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ABSTRACT

This project investigates how changes in Metropolitan Statistical Area (MSA)- level housing prices affect household fertility decisions. Recognizing that housing is a major cost associated with child rearing, and assuming that children are normal goods, we hypothesize that an increase in real estate prices will have a negative price effect on current period fertility. This applies to both potential first-time homeowners and current homeowners who might upgrade to a bigger house with the addition of a child. On the other hand, for current homeowners, an increase in MSA-level house prices will increase home equity, leading to a positive effect on birth rates. Controlling for MSA fixed effects, trends, and time-varying conditions, our analysis finds that indeed, short-term increases in house prices lead to a decline in births among non-owners and a net increase among owners. Our estimates suggest that a $10,000 increase in house prices leads to a 2.1 percent increase in births among home owners, and a 0.4 percent decrease among non-owners. At the mean U.S. home ownership rate, our estimates imply that the net effect of a $10,000 increase in house prices is a 0.8 percent increase in births. Given underlying differences in home ownership rates, the predicted net effect of house price changes varies across demographic groups. Our paper provides evidence that homeowners use some of their increased housing wealth, coming from increases in local area house prices, to fund their childbearing goals. In addition, we find that changes in house prices exert a larger effect on current period birth rates than do changes in unemployment rates.

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1 Introduction

This project investigates how changes in Metropolitan Statistical Area (MSA)-level house prices affect household fertility decisions. The conceptual approach is based on an economic model of fertility that recognizes that changes in house prices potentially have offsetting effects on fertility. Assuming that children are normal goods, and recognizing that housing is a major cost associated with (additional) children, an increase in the price of housing will have a negative substitution effect on the demand for children in the current period, ceteris paribus. This is true for both potential first-time homeowners (i.e., current renters who would buy a house with the addition of a child) and current homeowners who might buy a larger house with the addition of a child. On the other hand, for a homeowner, an increase in MSA-level house prices increases home equity. This could lead to an increase in birth rates among homeowners through two channels – a traditional wealth effect and/or an equity extraction effect. In either case, when home prices increase, homeowners might use some of their new housing equity to fund their childbearing goals. The net effect of house prices on aggregate birth rates will depend on individual's responsiveness along these margins and rates of home ownership.

We are interested in identifying the causal relationship between movements in local area house prices and current period fertility decisions. Our main empirical analyses consist of ordinary least square (OLS) regressions of MSA-demographic group level fertility rates on MSA level house prices interacted with a baseline measure of MSA-group level home ownership rates, controlling for conditional variable main effects, time-varying MSA conditions, MSA fixed effects, and MSA-specific time trends. Our main analyses focus on the housing price cycle of 1997 to 2006, a period of general housing price growth. Groups are defined by age and race/ethnicity. We use the county-level identifiers in the confidential Vital Statistics natality files to construct MSA level fertility rates, using MSA definitions that are consistent with the MSA definitions in the federal housing dataset. Our main source of house price data is the Federal Housing Finance Agency House Price Index, which we use in combination with 2000 MSA-level median home values to generate house price levels over time. We alternatively consider the Case-Shiller Index.

Conceptually, we are examining how short-term fluctuations in house prices affect current period fertility decisions, all else equal. Our empirical analysis controls for time-varying MSA-level economic conditions that potentially covary with real estate markets and also fertility timing decisions, including the local area unemployment rate and measures of the local wages. It is imperative that the regression specification control for MSA fixed effects so that the estimated relationship between house prices and birth rates is not confounded by time-invariant differences in preferences for children across MSAs. If couples with lower preferences for children sort into areas with higher costs of living – driven by other amenities – there will be a negative correlation between house prices and fertility. Our estimated relationship of interest will be net of any such sorting patterns. We add MSA-specific time trends and MSA-ownership cell-specific time trends to the model to control for the possibility that individuals with plans to increase or decrease their fertility move into MSAs with upward or downward trending house prices, and that renters and owners behave differently in this manner.

Results indicate that as the proportion of women in a demographic cell who are home owners increases, an increase in house prices is conditionally associated with an increase in current period fertility. This is consistent with a positive "home equity effect" that dominates any negative price effect. The data also indicate that as the proportion of homeowners approaches zero, an increase in MSA-level house prices leads to a decrease in current period fertility, which is consistent with a negative price effect among non-owners. In general, the main results hold across race/ethnic groups and are equally driven by first and high-order births. These main results are statistically significant and economically meaningful. Employing our regression estimates in a straightforward simulation exercise, we find that a $10,000 increase in home prices is associated with a 2.1 percent increase in fertility rates among owners. For non-owners, we estimate a corresponding decrease in fertility rates of 0.4 percent. For an MSA, as home ownership rates increase from 10 to 20 percent, the net effect of a $10,000 increase in house prices becomes positive. Our simulations suggest that all else held constant, the roughly $119,000 average increase in house prices during the housing boom of 1997 to 2006 was associated with a 10 percent increase in births over that time.

We implement a number of robustness checks on the model specification and sample construction. We examine how the estimates compare across housing markets characterized by a measure of housing supply elasticity. We also turn to individual-level data from the Current Population Survey (CPS) to confirm that the pattern of effects we see in the aggregate data is found at the individual-level in the ways expected. In addition, we estimate our model on data from two housing bust periods, to see how the estimated relationships compare to those estimated during the 1997-2006 housing boom period. And finally, we tabulate data from the American Housing Survey (AHS) to see if home equity extraction - via mortgage refinancing or home equity loans/lines of credit - is a viable mechanism contributing to the positive effect of house price increases on fertility for home owners.

The main contribution of the paper is to provide an empirical examination of how aggregate movements in house prices affect aggregate level birth rates. First, as an issue of economic demography, it is informative to understand how movements in the real estate market affect current period birth rates, overall and for various demographic subgroups. Second, within the research literature on the nature of the demand for children, an examination of the effect of house prices on the fertility outcomes of homeowners constitutes a useful test of wealth effects. Third, our paper highlights the importance of including housing markets in any model of how economic conditions affect fertility outcomes. In fact, as an empirical matter, we find that changes in house prices exert a larger effect on current period birth rates than do changes in unemployment rates. Fourth, our results potentially speak to the role of credit constraints, and imperfect capital markets, in affecting the timing of fertility decisions. This is an issue that features prominently in the literature on the cyclicality of fertility timing, as reviewed in Hotz, Klerman, and Willis (1997). Our finding of a positive effect among home owners suggests that some individuals may consume out of home equity to fund their childbearing goals. And finally, there is a literature, described below, on the tendency of individuals to consume out of housing wealth. To our knowledge, that literature has not previously considered children as a potential "consumption" good in this regard. Our results provide clear empirical support for the idea that house prices impact birth rates in a statistically significant and economically meaningful way.

2 Conceptual Framework and Related Literature

There is a large literature in neoclassical economics investigating the nature and determinants of fertility in developed countries. In the most simple static approach to this question, parents are viewed as consumers who choose the quantity of children that maximizes their lifetime utility subject to the price of children and the budget constraint that they face. Children are conventionally thought to be normal goods, but an empirical puzzle presents itself in both time series and cross-sectional data, which tend to show a negative correlation between income and number of children.

There are two leading explanations for this observed correlation that maintain the basic premise of children as normal goods: (1) the quantity/quality trade-off (Becker, 1960) and (2) the cost of time hypothesis (Mincer (1963); Becker (1965)). The first refers to the observation that parents have preferences for both the quantity and quality of children. If the income elasticity of demand for quality exceeds the income elasticity of demand for number of children, then as income rises, parents will substitute away from the number of children, toward quality per child. The second hypothesis attributes the observed negative relationship between income and fertility to the higher cost of female time experienced by higher income families, either because of increased female wage rates or because higher household income raises the value of female time in non-market activities. There is a long and active literature that attempts to estimate the effect of changes in family income and of own-prices on fertility.[1]

There exists a closely related literature investigating the cyclicality of fertility, which is a literature about fertility timing (e.g., Galbraith and Thomas (1941); Becker (1960); Silver (1965); Ben-Porath (1973)). Changes in the unemployment rate are typically thought to affect the wages of women and their husbands. Under the standard assumption that women bear the primary responsibility for child rearing, it becomes optimal for woman to select into childbearing at times when their opportunity cost is lowest, that is, when economic conditions are least favorable. Another consideration affecting optimal timing with regard to unemployment rates is skill depreciation (Happel, Hill, and Low, 1984).

In a world with imperfect capital markets and credit constraints, women might not be able to optimally time fertility with regard to opportunity cost and skill depreciation considerations. In particular, though some women might optimally choose to select into childbearing during economic downturns, they might not be able to afford to do this, if husbands' income is also negatively affected. Schaller (2011) provides a recent examination of this issue and explicitly considers the role of gender-specific labor market conditions. Her results confirm previous empirical findings that increases in overall unemployment rates are associated with decreases in birth rates. In other words, her empirical work confirms that births are pro-cyclical. In support of the predictions of Becker's time cost model, she further finds that improved labor market conditions for men are associated with increases in fertility, while improved labor market conditions for women have the opposite-signed effect.[2]

In many respects, the context of real estate markets is more straightforward to consider

[1] The key empirical challenge in this literature is to find variation that is exogenous to women's (or couple's) preferences and that alter price or income without affecting the opportunity cost of women's time. Many of these papers are reduced-form in nature, and include examinations, for example, of the effect of direct pro-natalist government payments (e.g., Milligan (2005); Cohen, Dehejia, and Romanov (2007)) and of exogenous changes in income (Lindo (2010); Black et al. (2011)).

[2] Dehejia and Lleras-Muney (2004) suggest that relatively more white women opt into childbearing during economic downturns than black women; they attribute this difference to credit constraints facing blacks. Neither Schaller (2011) nor we find evidence in the data consistent with this idea. In particular, we find a larger negative relationship between unemployment rates and birth rates among whites than among blacks.

conceptually because changes in house prices do not affect the cost of parental time. Our conceptual framework is thus not encumbered by considerations of skill depreciation or opportunity cost of time. We motivate our empirical model and interpret our estimated effects simply in terms of housing costs (which affect the price of childbearing) and housing income effects (which affect ability to consume in the current period).[3] Our focus on current period prices and contemporaneous fertility allows us to look separately for price and "income" effects. Changes in the real estate market are expected to generate price effects because housing costs are estimated as the greatest portion of the annual cost of raising a child: greater than food, child care, or education (Lino, 2007).

We qualify the term "income" because an increase in house prices does not necessarily imply increased wealth or income for home owners. If price increases are viewed to be permanent and homeowners see their home as a store of wealth, an increase in house prices can be thought of as an increase in (perceived) wealth for existing homeowners. This could lead to an increase in the demand for children in the current period, as well as in a completed lifetime setting. But, if homeowners do not intend to "cash out" and move to a lower-priced real estate market during their lifetime, or if they view the increase in house prices as transitory and expect it to be undone at a later period, there is no change in actual wealth or permanent income. However, if homeowners are otherwise credit constrained but can liquefy increases in home equity, there can be an increase in current period accessible income and this could lead to an increase in current period birth rates. To the extent that equity extraction is driving our results, our paper potentially speaks to the role that credit constraints play in affecting the timing of childbearing. For the sake of convenience of exposition, we refer to this general class of explanations as a "home equity effect".

One could reasonably argue that in contrast to unemployment rates – which are generally

[3] There exists a class of dynamic or life-cycle models of fertility decisions, which recognize that changes in prices and income over the life cycle may result in changes in the timing of childbearing, even if they do not cause completed lifetime fertility to change. The Handbook chapter by Hotz et al. (1997) provides an overview of these theoretical models. Heckman and Walker (1990) provides an empirical examination of the effect of income and wages on life-cycle fertility using data from Sweden.

understood to be cyclical – movements in the housing market over the period we analyze were likely to have been perceived at least in part as permanent. This would follow from the observation that the national trend in housing prices between 1997 and 2006 was steadily increasing. This suggests our results may be indicative of a change in completed fertility, as opposed to simply a story about timing or cyclicality. We give a cursory treatment of this possibility in our empirical analyses below - in particular by looking at higher-order births - but we leave it to future research to thoroughly examine this possibility.

Finally, we acknowledge that we talk about fertility throughout the paper as though it is a simple decision. Of course, fertility is a stochastic outcome, albeit one that is to a large extent controllable by individual's actions with regard to sexual activity, contraceptive use, fertility treatments, and abortion. We recognize, however, that latent demand for fertility timing will not be perfectly realized. Thus, any response we see of fertility to house prices will be a muted reflection of a couple's desired fertility response.

3 Data and Empirical Approach

The main empirical approach of this paper is to empirically relate MSA level fertility rates to demeaned and de-trended MSA-level house prices, interacting house prices with a baseline measure of group-level home ownership rates and controlling for time-varying MSA level characteristics. The three main data requirements are (1) MSA-level fertility rates, (2) MSA-level house prices, and (3) group-level home ownership rates. In this section we describe our main data sources and briefly describe how we construct the relevant variables. Table 1 provides details on explanatory variables and associated data sources.

3.1 Data

Data on births come from the Vital Statistics Natality Files, years 1990 to 2007. Vital statistics data contain birth certificate information for virtually every live birth that takes place in the United States. Vital statistics data identifies the race/ethnicity, marital status, age, and education of the mother, as well as some limited information about the baby's pregnancy conditions, and the baby's health status at time of birth. These data do not include information about home ownership status of the parent. For the purposes of matching births to our explanatory variables, we create a file of conceptions for the years 1990 to 2006, using information on the date of birth and length of gestation to identify year of conception. We do this because in terms of the decision-making process, the most relevant decision is the decision to get pregnant in a given time period. It is thus the economic conditions that exist at the conception decision point that are relevant, as opposed to the economic conditions in place at the time when the birth actually occurs (typically 40 weeks later.) To be precise, our analysis sample is a sample of conceptions that result in live births in year t.

We construct MSA-year-group level fertility rates by aggregating births and female population counts to the MSA-year-group cell, where groups are defined by the interaction of race/ethnicity and age category. We define three mutually-exclusive race/ethnic groups: Non-Hispanic White, Non-Hispanic Black, and Hispanic. We exclude other race/ethnicities from the analysis. We define two age categories, 20-29 and 30-44. We applied for and obtained access to confidential natality files that identify the mother's state and county of residence. We obtained annual female population counts (by age, race, ethnicity, and county) from the National Center for Health Statistics (National Center for Health Statistics, 2003 2010). We use these data to construct MSA-group-level fertility rates, defined as the total number of births to women in the MSA-year-group cell divided by the MSA-year-group population. To aggregate from counties to MSAs, we use the MSA definitions that are used in the federal housing datasets: 5-digit MSAs and Divisions as defined by the Office of Management and Budget in December 2009 (Bulletin 10-02).

