example, the areas with the highest increase in house prices tend to also be the ones where the supply of housing is most inelastic, such as coastal cities. Because new housing units are difficult to build, individuals in these areas will be less likely to purchase a home than similar individuals in areas with elastic housing supply. Alternatively, if such areas also have booming economies, then the opportunity cost of having children for young individuals residing in those areas will be higher, weakening their incentives to buy a home. We address these issues by implementing an Instrumental Variables procedure whereby in a first stage, we regress the change in house prices between 2001 and 2006 on the share of the workforce employed in manufacturing in 2001, and on the local topological elasticity of housing supply from Saiz (2010). Then we use the predicted change in house prices in the second stage to evaluate the effect of credit constraints on the propensity for home ownership. The idea behind this instrumental variables approach is twofold. First, we expect an increase in the economy-wide demand for housing to increase house prices, relatively less in areas with a high share of the population about to become unemployed due to an ongoing secular decline in U.S. manufacturing. Second, we expect a stronger increase in house prices in MSAs with less elastic housing supply where the adjustment in response to aggregate demand shocks takes place on the price margin. Finally, we also include interactions of the age dummies with our proxies for

current and expected income, to control for the possibility that younger individuals' opportunity cost of time is higher in areas with higher house price changes, leading them to delay both fertility and home ownership decisions.

We also study short-run versus long-run effects. Our results would be much more compelling if younger households were shut out of the housing market not only at the peak of the house price cycle in 2006, but also at its trough in 2011. This would imply that even when house prices revert to previous levels, they do not do so sufficiently in order to enable renewed entry into home ownership. To test for this possibility, in Section 4.4 we test Model (1) using data on demographics and on home purchases in 2011, and studying the effect of changes in house prices between 2001 and 2011.

Finally, we adapt our strategy to test for the economic and social impact of a mechanism whereby credit constraints distort the life cycle of home ownership. In particular, we also explore the effect of past changes in house prices on household leverage—relative to labor income—of new home owners, testing for whether for a unit of housing, younger individuals who decide to buy a house in areas where house prices increased a lot in the past, are more likely to end up with higher housing debt. This would imply that credit constraints impose a two-pronged economic cost on young households: they shut the marginal would-be home owner out of the housing market, and they increase the long-term indebtedness of those with the highest willingness to purchase residential property. We also test for the effect of changes in local house prices on non-economic choices, such as marriage and fertility, both in general and for home owners. If, for example, we find that in 2006 younger individuals are less likely to have a child in areas which experienced a rapid increase in house prices between 2001 and 2006, this would imply that housing booms have not only negative economic, but also negative social implications for households at the bottom of the property ladder.

4 Empirical evidence

4.1 OLS results

Before we proceed to our parametric estimates of Model (1), we first present the raw data. Figure 1 shows a simple scatter plot of the change in the FHFA house price index between 2001 and 2006 against the proportion of households aged 18-35 which purchased residential property in 2006, for

the 254 MSAs in our sample. As seen from the scatter plot, there is a strong negative relationship between the share of young households who entered the housing market and the MSA-wide change in house prices. While only 5% of the households aged 18-35 purchased residential property in an MSA where house prices appreciated by 95% in the past 5 years, 7% of young households did so in an MSA where house prices appreciated by less than 10%. This may at first seem like a small difference but one should bear in mind that these are statistics for first-time home buyers (not owners) in a given year. The cumulative effect on home ownership for young households that one would obtain when estimating the effect over a longer period of time would be substantially higher.

Table 2 reports the OLS estimates of Model (1). In addition to our main model with MSA fixed effects, we also run regressions without MSA fixed effects, in order to be able to include the variable capturing MSA-specific changes in house prices between 2001 and 2006, whose coefficient is of independent interest.

In columns (1) and (2), we report estimates from a parsimonious version of the model where we include the age dummies and their interaction with past house price changes, but without controls for individual demographic characteristics and income. We first establish that all households younger than 65+ are considerably more likely on average to purchase a house than household where the head is aged 65+. This is natural given that most demand shocks related to housing choices take place prior to retirement. Regarding the main variable of interest, the estimates strongly imply that past increases in house prices deter younger households (in particular in the age categories 18-35 and 36-45) from purchasing a house. The increase in house prices on its own, in the specification without MSA fixed effects, is uncorrelated with the proportion of young households purchasing a home (column (1)).

In columns (3) and (4), we add all remaining individual-level variables that control for demographic characteristics and for income and wealth. The estimates imply that all else equal, households where the head is female, single, poorly educated, black, and unemployed are less likely to have purchased a home in the past year. In addition, having a job in real estate is associated with a considerably higher probability of purchasing a house. This is likely because a real estate job in a booming area is a proxy for higher expected income, because real estate agents have inside knowledge of the market and can cherry pick, or because a real estate agent is expected to own a home to signal success to clients. Our main result still obtains in the richest empirical specification,

with proxies for demographics and financials and with MSA fixed effects (column (4)): in areas that experienced a large house price increase in the past five years, younger households (age category 18-35) are considerably less likely to purchase a home. The effect is economically meaningful, too. The estimate in column (4) implies that relative to the control group of 65+ years of age, a household whose head is in the 18-35 age category, residing in an MSA at the 75th percentile of house price increases between 2001 and 2006, is 0.9 percentage points less likely to have purchased a home in the previous year than a similar household at the 25th percentile. Given that 6 percent of households in the 18-35 age category in the sample purchased residential property in 2006, this implies a 15% decline in the probability of purchasing residential property for the youngest households brought about by the housing boom. At the same time, older households (age category 56-65) are considerably more likely to do so. As such households are unlikely to be first-time buyers, the latter effect is consistent with the idea of households extracting the additional home equity from their existing home and investing in a trade-up home, or with home equity enabling them to move residence for economic reasons.

The results for the youngest households are consistent with two separate mechanisms: a tightening of credit constraints, whereby rising house prices increase the size of the down payment necessary to obtain a mortgage, and a plain price effect, whereby raising house price increase debt servicing costs. In Table 3, we attempt to separate the two effects by adding interactions of the age dummies with an MSA-specific down payment proxy in Model (1). Individuals in the IPUMS do not disclose information on down payments, and it is not possible to construct one because the size of the mortgage is not reported, either. Therefore, we turn to another data set, the Survey on Income Program Participation (SIPP). The SIPP contains information on property values and mortgage size, as well as on the year in which the property was purchased. However, for confidentiality purposes, geographic information is disclosed only for individuals in 91 MSAs, and only until 2004. For 2004, we calculate the down payment for each home owner aged 18–35 as the difference between property value and mortgage size, and then we calculate an MSA-specific average. The mean MSA-specific down payment in the sample is rather high, at 31% (corresponding to a loan-to-value ratio of 0.69), reflecting the fact that a higher down payment is required of young (first-time) buyers, and it ranges from a low of 5% to a high of 76%. We then interact the age dummies with this variable and include it in the main regression. The estimates from this regression, reported

in Column (1) of Table 4, indeed suggest that the size of the down payment is negatively related to the probability of home purchase, and more so for the youngest individuals. When included alongside the interaction of age dummies and changes in home prices (column (2)), the effect of the down payment is still negative and significant at the 1% statistical level for the youngest household. Importantly, the negative effect of positive shocks to home prices on the youngest households' home purchase probability still obtains, and we also detect a strong positive effect on household heads aged 45+. Given that we formally control for the effect of the down payment constraints, the interaction of age dummies with house prices now captures a plain price effect related to debt servicing.

Overall, our results suggest that a housing boom has different effects on the propensity to acquire residential property, depending on whether the household has experienced an increase in housing wealth on its existing property. The effect on older households is positive, suggesting that an increase in housing wealth allows them to purchase a new property more easily. The effect on younger households is negative, and it operates both through a tightening of credit constraints effect and a plain pricing effect. Because the specification includes MSA fixed effects, we are confident that the main effect holds independent of any region-wide differences in economic conditions or housing supply that affect all agents equally.

4.2 2SLS results

While the estimates reported in Table 2 support the idea that positive shocks to house prices affect negatively the ability of households to purchase a home, this effect could be driven by a number of other factors. For example, the supply of housing tends to be the most inelastic in areas which experience large house prices increases (such as Miami or San Francisco), both due to land scarcity and to more stringent regulations on construction. Because the supply of new houses adjusts slowly to positive shocks to housing demand, individuals in such areas will be less likely to purchase a home than similar individuals in areas with more elastic housing supply. The estimates we reported can be contaminated by such omitted variable bias.

We address this issue by implementing an Instrumental Variables procedure whereby in the first stage, we regress the change in house prices between 2001 and 2006 on the local (MSA-level) share of the workforce employed in manufacturing, and on the local (MSA-level) topological elasticity

of housing supply from Saiz (2010). Then we use the predicted change in house prices in the second stage. We expect that an economy-wide shock to the demand for housing should have a weaker impact on house prices in depressed manufacturing areas. The reason is that in such areas a smaller fraction of the workforce is at risk of becoming unemployed due to the general decline in manufacturing. We also expect that such a shock should increase house prices more in MSAs with less elastic housing supply where the adjustment in response to aggregate demand shocks takes place on the price margin, while in flat areas with abundant land (and thus elastic housing supply) the adjustment will take place on the quantity margin.

Table 4 reports the estimates from this alternative model. We begin by reporting, in columns (1)–(3), the coefficients from the first stage. The estimate on the variable of interest strongly supports the notion that both the share of the workforce employed in manufacturing in the beginning of the period (column (1)), and the elasticity of the housing supply (column (2)), exert a negative effect on house price growth. The two instruments are jointly significant at the 1% statistical level, too (column (3)). Each of the instruments explains about one-third of the variation in MSA-level house price changes between 2001-2006, and the two instruments combined explain 51% of this variation. Numerically, moving from an MSA at the 75th percentile to an MSA at the 25th percentile of relative manufacturing employment increases house price growth between 2001 and 2006 by 0.25, or by one standard deviation. Analogously, moving from an MSA at the 75th percentile (very elastic) to one at the 25th percentile (very inelastic) increases house price growth by 0.17, or by 0.7 standard deviations. The value of the first-stage Wald statistic, reported as "Wald F-statistics", is strictly higher than the critical value for the IV regression to have no more than 10% of the bias of the OLS estimate (see Stock and Yogo, 2005), supporting the use of our instrumental variables approach.

Columns (4) and (5) report the estimates from the second stage. To facilitate comparison with the OLS case, we again report estimates from a regression without MSA fixed effects which includes the MSA-wide change in house prices between 2001 and 2005, and estimates from a regression with MSA fixed effects. In the former case (column (4)), we find that households in general were less likely to purchase a house in areas where house prices appreciated substantially in the past 5 years, relative to areas where they did not. Our main results continue to hold: younger households are considerably less likely to purchase residential property if they reside in MSAs which experienced a

large increase in house prices in the past 5 years. In our preferred specification with demographics, financials, and MSA fixed effects (column (5)), this effect obtains only for the youngest households (age 18-35). The magnitude of the estimate is similar to the one reported in Table 2, suggesting that in this case, omitted variable bias is not a serious econometric issue. However, we no longer find a differential effect, across MSAs, for the group of old households (age category 56-65).

The validity of the identification strategy rests on the assumption that the local beginning-of-period share of employment in manufacturing and the local elasticity of housing supply are legitimate instruments for changes in house prices in Model (1). The first-stage estimates reported in Columns (1)–(3) of Table 4 suggest that the instruments are strongly related to changes in house prices. However, for the 2SLS estimate to be consistent, it must also be the case that the instruments are uncorrelated with the residual in Model (1). If the instruments influence the probability of purchasing residential property for reasons other than tightening credit constraints or rising debt servicing costs, brought about by changes in property prices, our approach is called into question. As a way of addressing this concern, we note that if the only impact of the instruments is through changes in house prices, then the instruments should be insignificant if included in Model (1). Column (6) reports the estimates from this reduced form model. The test fails to reject the null hypothesis that the joint effect of the local industry structure and of the local elasticity of housing supply on home ownership equals zero, supporting the use of our instrumental variables approach.

4.3 Controlling for rent and income effects

While the specification so far allows us to control for income effects, it does not allow us to control for income effects that vary across age groups or MSAs. For example, it is possible that younger households have higher incomes in areas with booming housing markets, raising their opportunity cost of child rearing. This may in turn weaken their incentives to enter the housing market. It is therefore important to test a specification where both current and expected incomes are allowed to have a differential effect on various age groups. Finally, it is possible that younger households are more risk averse investors, and so they are more likely to postpone the purchase of a house when prices are high, even though they are not credit constrained.

Table 5 reports the estimates from this augmented version of Model (1). In column (1), we

control for interactions between the age dummies and the average increase in rents on a 2-bedroom apartment (the median apartment of choice for first-time buyers in the age category 18-35). The difference between changes in house prices and changes in rents captures the change in investment opportunities for a durable good that generates a flow of income, in addition to providing housing services. Therefore, this test directly controls for the possibility that we are capturing the differential effect of a decline in the incentive to invest in a durable good, rather than a pricing of young households out of the market. We find no evidence for the investment channel of changes in house prices. However, we still find strong evidence that the youngest households are less likely, and older households are more likely, to purchase a home in MSAs with a large increase in house prices between 2001 and 2006, pointing to the role that shocks to home prices play in the life cycle of home ownership.

Next, we interact the age dummies with the average growth in MSA-level income between 2001 and 2006 in order to test for whether the growth in house prices is providing a binding constraint for home ownership, controlling for income growth. Column (2) suggests that households in the age group 36-45 are more likely to purchase a house in an MSA where house prices appreciated rapidly in the past 5 years. Crucially, the evidence suggests that controlling for the rate of income growth, young households (age groups 18-35 and 36-45) are less likely to purchase residential properties in such MSAs. In addition, older ones (age group 56-65) are more likely to purchase a home, suggesting wealth effects for home owners of rising house prices.

We next interact each age group with current labor income. Column (3) reports that younger households (in age categories 18-35 and 36-45) are more likely to purchase residential property if they have higher labor income, while the same is not the case for older households. This suggests that higher levels of disposable income indeed help alleviate the adverse conditions that younger households face in housing markets due to rising house prices. Crucially, the effect of past increases in house prices on young households' propensity to buy a home is still negative and significant at the 1% statistical level.

In column (4), we include an interaction of each age category with a dummy variable equal to 1 if the household head is a real estate agent or a mortgage broker. Apart from signalling high expected income in a booming area (as mortgage broker fee income increases linearly with house prices), being in the real estate business may facilitate acquiring residential property by reducing

informational asymmetries and network effects. The estimates imply that indeed, young households (age 18-35) employed in real estate are considerably more likely to purchase a home if they reside in booming areas. Even controlling for this effect though, young households face significantly higher constraints to home ownership in such areas, while older households are considerably more likely to buy a home. The interaction with the real estate dummy is only significant in the case of the youngest households (age 18-35), suggesting that they are the ones for which higher disposable income or liquid wealth is most relevant in overcoming home ownership constraints.

In column (5), we interact all age categories with a dummy equal to 1 if the household head has a college degree or more. In this case, higher education proxies for both higher current income and higher future income because skilled agents tend to have higher lifetime earnings and face more stable income streams. We confirm that individuals of all age categories are more likely to buy residential property if they have at least a college degree. Importantly, the effect of past changes in house prices on housing choices by the youngest households survives the inclusion of these control variables.