We identify a total of 384 MSAs in the birth records. We restrict our sample to MSAs that have at least five births in every year-group cell, which leaves us with a sample of

222 MSAs.[4] When we further restrict the sample to those MSAs for which all explanatory variables used in the baseline specification are available, we are left with a sample of 163 MSAs.[5]

The main data source used to construct MSA-level house prices is the Federal Housing Finance Agency (FHFA) housing price index (HPI), previously known as the OFHEO housing price index. The FHFA index is available for nearly all metropolitan areas in the United States.[6] It measures the movement of single family home prices by looking at repeat mortgage transactions on homes with conforming, conventional mortgages purchased or securitized through Fannie Mae or Freddie Mac since 1975.[7] Since the index looks at repeat mortgages of the same home, it is continually revised to reflect current MSA boundaries. This is the reason we must use the most current definitions of MSAs in constructing the birth data.

We use the FHFA index to construct real house prices for each MSA-year by combining it with information on median home values obtained from the 2000 census. The 2000 Census records median home values for each county in the U.S. We use the same county crosswalk used to construct MSAs in the birth data to construct MSA-level median 2000 house values, which are the population-weighted average across all counties in each MSA. Home values are scaled by the relevant change in the FHFA index over time and are adjusted to 2006 dollars using the CPI-U "All items less shelter" series. This measure serves as a proxy for real house

[4]Other empirical papers that have used aggregate level MSA data have used the following rules: Blau, Kahn, and Waldfogel (2000) look at MSA level marriage rates and MSA level indicators of labor and marriage market conditions. They use a rule of 20 observations per race-education group. Blau et al. (2004) look at MSA level single motherhood and headship rates and welfare benefits. They use a rule of 10 observations per race-education group.

[5]While this process eliminates 58 percent of MSAs, it only eliminates about 17 percent of births.

[6]FHFA requires a metro area to have at least 1,000 transactions before it is published.

[7]Conventional mortgages are those that are neither insured nor guaranteed by the FHA, VA, or other federal government entities. Mortgages on properties financed by government-insured loans, such as FHA or VA mortgages, are excluded from the HPI, as are properties with mortgages whose principal amount exceeds the conforming loan limit. Mortgage transactions on condominiums, cooperatives, multi-unit properties, and planned unit developments are also excluded. This contrasts to the alternative Case-Shiller index, which includes all homes, but is only available for 37 states and a more limited set of MSAs. Additional differences between the two indices are that the Case-Shiller index puts more weight on more expensive homes and the Case-Shiller index uses purchases only, whereas the FHFA index also includes refinance appraisals. As a robustness check, we re-estimate our results using the Case-Shiller index.

price movements of median value homes in each MSA.[8]

The third main variable we need to construct is a measure of mean group-level home ownership rates at the MSA level. This is key to our analysis because conceptually, we expect there to be heterogeneous responses of birth rates to home prices across groups with different rates of home ownership. Recall that Vital Statistics data do not include information about home ownership status, so we can not separately tabulate current period births (or conceptions) separately for home owners and non owners. Furthermore, we ideally do not want to use an individual-level measure of realized home ownership rate, as that is potentially endogenously determined with childbearing outcomes. Our implemented solution is to use MSA-group level home ownership rates calculated from the 1990 5 percent sample of the decennial census. As above, groups are defined by race/ethnicity and age category. We match the MSA definitions provided in the Census to the 2009 MSA definitions used for the birth and housing price data according to the crosswalk procedure described in the appendix. To be clear, our group-level measure of home ownership is taken at baseline and is time invariant.

3.2 Descriptive statistics and trends

Figure 1 displays trends in mean (CPI adjusted) house prices, constructed as described above, in our sample, both in levels (panel (a)) and yearly percentage changes between year $t-1$ and t (panel (b)). Figure 1 also displays house prices alternatively constructed using the Case-Shiller Index to scale 2000 median home prices. The three housing cycles that fall within our period of study are highlighted: the 1990-96 period of price decline, the 1997-2006 housing boom, and the subsequent 2007-2010 housing bust. Appendix Table 1 lists the 163 MSAs included in our analysis sample, ranked according to the percentage increase in housing prices between 1997 and 2006. The table also lists the computed median home price in 2006 and the fertility rate in 2006. The top eight ranking MSAs/MSADs in terms of the

[8] This is the same procedure used by Glaeser et al. (2008).

percent change during the boom cycle are all in California. Among the top 24 ranked, 16 are in California, 7 are in Florida, and the remaining one is in New York. The most expensive housing market in the nation is the San Francisco MSA, with a 2006 median home price of $781,891. The MSAs with the least house price growth during this boom cycle are Dayton, OH (3.92 percent), Fort Wayne, IN (3.27 percent), and Springfield, IL (1.19 percent).

Figure 2 displays the time-series correlation between fertility rates and house prices and then between fertility rates and unemployment rates, for the period 1990-2006, averaged across the MSAs in our sample. These plots suggest that movements in fertility rates track movements in house prices fairly closely, particularly in more recent periods. In fact, a comparison of the graphs reveals that the time-series correlation between aggregate fertility rates and housing prices is much greater than it is between aggregate fertility rates and unemployment rates, .85 versus -.04 This provides a prima facie case for the importance of considering housing prices when investigating how economic conditions affect current period birth rates.

Table 2 provides summary statistics from the 1997-2006 Vital Statistics natality files and the 1990/2000 Census. These data are used collectively in various analyses presented below. All measures are population weighted. The first three columns summarize the main dependent variable of interest: fertility rates (group-level births per 1000 women age 20-44), overall and for first and higher parity births. The overall fertility rate in our sample is 70.2 births per 1000 women aged 20-44. The highest fertility rates are found among Hispanics age 20-29: 154 births per 1000 women. The lowest rate is among Black mothers age 30-44:37.7 births per 1000 women.

The next column summarizes data from the 1990 census on MSA-group level home ownership rates. The overall home ownership rate among our sample of women age 20-44 is 44 percent. The highest home-ownership rates are found among older (age 30-44) white women, who have an ownership rate of 68 percent. The lowest rates are found among younger (age 20-29) Black women, whose ownership rate is on average 10 percent. This indicates there is substantial variation across groups in rates of ownership. For the sake of comparison, the next column shows the rates as calculated from the 2000 census. Comparing the group-level ownership rates in 1990 and 2000 we see that home ownership rates are extremely stable over this time period. The final column displays the range of the 1990 ownership rate across MSAs, for each group. These numbers indicate that in addition to the substantial variation across groups in rates of home ownership, there is also substantial variation within groups across MSAs.

3.3 Empirical Specification

Our main empirical analysis consists of ordinary-least squares regressions (OLS) at the MSA-group-year level. For our baseline analysis, we restrict our attention to the housing cycle of 1997-2006. This facilitates interpretation as the period was one of nearly uniform house price growth, and is recognized by the real estate literature as a housing boom period. We will subsequently consider two housing bust periods: the early 1990s bust period (1990-1996) and the post-2006 housing bust (2007-2010).

We estimate regression models of the following form:

$$\begin{aligned} ln(FertRate_{mtg}) &= \beta_0 + \beta_1(HousePrices_{mt-1} * OwnRate_{mg}) + \beta_2 HousePrices_{mt-1} \\ &\quad + \beta_3 OwnRate_{mg} + \beta_4 \mathbf{X}_{mt-1} + FracColl_{mgt} + \gamma_m + \gamma_t + \gamma_g \\ &\quad + \gamma_m * (t-1) + \gamma_m * OwnCat_{mg} * (t-1) + \epsilon_{mgt} \end{aligned} \tag{1}$$

The level of analysis is an MSA-year-group cell. In the above equation, the subscript m denotes MSA division, t denotes year of the birth (where *t-1* refers to the year of conception), and g denotes group.[9] There are six groups, defined by the interaction of our three race/ethnic groups (non-Hispanic white, non-Hispanic black, and Hispanic) and two age categories (age 20-29 and age30-44). Our final analysis sample consists of 9,780 observations

[9]For the sake of convenience, we write *t-1*, but our empirical analysis is precise in dating the year of conception by taking the date of birth and subtracting off the reported weeks of gestation.

(10 years * 6 groups * 163 MSAs). All regression are weighted by the total number of births in each cell.[10]

The coefficients of primary interest are β_1 and β_2 , which capture the conditional effect, respectively, of MSA-year house price index (HPI) interacted with a baseline measure of MSA-group-level ownership rates and the conditional main effect of the MSA-year house prices ($HousePrice_{mt-1}$) on fertility rates. The former indicates how an increase in home ownership rates affects the relationship between de-meaned, de-trended MSA house prices and births. The conditional main effect of $HousePrice_{mt-1}$ indicates how movements in house prices affect fertility rates net of ownership interactions, all else held constant. We interpret this to be the conditional relationship between $HousePrice_{mt-1}$ and log fertility rates among a non-home-owning population of households.

The variable $OwnRate_{mg}$ is the MSA-group level home ownership rate measured in the 1990 5-percent sample of the decennial census. This measure is taken at baseline to minimize concerns about the endogeneity of year-specific MSA-home ownership rates and year-specific MSA-fertility rates. Taking a baseline measure of home ownership rates for a group is therefore preferable. As reported in Table 2, there is considerable heterogeneity across groups in home ownership rates, as well as heterogeneity within groups across MSAs. It is also true that home ownership rates are quite stable over time within groups, which means the baseline measure is highly predictive of current period home ownership rates. Therefore, this approach does not entirely eliminate any concern about endogenously determined current period births and our measure of home ownership rates. We control for this conditional main effect to facilitate a causal interpretation of β_1, but we are careful not to assign a causal interpretation to the coefficient on ownership rates.

We are interested in identifying the causal relationship between lagged house prices and fertility rates. It is thus important to control for other time-varying MSA-level economic conditions that potentially covary with real estate markets and also fertility timing decisions.

[10]Results alternatively weighting by total female population in each cell are similar and available from the authors upon request.

Our regression specification includes controls for MSA-year unemployment rate, MSA-year male wages included in the vector X_{mt} in equation (1). The specification also controls for $FracColl_{mgt}$, the fraction college educated in each MSA-group-year. This is calculated as a three year moving average using data from the Current Population Survey. Data on MSA-year level unemployment rates come from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics. Our measure of MSA-year level male wages is the 25th, 50th, and 75th percentile male wage, which was calculated by MSA and year in the Current Population Survey. Percentiles of the wage distribution were constructed based on hourly earnings for full-time, full-year male workers.[11] Unemployment rates were collected at the county level and aggregated to MSAs using the crosswalk procedure described in the appendix. The wage and fraction college measures were calculated using the MSA definitions available in the CPS and translated to 2009 MSAD definitions using the crosswalk procedure.

The regression also includes controls for MSA fixed effects (γ_m), year fixed effects (γ_t), group fixed effects (γ_g), MSA-specific time trends ($\gamma_m * (t-1)$) and MSA-ownership-cell-specific time trends ($\gamma_m * OwnCat_{mg} * (t-1)$). It is imperative that the regression specification control for MSA fixed effects so that the estimated relationship between house prices and birth rates is not confounded by time-invariant differences in preferences for children across MSAs. If couples with lower preferences for children sort into areas with higher costs of living – driven by other amenities – there will be a negative correlation between house prices and fertility.[12] Given our goals in this paper, we want to isolate the effect of house prices on

[11] We construct wages as in Autor, Katz, and Kearney (2008). We define full time as 35 or more hours per work, and full year as 40 or more weeks worked in the past year. We drop individuals who make less than one half the 2006 minimum wage (in 2006 dollars). Top-coded observations are multiplied by 1.5.

[12] For example, consider the hypothetical case of two couples, in which one moves to San Francisco, where household expenses are high, because they expect to have few children and spend their time and money instead indulging in city-type amenities. The other couple moves to Wichita, in expectation of buying a big house at a much lower cost per square foot, and filling it with kids. If these couples are typical, then high-latent-fertility couples will sort into lower priced real estate markets and low-latent-fertility couples will sort into lower priced real estate.Simon and Tamura (2008) examine the cross-sectional relationship between fertility and the price of living space across U.S. metropolitan areas, as captured by the average rent per room in an urban area (calculated among renting households.) Their baseline specification, which controls for region effects and demographic composition, suggests that a one percent increase in rent is associated with 0.16 fewer children per household.

current period fertility net of these sorting patterns. It is thus important that our regressions control for mean MSA-level differences in birth rates. The resulting regression estimate of the relationship between house prices and birth rates is identified off within-MSA changes in house prices. We add MSA specific time trends to the model to control for the possibility that individuals with plans to increase or decrease their fertility move into MSAs with upward or downward trending house prices. If there exist trends of this kind that are distinct for groups with high and low ownership rates, our estimated β_1 might be a biased estimate of the conditional causal effect of interest. We thus allow for separate MSA specific time trends based on whether a group's level of ownership is above or below the median, yielding two values of $OwnCat_{mg}$. So, for example, this allows for white women age 30-44 in the Boston metro area to be on a different trend then black women age 20-29 in the Boston metro area.

As noted above, our empirical analysis is designed to capture current period fertility responses to movements in local house prices. Certainly it would be interesting to know whether any short term responses observed translate into changes in completed fertility. To the extent that we observe a change in higher-order births, we can speculate that those changes reflect changes in total completed fertility. But, we leave it to future research to carefully consider the lifetime implications of any short term changes that we find. Such an analysis requires a different empirical framework.[13]

4 Estimation results

4.1 Main specifications

Table 3 presents the results of estimating equation (1). Column 1 reports the results with all fixed effects included, but without MSA-specific trends or controls for labor market condi-

[13]In future work we plan to compare the completed fertility of cohorts who experienced their prime childbearing years during different real estate market realizations, controlling econometrically for differences in wage levels and income over those periods. In such an approach, given that the empirical analysis is no longer about a point in time, one needs to grapple with the issue of mobility over the course of one's childbearing years, which is not observed in most datasets.

tions. This sparse specification yields a point estimate of β_1 of 0.00437 and a point estimate on β_2 of -0.00124, both statistically significant at the one percent level. The positive and statistically significant point estimate on the interaction term $HousePrice_{mt-1} * OwnRate_{mg}$ indicates that as home ownership rates increase, higher house prices lead to an increase in current period births, all else held constant. This implies that a positive home wealth effect dominates any negative price effect among current home owners. The negative and statistically significant point estimate on $HousePrice_{mt-1}$ is consistent with a negative price effect of house prices on current period fertility for non-home owners. Column 2 adds the unemployment rate, Column 3 adds wage measures, and Column 4 includes both the unemployment and the wage measures. The main point estimates of interest are qualitatively unchanged. Looking at other explanatory variables, we see that the estimated coefficient on the mean ownership rate is positive, but statistically insignificant. As noted above, we do not propose a causal interpretation to this relationship. The unemployment rate is found to be negatively related to the fertility rate in all specifications, but it does not enter with statistical significance

Columns 5 and 6 report the results with MSA specific linear trends and MSA specific quadratic trends, respectively. The pattern remains the same – a positive coefficient on $HousePrice_{mt-1} * OwnRate_{mg}$ and a negative coefficient on $HousePrice_{mt-1}$– and the magnitudes of the coefficients are similar. The inclusion of quadratic trends demands a lot of the data and does not alter our main estimates; hence we do not include quadratic trends in our preferred specification. However, we do maintain distinct MSA-specific trends for cells with ownership rates above and below the median home ownership rate. As reported in Column 8, these trends do affect the point estimates of interest. In this model, the estimated coefficient on the $HousePrice_{mt-1} * OwnRate_{mg}$ interaction is 0.0247 (with a standard error of .00373) and the estimated coefficient on $HousePrice_{mt-1}$ is -0.00411 (standard error of .00164).[14]

[14] As described earlier, these estimates are weighted by the total number of births in each cell. If we alternatively weight by total female population in each cell we obtain an estimate of 0.0288 with a standard error of 0.00412 on the interaction term and an estimate of -0.0077 with a standard error of 0.0018 on the main effect.

We take this to be our preferred specification. These estimates suggest that if house prices increase by $10,000, as we move from an MSA-group with an ownership rate of 0 to a cell with an ownership rate of 1, there would be a relative increase of 2.5% in fertility rates. More usefully, if house prices increase by $10,000, comparing MSA-groups with ownership rates of 0.25 to those with ownership rates of 0.75, we would see a relative increase of 1.25% in fertility rates. We put these numbers into context below with the use of simulation exercises.

4.2 Alternate Measures of Home Prices

In this section we consider how our estimates change if we replace the house price in the year of conception with alternative measures of house prices. We do not have a strong a priori reason to believe that house prices in the year of conception is the most relevant measure, as opposed to, say, house prices averaged over the three years prior. It may be the case that couple's fertility decisions are based on a longer time horizon or on longer terms averages. Table 4 reports the results of estimating alternative models of this sort. Columns 1-4 use house prices in the years 1, 2, 3, and 4, respectively, prior to conception. Columns 5, 6, and 7 use the 3-year moving average of house prices over the two, three, and four years, respectively, prior to conception. In all of these seven alternative models, the familiar pattern emerges of a positive coefficient on the interaction between $HousePrice_{mt-1}$ and $OwnRate_{mg}$and a negative coefficient on $HousePrice_{mt-1}$. Results are within a reasonable range of magnitudes – with the point estimates of β_1 ranging from 0.0025 to 0.0045 – giving us no reason to prefer one of these specifications over our baseline specification.

In column 9 of Table 4, we consider computing the measure of house prices using an alternative housing price index, the Case-Shiller Index. This index differs from the FHFA index used above in a few ways. As compared to the FHFA index, which is available for all MSAs, the Case-Shiller index is only available for 20 metropolitan areas, which we are able to match to 27 of the metropolitan divisions we use in the main analysis.[15] However,

[15]See the data appendix for how we match the Case-Shiller index to the rest of our data.

the Case-Shiller index offers the benefit of being constructed using virtually all homes in the MSAs it covers, whereas the FHFA index only includes homes purchased or refinanced using conventional, conforming mortgages. In addition, the Case-Shiller index is value-weighted, meaning more expensive homes figure more heavily in its construction, and it only includes purchases, whereas the FHFA index includes purchases and refinances. In column (8) we show the results using the FHFA index home price data on the Case-Shiller sample MSAs and in column (9) we use the Case-Shiller index home price data. Even though the indices are slightly different and the sample size is limited by using the Case-Shiller index, the pattern of the coefficients is familiar and the results moving from (8) to (9) are similar, confirming the results are not sensitive to the chosen housing price index.

4.3 Robustness Checks

In this section we estimate alternative specifications to equation (1) above, providing some robustness checks on the main MSA-group level analysis. Table 5 reports these results. Column 1 reproduces the main results from Table 3, for the sake of comparison. First we consider alternate measures of the labor market conditions. In column 2 we replace male wages with separate measures of male and female wages. In Column 3 we replace the wage distribution measures with the mean wage. In column 4 we replace the wage distribution measures with a measure of Income per Capita collected from the Bureau of Economic Analysis (BEA) regional economic accounts. To create this variable at the MSA-year level, we employ our crosswalk procedure described in the appendix. Income included in this measure includes all wage and salary income as well as supplements to wages and salaries, proprietors' income with inventory valuation and capital consumption adjustments, rental income of persons with capital consumption adjustment, personal dividend income, personal interest income, and personal current transfer receipts, less contributions for government social insurance. In each case, the coefficients are virtually unchanged.

Next, we consider that owners and non-owners might be differentially affected by general economic conditions in a way that is not captured by simply including a measure of wages. If this were the case, the coefficient on $HousePrice_{mt-1} * OwnRate_{mg}$ might capture this difference, leading to a biased estimate of the causal effect of interest. To do this, we interact the home-ownership rate with the wage measures. Column 5 displays the results of this exercise. The coefficient on $75thWage_{mt-1} * OwnRate_{mg}$ is positive and statistically significant, indicating owner's fertility decisions are positively effected by increases in male wages at the top of the distribution. However, the coefficients on $HousePrice_{mt-1} * OwnRate_{mg}$ and $HousePrices_{mt-1}$ remain unaffected.

Next, we add a control variable for average rental prices in the MSA-year. Average rental prices and house prices tend to covary, but there are years during which the two series are more or less closely aligned. Our measure of average rental prices comes from the Department of Housing and Urban Development (HUD) Fair Market Rents program, used for the purpose of calculating rent for the Section 8 housing assistance payment program.[16] We adjust the nominal values of rental prices to 2006 dollars using the CPI-U "all items less shelter" series (as we do for the HPI). As shown in the table, the inclusion of this control variable does not appreciably change the estimated coefficients on our two explanatory variables of interest: $HousePrice_{mt-1}$ and $HousPrice_{mt-1} * OwnRate_{mg}$.

Finally, in column 7 of table 5 we consider an alternative sample of MSAs to check on whether the changing boundaries of MSAs over the sample period is influencing our estimates. We re-estimate the specifications reported in Table 4 using a restricted set of MSAs. In particular, we limit the sample to MSAs whose boundaries did not change between 1990 and 2009. This is done as a check on the sensitivity of our estimates to the crosswalk procedure we have used to link current MSAs (2009 OMB definitions) to vintage MSAs (1983 OMB definitions) which we use to match the group level home ownership rates to the rest of

[16]Calculated rent is inclusive of utilities and is typically calculated at the 40th percentile of the rent distribution by number of bedrooms. Prior to 1995, rent was calculated at the 45th percentile. Some cities are calculated at the 50th percentile. We take the unweighted average of the reported fair market rental value for zero to four bedroom units as the average rental price in a given city.

the data. This procedure effectively ignores boundary changes that have occurred over our sample period. Though the sample size is reduced, the range of point estimates on the two coefficients of primary interest is not qualitatively altered.

4.4 Different Demographic Groups

In Table 6, we report the results of estimating equation (1) for various demographic subgroups and for first and higher order births. Column 2 reports the results for non-Hispanic whites, column 3 reports the results for non-Hispanic blacks and column 4 reports the results for Hispanic whites. The point estimate on the interaction term $HousePrice_{mt-1} * OwnRate_{mg}$ is always positive, implying a net positive effect of house price increases among home owners across all groups. The estimated magnitude of this relationship is largest for blacks and smallest for Hispanics. The estimated coefficient on $HousePrice_{mt-1}$ is negative for whites and blacks, but positive for Hispanics. This last coefficient is puzzling. For both blacks and Hispanics, the estimated coefficient on $HousePrice_{mt-1} * OwnRate_{mg}$ and $HousePrice_{mt-1}$ are statistically different from the estimated coefficient for whites.

We next consider whether the effects of house prices on current period births are driven by first births or higher order births. It is not clear a priori which would be more price or income elastic. On the one hand, the optimal timing of first births might be less constrained, since mothers tend to be younger and might consider that a deliberate delay will be less consequential, as they have more childbearing years ahead of them. Also, if couples have specific ideas about optimal spacing, they might be more flexible about the timing of their first birth. On the other hand, subsequent births might be more "marginal" and thus might exhibit a great degree of elasticity with respect to price or a wealth shock. An additional motivation for this analysis is that an effect on higher order births might be indicative of a change in completed fertility.

Table 9 columns 6 and 7 report the results. For both first and higher parity births, the estimated coefficient on the interaction between $HousePrice_{mt-1}$ and ownership rate is positive and statistically significant, with very similar magnitudes: 0.00226 and 0.00261, respectively. The point estimate for the coefficient on $HousePrice_{mt-1}$ is negative and statistically significant for both first and higher-order births. The finding of an effect on both first and higher-order births is potentially informative about the nature of the effects we are estimating. Increases in first births might reasonably be interpreted as a change in timing, while changes in higher order births might reasonably be interpreted as an increase in the total number of children. These interpretations are merely speculative, and warrant further investigation.

Given that a previous literature exists on the relationship between unemployment rates and contemporaneous fertility rates, it is interesting to consider the estimated coefficients on the unemployment rate. Our regression models yield statistically significant negative estimates of the relationship between unemployment rates and fertility rates among whites and Hispanics, but not among blacks. When house prices are not included in the model (not shown in the table), the estimated relationship is largely unchanged for whites (a statistically significant -0.0067), but it becomes attenuated and statistically insignificant for Hispanics. (The point estimate is largely unchanged for blacks and remains statistically insignificant.) It is also interesting to note that in terms of separate effects by birth parity, the unemployment rate is negatively related to first births, but not discernibly related to higher-order births. This would be consistent with the unemployment rate having an effect on the timing of childbearing initiation, but potentially not with completed fertility. To the extent that this interpretation is warranted, this is an interesting contrast to the potentially more permanent effect of house prices. Again, we think these considerations deserve further examination, although it is outside the scope of this paper.

5 Extensions

In this section, we undertake three extensions to previous analyses. First, we consider variation across different types of housing markets. Second, we confirm that the aggregate results hold at the individual level. And finally, we consider periods of declining house prices.

5.1 Comparisons by Local Housing Supply Elasticity and "Sand" versus "Coastal" MSAs

The main threat to assigning a causal interpretation to the estimated β_1 is the possibility of reverse causality. This alternative interpretation holds that house prices are driven up in places with relatively higher rates of home ownership (as measured in a pre-period baseline year) by households who intend of conceive a baby in the coming year. This confounding story is one of fertility-preference demand driven price changes. Recall that we find that the estimated conditional relationship between house prices and birth rates is negative, but the interaction with ownership is positive. For this finding to be explained by the alternative reverse causality story, it must be the case that fertility-related demand pressures occur disproportionately in areas with higher rates of home ownership. This is not inconceivable, but we would be more concerned if we didn't find separating effects for the conditional main effect and the interaction term. If it were simply the case that in MSAs where people demanded more children house prices got driven up, ceteris paribus, then both $\beta_1$and β_2 would be estimated to be positive.

We would clearly prefer to have an observable variable that could explain or predict these shorter term price changes that our analysis exploits. To that end, we have attempted to find a suitable instrumental variable. Our review of the relevant literature on housing markets has led us to a consideration of supply side constraint measures. The housing literature has produced three common measures of supply constraints: the Rappaport and Sachs (2003) status as a Coastal market based on a threshold distance to an ocean, the Gulf Coast, or a

Great Lake; the Saiz (2008) calculation of the fraction of land lost to steep slopes and water; and the Wharton Residential Urban Land Regulation Index created by Gyourko et al. (2008). Saiz (2012) has produced estimates of housing supply elasticity for 95 MSAs based on non-linear combinations of both the Saiz (2008) geographic limitations and the Regulation Index. Saiz clearly notes that this elasticity measure predicts long-frequency house price volatility, not high-frequency changes; in particular, he focuses on the house price growth from 1970 to 2000.[17] We are thus left without a feasible instrumental variable strategy. However, we do make use of these concepts as way to compare locations which are expected to potentially have demand driven price growth and those that are not.

We propose that concerns about fertility-preference demand driven price changes are less likely to be a concern in places with lower housing supply constraints. We thus estimate our regression models separately for MSAs with higher and lower levels of supply elasticity, as captured by the Saiz (2012) measure. If the estimated relationship is maintained in less supply constrained places, we are more confident in the assumption that our estimated effect is not driven by homeowners with babies (or fertility intentions) bidding up the prices of inelastically supplied houses. Table 7 reports the results. Column 1 reports the results for the sample of MSAs with supply elasticity below the median and column 2 above the median. In fact, moving from column 1 to 2, the estimated coefficient on $HousePrice_{mt-1} * OwnRate_{mg}$ increases, as does the conditional main effect of $HousePrice_{mt-1}$. This is opposite of what would be expected under the reverse causality scenario. Columns 3 and 4 display the results for the first and fourth quartile of the elasticity distribution, respectively. Again, the results on the elastically supplied MSAs are the largest. This suggests reverse causality is not likely to be driving results.

An alternative strategy addresses the potential concern that markets with relatively high

[17] Mian and Sufi (2009) use the Saiz (2008) elasticity estimates to instrument for house price changes over the period 2000 to 2005. We have experimented with using this measure interacted with year fixed effects or with an annual measure of interest rates as an instrumental variable for MSA by year house prices, but its first stage predictive relationship with house price changes varies depending on the years selected; for some periods it is positively related with house price changes, for others negatively, and the magnitudes fluctuate widely. In other words, its relationship with short-term house price changes is not stable.

and low elasticities are not comparable in terms of the price changes they experienced during the 1997-2006 housing cycle. To address this concern, we also look specifically at a set of MSAs shown to have experienced large price increases despite their relatively high level of supply elasticity – MSAs in the "Sand States" of Arizona, California, Florida, and Nevada, as identified by Davidoff (2012). If the estimated empirical relationships of interest are maintained in the "Sand States", that would further boost our confidence in the assumption that our estimated effect is not contaminated by reverse causality (i.e., homeowners with fertility intentions bidding up the prices of inelastically supplied houses). The fifth column of Table 7 displays these results. Although the sample of sand only MSAs limits us to just 8 MSAs, the positive coefficient on the interaction term remains statistically significant. As a comparison, in column 6 we also show the historically supply-constrained "coastal" MSAs according the Rappaport and Sachs (2003) measure, which display a similar pattern.

5.2 Individual level estimation – using Current Population Survey (CPS) 1996-2006

The empirical results presented above suggest that an increase in MSA-level house prices exert a negative price effect on births among non-owners and a net positive effect on births among owners, all else equal. These estimates are generated by an aggregated cell-level analysis, but the underlying conceptual framework is at the individual level. We thus turn to individual-level Current Population Survey (CPS) data to check that the story told by aggregate level data is confirmed with individual level data. We map the older MSA designations provided in the CPS (as in the Census) to the 2009 MSA designations provided in the FHFA house price data using the crosswalk procedure described in the appendix. In the CPS we do not see the full population of births, as we do with an analysis of Vital Statistics birth data. However, as a supplementary data source, the CPS offers the distinct advantage of directly identifying home-owners.