The last two columns of Table 5 report the estimates from a horse race regression where we include the interactions of all empirical proxies for investment opportunities and for current and future income with the age categories. We continue to observe a strong negative association for young households between past increases in house prices and propensity to enter home ownership. This is true both in the OLS regression (column (6)) and in the IV regression (column (7)). In both specifications, the differential effect across MSAs is also observed in the case of age category 36-45, implying that rising property house prices can deter home ownership in later stages of the home ownership cycle, too.[10]

4.4 Long-run effects

Is the negative effect of housing booms on young households' propensity to purchase residential property long-lasting? In particular, even at the trough of the housing bust in 2011, house prices remained substantially above their levels before the crisis. This raises the possibility that housing booms can lead to situations whereby young households are shut out of housing markets long after

[10] The main results are qualitatively unaffected when we include on the right hand side interactions of age and race and of race and house price changes. Results are available upon request from the authors.

the housing boom is over. Evidence already suggests that areas which experienced the largest run-up of house prices also experienced the deepest recessions and the largest increases in unemployment (Midrigan and Philippon, 2011), an effect largely attributed to leverage accumulated through home equity borrowing. If the results we have found so far extend to 2011, this would suggest that housing booms have a long-lasting negative effect even on groups of individuals (young households) who did not increase their housing debt during the boom in order to finance increased consumption.

We test for this possibility in Table 6. Specifically, we estimate a version of Model (1) for a representative sample of households in 2011 and we interact all age dummies with the MSA-wide change in house prices between 2001 and 2011, where the end point corresponds to the trough of the cycle. We confirm a strong negative effect of the overall change in property prices between 2001 and 2011 on the probability of purchasing a house in 2011 for young households. This is the case both in the OLS (column (1)) and in the IV (column (2)) specification. Numerically, the effect is about half the size of the one for the 2006 sample of households, and it is significant at least at the 5% statistical level. Our results thus suggest that housing booms can impose a long-lasting externality on agents who do not benefit directly from the booms.

5 Extensions

In this section, we analyze the consequences of rising house prices across age groups for households who purchased a home in the previous year. We first examine whether for agents who become home owners, rising house prices affect the characteristics of the housing unit purchased. Then we study the economic implications of home ownership in terms of the amount of housing debt of the household. Finally, we look at the social implications of home ownership by examining the marital and fertility choices of young households in booming areas.

5.1 Home ownership, house value and housing size

We first address the question of whether rising house prices affect the value and the size of residential units purchased by young households. The model by Ortalo-Magne and Rady (2006) does not have a prediction on the equilibrium size of start-up homes, rather imposing as an assumption that start-up homes and trade-up homes are of a different size. Recent empirical work has uncovered

a causal link between the cost of housing and the size of purchased housing units. For example, Hanson (2012) finds a large effect of the mortgage interest deduction on the size of purchased home (the intensive margin), albeit the data provide no evidence that mortgage deductions affect the rate of home ownership (the extensive margin). We hypothesize that rising house prices can affect either the value of the purchased home, if households choose to economize in the price dimension, the size of the purchased home, if households choose to economize in the quantity dimension, or both.

Table 7 reports the estimates from a version of Model (1) run on the sample of new home owners only. Moreover, rather than estimating the probability of purchasing a house, we test for the effect of age and of house prices on a range of housing characteristics. Namely, we examine the heterogeneous impact of rising house prices on the value and on the size of the purchased home, where size is proxied by the number of room and by the number of bedrooms in the residential unit.[11] We present evidence from OLS estimation in Panel A, and from an IV procedure in Panel B.

Column (1) reports that in areas which experienced a large increase in house prices in the first half of the 2000s, new home owners of all age groups were more likely to purchase a more expensive house than in areas where house prices increased by less. While the average effect is natural given the difference in equilibrium house prices, we also find that this effect is substantially stronger for younger households (age category 18-35) than for older ones (age category 56-65). This suggests that while younger households are more constrained than older ones in areas where house prices increased considerably, actual transactions (conditional on buying a home) are associated with relatively higher house values. Alternatively, the results suggest that otherwise identical households, in terms of demographics and income, end up purchasing substantially more expensive residential units in areas with large past house price appreciations.

The next two columns of Table 7 test for the effect of rising house prices on housing unit size. The evidence suggests that for the youngest households (age 18-35), rising house prices have no impact on the intensive margin of home ownership. In particular, relative to young households in areas where house prices did not increase by much, young households in areas where house prices increased substantially do not acquire a larger house, as proxied by the number of rooms (column

[11] We do not have information on the square footage of each home.

(2)) and the number of bedrooms (column (3)). The effect of past changes in house prices on housing value for first-time home owners is thus observed only in the price dimension. This suggests that first-time home owners in boom areas tend to purchase more expensive homes per unit of housing. At the same time, households in the age categories 35-45 and 46-55 acquire residential property with strictly more bedrooms relative to similar households in control areas (column (3)). This result obtains both when we estimate the model using OLS (Panel A) and when we estimate it using IV (Panel B). To the extent that such households are unlikely to be first-time home owners, the evidence suggests that housing booms increase home owners' housing wealth and make it easier for them to climb up the property ladder.

5.2 Home ownership and household leverage

We next examine the implications of rising house prices for the resulting household leverage of young households. It is reasonable to hypothesize that the youngest households with the highest willingness to purchase residential property will end up with higher household leverage in areas with rapidly rising house prices. At the same time, because booming areas are characterized by more dynamic local economies and, as a result, by higher average incomes (Mian and Sufi, 2009), the predicted effect of house price changes on household debt relative to household income is ambiguous.

In Table 8, we report evidence related to this particular consequence of home ownership. We first look at the effect of changes in house prices on the monthly mortgage payment relative to monthly income in 2006 (first two columns), and then we look at the same effect in 2011 (last two columns of Table 8). For the peak of the boom, we find that in 2006 household heads aged 18–35 living in MSAs where home prices appreciated more between 2001 and 2006 and who purchased a home last year have a higher mortgage payment relative to income than similar households who purchased a home in the past year but live in a non-booming MSA. This effect is significant in the OLS specification (column (1)), but not in the IV one (column (2)). We next look at the sample of households observed in 2011 who bought a home at the height of the boom, i.e., between 2004 and 2006. Column (3) suggests that in areas with higher past house price growth, actual home purchase transactions also resulted in substantially higher long-term household leverage. This is particularly true for the youngest households (age 18-35 and 36-45). Once again, this result only obtains when we estimate the model using OLS (column (3)), but not when we estimate it using

IV (column (4)).

Overall, the evidence in Tables 7 and 8 is consistent with the idea that housing booms restrict the share of young first-time home owners to those with the highest willingness to pay for a unit of housing. Such households end up accumulating substantial amounts of mortgage debt relative to income, too. At the same time, our results also suggest that an increase in house prices provides existing home owners with additional housing wealth that can be extracted in order to (potentially) switch from a start-up to a trade-up home, where a trade-up home is proxied by a residential unit with a higher number of bedrooms than the previous home. For such households, the positive income effect of additional home equity seems to mildly dominate the negative effect of tightening credit constraints and of higher debt servicing costs, although results are not robust across specifications.

5.3 Social implications of home ownership during a housing boom

We now turn to the social implications of acquiring a home during a housing boom. Specifically, in Table 9 we study the differential effect across age groups of past increases in house prices on households' fertility and marriage decisions. Recent research has provided compelling evidence that positive shocks to the value of the residential property raise home-owners' probability of having a child, consistent with the idea that children are a "normal good" (Becker, 1960; Lovenheim and Mumford, 2013; Dettling and Kearney, 2014). There is no evidence so far, however, on the effect of house prices on the fertility of non-home owners by age groups. In addition, recent evidence has suggested that positive shocks to house prices tend to increase marital stability (Milosch, 2014). Farnham, Schmidt, and Sevak (2011) qualify this result by arguing that the effect is asymmetric across age categories, which they argue is a proxy for home ownership. In comparison, our data allow us to actually focus on a sample of home owners and examine the effect of shocks to house prices on marriage.