In this individual level analysis, we define Own_i as an indicator for whether the individual in the CPS is the household head or head's spouse and the household is reported to own their home. In the aggregate analysis above, ownership was defined at the group level in the baseline year of 1990. Here it is defined at the individual level in the current year, as we have no measure of lagged home ownership available. Caution should thus be exercised in assigning a causal interpretation to the $HousePrice_{mt-1} * Own_i$ interaction term in this specification, since individuals who intend to have a baby this year might decide to buy a house in anticipation of that event. This is another reason we consider this analysis supplementary to the main analysis above.

We define the dependent variable $HadBaby_i$ to be one if there is a child under the age of one in the household. All the other variables are defined at the MSA level as defined in equation (1) above. Explanatory variables, including the house price index, are matched to observations by the year prior to the survey year in order to capture the effect of conditions in the year of the baby's conception. (We do not have perfect birth-date or gestation information, as we do in the Vital Statistics natality files, and so here we use year minus one as an approximation.) Recall that our goal is to obtain an estimate of the causal relationship of house prices on current period birth rates. Even if we had individual level house prices, we would not use them because individuals are likely to sort into houses at least in part based on their expectations of number of children. For example, individuals intending to have more children will likely seek larger houses or houses in better school districts, which tend to be more expensive. We thus use MSA-level house prices conditional on MSA fixed effects (to control for endogenous sorting into higher or lower priced MSAs) in all our analyses.

Table 9 reports the results estimated using a linear probability model.[18] In the pooled sample regression reported in column 1, we see the familiar pattern of point estimates – a negative point estimate on $HousePrice_{mt-1}$ (significant at the 5 percent level) and a

[18]Probit marginal effects are similar and available upon request.

positive point estimate on the interaction of $HousePrice_{mt-1} * Own_i$ (significant at the 1 percent level). Columns 2-4 report the results including the additional time-varying MSA-level controls: unemployment rates and wages. Overall, this set of individual-level results give us confidence that our interpretation of the results from the aggregate level analyses is appropriate. In particular, we see that the positive effect is being driven by individuals that are self-reported to be home owners.

5.3 Housing Bust Periods (1990-1996 and 2007-2009)

Our analysis has thus far been limited to a period of history characterized by rising house prices. It is interesting to consider explicitly the relationship between housing price decreases and birth rates. There might be asymmetric effects, whereby an increase in housing wealth might lead people move up their period of childbearing to a greater extent than a decrease in housing wealth will lead people to delay. One possible reason for such an asymmetry is that there is a biological timing constraint that individuals are reluctant to push against. It becomes an empirical question as to whether there are differential responses to house price rises and declines. To consider this explicitly, we want use data from two periods of house price decline: 1990-1996 and 2007-2010. Figure 1 shows these two periods: between 1990-1996 prices declined gradually and between 2007-2010 there is a dramatic decline in prices. Unfortunately Vital Statistics birth data is not available for conception years past 2006, so we can only look at the 1990-1996 housing bust period using the approach of the main analysis. We therefore turn to individual level data sources for 2007-2010 period.

We begin by examining the 1990-1996 bust period using the approach used in the main analysis. Table 9, column 1 displays the results. The pattern on the coefficients remains similar to the 1997-2006 period – a positive coefficient on $HousePrice_{mt-1} * Own_{mg}$ and a negative coefficient $HousePrice_{mt-1}$ – although results are not statistically significant. In column 2 we report results from an individual level analysis from the CPS for this time period. Again, results are similar to those found in the 1997-2006 period, except in this case the coefficient on $HousePrice_{mt-1} * Own_{mg}$ is statistically significant at the 5 percent level. As in the analysis for 1997-2006 period, the coefficient on $HousePrice_{mt-1}$is not statistically significant.

Next, we move on to the 2007-2010 housing bust period, which is characterized by a steep decline in prices. First, we repeat the individual-level CPS analysis for this period. Table 9, column 3 displays results.The pattern on the coefficients is extremely similar to both the earlier bust period (1990-1996) and the housing boom period (1997-2006). Since Vital Statistics birth data is not available for this period, we supplement the analysis by examining data from the American Communities Survey (ACS), conducted annually by the U.S. Census Bureau, beginning in 2000. We obtained this data from IPUMS. The data is available with the equivalent of MSA identifiers starting in 2005.[19] We construct the indicator variables "had baby" and "own home" in the same manner as described above for the CPS data. Again, the coefficient on $HousePrice_{mt-1} * Own_i$ is positive and statistically significant at the 1% level. The coefficient on $HousePrice_{mt-1}$is positive, although it is not statistically significant.

These findings give us some confidence that it is appropriate to use our preferred aggregate results above – generated from data for the years 1997-2006, a period characterized by house price increases – to make out-of-sample predictions to more recent years, characterized by house price declines. Between 2006 and 2010, housing prices fell $63,000 among the MSAs in our sample. At the mean rate of home ownership, our estimates imply that this corresponds to a 5.1 percent decline in births. We can also simulate the effect of the rise in unemployment rates over the period. Between 2006 and 2010, unemployment rates rose 5.14 percentage points.[20] Holding housing prices fixed, our estimates imply that this corresponds to a 1.1%

[19]The ACS identifies PUMAs (Public Use Microdata Areas), which IPUMS has matched to MSAs. We then use the crosswalk procedure described in the data appendix to match to the housing data (Ruggles et al., 2010). PUMAs are also identified in 2003, but we do not use this data.

[20]Both the average fall in home prices and the average increase in unemployment rates are population weighted average changes for the 163 MSAs in our sample between 2006 and 2010.

decline in births. A simulation of the two changes in tandem implies that in the great recession period 2007-2010 the decline in housing prices and increase in unemployment rates is associated with a 6 percent decline in current-period birth rates.

6 Interpreting the Results

6.1 Interpreting the Magnitudes of the Estimated Effects: Simulation Exercise

Our analysis of Vital Statistics birth data coupled with MSA-level house prices shows that an increase in MSA-level house prices, all else held constant, is associated with fewer births among non-owners and a net increase in births among owners. In order to facilitate an understanding of whether these results are economically large or small, we have conducted a simple simulation exercise. Figure 4 presents the predicted effect of a $10,000 increase in house prices on births for each race/ethnic group as well as first and higher parity births. The x-axis represents group home ownership rates and the y-axis represents the net predicted percentage change in births from of a $10,000 increase in house prices, conditional on each level of home ownership. The prediction is indicated by the solid line and a 95% confidence interval is indicated by the dashed lines.[21] The predictions are calculated based on point estimates displayed in Table 6, which include all of the main demographic group and MSA level control variables, MSA and year fixed effects, and MSA ownership-category time trends.

In all cases, the exercise suggests a positive, linear relationship between home ownership rates and the change in births due to a $10,000 increase in house prices. The pooled estimates imply that as the ownership rate increases from 10 percent to 20 percent, the net effect become positive. This implies that in MSAs with sizable rates of home ownership, the

[21] The 95% confidence interval was estimated by 100 bootstrap replications. The net predicted effect and confidence intervals were calculated at each displayed value of home ownership in 10% intervals and smoothed using a locally weighted linear regression.

positive home equity effect among owners is large enough to outweigh the negative price effect, leading to increases in MSA-level birth rates. Among whites, the impact switches from negative to positive between 40 and 50 percent ownership. For blacks, the impact becomes positive between 10 and 20 percent, and for Hispanics, it is always positive (which follows from the surprising positive point estimate on the house price variable in that specification).

In the CPS, for the period 1997-2006, mean home ownership among females age 20-44 is 50 percent. At this rate, the net effect of a $10,000 increase in prices is a 0.8 percent increase in births. We also simulate effects using group-specific rates of home ownership and group-specific point estimates. Among whites, the mean home ownership rate is 59 percent, which is associated with a net increase of 0.5 percent in births. Among blacks, the mean home ownership rate is 30 percent, which is associated with a net increase of 0.8 percent in births. And among white Hispanics, the mean home ownership rate is 35 percent, which is associated with a net increase in births of 0.9 percent. It is also instructive to consider an out-of-sample prediction assuming extreme values of ownership rates, to obtain an estimate of the effect among owners and non-owners. Assuming a 100 percent ownership rate, the net impact of a $10,000 house price increase is a 2.1 percent increase overall. Separately by race/ethnicity, our simulations suggest a 1.9 percent increase for whites, a 4.9 percent increase for Blacks, and a 1.9 percent increase for Hispanics.[22]

An additional interesting empirical exercise is to consider the relative impact of unemployment rates versus housing prices. Using the same simulation procedure described above, we estimate the relative impacts of a one standard deviation increase in housing prices and decrease in unemployment rates. We find that at the mean rate of ownership (49%), a one standard deviation increase in housing prices leads to a 7.8 percent increase in births while a

[22]These results are comparable to those found in a contemporaneous working paper by Lovenheim and Mumford (2011), which investigates the relationship between changes in home value and current period fertility using individual-level data from the Panel Study of Income Dynamics (PSID) from 1990-2007. The authors estimate linear probability models of the probability that a woman gives birth in a given year as a function of two and four year changes in the reported market value of her home. The authors find that a $10,000 increase in an individual's real housing wealth is associated with a 0.07 percentage point (1.3 percent at the mean) increase in the probability of having a child.

one standard deviation increase in unemployment rates leads to only a 0.37 percent decrease across all rates of ownership. (Note that this estimated effect of unemployment is based on the point estimate in table 3, column 7, which is not significantly different from zero at conventional levels). At a 100 percent rate of ownership, a one standard deviation increase in housing prices is associated with a 25 percent increase in births. This indicates that for homeowners, the impact of a change in housing prices is almost 100 times that of a change in unemployment rates. Even among renters, the negative price effect an increase in housing prices is 3.8 percent, 10 times as large as the effect of unemployment rates. This highlights the importance of considering housing markets in any empirical analysis of how economic conditions affect fertility outcomes.

Finally, we use our estimates to simulate the aggregate effects of the recent housing boom and bust periods. The average year-to-year increase in prices 1997-2006 was $12,000. Our estimates imply that at the mean level of home ownership among women age 20-44 (50 percent), this would have led to a 0.9 percent increase in births, all else held constant. The average increase in prices from 1997 to 2006 was $119,000; which our estimates imply would have led to a 10 percent increase in births, all else held constant.[23]

6.2 The "Home Equity Effect"

We have interpreted the positive effect of house price increases for owners – inferred from the estimated coefficient on the $HousePrice_{mt-1} * Own_{mg}$ interaction in the MSA-group level analyses and the individual-level CPS analysis – as a net positive housing wealth effect. As noted above, we use this term to encompass two potential mechanisms. First, there could be a traditional wealth effect that increases the demand for children. Second, there could be an increase in liquifiable housing wealth that otherwise credit-constrained consumers use

[23] The population weighted average home price change for the 163 MSAs in our sample from 1997 to 2006 was $119,293 and the average year to year change was $12,052.

to fund current period consumption, including child-related expenses. (Note that the first effect likely implies an increase in the number of children ever born, while the second effect could simply reflect a change in timing.) We are agnostic about the extent to which each of these two mechanisms is separately contributing to the empirical effect we observe in the data. However, it is interesting to consider the feasibility of the home equity extraction explanation.

Before examining data on home equity extraction, it is useful to place our finding in the context of the existing literature on consumption and housing wealth. There is a large body of research on the propensity for households to fund current consumption out of housing wealth (See for example, Case, Quigley, and Shiller (2005); Benjamin, Chinloy, and Jud (2004); Bostic, Gabrial, and Painter (2009); Haurin and Rosenthal (2005)). Most work in this literature finds that the propensity to consume out of housing wealth is substantially higher than the propensity to consume out of financial wealth, although there is disagreement about the magnitudes of these distinct marginal propensities to consume (Greenspan and Kennedy, 2007). It is also understood that there are two distinct effects of housing values on consumption – the traditional wealth effect and a home equity extraction effect. According to the Federal Reserve Survey of Consumer Finances, among families in the 40-60th percentile of the income distribution in 2004, housing represents an average of 48 percent of a household's total assets (Bucks et al., 2009). This indicates an increase in home prices could lead to a substantial increase in wealth for many homeowners. But, if households do not intend to realize these gains over their lifetime by selling their current house and moving to a lower-priced real estate market, there is not necessarily an increase in permanent wealth. However, there might still be an equity extraction effect. That effect is practically realized by refinancing one's mortgage, or obtaining a second mortgage, home equity loan, or home equity line of credit.

Greenspan and Kennedy (2007) empirically investigate the use of home equity extractions to fund consumption during the period 1991 to 2005, a similar time period to the one that we study in the present paper. They report that during this period, free cash resulting from the three types of equity extraction averaged about $530 billion annually. Equity extracted through sales of existing homes accounted for about two-thirds of total free cash; home equity loans accounted for close to 20 percent, and cash-out refinancings about 13 percent. The extracted cash was used to finance consumer spending, outlays for home improvements, debt repayment, acquisition of assets, and other uses. In general, the use of housing equity to fund consumption is a relatively expensive approach. Hurst and Stafford (2004) propose that extracting home equity to fund consumption, as opposed to tapping into more liquid assets, should be relatively more common among individuals with lower amounts of liquid assets. They empirically confirm this pattern using individual-level data on households during the period 1991 to 1996 (Hurst and Stafford, 2004). Mian and Sufi (2009) estimate that the average homeowner extracted 25 to 30 cents for every dollar increase in home equity during the 1997 to 2009 period. They further find that money extracted from increased home equity was not used to purchase new real estate or pay down high credit card balances, which they interpret as suggesting that borrowed funds were used for consumption or home improvement expenses. In addition, they find that home equity-based borrowing was strongest among younger households. We view these patterns as being potentially consistent with the suggestion of our work that individuals used increased housing equity to pay for child-related expenses.

We use data from the 1997-2009 files of the American Housing Survey (AHS) to tabulate rates of home equity borrowing and refinancing, and the extent to which this is related to rising house prices. Our main goal is to simply observe the extent to which households are accessing their housing wealth. This speaks to the possibility that part of our documented "home equity effect" might be driven by the use of extracted home equity to fund current childbearing-related expenses. The AHS includes a survey of about 60,000 housing units across all 50 states and the District of Columbia. It is conducted every two years, in oddnumbered years.[24]

Table 10 reports the results from estimating regressions of the likelihood of having an equity loan/line or a refinanced mortgage on $HousePrice_{mt}$, as well as MSA-year means for the relevant variables. The top panel of the table reports rates of housing equity loans and lines of credit and mortgage refinancing. These questions are asked of home owners only. We see in the data that 20 percent of owners report having an equity loan or line of credit and as prices increase homeowners are more likely to tap into housing wealth in this matter. In column (3) we can see that this is being driven by increases in home equity lines of credit.

The AHS also gives information about rates of refinancing. The mean rate of having refinanced a first mortgage is 35 and the mean rate of having refinanced a second mortgage is 7 percent. The survey asks homeowners who report having refinanced why they chose to refinance, which is reported in the bottom panel of table 10. Eighty-six percent respond to obtain a lower interest rate. Lower interest rates leave people with lower monthly payments, which would make more disposable income available to fund current consumption. Interestingly, the only motivating factor in the decision to refinance which is increasing with house prices is explicitly "to get cash." This speaks directly to the use of housing equity to fund current consumption and its relationship to rising home prices.

7 Conclusion

This paper has investigated how current house prices affect current period fertility. Our results suggest that house prices are a relevant factor in a couple's decision to have a baby at the present time. House prices lead to a negative price effect that conditionally reduces birth rates in the current period, and an offsetting positive home equity effect that leads to a net increase in births among homeowners. We use the estimated coefficients from our

[24]The AHS also includes a metropolitan area survey that has included varying numbers of areas and has been conducted at varying intervals over the past 30 years.

regression analyses to simulate the effect of a $10,000 increase in house prices on current year births. This exercise indicates that when home ownership rates reach 20 percent, the net effect becomes positive. At the mean U.S. home ownership in our sample period, the net effect of a $10,000 increase in prices is a 0.8 percent increase in births. Given underlying differences in home ownership rates and slightly different point estimates, the predicted net effect of house price changes varies across race/ethnic groups. We simulate that a $10,000 increase in MSA-level house prices leads to a 0.4 percent increase in current year births among whites, a 0.6 percent increase in births among blacks, and a 0.8 percent increase in births among white Hispanics. Interestingly, these effects are substantially larger than the effects of changes in the unemployment rate. Moreover, using our estimates to make an out-of-sample prediction of the the impact of the "Great Recession", we find that the fall in housing prices between 2006 and 2010 was associated with a 4.9 percent decline in births.

Our paper is written within the paradigm of the empirical literature on the cyclicality of fertility and as such, it is about the timing of fertility decisions. We provide evidence suggesting that couples use some of their increased housing wealth to "fund" their childbearing goals. Our paper potentially demonstrates empirically that (imperfect) credit markets affect fertility timing. We have discussed our results in terms of the decision couples make with regard to whether or not to have a baby in the current period. We leave it to future research to investigate how house prices affect completed fertility or the demand for children more generally. In addition, it might also be true that when house prices increase or decrease, parents increase (or decrease) quality investments in children, where quality of children is meant in the Beckerian sense. For example, perhaps some home-owning parents use their increased home equity to purchase, say, private education for their children. Once we allow for this possibility, it becomes clear that our empirical analysis is not designed to capture the full range of how real estate markets might affect childbearing and child rearing decisions.

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Appendix

A.1 Metropolitan Areas

Metropolitan statistical areas are defined by the Office of Management and Budget. Their geographic definitions are based on core urban areas with a population of 50,000 or more and adjacent counties with a "high degree of social and economic integration (as measured by commuting to work) with the urban core" (Census Bureau documentation). Current metropolitan area definitions include both metropolitan areas (MSA) and divisions (MSADs), which are smaller units within this metropolitan area. Current definitions also include an alternative to the MSA/MSAD for metropolitan areas in the New England states, which are called New England City Town Areas (NECTAs). The boundaries of MSAs change over time as city populations change. The Office of Management and Budget releases revised definitions based on the decennial census and yearly census population estimates, and in addition to changing MSA compositions, sometimes changes the labels associated with each type of unit. A major change was done in 2003, at which point the coding system changed from a 4-digit coding system to a 5-digit coding system. Prior to 2003, instead of MSADs Primary Metropolitan Statistical Areas (PMSAs) were used and instead of NECTAs, New England Metropolitan County Areas (NECMAs) were used.

The housing price index is available at the level of MSA/MSAD, based on the November 2008 definitions (released in December 2009) , Since the index is based on repeat sales of the same home, the 2009 definitions apply throughout the data. For example, suppose a home sells once in 1980, 1990, and 2005. Suppose that in 1980 and 1990 it was not in an MSA, but in 2005 it was. Then, the home is considered part of the MSA and the housing price indices for 1980 and 1990 are revised to reflect the current boundaries.The rest of this appendix explains how we harmonize all other data sources to match this level of aggregation. Table 1 lists the level of geographic detail available for each of our control variables.

A-1-1 County Level Data

Whenever county level data is available, it is the preferred level of disaggregation because we can use it to construct MSA/MSADs which will exactly match the housing price index data. Data available at this level of disaggregation includes the Vital Statistics Natality Data (confidential files), Vital Statistics population data, Census median home value data, Bureau of Labor Statistics Unemployment data, Bureau of Economic analysis income per capita data, and the Rappaport and Sachs (2003) coastal measure. To construct MSAs from the county level data, we use the 2009 metropolitan area definition files available from the Census Bureau at: `http://www.census.gov/population/metro/files/lists/2009/List1.txt`. These files map entire counties to a 2009 OMB MSA/MSAD definitions, thus, we can construct MSAs/MSADs that are exactly equivalent to those used in the housing price data.

It is worth noting a few technical points about linking counties to MSAs. First, Miami-Dade County, FL was renamed between the 1990 and 2000 census; so in all cases we have assigned the post-2000 FIPS code to this county.[25] Another issue concerns BLS Local Area Unemployment (LAU) Statistics, which are calculated at the county level, but use a coding system based on what are called "areas". For the most part, the area codes are simply county FIPS codes. However, for counties which had large populations (50,000-100,000 and 100,000 plus) in 1970; a different coding system is applied.[26] We construct a crosswalk between the two using state FIPS codes and county names using vintage 2009 county FIPS codes.[27] Finally, in the BEA personal income data, BEA combines some counties/county equivalents in Virginia and assigns new county codes. We re-assign those counties which are contained within an MSA to one of the combined counties' FIPS code. In all cases these combinations were wholly contained within one MSA/MSAD.[28]

[25]See, for example,`http://www.census.gov/popest/archives/files/90s-fips.txt`
[26]See `http://www.bls.gov/lau/laucodes.htm`
[27]`http://www.census.gov/popest/geographic/codes02.html`
[28]See `http://www.bea.gov/regional/docs/msalist.cfm`

A-1-2 Vintage Metropolitan Area Level Data

For the case when counties are not available, but vintage metropolitan area definitions are available, we use those. By vintage metropolitan area definitions, we are referring to metropolitan areas based on historical definitions which may differ in composition from the 2009 definitions. Data that is available in this manner includes the 1990 and 2000 Census microdata (used to construct home ownership rates), the Current Population Survey data (used to construct wages and fraction college educated), and the Saiz (2012) elasticity measure. The vintage definitions used in these data include the 1983 MSA/PMSA, 1993 MSA/PMSA, 1999 MSA/NECMA, and 2003 MSA/NECTA codes, as described in table 1.

To match the vintage definitions to the 2009 definitions, we begin by creating a crosswalk that links the counties that make up the different metropolitan areas over time. Unlike the current 2009 MSA/MSAD definitions (and vintage 2003 MSA/MSAD definitions) which directly map entire counties to MSAs, the earlier metropolitan area (and NECTA/NECMA) definitions allow for a single county to be in multiple metropolitan areas. For the case when a single county is in multiple MSAs/PMSAs/NECTAs/NECMAs, we use 1990 population counts of the minor civil divisions (a smaller unit within the metropolitan area) to assign the county to whichever MSAs/PMSAs/NECTAs/NECMAs the majority of the population resides.

From this county-msa crosswalk, we construct vintage MSA-to-2009 MSA/MSAD crosswalks. In most cases, there is a one to one match between the vintage MSA definitions and the 2009 definitions. In some cases, however, its possible for a vintage metropolitan area to have split into two or combined to form a single metropolitan area by 2009. For metropolitan areas that have combined to form one metropolitan area by 2009, we use 1990 population weights to create a population weighted average of the data. For metropolitan areas that have split , we apply the single data point to all the split-off areas.

A-1-3 Other Data Used in Aggregate Analyses

There are two final types of matches that are made to the aggregate data: the Davidoff (2012) "Sand State" measure and the Case-Shiller data. The Davidoff (2012) data is only available at the state level. Since counties are wholly contained within states, we use the county-to-MSA crosswalk to identify the state(s) in which each MSA is contained. All of the MSAs used in the "Sand State" specification were wholly contained in a single state, so we simply labeled the MSAs accordingly. The Case-Shiller housing price index (which is used in place of the FHFA housing price index in table 5), is available for only 20 metropolitan areas, 18 of which match to the 2009 OMB MSA definitions, one matches to an 2009 OMB MSAD definition (Chicago), and one does not match any OMB definition (New York City). When constructing the data for specifications that use the Case-Shiller HPI, we use only the 27 MSADs that match to one of the 19 OMB MSA/MSAD definition. This means that multiple MSADS in one MSA may use the same value for the Case-Shiller HPI index. However; when we construct housing prices from the Case-Shiller index we use MSAD-specific 2000 median home values.

A-1-3 Attaching Aggregate Measures to the Individual Level Data

In the individual level data, we are given the vintage metropolitan area codes. In this case, we need to construct the housing price, wage, and unemployment data according to those definitions. In the individual CPS we are provided with 1983, 1993 and 2003 MSA/2003 NECTA codes and in the AHS we are provided with 1980 MSA codes. For the ACS, only PUMAs (Public Use Microdata Areas) are provided, however, IPUMS has created a cross-walk procedure and attached 1993 MSA codes, which we will use Ruggles et al. (2010). Recall the unemployment data is at the county level. In this case, we use county-to-vintage MSA cross walk described in the section above. For the wage data, linking to the CPS is trivial since it was constructed in the CPS and therefore uses the same MSA definitions.

For linking the wage data to the ACS and for linking the housing data to the CPS, ACS and AHS , we again use the county-to-vintage MSA crosswalk described above. In this case, if multiple 1980/1983/1993/2003 MSA/2003 NECTA combine to form a single MSA in 2009, we assign the housing price data to each vintage MSAs. For the case when a single 1980/1983/1993/2003 MSA/2003 NECTA splits to form multiple MSAs in 2009, we we use 1990 population weights to assign a weighted average of home prices to the vintage metropolitan areas codes. Finally, since CPS uses different MSA codes over time which are not consistent, we use the linked 2009 MSA definition for the fixed effects. In the case where the vintage MSA split into multiple 2009 MSADs, we use assign the code of the MSAD with the largest population share.

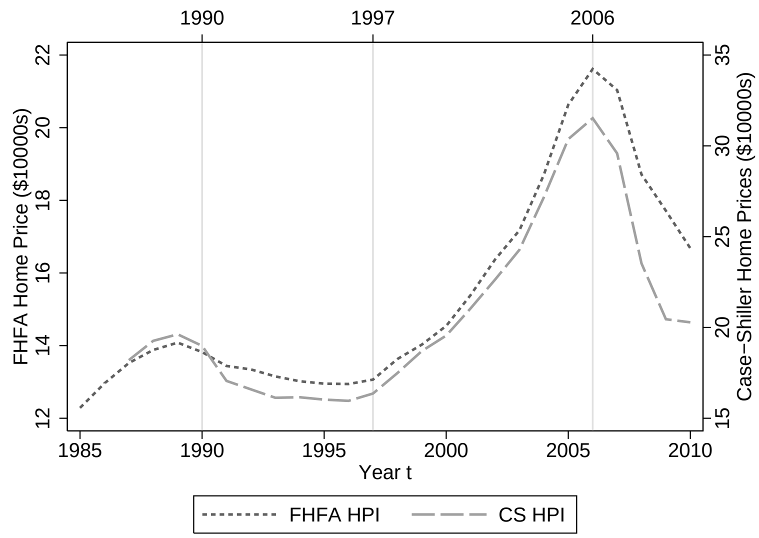
A-2 Construction of House Prices

We use the same procedure used by Glaeser et al. (2008) to construct house prices. First, we construct a 2000 median home value from county-level census data, using the crosswalk procedure outlined above to create a population-weighted median home value. We inflate this value to 2006 dollars using the CPI-U "All Items-Less Shelter Series." We then take this value and scale it by the percent change in the housing price index from 2000 to the year of interest, which is calculated: $(hpi_t - hpi_{2000})/hpi_{2000}$. The housing price index is also inflated to 2006 dollars using the the CPI-U "All Items-Less Shelter Series" prior to scaling. This gives us a value that proxies for the price growth of a median value home in each MSA over time.

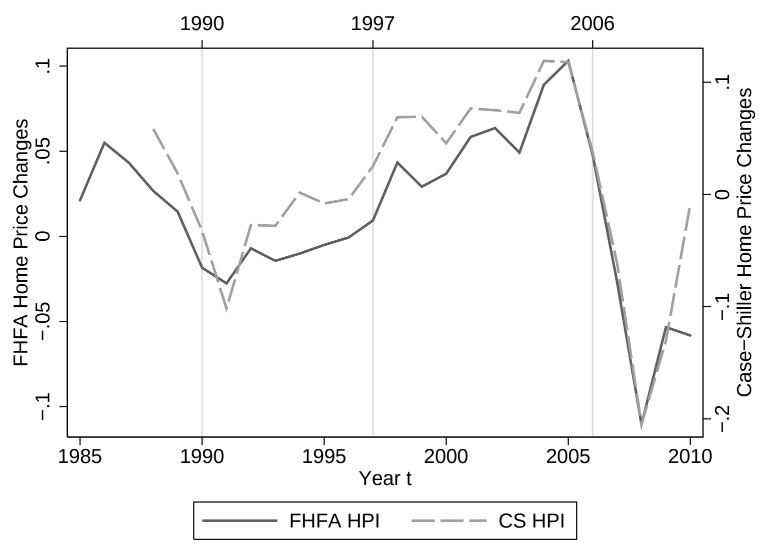
Tables and Figures

Figure 1: Housing Price Index (FHFA and Case-Shiller)