We modify regression model (1) such that the dependent variable is, alternatively, a dummy variable equal to 1 if the household is married[12] ("marriage equation") and a dummy variable equal to 1 if the household had a child last year ("fertility equation"). We perform both an analysis of the peak (Panel A) and an analysis of the trough of the housing cycle (Panel B). We estimate the marriage equation and the fertility equation using a Seemingly Unrelated Regressions framework

[12] We need to note that unmarried partners are not identified in the ACS.

where the two equations are estimated as a simultaneous system, together with the main home-ownership equation (1). In addition, we estimate a model where we use the beginning-of-period MSA-level share of manufacturing employment and the MSA-level elasticity of housing supply as instruments for changes in house prices. Expanding further on our empirical strategy so far, we distinguish between home owners and renters. We do so in order to investigate two separate mechanisms. The first one is related to rising house prices providing a positive wealth shock to home owners. Because children are a normal good, homeowners—and in particular younger ones—are more likely to have a child when house prices go up. The second one is related to rising house prices providing an adverse wealth shock to families that do not own a house yet, because it will be more expensive for them to buy one eventually. With lower overall wealth, such families consume both less housing and fewer kids, and as a consequence are more likely to postpone getting married, too.

Column (1) of Panel A of Table 9 suggests that, consistent with the second mechanism, the youngest households are considerably less likely to be married in 2006 if they reside in MSAs that experienced a large increase in house prices between 2001 and 2006. The evidence is equally strong when we use an IV analysis (column (2) of Panel A). We find the same effect for 2011, the trough of the housing cycle, but only when we employ the IV specification (Panel B, column (2)).

Turning to fertility choices, column (3) of Panel A suggests that in 2006, households in age categories 36-45 were more likely to have a child if they reside in areas that saw large house price increases in the past five years, relative to identical households residing in areas that did not experience large recent house price appreciations. As such households are more likely to already own property, the evidence is consistent with a mechanism whereby an increase in house prices constitutes a positive wealth shock to home owners and whereby children are a normal good. However, the opposite is true for households aged 18-35, and the effect is significant at the 10% statistical level in the IV specification (column (4)), suggesting that for most (non-home-owning) young households, rising house prices provide an adverse wealth shock, making it more expensive for them to buy property in the future and leading them to consume less housing and fewer children. Completing the analysis, columns (3) and (4) of Panel B suggests that younger households residing in MSAs that experienced a larger overall increase in house prices between 2001 and 2011 are less likely to have a child in 2011, five years after the peak of the housing boom. The point estimate is

significant at the 1% statistical level in the IV specification (column (4)). Moreover, the numerical effect for 2011 is considerably larger than the one for 2006. We conclude that rising property prices not only affect negatively the youngest individuals' probability of becoming home owners, but also lead them to postpone marriage and fertility.

6 Conclusion

We study the effect of rising house prices on the life cycle of home ownership, as well as on marriage and fertility, differentiating by age. Past increases in house prices increase debt servicing costs, and they can also tighten credit constraints by increasing the amount of cash that one needs to pay up front in order to buy a home. For 1.5 million households in the United States in 2006 (the peak of the housing boom), we evaluate the effect of past shocks to local house prices at different stages of the household's life cycle. We focus on the youngest households (age 18-35) because they are the most likely to be the marginal first-time buyers. We test whether housing booms distort home ownership choices for these households, as well as whether they have negative consequences in terms of debt levels and whether they distort the demographic dynamics.

We also introduce a novel instrument for house prices changes based on the predetermined local industrial structure. In particular, we use the beginning-of-period local share of manufacturing employment to extract the exogenous component of subsequent local changes in house prices. We argue that the U.S.-wide increase in the demand for housing, which coincided with the manufacturing decline of the 2000s, was likely to result in a higher increase in local house prices in MSAs where a smaller share of the working population was employed in manufacturing in the early stages of the boom, i.e., where a smaller share of the workforce was at the risk of becoming unemployed due to the decline in manufacturing. We use this instrument together with the other instrument for house prices that is common in the literature, the MSA's topological elasticity of housing supply from Saiz (2010).

Our evidence suggests that higher prices on residential property reduce the probability of becoming a first-time home owner, proxied by a lower propensity to purchase a home among the youngest households (age category 18-35). This effect operates through two channels: a tightening of credit constraints due to rising down payments, and a plain price effect whereby rising house

prices increase debt servicing costs. The result is not driven by investment opportunities, by income effects, or by demographic characteristics. The effect still obtains when we use the local industrial structure and the local elasticity of housing supply as instruments for changes in house prices. It is also long-lasting, as young households residing in areas that experienced a larger overall increase in house prices between 2001 and 2011 were relatively more likely to be deterred from purchasing residential property as late as 2011 (the trough of the house price boom-bust cycle). We also find that young households that decided to acquire a home at the peak of the housing boom in areas with rapidly increasing house prices ended up with higher mortgage debt per unit of income, but not necessarily with a larger property. Finally, young households in general were considerably less likely be married and to have a child—both in 2006 and in 2011—in MSAs where house prices increased substantially after 2001. This is consistent with a mechanism whereby when house prices go up, families that do not own a home experience an adverse wealth shock—because it will be more expensive for them to buy one eventually—and so with lower wealth, they consume both less housing and fewer kids. At the same time older households, which tend to be home owners already when the boom started, were more likely to purchase a home, and this home was on average larger than in non-booming areas, suggesting a positive income effect, through increased home equity, for home owners wishing to move up the property ladder.

Our results paint a moderately dark picture of the "American Dream" in the presence of housing boom-bust cycles, in the case of young individuals. It suggests that housing booms tend to distort the life cycle of home ownership by pricing out young households from the housing market. By making it difficult to transition from renting to owning, house price booms also distort young individuals' marriage and fertility choices. Finally, the young households with the highest willingness to purchase a home end up with substantially higher debt during the bust phase of housing cycles. Given the crucial role public policy and financial sector imperfections play in determining individual home ownership incentives, a systematic analysis of the macroeconomic implications of housing boom-bust episodes is needed. We leave these important questions for future research.

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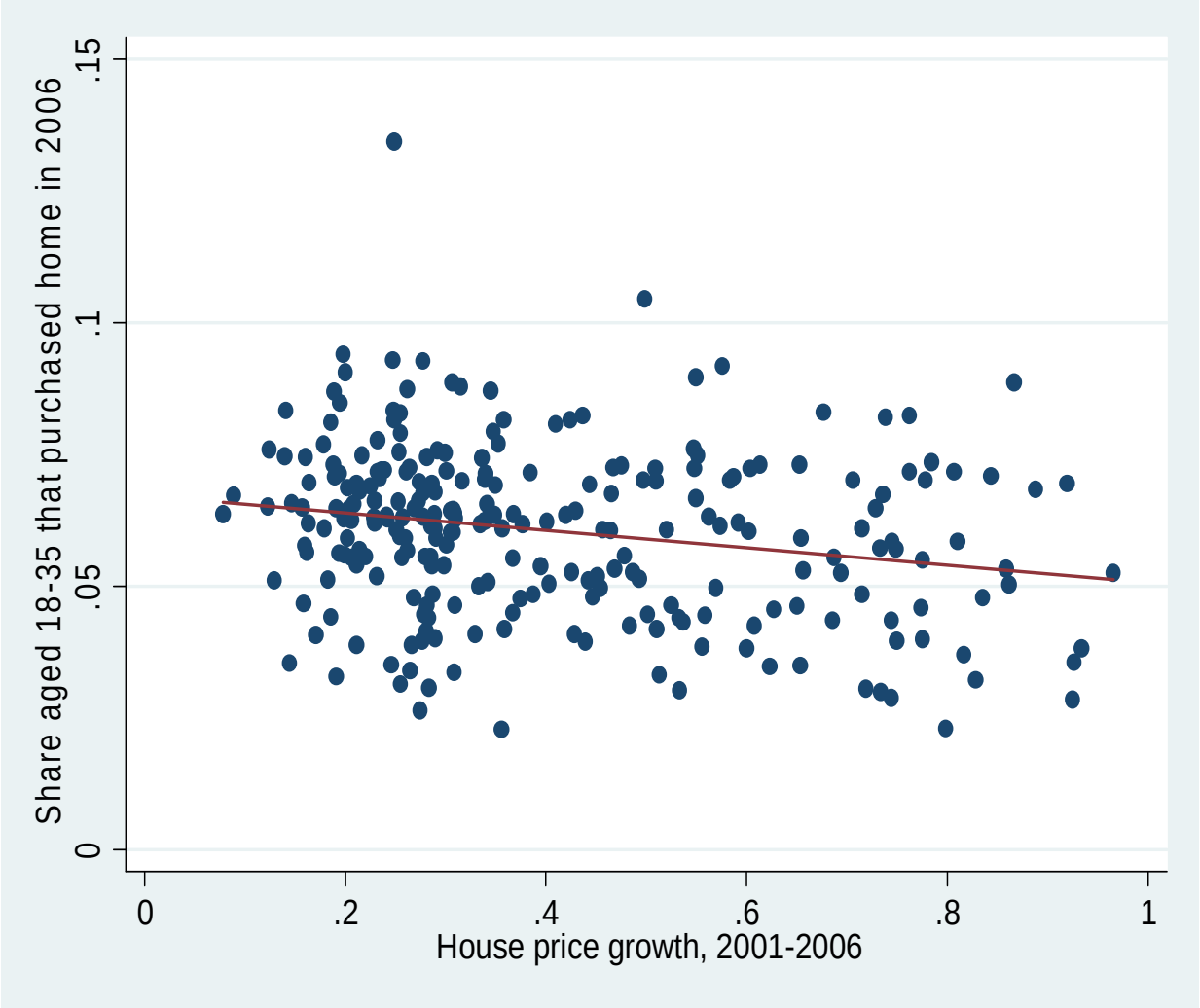
Figure1. House price growth over 2001-2006 and the share of young households that purchased a home in 2006