(a) House Prices

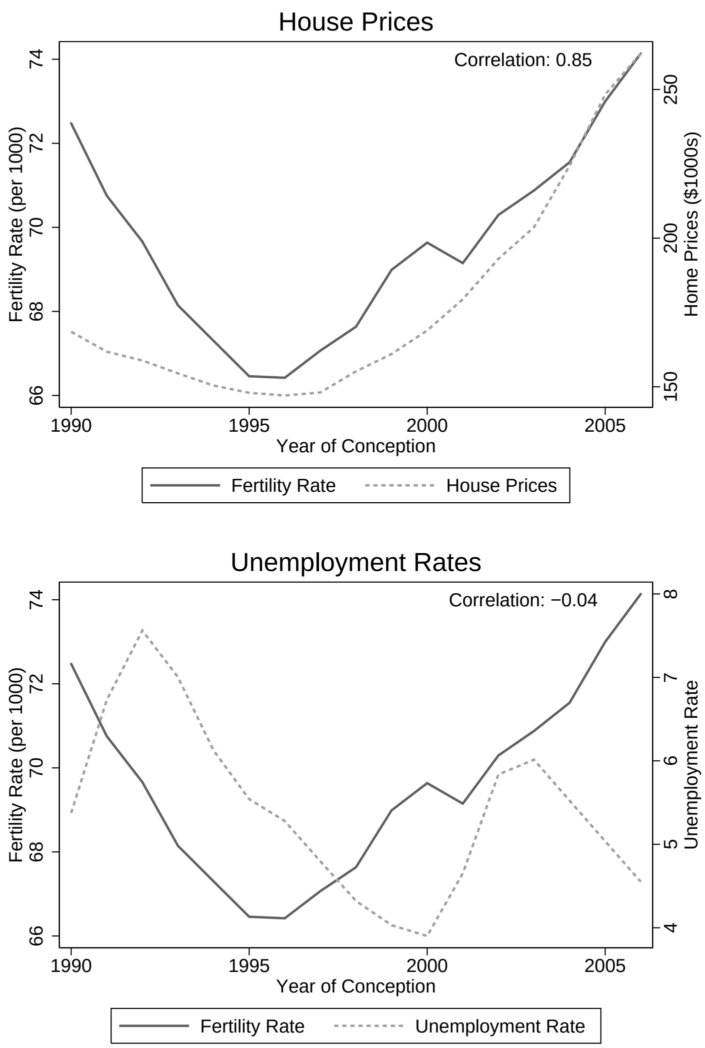


(b) Percentage Change House Prices Year t-1 to Year t



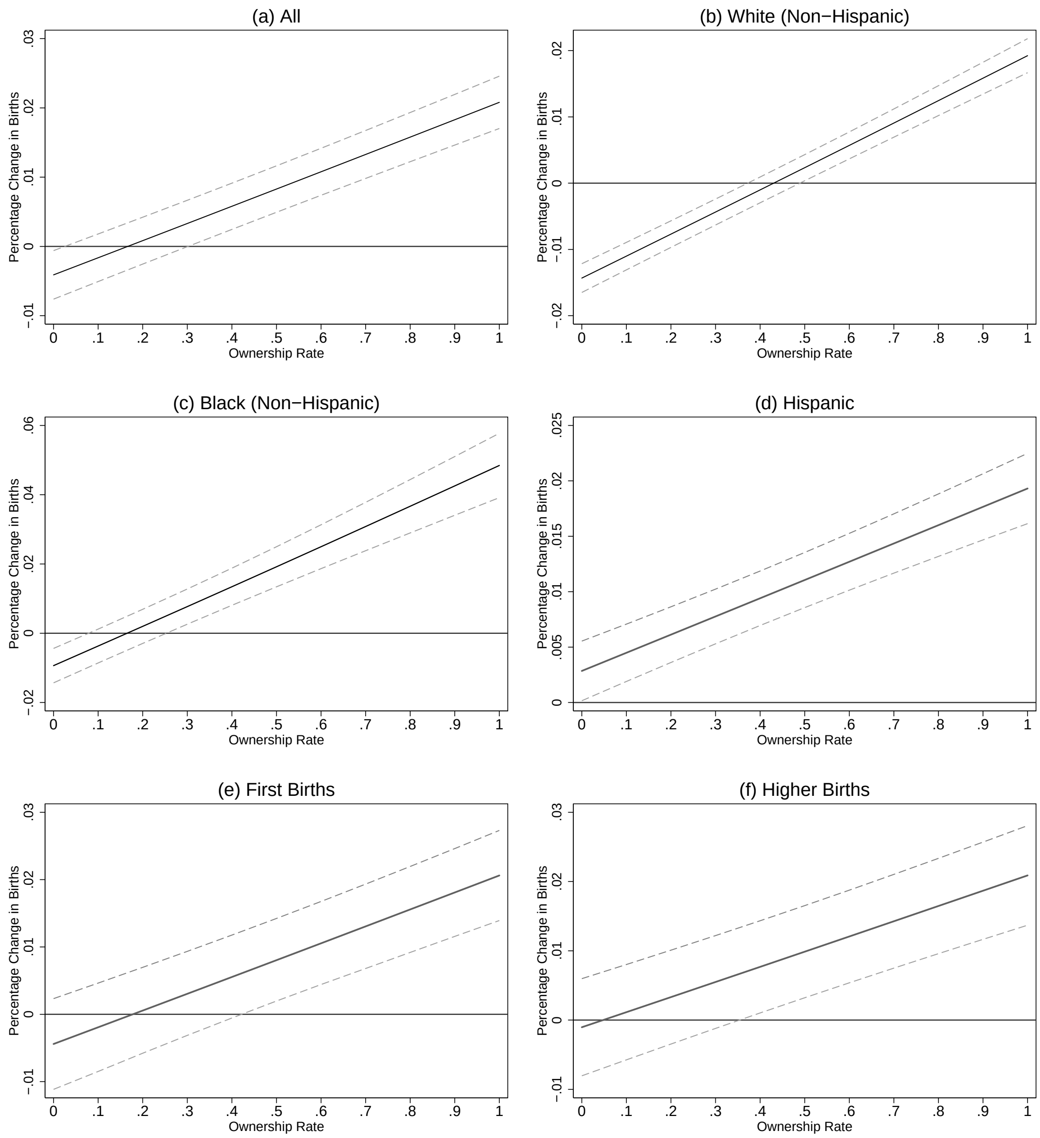
Notes: House prices are calculated using 2000 MSA median home values, which are scaled by either the FHFA house price index or the Case-Shiller house price index to create MSA-year median home values, which are then averaged over the 163 MSAs (27 MSAs for the Case-Shiller Index) in our sample each year 1984-2010. Both are adjusted to 2006 dollars using CPI-U "all items less shelter" series. Percentage change in home prices is calculated as $(HousePrice_t - HousePrice_{t-1})/HousePrice_{t-1}$. In both figures, the left y-axis is represents the mean value of the FHFA-constructed prices and the right y-axis represents the mean value of the Case-Shiller constructed prices.

Figure 2: Fertility Rates and Macro Indicators



Notes: Displayed are trends in fertility rates, housing prices, and unemployment rates. Annual fertility rates (births per 1000 women) are calculated using yearly totals of MSA-level births to women age 20-44 divided by total female population age 20-44, both obtained from the National Center for Health Statistics, National Vital Statistics System. House Prices are 2000 median home values scaled by the Federal Housing Finance Agency (FHFA) housing price index, and are displayed in 2006 dollars. Unemployment rate is the annual mean unemployment are taken from Bureau of Labor Statistics local area unemployment statistics. All three measures are yearly mean values calculated based on the 163 MSAs in our sample.

Figure 3: Predicted Percentage Change in Births for a 10% Increase in MSA Housing Prices



Notes: These figures display the results of simulation exercises using estimates from the regression specification displayed table 6. Simulated is the percentage change in predicted births from a $10,000 increase in mean housing prices for each ownership rate o displayed on the x axis: $(FertRate|HousePrice = h + 10k, OwnRate = o) - (FertRate|HousePrice = h, OwnRate = o)/(FertRate|HousePrice = h, OwnRate = o)$. The solid line represents the predicted effect and the dashed line represents a 95% confidence interval, both of which were calculated for each displayed level of o and smoothed using a locally weighted linear regression. Estimates of the confidence intervals at each value of o were calculated using 100 bootstrap replications.

Table 1: Aggregate Variables

Variable	Mean	Std Dev.	Source	Description	Geographic Detail
HPI	163.63	38.94	Federal Housing Finance Agency	House Price Index (All Transactions)	MSA Divisions (2009)
Home Price	$165,152	$93.767	Census (2000) and HPI	Average MSA home price in 2000 scaled by Housing Price Index (HPI) to create yearly series	County
Male Wages:			Current Population Survey	Individual wage and salary	Primary MSAs
25th Percentile Wage	$12.95	$2.37		income divided by the product	(1983, 1993, 2003)
50th Percential Wage	$19.13	$3.67		of weeks and hours worked	
75th Percentile	$28.18	$6.51		for full time working adult men	
Mean	$23.23	$4.42			
All Wages:				Individual wage and salary	
25th Percentile Wage	$11.59	$1.82		income divided by the product	
50th Percential Wage	$17.03	$2.76		of weeks and hours worked	
75th Percentile	$24.99	$4.37		for all full time adult workers	
Unemployment Rate	4.82	1.71	Bureau of Labor Statistics Local Area Unemployment Statistics	Number of unemployed divided by the total labor force	County
Income Per Capita	$39,782	$7,093	Bureau of Economic Analysis Regional Economic Accounts	Sum of income from all sources divided by the total population	County
Average Rent	$794	$225	Department of Housing and Urban Development	Mean fair market rent for 0-4 bedroom residences	County
Housing Supply Elasticity	1.95	0.97	Saiz (2011)	Measure of elasticity of housing supply	Primary MSAs and NECMAs (1999)
Sand (Only) MSA	0.05	0.22	Davidoff (2011)	MSAs in "sand" states	State
Coastal (Only) MSA	0.54	0.50	Rappaport and Sachs (2003)	MSAs in which majority of population resides in "Coastal" county	County
Fraction College	0.19	0.19	Current Population Survey	Fraction of MSA-Group with a college degree	Primary MSAs (1983, 1993, 2003)

Notes: Listed are aggregate level variables and their means for the 163 MSAs used in the baseline specification. All variables are aggregated up the the MSA level from the level of geographic detail (column 6) available using the crosswalk procedure described in the text and data appendix. All nominal values are CPI adjusted to 2006 dollars.

Table 2: Summary Statistics

	Vital Statistics			Census		
	Fertility Rate (1000)	First Birth Fertility Rate	Higher Birth Fertility Rate	Home Ownership Rate 1990	Home Ownership Rate 2000	Min/Max Ownership Rate
All	70.2	24.7	45.6	0.44	0.44	[0.00, 0.80]
	(36.2)	(16.5)	(22.6)	(0.23)	(0.23)	
White 20-29	88.1	41.9	46.1	0.27	0.25	[0.07, 0.39]
	(20.6)	(6.9)	(14.4)	(0.06)	(0.07)	
Black 20-29	117.8	40.2	77.6	0.08	0.10	[0.00,0.28]
	(17.3)	(5.1)	(16.9)	(0.03)	(0.03)	
Hispanic 20-29	154.0	54.9	99.2	0.14	0.14	[0.00,0.50]
	(30.3)	(9.7)	(24.1)	(0.06)	(0.06)	
White 30-44	48.7	15.0	33.7	0.67	0.68	[0.32, 0.80]
	(8.6)	(4.6)	(5.0)	(0.07)	(0.08)	
Black 30-44	37.7	7.9	29.8	0.34	0.35	[0.06, 0.60]
	(8.0)	(2.8)	(5.9)	(0.08)	(0.08)	
Hispanic 30-44	60.1	10.9	49.2	0.40	0.41	[0.00,0.80]
	(11.1)	(3.1)	(10.6)	(0.12)	(0.12)	

Notes: Source for aggregate births and population is Vital Statistics birth certificate data (1997-2007) and population data (1996-2006), and for home ownership data Census (1990 and 2000). All are population weighted means. Samples are limited to women age 20-44. Home owners are household heads and spouses in households who own their home. Min/Max home ownership rates are based on 1990 data. Standard deviations are in parentheses.

Table 3: Main Specification

	(1) log(FertRate)	(2) log(FertRate)	(3) log(FertRate)	(4) log(FertRate)	(5) log(FertRate)	(6) log(FertRate)	(7) log(FertRate)
$HousePrice_{mt-1} * Ownrate_{mg}$	0.0437***	0.0437***	0.0437***	0.0438***	0.0453***	0.0456***	0.0247***
	(0.00409)	(0.00412)	(0.00411)	(0.00414)	(0.00447)	(0.00453)	(0.00373)
$HousePrice_{mt-1}$	-0.0124***	-0.0127***	-0.0125***	-0.0128***	-0.0101***	-0.0152***	-0.00411**
	(0.000949)	(0.00107)	(0.000970)	(0.00109)	(0.00212)	(0.00182)	(0.00164)
$OwnRate_{mg}$	0.117	0.116	0.116	0.116	0.101	0.0988	0.101
	(0.323)	(0.323)	(0.323)	(0.323)	(0.324)	(0.327)	(0.275)
race1age20_29	0.950***	0.950***	0.950***	0.950***	0.955***	0.955***	0.893***
	(0.130)	(0.130)	(0.130)	(0.130)	(0.128)	(0.129)	(0.123)
race2age20_29	1.340***	1.340***	1.340***	1.340***	1.343***	1.340***	1.243***
	(0.188)	(0.188)	(0.188)	(0.187)	(0.186)	(0.187)	(0.177)
race3age20_29	1.577***	1.577***	1.576***	1.577***	1.579***	1.576***	1.496***
	(0.165)	(0.165)	(0.165)	(0.165)	(0.163)	(0.165)	(0.166)
race2age30_44	0.0155	0.0158	0.0153	0.0155	0.0171	0.0148	-0.0532
	(0.0759)	(0.0757)	(0.0759)	(0.0757)	(0.0748)	(0.0754)	(0.0672)
race3age30_44	0.374***	0.374***	0.373***	0.373***	0.372***	0.368***	0.320***
	(0.0786)	(0.0784)	(0.0786)	(0.0784)	(0.0775)	(0.0782)	(0.0593)
$FracCollege_{mgt-1}$	-0.350***	-0.349***	-0.353***	-0.352***	-0.371***	-0.389***	-0.352***
	(0.0594)	(0.0595)	(0.0598)	(0.0599)	(0.0627)	(0.0653)	(0.0632)
$UnemploymentRate_{mt-1}$		-0.00465		-0.00448	-0.00178	-0.00198	-0.00218
		(0.00367)		(0.00352)	(0.00205)	(0.00198)	(0.00194)
$25thWage_{mt-1}$			0.00197*	0.00184*	0.000556	0.000167	0.000608
			(0.00109)	(0.00104)	(0.000621)	(0.000524)	(0.000590)
$50thWage_{mt-1}$			0.000810	0.000792	0.000887*	0.000479	0.000767*
			(0.000900)	(0.000887)	(0.000500)	(0.000402)	(0.000446)
$75thWage_{mt-1}$			0.000488	0.000527	0.000205	0.000168	0.000154
			(0.000525)	(0.000511)	(0.000223)	(0.000204)	(0.000215)
MSA Fixed Effects	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x
MSA Trends					x	x	
MSA Quadratic						x	
MSA-Own Category Trends							x
R^2	0.906	0.906	0.906	0.906	0.908	0.909	0.936
Number of MSAs	163	163	163	163	163	163	163
N	9780	9780	9780	9780	9780	9780	9780

Notes: Fertility rates are total births over the total female population in each MSA, year of conception, age category and race/ethnicity cell for women age 20-44. Mean home ownership rates are calculated in 1990 Census by year, msa, age category, and race/ethnicity. Fraction of cell that is a college graduate is matched by msa, year, age category and race. House prices (10,000s), unemployment rates, and male wages are matched by msa and year of conception. Data sources are: Vital Statistics (births, population), Census and Federal Housing Finance Agency (house prices), Current Population Survey (wages, fraction college), and Bureau of Labor Statistics (unemployment rates). All specification are weighted by the total number of births in the cell. Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 4: Alternate House Price Measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$Price_{mt-1}$	$Price_{mt-2}$	$Price_{mt-3}$	$Price_{mt-4}$	$AvgPrice_{mt-2}$	$AvgPrice_{mt-3}$	$AvgPrice_{mt-4}$	$Case-ShillerSample$	$Case-ShillerPrice_{mt-1}$
$HousePrice_{mt-1} * Ownrate_{mg}$	0.0247***	0.0285***	0.0359***	0.0439***	0.0267***	0.0295***	0.0327***	0.0211***	0.00195***
	(0.00373)	(0.00421)	(0.00529)	(0.00672)	(0.00397)	(0.00436)	(0.00481)	(0.00462)	(0.000438)
$HousePrice_{mt-1}$	-0.00411**	-0.00505***	-0.00642***	-0.00908***	-0.00429***	-0.00451***	-0.00491***	-0.00146	-0.000186
	(0.00164)	(0.00159)	(0.00187)	(0.00246)	(0.00163)	(0.00170)	(0.00186)	(0.00179)	(0.000179)
$OwnRate_{mg}$	0.101	0.0575	-0.0354	-0.131	0.0781	0.0428	0.00343	0.688	0.709
	(0.275)	(0.275)	(0.276)	(0.281)	(0.275)	(0.275)	(0.275)	(0.441)	(0.444)
$UnemploymentRate_{mt-1}$	-0.00218	-0.00419**	-0.00521**	-0.00398*	-0.00327	-0.00405**	-0.00429**	-0.00619	-0.00587
	(0.00194)	(0.00205)	(0.00217)	(0.00223)	(0.00199)	(0.00202)	(0.00206)	(0.00592)	(0.00572)
$25thWage_{mt-1}$	0.000608	0.000653	0.000524	0.000655	0.000628	0.000591	0.000585	0.00406**	0.00360**
	(0.000590)	(0.000586)	(0.000585)	(0.000587)	(0.000587)	(0.000584)	(0.000579)	(0.00171)	(0.00174)
$50thWage_{mt-1}$	0.000767*	0.000846*	0.000922**	0.00104**	0.000797*	0.000827*	0.000872*	0.00180	0.00209
	(0.000446)	(0.000453)	(0.000466)	(0.000485)	(0.000446)	(0.000448)	(0.000450)	(0.00162)	(0.00156)
$75thWage_{mt-1}$	0.000154	0.000214	0.000252	0.000200	0.000182	0.000203	0.000203	0.0000761	0.000116
	(0.000215)	(0.000229)	(0.000241)	(0.000253)	(0.000219)	(0.000223)	(0.000227)	(0.000843)	(0.000865)
$FracCollege_{mgt-1}$	-0.352***	-0.355***	-0.362***	-0.366***	-0.354***	-0.357***	-0.361***	-0.612***	-0.607***
	(0.0632)	(0.0635)	(0.0647)	(0.0658)	(0.0634)	(0.0638)	(0.0642)	(0.175)	(0.174)
MSA Fixed Effects	x	x	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x	x	x
MSA-Own Cat Trend	x	x	x	x	x	x	x	x	x
Unemployment and Wages	x	x	x	x	x	x	x	x	x
Number of MSAs	163	163	163	163	163	163	163	27	27
R^2	0.936	0.936	0.937	0.937	0.936	0.936	0.937	0.948	0.948
N	9780	9780	9780	9780	9780	9780	9780	1620	1620

Notes: Fertility rates are total births over the total female population in each MSA, year of conception, age category and race/ethnicity cell for women age 20-44. Mean home ownership rates are calculated in 1990 Census by year, msa, age category, and race/ethnicity. Fraction of cell that is a college graduate is matched by msa, year, age category and race. House prices (10,000s) are matched by msa and year of conception (or years prior to conception where noted). Average house price refers to the average home price from the year indicated up to the year of conception. Case-Shiller refers to use of the Case-Shiller Index (as opposed to the Federal Housing Finance Agency Index) to construct house prices. All regression include group, MSA and year fixed effects, as well as MSA-year unemployment rates and male wages. Data sources are: Vital Statistics (births, population), Census and Federal Housing Finance Agency (house prices), Current Population Survey (wages, fraction college), and Bureau of Labor Statistics (unemployment rates). All specification are weighted by the total number of births in the cell. Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 5: Alternate Controls

	(1) log(FertRate)	(2) log(FertRate)	(3) log(FertRate)	(4) log(FertRate)	(5) log(FertRate)	(6) log(FertRate)	(7) log(FertRate)
$HousePrice_{mt-1} * Ownrate_{mg}$	0.0247***	0.0247***	0.0247***	0.0247***	0.0207***	0.0247***	0.0218***
	(0.00373)	(0.00373)	(0.00372)	(0.00372)	(0.00355)	(0.00373)	(0.00367)
$HousePrice_{mt-1}$	-0.00411**	-0.00415**	-0.00411**	-0.00399**	-0.00305**	-0.00470***	-0.00416*
	(0.00164)	(0.00165)	(0.00164)	(0.00162)	(0.00144)	(0.00162)	(0.00246)
$OwnRate_{mg}$	0.101	0.101	0.101	0.101	-0.636**	0.101	0.310
	(0.275)	(0.275)	(0.275)	(0.275)	(0.291)	(0.275)	(0.237)
$UnemploymentRate_{mt-1}$	-0.00218	-0.00219	-0.00208	-0.00209	-0.00192	-0.00296	0.000364
	(0.00194)	(0.00193)	(0.00194)	(0.00200)	(0.00193)	(0.00184)	(0.00312)
$25thWage_{mt-1}$	0.000608				-0.00310	0.000526	0.000284
	(0.000590)				(0.00505)	(0.000593)	(0.000827)
$50thWage_{mt-1}$	0.000767*				-0.00202	0.000803*	-0.0000452
	(0.000446)				(0.00240)	(0.000449)	(0.000736)
$75thWage_{mt-1}$	0.000154				-0.00581***	0.000136	0.0000944
	(0.000215)				(0.00158)	(0.000209)	(0.000245)
$FracCollege_{mgt-1}$	-0.352***	-0.353***	-0.352***	-0.351***	-0.356***	-0.353***	-0.307***
	(0.0632)	(0.0632)	(0.0631)	(0.0631)	(0.0632)	(0.0636)	(0.0714)
$25thWageAll_{mt-1}$		0.00172**					
		(0.000869)					
$50thWageAll_{mt-1}$		0.000491					
		(0.000763)					
$75thWageAll_{mt-1}$		0.000670					
		(0.000458)					
$MeanWage_{mt-1}$			0.000746**				
			(0.000323)				
$IncomePC_{mt-1}$				-0.000249			
				(0.00144)			
$25thWage_{mt-1} * OwnRate_{mg}$					0.00960		
					(0.0129)		
$50thWage_{mt-1} * OwnRate_{mg}$					0.00792		
					(0.00617)		
$75thWage_{mt-1} * OwnRate_{mg}$					0.0153***		
					(0.00419)		
$AvgRent_{mt-1}$						0.0000431*	
						(0.0000254)	
MSA Fixed Effects	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x
MSA-Own Cat Trend	x	x	x	x	x	x	x
MSA Boundaries Constant							x
R^2	0.936	0.936	0.936	0.936	0.937	0.936	0.938
Number of MSAs	163	163	163	163	163	163	117
N	9780	9780	9780	9780	9780	9780	7020

Notes: Fertility rates are total births over the total female population in each MSA, year of conception, age category and race/ethnicity cell for women age 20-44. Mean home ownership rates are calculated in 1990 Census by year, msa, education category, age category, and race. Fraction of cell that is a college graduate is matched by msa, year, age category and race. House prices (10,000s), Income per capita, Male wages, All wages, and average rent are matched by MSA and year of conception. All regressions include group, MSA and year fixed effects. In column (7) the sample is limited to MSAs with boundaries that do not change 1990-2006. Data sources are: Vital Statistics (births, population), Census and Federal Housing Finance Agency (house prices), Current Population Survey (wages, fraction college), and Bureau of Labor Statistics (unemployment rates). All specification are weighted by the total number of births in the cell. Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 6: Different Groups

	(1) All	(2) White	(3) Black	(4) Hispanic	(5) First Births	(6) Higher Births
$HousePrice_{mt-1} * Ownrate_{mg}$	0.0247***	0.0335***	0.0567***	0.0163***	0.0226***	0.0261***
	(0.00373)	(0.00310)	(0.0109)	(0.00332)	(0.00460)	(0.00435)
$HousePrice_{mt-1}$	-0.00411**	-0.0144***	-0.00938***	0.00285*	-0.00437***	-0.00412**
	(0.00164)	(0.00155)	(0.00253)	(0.00166)	(0.00155)	(0.00195)
$OwnRate_{mg}$	0.101	3.960***	-3.311***	-0.495	0.306	-0.0424
	(0.275)	(0.655)	(0.810)	(0.419)	(0.370)	(0.296)
$UnemploymentRate_{mt-1}$	-0.00218	-0.00646**	0.00258	-0.00586**	-0.00427*	-0.00120
	(0.00194)	(0.00254)	(0.00280)	(0.00286)	(0.00254)	(0.00235)
$25thWage_{mt-1}$	0.000608	0.000379	0.000479	-0.000296	0.000316	0.000802
	(0.000590)	(0.000515)	(0.00109)	(0.00136)	(0.000807)	(0.000765)
$50thWage_{mt-1}$	0.000767*	0.000127	-0.000499	0.00141	0.000746	0.000761
	(0.000446)	(0.000389)	(0.000819)	(0.000969)	(0.000607)	(0.000586)
$75thWage_{mt-1}$	0.000154	0.0000521	0.000153	-0.000553	0.0000727	0.000232
	(0.000215)	(0.000188)	(0.000314)	(0.000456)	(0.000334)	(0.000251)
MSA Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
MSA-Own Cat Trend	x	x	x	x	x	x
R^2	0.936	0.982	0.987	0.992	0.953	0.906
N	9780	3260	3260	3260	9774	9780

Notes: Fertility rates are total births over the total female population in each MSA, year of conception, age category and race/ethnicity cell for women age 20-44. Mean home ownership rates are calculated in 1990 Census by year, msa, age category, and race/ethnicity.House prices (10,000s), unemployment rates, and male wages are matched by msa and year of conception. All regression include group, MSA and year fixed effects, as well as MSA-year unemployment rates and male wages. Data sources are:Vital Statistics (births and population), Census and Federal Housing Finance Agency (house prices), Current Population Survey(wages), and Bureau of Labor Statistics (unemployment rates). All specification are weighted by the total number of births in the cell. Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 7: Elasticity Coast/Sand MSAs

	Low Elasticity	High Elasticity	Lowest Elasticity	Highest Elasticity	Sand MSAs	Coastal MSAs
$HousePrice_{mt-1} * Ownrate_{mg}$	0.0240***	0.0339***	0.0246***	0.0686*	0.0160***	0.0233***
	(0.00331)	(0.0112)	(0.00402)	(0.0343)	(0.00220)	(0.00530)
$HousePrice_{mt-1}$	-0.00381*	-0.00769*	-0.00319	-0.0212	0.000295	-0.00742***
	(0.00195)	(0.00410)	(0.00217)	(0.0147)	(0.00256)	(0.00196)
$OwnRate_{mg}$	0.188	-0.456	0.0743	-1.559****	0.159	-0.223
	(0.315)	(0.398)	(0.427)	(0.561)	(0.301)	(0.370)
$UnemploymentRate_{mt-1}$	-0.00338	-0.00151	-0.000825	-0.00224	0.000793	-0.00642
	(0.00275)	(0.00189)	(0.00316)	(0.00292)	(0.00477)	(0.00425)
$25thWage_{mt-1}$	0.00183*	-0.000917	0.00206*	-0.00171	0.000451	0.00181**
	(0.000958)	(0.000636)	(0.00117)	(0.00109)	(0.00200)	(0.000769)
$50thWage_{mt-1}$	0.00116	0.0000883	0.000614	0.000646	0.000155	0.000206
	(0.000842)	(0.000374)	(0.000981)	(0.000825)	(0.00173)	(0.000574)
$75thWage_{mt-1}$	0.000142	0.000232	0.000101	0.000341	0.000672	0.000114
	(0.000360)	(0.000214)	(0.000381)	(0.000674)	(0.00124)	(0.000237)
MSA Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
MSA-Own Cat Trend	x	x	x	x	x	x
R^2	0.935	0.959	0.933	0.958	0.991	0.920
Number of MSAs	77	77	39	38	8	58
N	4620	4620	2340	2280	480	3480

Notes: Fertility rates are total births over the total female population in each MSA, year of conception, age category and race/ethnicity cell for women age 20-44. Mean home ownership rates are calculated in 1990 Census by year, msa, age category, and race/ethnicity. Fraction of cell that is a college graduate is matched by msa, year, age category and race. House prices (10,000s), unemployment rates, and male wages are matched by msa and year of conception. All regression include group, MSA and year fixed effects, as well as MSA-year unemployment rates and male wages. Low and High elasticity refer to below and above the median measure of housing supply elasticity developed by Saiz (2008).Highest and lowest elasticity refer to the 1st and 4th quartile of the distribution. Sand and Coastal MSAs refer to MSAs in sand states and coastal areas according to Davidoff (2011) and Rappaport and Sachs (2003). Data sources are: Vital Statistics (births, population), Census and Federal Housing Finance Agency (house prices), Current Population Survey (wages, fraction college), and Bureau of Labor Statistics (unemployment rates). All specification are weighted by the total number of births in the cell. Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 8: Individual Level Analysis

	(1)	(2)	(3)	(4)
$HousePrice_{mt-1} * Own_i$	0.000509***	0.000509***	0.000509***	0.000510***
	(0.000172)	(0.000172)	(0.000179)	(0.000179)
$HousePrice_{mt-1}$	-0.000303**	-0.000304**	-0.000299**	-0.000314**
	(0.000120)	(0.000125)	(0.000130)	(0.000134)
Own_i	0.0368***	0.0368***	0.0372***	0.0371***
	(0.00365)	(0.00365)	(0.00377)	(0.00377)
$UnempRate_{mt-1}$		-0.0000504		-0.000276
		(0.000557)		(0.000592)
$25thWage_{mt-1}$			-0.000526	-0.000528
			(0.000600)	(0.000601)
$50thWage_{mt-1}$			0.000430	0.000421
			(0.000512)	(0.000514)
$75thWage_{mt-1}$			0.0000987	0.000102
			(0.000245)	(0.000245)
Demographics	x	x	x	x
MSA Fixed Effects	x		x	x
Year Fixed Effects	x		x	x
Mean Had Baby	0.063	0.063	0.063	0.063
Mean Own	0.498	0.498	0.498	0.498
R^2	0.028	0.028	0.028	0.028
N	233942	233823	206169	206050