Note: This figure shows house price growth over the period 2001-2006 and the share of the population with ages between 18 and 35 that purchased a home in 2006, both calculated at the MSA level.

Table 1. Summary statistics

Variable	Observations	Mean	Median	St. dev	Min	Max
Purchased a home last year	1,509,674	0.05	0	0.21	0	1
Age 18-35	1,509,674	0.29	0	0.45	0	1
Age 36-45	1,509,674	0.19	0	0.39	0	1
Age 46-55	1,509,674	0.20	0	0.40	0	1
Age 56-65	1,509,674	0.15	0	0.35	0	1
Age 66+	1,509,674	0.17	0	0.38	0	1
Female	1,509,674	0.53	1	0.50	0	1
Single	1,509,674	0.24	0	0.43	0	1
Married	1,509,674	0.57	1	0.50	0	1
Divorced	1,509,674	0.13	0	0.33	0	1
College or more	1,509,674	0.29	0	0.45	0	1
College drop-out	1,509,674	0.07	0	0.26	0	1
High school	1,509,674	0.64	1	0.48	0	1
White	1,509,674	0.76	1	0.43	0	1
Black	1,509,674	0.11	0	0.31	0	1
Asian	1,509,674	0.06	0	0.23	0	1
Income	1,461,565	80,702.97	62,000.00	77,740.66	0	2,094,000
Unemployed	1,509,674	0.04	0	0.19	0	1
Real estate job	1,509,674	0.02	0	0.12	0	1
Home value	1,093,801	310,904.60	220,000.00	246,719.00	5,000	1,000,000
Mortgage payment	1,509,674	734.58	330.00	1007.73	0	13,600
No. rooms	1,461,565	5.98	6	1.84	1	9
No. bedrooms	1,461,565	2.95	3	1.01	0	5
Child born last year	452,522	0.06	0	0.23	0	1
Δ5-year house prices	1,509,674	0.50	0.47	0.24	0.08	0.97
Δ5-year house rents	1,509,545	0.21	0.18	0.12	-0.11	0.54
Δ5-year MSA income	1,509,545	0.21	0.21	0.06	0.03	0.44
Share manufacturing in 2001	1,509,545	0.10	0.10	0.04	0.02	0.35
MSA elasticity	1,425,146	1.72	1.61	1.04	0.60	12.15
Median down payment	1,117,796	0.31	0.30	0.11	0.05	0.76

Note: This table presents summary statistics for the main variables used in the empirical tests. 'Purchased a home last year' is a dummy equal to 1 if the household purchased a house in the previous year. 'Age 18-35' is a dummy variable equal to 1 if the household head is between 18 and 35 years old. 'Age 36-45' is a dummy variable equal to 1 if the household head is between 36 and 45 years old. 'Age 46-55' is a dummy variable equal to 1 if the household head is between 46 and 55 years old. 'Age 56-65' is a dummy variable equal to 1 if the household head is between 56 and 65 years old. 'Age 65+' is a dummy variable equal to 1 if the household head is over 65 years old. 'Female' is a dummy variable equal to 1 if the household head is a female. 'Single' is a dummy variable equal to 1 if the household head is single. 'Divorced' is a dummy variable equal to 1 if the household head is divorced. 'College or more' is a dummy variable equal to 1 if the household head has at least a college degree. 'College drop-out' is a dummy variable equal to 1 if the household head dropped out from college. 'White' is a dummy variable equal to 1 if the household head is white. 'Black' is a dummy variable equal to 1 if the household head is black. 'Asian' is a dummy variable equal to 1 if the household head is Asian. 'Income' is the total household income. 'Unemployed' is a dummy variable equal to 1 if the household head is unemployed. 'Real estate job' is a dummy variable equal to 1 if the household head is employed in real estate. 'House value' is the total value of the house. 'Mortgage payment' is the value of the monthly payment on the household's mortgage. 'No. rooms' is the total number of rooms in the household's home. 'No. bedrooms' is the total number of bedrooms in the household's home. 'Child born last year' is a dummy variable equal to 1 if the household had a child born in the previous year. Data are from IPUMS, for 2006. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. 'Δ5-year rents' is the percentage change in MSA-wide rents on a 2-bedroom apartment between 2001 and 2006. Data are from the FHFA, for 2001-2006. 'Δ5-year MSA income' is the percentage change in average MSA-wide total household income between 2001 and 2006. 'Share manufacturing in 2001' is the MSA-specific share of working population employed in manufacturing in 2001. 'MSA elasticity' is the MSA-level topological elasticity of housing supply, from Saiz (2010). 'Median down payment' is the median MSA-specific difference between home value and mortgage value, divided by home value, for respondents' aged 18–35 in the Survey of Income and Program Participation

Table 2. House prices and home ownership over the life cycle: OLS

	Purchased a home last year			
	(1)	(2)	(3)	(4)
Age 18-35 × Δ5-year house prices	-0.0314***	-0.0232***	-0.0264***	-0.0194***
	(0.0064)	(0.0057)	(0.0061)	(0.0058)
Age 36-45 × Δ5-year house prices	-0.0171***	-0.0100**	-0.0108**	-0.0044
	(0.0054)	(0.0046)	(0.0050)	(0.0045)
Age 46-55 × Δ5-year house prices	-0.0068***	-0.0014	-0.0028	0.0022
	(0.0030)	(0.0027)	(0.0032)	(0.0030)
Age 56-65 × Δ5-year house prices	0.0049	0.0076	0.0067	0.0092**
	(0.0045)	(0.0046)	(0.0044)	(0.0047)
Age 18-35	0.0499***	0.0459***	0.0642***	0.0589***
	(0.0028)	(0.0026)	(0.0027)	(0.0026)
Age 35-45	0.0452***	0.0418***	0.0393***	0.0354***
	(0.0024)	(0.0020)	(0.0023)	(0.0020)
Age 45-55	0.0206***	0.0180***	0.0132***	0.0102***
	(0.0015)	(0.0014)	(0.0016)	(0.0015)
Age 55-65	0.0109***	0.0093***	0.0035***	0.0017***
	(0.0018)	(0.0018)	(0.0018)	(0.0019)
Δ5-year house prices	0.0044		0.0005	
	(0.0075)		(0.0070)	
Female			-0.0235***	-0.0232***
			(0.0015)	(0.0015)
Single			-0.0300***	-0.0278***
			(0.0010)	(0.0011)
Divorced			0.0185***	0.0184***
			0.0012)	0.0012)
College or more			0.0365***	0.0373***
			(0.0019)	(0.0017)
College drop-out			0.0174***	0.0176***
			(0.0010)	(0.0011)
White			0.0088***	0.0042***
			(0.0012)	(0.0009)
Black			-0.0034**	-0.0080***
			(0.0014)	(0.0012)
Log (Income)			-0.0012**	-0.0005
			(0.0005)	(0.0005)
Unemployed			-0.0163***	-0.0154***
			(0.0010)	(0.0010)
Real estate job			0.0224***	0.0214***
			(0.0027)	(0.0025)
MSA fixed effects	No	Yes	No	Yes
No. Observations	1,509,674	1,509,674	1,509,674	1,509,674
R-squared	0.01	0.01	0.02	0.02

Note: The dependent variable is a dummy equal to 1 if the household purchased a home in the previous year. 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. 'Female' is a dummy equal to 1 if the household head is a female. 'Single' is a dummy equal to 1 if the household head is single. 'Divorced' is a dummy equal to 1 if the household head is divorced. 'College or more' is a dummy equal to 1 if the household head has at least a college degree. 'College drop-out' is a dummy equal to 1 if the household head dropped out from college. 'White' is a dummy equal to 1 if the household head is white. 'Black' is a dummy equal to 1 if the household head is black. 'Log (Income)' is the natural logarithm of total household income. 'Unemployed' is a dummy equal to 1 if the household head is unemployed. 'Real estate job' is a dummy equal to 1 if the household head is employed in real estate. Data are from IPUMS, for 2006. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 3. House prices and home ownership over the life cycle: Down payment versus price effect

	Purchased a home last year	
	(1)	(2)
Age 18-35 × Δ5-year house prices		-0.0119*
		(0.0070)
Age 36-45 × Δ5-year house prices		0.0009
		(0.0056)
Age 46-55 × Δ5-year house prices		0.0087***
		(0.0033)
Age 56-65 × Δ5-year house prices		0.0125***
		(0.0047)
Age 18-35 × Median down payment	-0.0459***	-0.0335***
	(0.0127)	(0.0119)
Age 36-45 × Median down payment	-0.0021*	-0.0219*
	(0.0011)	(0.0120)
Age 46-55 × Median down payment	-0.0185**	-0.0272***
	(0.0092)	(0.0093)
Age 56-65 × Median down payment	-0.0216***	-0.0335***
	(0.0092)	(0.0094)
Age 18-35	0.0629***	0.0652***
	(0.0036)	(0.0039)
Age 36-45	0.0401***	0.0400***
	(0.0033)	(0.0034)
Age 46-55	0.0170***	0.0153***
	(0.0029)	(0.0028)
Age 56-65	0.0126***	0.0099***
	(0.0030)	(0.0030)
Household controls	Yes	Yes
MSA fixed effects	Yes	Yes
No. Observations	1,078,644	1,078,644
R-squared	0.02	0.02

Note: The dependent variable is a dummy equal to 1 if the household purchased a house in the previous year. 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. Data are from IPUMS. 'Median down payment' is the MSA-specific median difference between property value and mortgage value, divided by property value, for home buyers aged 18-35, in 2003. Data are from SIPP. All remaining household controls from Table 2 are included in the regressions. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4. House prices and home ownership over the life cycle: 2SLS

	First stage			Second stage		Reduced form
	(1)	(2)	(3)	(4)	(5)	(6)
Share manufacturing in 2001	-3.0841***		-2.4080***			-0.1399
	(0.4191)		(0.5151)			(0.0982)
MSA elasticity		-0.1372***	-0.1106***			0.0030
		(0.0196)	(0.0251)			(0.0018)
Age 18-35 × Δ5-year house prices				-0.0278***	-0.0208***	-0.0151**
				(0.0075)	(0.0073)	(0.0066)
Age 36-45 × Δ5-year house prices				-0.0084	-0.0016	-0.0005
				(0.0067)	(0.0064)	(0.0051)
Age 46-55 × Δ5-year house prices				-0.0050	-0.0001	0.0040
				(0.0045)	(0.0047)	(0.0031)
Age 56-65 × Δ5-year house prices				0.0058	0.0081	0.0095**
				(0.0054)	(0.0059)	(0.0047)
Age 18-35				0.0649***	0.0597***	0.0538***
				(0.0031)	(0.0030)	(0.0025)
Age 36-45				0.0383***	0.0342***	0.0311***
				(0.0029)	(0.0027)	(0.0021)
Age 46-55				0.0144***	0.0115***	0.0087***
				(0.0021)	(0.0021)	(0.0014)
Age 56-65				0.0038*	0.0021	0.0007
				(0.0023)	(0.0024)	(0.0018)
Δ5-year house prices				-0.0021		-0.0113
				(0.0083)		(0.0199)
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
MSA fixed effects	No	No	No	No	Yes	No
Wald F-statistics	22.94	12.15	19.55			
No. Observations	1,453,798	1,373,067	1,373,067	1,373,067	1,373,067	1,334,415
R-squared	0.30	0.37	0.51	0.02	0.02	0.02

Note: The dependent variable is a dummy equal to 1 if the household purchased a house in the previous year. 'Share manufacturing in 2001' is the MSA-specific share of working population employed in manufacturing in 2001. 'MSA elasticity' is the MSA-specific topological elasticity of housing supply, from Saiz (2010). 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house price' is the percentage change in MSA-wide house prices between 2001 and 2006. All remaining household controls from Table 2 are included in the regressions. In columns (4) and (5), 'Δ5-year house prices' is instrumented using 'Share manufacturing in 2001' and 'MSA elasticity'. Data are from IPUMS, for 2006. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5. House prices and home ownership over the life cycle: Controlling for income effects

	Purchased a home last year						
	OLS	OLS	OLS	OLS	OLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age 18-35 × Δ5-year house prices	-0.0218***	-0.0147**	-0.0232***	-0.0197***	-0.0229***	-0.0195***	-0.0363***
	(0.0060)	(0.0066)	(0.0057)	(0.0058)	(0.0052)	(0.0068)	(0.0134)
Age 36-45 × Δ5-year house prices	-0.0078	-0.0118**	-0.0064	-0.0044	-0.0070	-0.0154***	-0.0196*
	(0.0049)	(0.0049)	(0.0043)	(0.0049)	(0.0041)	(0.0053)	(0.0109)
Age 46-55 × Δ5-year house prices	0.0006	-0.0114	0.0018	0.0021	0.0011	-0.0035	-0.0089
	(0.0042)	(0.0048)	(0.0030)	(0.0030)	(0.0029)	(0.0049)	(0.0084)
Age 56-65 × Δ5-year house prices	0.0129**	0.0151***	0.0096**	0.0092**	0.0086*	0.0166***	0.0125
	(0.0052)	(0.0064)	(0.0046)	(0.0047)	(0.0046)	(0.0061)	(0.0105)
Age 18-35 × Δ5-year rents	0.0088					0.0090	0.0209
	(0.0144)					(0.0142)	(0.0170)
Age 36-45 × Δ5-year rents	0.0128					0.0085	0.0121
	(0.0110)					(0.0097)	(0.0126)
Age 46-55 × Δ5-year rents	0.0060					0.0047	0.0111
	(0.0070)					(0.0068)	(0.0076)
Age 56-65 × Δ5-year rents	-0.0141					-0.0107	-0.0076
	(0.0095)					(0.0095)	(0.0119)
Age 18-35 × Δ5-year MSA income		-0.0295				-0.0460*	-0.0072
		(0.0307)				(0.0257)	(0.0371)
Age 36-45 × Δ5-year MSA income		0.0460*				0.0333	0.0437
		(0.0259)				(0.0223)	(0.0333)
Age 46-55 × Δ5-year MSA income		0.0215				0.0192	0.0261
		(0.0194)				(0.0186)	(0.0263)
Age 56-65 × Δ5-year MSA income		-0.0365				-0.0305	-0.0246
		(0.0226)				(0.0224)	(0.0292)
Age 18-35 × Log (Income)			0.0114***			0.0046***	0.0049***
			(0.0007)			(0.0007)	(0.0008)
Age 36-45 × Log (Income)			0.0071***			0.0042***	0.0045***
			(0.0008)			(0.0008)	(0.0009)
Age 46-55 × Log (Income)			0.0001			0.0001	0.0001
			(0.0006)			(0.0006)	(0.0006)
Age 56-65 × Log (Income)			-0.0011*			-0.0014**	-0.0011*
			(0.0006)			(0.0006)	(0.0006)
Age 18-35 × Real estate job				0.0311***		0.0256***	0.0258***
				(0.0055)		(0.0054)	(0.0054)
Age 36-45 × Real estate job				-0.0002		-0.0034	-0.0025

				(0.0056)		(0.0057)	(0.0056)
Age 46-55 × Real estate job				0.0076		0.0055	0.0050
				(0.0056)		(0.0056)	(0.0057)
Age 56-65 × Real estate job				0.0036		0.0024	0.0016
				(0.0061)		(0.0061)	(0.0061)
Age 18-35 × College or more					0.0618***	0.0594***	0.0594***
					(0.0033)	(0.0034)	(0.0036)
Age 36-45 × College or more					0.0282***	0.0254***	0.0254***
					(0.0016)	(0.0016)	(0.0016)
Age 46-55 × College or more					0.0074***	0.0072***	0.0070***
					(0.0013)	(0.0012)	(0.0012)
Age 56-65 × College or more					0.0065***	0.0075***	0.0072***
					(0.0013)	(0.0013)	(0.0013)
Age 18-35	0.0582***	0.0628***	-0.0617***	0.0586***	0.0432***	0.0003	-0.0052
	(0.0031)	(0.0050)	(0.0080)	(0.0026)	(0.0027)	(0.0082)	(0.0087)
Age 36-45	0.0343	0.0295***	-0.0406	0.0354***	0.0294***	-0.0195**	-0.0241***
	(0.0023)	(0.0041)	(0.0087)	(0.0020)	(0.0018)	(0.0088)	(0.0091)
Age 46-55	0.0097***	0.0075***	0.0127*	0.0102***	0.0106***	0.0085	0.0090
	(0.0013)	(0.0024)	(0.0071)	(0.0015)	(0.0014)	(0.0068)	(0.0072)
Age 56-65	0.0028	0.0063**	0.0158**	0.0017	0.0021	0.0221***	0.0197***
	(0.0019)	(0.0030)	(0.0069)	(0.0019)	(0.0018)	(0.0069)	(0.0072)
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Observations	1,453,798	1,453,798	1,453,798	1,453,798	1,453,798	1,453,798	1,373,067
R-squared	0.02	0.02	0.02	0.02	0.02	0.03	0.03

Note: The dependent variable is a dummy equal to 1 if the household purchased a house in the previous year. 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. 'Δ5-year rents' is the percentage change in MSA-wide rents on a 2-bedroom apartment between 2001 and 2006. 'Δ5-year MSA income' is the percentage change in average MSA-wide total household income between 2001 and 2006. 'Log (Income)' is the natural logarithm of total household income. 'Real estate job' is a dummy equal to 1 if the household head is employed in real estate. 'College or more' is a dummy equal to 1 if the household head has at least a college degree. All remaining household controls from Table 2 are included in the regressions. In column (7), 'Δ5-year house price' is instrumented using 'Share manufacturing in 2001' and 'MSA elasticity' (see Table 3 for details). Data are from IPUMS, for 2006. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6. House prices and home ownership over the life cycle: Long-term effects

	Purchased a home last year	
	OLS	2SLS
	(1)	(2)
Age 18-35 × Δ10-year house prices	-0.0103**	-0.0388***
	(0.0053)	(0.0125)
Age 36-45 × Δ10-year house prices	-0.0028	-0.0069
	(0.0040)	(0.0088)
Age 46-55 × Δ10-year house prices	-0.0028	-0.0045
	(0.0028)	(0.0065)
Age 56-65 × Δ10-year house prices	0.0044*	0.0033
	(0.0023)	(0.0065)
Age 18-35	0.0326***	0.0417***
	(0.0014)	(0.0037)
Age 36-45	0.0220***	0.0233***
	(0.0014)	(0.0026)
Age 46-55	0.0099***	0.0103***
	(0.0010)	(0.0020)
Age 56-65	0.0057***	0.0030
	(0.0009)	(0.0019)
Household controls	Yes	Yes
MSA fixed effects	Yes	Yes
No. Observations	1,491,409	1,410,198
R-squared	0.01	0.01

Note: The dependent variable is a dummy equal to 1 if the household purchased a house in the previous year. 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ10-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2011. All remaining household controls from Table 2 are included in the regressions. In Column (2), 'Δ10-year house price' is instrumented using 'Share manufacturing in 2001' and 'MSA elasticity' (see Table 3 for details). Data are from IPUMS, for 2011. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7. House prices and home ownership over the life cycle: Home size

Panel A. OLS

	House value	# rooms	# bedrooms
	(1)	(2)	(3)
Age 18-35 × Δ5-year house prices	0.5944***	-0.1944	0.1064
	(0.0781)	(0.1769)	(0.1223)
Age 36-45 × Δ5-year house prices	0.4849***	-0.1392	0.1963*
	(0.0754)	(0.1823)	(0.1062)
Age 46-55 × Δ5-year house prices	0.4544***	0.1387	0.3392***
	(0.0728)	(0.1549)	(0.0830)
Age 56-65 × Δ5-year house prices	0.3097***	0.0645	0.1520***
	(0.0601)	(0.1146)	(0.0587)
Age 18-35	-0.3564***	0.4381***	0.3084***
	(0.0367)	(0.0944)	(0.0521)
Age 36-45	-0.1748***	0.8344***	0.4718***
	(0.0358)	(0.1039)	(0.0505)
Age 46-55	-0.1737***	0.5452***	0.2386***
	(0.0336)	(0.0904)	(0.0433)
Age 56-65	-0.1191***	0.3647***	0.1453***
	(0.0320)	(0.0694)	(0.0320)
Household controls	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes
No. Observations	70,139	70,139	70,139
R-squared	0.48	0.24	0.22

Panel B. 2SLS

	House value	# rooms	# bedrooms
	(1)	(2)	(3)
Age 18-35 × Δ5-year house prices	0.5641***	-0.1055	-0.0427
	(0.0987)	(0.1684)	(0.1143)
Age 36-45 × Δ5-year house prices	0.4648***	0.1781	0.2125**
	(0.0971)	(0.1621)	(0.0906)
Age 46-55 × Δ5-year house prices	0.4516***	0.0237	0.4079***
	(0.0959)	(0.1259)	(0.0908)
Age 56-65 × Δ5-year house prices	0.2617***	-0.1841	0.0863
	(0.0719)	(0.1607)	(0.0686)
Age 18-35	-0.3414***	0.4349***	0.3782***
	(0.0442)	(0.0837)	(0.0512)
Age 36-45	-0.1662***	0.8186***	0.4648***
	(0.0438)	(0.0912)	(0.0465)
Age 46-55	-0.1746***	0.5314***	0.2114***
	(0.0434)	(0.0859)	0.0444)
Age 56-65	-0.0994***	0.3909***	0.1834***
	(0.0362)	(0.0700)	(0.0371)
Household controls	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes
No. Observations	66,176	66,176	66,176
R-squared	0.48	0.24	0.22

Note: The dependent variable is the natural logarithm of the house value (column (1)); the number of rooms in the house (column (2)); and the number of bedrooms in the house (column (3)). The sample is restricted to households who purchased a home in the past year. 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. All remaining household controls from Table 2 are included in the regressions. In Panel B, 'Δ5-year house price' is instrumented using 'Share manufacturing in 2001' and 'MSA elasticity' (see Table 3 for details). Data are from IPUMS, for 2006. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 8. House prices and home ownership over the life cycle: Housing debt

	Mortgage/income			
	2006		2011	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
Age 18-35 × Δ5-year house prices	0.0023*	0.0023		
	(0.0016)	(0.0019)		
Age 36-45 × Δ5-year house prices	-0.0040	-0.0042		
	(0.0037)	(0.0042)		
Age 46-55 × Δ5-year house prices	0.0010	0.0012		
	(0.0008)	(0.0008)		
Age 56-65 × Δ5-year house prices	0.0004	0.0002		
	(0.0016)	(0.0016)		
Age 18-35 × Δ10-year house prices			0.0029*	0.0046
			(0.0019)	(0.0064)
Age 36-45 × Δ10-year house prices			0.0086*	0.0057
			(0.0051)	(0.0065)
Age 46-55 × Δ10-year house prices			0.0008	0.0040
			(0.0035)	(0.0064)
Age 56-65 × Δ10-year house prices			0.0246	0.0002
			(0.0220)	(0.0078)
Age 18-35	0.0014*	0.0015*	0.0114*	0.0139
	(0.0008)	(0.0008)	(0.0070)	(0.0086)
Age 36-45	0.0061	0.0064	0.0150*	0.0198*
	(0.0046)	(0.0050)	(0.0090)	(0.0118)
Age 46-55	0.0030*	0.0030	0.0165*	0.0179*
	(0.0018)	(0.0019)	(0.0099)	(0.0107)
Age 56-65	0.0025**	0.0027**	0.0071**	0.0151
	(0.0013)	(0.0012)	(0.0036)	(0.0107)
Household controls	Yes	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes	Yes
No. Observations	70,139	70,139	108,922	108,922
R-squared	0.02	0.02	0.01	0.01

Note: The dependent variable is the ratio of the monthly mortgage payments to income. 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. 'Δ10-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2011. All remaining household controls from Table 2 are included in the regressions. In columns (2) and (4), 'Δ5-year house price' and 'Δ10-year house price' are instrumented using 'Share manufacturing in 2001' and 'MSA elasticity' (see Table 3 for details). Data are from IPUMS, for 2006 (columns (1) and (2)) and for 2011 (columns (3) and (4)). The sample is restricted to households who bought a home at the height of the boom. Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 9. House prices and home ownership over the life cycle: Social implications

Panel A. 2006

	Married		Had a child last year	
	SUR	2SLS	SUR	2SLS
	(1)	(2)	(3)	(4)
Age 18-35 × Δ5-year house prices	-0.2605***	-0.1140***	-0.0040	-0.0077*
	(0.0820)	(0.0253)	(0.0039)	(0.0050)
Age 36-45 × Δ5-year house prices	-0.1709**	0.0113	0.0159***	0.0270***
	(0.0820)	(0.0160)	(0.0042)	(0.0055)
Age 46-55 × Δ5-year house prices	-0.1812**	-0.0139	-----	-----
	(0.0821)	(0.0172)		
Age 56-65 × Δ5-year house prices	-0.0295**	-0.0435***	-----	-----
	(0.0108)	(0.0134)		
Age 18-35 × Owner	-0.1898***	-0.1890***	0.0145**	0.0145***
	(0.0068)	(0.0069)	(0.0023)	(0.0023)
Age 36-45 × Owner	-0.0220***	-0.0194**	0.0018	0.0024*
	(0.0076)	(0.0081)	(0.0025)	(0.0013)
Age 46-55 × Owner	0.0061	0.0067	-----	-----
	(0.0056)	(0.0061)		
Age 56-65 × Owner	0.0342***	0.0323***	-----	-----
	(0.0051)	(0.0054)		
Age 18-35	-0.0152*	-0.0053	0.1080***	0.1099***
	(0.0090)	(0.0098)	(0.0029)	(0.0029)
Age 36-45	0.0797***	0.0747***	0.0085***	0.0028
	(0.0082)	(0.0108)	(0.0031)	(0.0026)
Age 46-55	0.0548***	0.0575***	-----	-----
	(0.0068)	(0.0093)		
Age 56-65	0.0609***	0.0675***	-----	-----
	(0.0054)	(0.0080)		
Owner	0.1999***	0.1995***	-0.0102***	-0.0085***
	(0.0086)	(0.0087)	(0.0021)	(0.0009)
Household controls	Yes	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes	Yes
No. Observations	1,453,798	1,373,067	439,302	415,901
R-squared	0.18	0.18	0.06	0.06

Panel B. 2011

	Married		Had a child last year	
	SUR	2SLS	SUR	2SLS
	(1)	(2)	(3)	(4)
Age 18-35 × Δ10-year house prices	0.0587	-0.1280***	-0.0031	-0.0177***
	(0.0480)	(0.0242)	(0.0048)	(0.0050)
Age 36-45 × Δ10-year house prices	0.1476***	0.0217	0.0192***	0.0326***
	(0.0481)	(0.0139)	(0.0052)	(0.0059)
Age 46-55 × Δ10-year house prices	0.1484***	0.0230	-----	-----
	(0.0484)	(0.0161)		
Age 56-65 × Δ10-year house prices	-----	-0.0023	-----	-----
		(0.0126)		
Age 18-35 × Owner	-0.2026***	-0.2425***	0.0163***	0.0141***
	(0.0043)	(0.0054)	(0.0022)	(0.0019)
Age 36-45 × Owner	-0.0199**	-0.0509**	0.0011	0.0029**
	(0.0047)	(0.0085)	(0.0024)	(0.0014)
Age 46-55 × Owner	-----	-0.0198**	-----	-----
		(0.0077)		
Age 56-65 × Owner	-----	0.0120***	-----	-----
		(0.0044)		
Age 18-35	-0.0783***	-0.0049	0.1016***	0.1132***
	(0.0049)	(0.0080)	(0.0025)	(0.0033)
Age 36-45	0.0279***	0.0900***	0.0114***	0.0091***
	(0.0054)	(0.0104)	(0.0027)	(0.0027)
Age 46-55		0.0600***	-----	-----
		(0.0104)		
Age 56-65		0.0573***	-----	-----
		(0.0071)		
Owner	0.2076***	0.2028***	-0.0112***	-0.0102***
	(0.0039)	(0.0093)	(0.0020)	(0.0010)
Household controls	Yes	Yes	Yes	Yes
MSA fixed effects	Yes	Yes	Yes	Yes
No. Observations	1,410,198	1,373,067	415,252	393,294
R-squared	0.19	0.20	0.05	0.05

Note: The dependent variable is a dummy equal to 1 if the household's head is married (columns (1) and (2)) and a dummy equal to 1 if the household had a child in the past year (columns (3) and (4)). 'Age 18-35', 'Age 36-45', 'Age 46-55', and 'Age 56-65' are dummies equal to 1 if the household head is between 18 and 35, 36 and 45, 46 and 55, or 56 and 65 years old, respectively. 'Δ5-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2006. 'Δ10-year house prices' is the percentage change in MSA-wide house prices between 2001 and 2011. 'Owner' is a dummy variable equal to 1 if the household owns residential property. All remaining household controls from Table 2 are included in the regressions. Columns (1) and (3) report estimates from Seemingly Unrelated Regressions where the marriage equation (column (1)) and the fertility equation (column (3)) are estimated simultaneously together with the main home-ownership equation. In columns (2) and (4), 'Δ5-year house price' and 'Δ10-year house price' are instrumented using 'Share manufacturing in 2001' and 'MSA elasticity' (see Table 3 for details). Data are from IPUMS, for 2006 (Panel A), and for 2011 (Panel B). Standard errors clustered by MSA are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

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