Notes: Sample is women age 20-44 in March Current Population Survey 1991-2007. Dependent variable is an indicator for having a child under one. House prices (10,000s), unemployment rates, and male wages are matched by msa and year. Ownership is the household's home ownership status, which is assigned as a 1 when the household owns a home and the respondent is the household head or spouse of the household head. All regressions include fixed effects for education, year, age category, race, Hispanicity, and msa. Data sources are: Census and Federal Housing Finance Agency (house prices), Current Population Survey (individual level data, wages), and Bureau of Labor Statistics (unemployment rates). Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 9: Bust Periods

	(1) Aggregate-90-96	(2) CPS-90-96	(3) CPS-07-09	(4) ACS-07-09
$HousePrice_{mt-1} * OwnRate_{mg}$	0.0122	0.000666**	0.000667***	0.000449***
	(0.0147)	(0.000279)	(0.000213)	(0.000116)
$HousePrice_{mt-1}$	-0.00256	-0.0000815	-0.000664	0.0000333
	(0.00633)	(0.000491)	(0.000495)	(0.000217)
Own	0.0695	0.0367***	0.0309***	0.0367***
	(0.370)	(0.00387)	(0.00465)	(0.00218)
$UnempRate_{mt-1}$	-0.000853	-0.000476	-0.000437	0.000481
	(0.00157)	(0.000896)	(0.00151)	(0.000470)
$25thWage_{mt-1}$	0.000285	-0.000400	0.000414	-0.000154
	(0.000728)	(0.000712)	(0.00125)	(0.000336)
$50thWage_{mt-1}$	0.000716	0.000223	-0.000694	-0.000270
	(0.000687)	(0.000676)	(0.00103)	(0.000331)
$75thWage_{mt-1}$	-0.000153	0.000476	-0.000652	0.000221
	(0.000415)	(0.000463)	(0.000498)	(0.000153)
Demographics	x	x	x	x
MSA Fixed Effects s	x	x	x	x
Year Fixed Effects	x	x	x	x
R^2	0.947	0.030	0.032	0.012
N	6684	141250	81907	851178

Notes: In columns (1) the sample is all births to women age 20-44 for the bust period of 1990-1996 according to the specification in table 1, column (6) and the dependent variable is the fertility rate. In column (2), the sample is women 20-44 in the March Current Population Survey for the bust period 1990-1996 and in column (3) for the bust period 2007-2009. In column (4) the sample is women 20-44 in the American Communities Survey for the bust period 2007-2009. The dependent variable in columns (2)-(4) is an indicator for having a child under one. In column (1) ownership rates are matched by MSA, age category and race/ethnicity. In columns (2)-(4), ownershipis the household's home ownershipstatus, which is assigned as a 1 when the household owns a home and the respondent is the household head or spouse of the household head. House prices (10,000s), unemployment rates, and male wages are matched by msa and year. Column (1) includes group, MSA and year fixed effects. Columns (2)-(4) include fixed effects for MSA, year, race, Hispanicity, age category and education. Data sources are: Census and Federal Housing Finance Agency (house prices), Current Population Survey (wages), and Bureau of Labor Statistics (unemployment rates). Robust standard errors are in parentheses and clustered at the msa level. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 10: House Prices and Home Equity Withdrawal Behavior

	Dependent Variable: Does the Home Owner Currently Have a....?				
	Equity Loan or Line of Credit	Equity Line of Credit	Equity Loan	First Mortgage Refinanced	Second Mortgage Refinanced
$HousePrice_{mt}$	0.00182**	0.00299***	-0.000478	0.00269*	-0.00171
	(0.000752)	(0.000890)	(0.000509)	(0.00145)	(0.00219)
Mean Dep Var.	0.196	0.185	0.0835	0.349	0.0755
	(0.00272)	(0.00329)	(0.00193)	(0.00449)	(0.00642)
R^2	0.055	0.262	0.026	0.104	0.072
N	21209	13948	20527	11289	1696
	Dependent Variable: Why Did You Refinance Your First Mortgage?				
	Lower Interest Rate	To Get Cash	Renew or Extend	Increase Payments	Reduce Payments
$HousePrice_{mt}$	-0.00319	0.00491***	-0.000503	0.000822	0.0000489
	(0.00199)	(0.00187)	(0.000527)	(0.000830)	(0.00147)
Mean Dep. Var	0.857	0.131	0.00965	0.0221	0.104
	(0.00558)	(0.00537)	(0.00156)	(0.00234)	(0.00487)
R^2	0.107	0.053	0.043	0.043	0.068
N	3937	3937	3937	3937	3937

Notes: Displayed is the coefficient of MSA-year house prices on the probability of making different types of home equity withdrawals, as well as the mean of each dependent variable. All regressions include control for msa, year, race, ethnicity, and age. House prices (10,000s) are matched by MSA and year. Source is American Housing Survey, National Version, Every other year 1997-2009. Refinancing is only available in 2001-2009. Questions only asked of home owners. Data is in panel form and respondents are asked if they have ever done the specific activity. For instance, the question will ask, "is the respondents first mortgage a refinancing of a previous mortgage?" "Why refinance?" is only asked for those who have refinanced. The categories are not mutually exclusive and respondents may respond yes to multiple categories.

Table 1: (Appendix) Characteristics of Metropolitan Areas in the Sample

Metropolitan Area Name (2009 MSAD)	Percent Change Prices 97-06	Home Price 2006	Fertility Rate 2006	Elasticity of Supply	Coastal MSA	Sand MSA
Salinas, CA	171.4%	$588,736	103.5	1.10	1	1
Santa Barbara-Santa Maria-Goleta, CA	165.5%	$628,696	86.3	0.89	1	1
Santa Ana-Anaheim-Irvine, CA	164.5%	$615,302	76.7		1	1
Riverside-San Bernardino-Ontario, CA	162.7%	$338,547	90.6	0.94		1
Los Angeles-Long Beach-Glendale, CA	162.6%	$515,061	76.1	0.63	1	1
Vallejo-Fairfield, CA	151.9%	$398,870	77.8	1.14	1	1
San Diego-Carlsbad-San Marcos, CA	151.4%	$474,242	81.1	0.67	1	1
Oxnard-Thousand Oaks-Ventura, CA	148.7%	$556,284	86.3	0.75	1	1
Fort Lauderdale-Pompano Beach-Deerfield Beach, FL	146.5%	$267,370	67.9	0.65	1	1
Stockton, CA	146.4%	$331,468	92.6	2.07	1	1
Modesto, CA	145.8%	$314,814	90.7	2.17	1	1
Oakland-Fremont-Hayward, CA	144.1%	$564,108	74.7	0.70	1	1
Miami-Miami Beach-Kendall, FL	142.6%	$295,201	71.4	0.60	1	1
West Palm Beach-Boca Raton-Boynton Beach, FL	140.7%	$290,506	76.3	0.83	1	1
Santa Rosa-Petaluma, CA	131.4%	$510,412	73.5	1.00	1	1
Cape Coral-Fort Myers, FL	131.3%	$241,947	86.4	1.28	1	1
Sacramento–Arden-Arcade–Roseville, CA	127.7%	$351,294	76.5		1	1
Fresno, CA	126.2%	$264,992	97.8	1.84		1
North Port-Bradenton-Sarasota, FL	125.7%	$247,504	75.6	0.92	1	1
Port St. Lucie, FL	125.4%	$238,298	79.9	1.19	1	1
Nassau-Suffolk, NY	124.7%	$436,655	71.5		1	
Bakersfield-Delano, CA	123.9%	$230,694	105.8	1.64		1
San Francisco-San Mateo-Redwood City, CA	122.9%	$781,891	64.0	0.66	1	1
Deltona-Daytona Beach-Ormond Beach, FL	117.7%	$194,512	65.8	1.07	1	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	117.2%	$401,637	74.7	1.61	1	
Palm Bay-Melbourne-Titusville, FL	117.0%	$210,691	67.1	1.04	1	1
San Jose-Sunnyvale-Santa Clara, CA	116.9%	$698,468	82.6	0.76	1	1
Tampa-St. Petersburg-Clearwater, FL	112.7%	$186,334	69.3	1.00	1	1
Orlando-Kissimmee-Sanford, FL	107.0%	$221,037	72.3	1.12	1	1
Bethesda-Rockville-Frederick, MD	106.4%	$445,442	80.1	1.61	1	
Phoenix-Mesa-Glendale, AZ	106.4%	$252,298	87.2	1.61		1
Atlantic City-Hammonton, NJ	105.1%	$258,536	71.7	1.12	1	
New York-White Plains-Wayne, NY-NJ	104.7%	$472,658	69.3	0.80	1	
Edison-New Brunswick, NJ	102.4%	$355,049	75.1		1	
Providence-New Bedford-Fall River, RI-MA	98.4%	$272,732	61.2	1.34	1	
Visalia-Porterville, CA	94.6%	$224,105	108.8	1.97		1
Boston-Quincy, MA	94.2%	$349,966	61.4	0.86	1	
Poughkeepsie-Newburgh-Middletown, NY	94.0%	$290,782	73.6	1.79	1	
Las Vegas-Paradise, NV	92.6%	$288,093	85.8	1.39		1
Jacksonville, FL	92.6%	$181,653	73.2	1.06	1	1
Baltimore-Towson, MD	89.8%	$258,936	66.9	1.23	1	
Ocala, FL	89.2%	$147,002	74.9	1.73	1	1
Newark-Union, NJ-PA	88.6%	$381,183	73.0	1.17	1	
Charleston-North Charleston-Summerville, SC	85.6%	$176,563	74.0	1.20	1	
Virginia Beach-Norfolk-Newport News, VA-NC	85.5%	$221,630	71.6	0.82	1	
Reno-Sparks, NV	84.7%	$316,406	80.0	1.39		1
Lakeland-Winter Haven, FL	82.9%	$141,875	84.9	1.56	1	1
Peabody, MA	81.8%	$335,451	68.9	0.86	1	
Bridgeport-Stamford-Norwalk, CT	81.0%	$468,745	74.9	0.98	1	
Trenton-Ewing, NJ	80.7%	$276,183	67.0	1.88	1	
Worcester, MA	80.6%	$245,583	66.0	0.86	1	
Seattle-Bellevue-Everett, WA	77.4%	$369,177	66.6	0.88	1	
Tucson, AZ	76.5%	$198,430	73.7	1.42		1
Cambridge-Newton-Framingham, MA	76.0%	$380,977	63.6	0.86	1	

Metropolitan Area Name (2009 MSAD)	Percent Change Prices 97-06	Home Price 2006	Fertility Rate 2006	Elasticity of Supply	Coastal MSA	Sand MSA
Gainesville, FL	75.6%	$169,875	52.6	2.48	1	1
Honolulu, HI	71.7%	$589,037	87.9			
New Haven-Milford, CT	71.3%	$261,064	65.8	0.98	1	
Tacoma, WA	71.0%	$261,712	73.2	1.21	1	
Camden, NJ	70.5%	$232,665	69.7	1.65	1	
Norwich-New London, CT	68.2%	$252,431	61.6	1.46	1	
Philadelphia, PA	67.6%	$211,020	67.9	1.65	1	
Minneapolis-St. Paul-Bloomington, MN-WI	66.5%	$221,112	74.0	1.45		
Wilmington, DE-MD-NJ	63.9%	$232,676	68.8	1.95	1	
Pensacola-Ferry Pass-Brent, FL	61.2%	$154,225	73.7	1.48	1	1
Vineland-Millville-Bridgeton, NJ	61.0%	$166,452	89.8	1.85	1	
Springfield, MA	59.4%	$209,209	57.4	1.52		
Richmond, VA	58.0%	$185,521	69.2	2.60	1	
Olympia, WA	57.3%	$248,438	66.9	1.75	1	
Hartford-West Hartford-East Hartford, CT	54.2%	$238,239	63.0	1.50	1	
Portland-Vancouver-Hillsboro, OR-WA	52.9%	$283,856	72.1	1.07		
Allentown-Bethlehem-Easton, PA-NJ	52.8%	$207,168	67.6	1.77		
Albany-Schenectady-Troy, NY	52.8%	$187,483	60.3	1.70		
Asheville, NC	51.8%	$159,848	69.3	1.55		
Chicago-Joliet-Naperville, IL	49.7%	$251,216	74.0	0.81	1	
Denver-Aurora-Broomfield, CO	40.1%	$216,292	77.5	1.53		
Milwaukee-Waukesha-West Allis, WI	38.2%	$180,640	71.3	1.03	1	
Spokane, WA	37.4%	$182,067	71.9	1.64		
York-Hanover, PA	36.8%	$172,685	68.4	1.99	1	
St. Louis, MO-IL	35.9%	$136,093	69.3	2.36		
Lake County-Kenosha County, IL-WI	35.4%	$258,459	75.9	1.00	1	
Racine, WI	35.1%	$161,554	73.0	1.77	1	
Madison, WI	34.0%	$201,667	63.0	2.25		
Reading, PA	33.9%	$166,269	70.5	2.03		
Fayetteville-Springdale-Rogers, AR-MO	32.7%	$132,146	82.9	2.06		
Austin-Round Rock-San Marcos, TX	32.7%	$157,418	75.6	3.00		
Lancaster, PA	31.8%	$180,168	84.7	2.24	1	
Binghamton, NY	31.7%	$107,227	65.2	2.26		
Houston-Sugar Land-Baytown, TX	30.9%	$113,243	85.0	2.23	1	
Utica-Rome, NY	30.1%	$106,208	67.2	2.79	1	
Colorado Springs, CO	30.0%	$198,587	78.2	1.67		
Atlanta-Sandy Springs-Marietta, GA	29.5%	$179,457	76.0	2.55		
Midland, TX	28.9%	$105,898	89.7			
Albuquerque, NM	28.2%	$183,194	76.2	2.11		
Mobile, AL	27.9%	$107,656	74.1	2.04	1	
Niles-Benton Harbor, MI	27.8%	$127,136	73.9	2.06	1	
Kansas City, MO-KS	27.6%	$132,024	77.6	3.19		
Salt Lake City, UT	27.4%	$225,663	97.0	0.75		
Lafayette, LA	27.1%	$120,141	72.9	4.84	1	
Baton Rouge, LA	27.0%	$122,634	72.3	1.74	1	
Ann Arbor, MI	26.6%	$212,388	55.7	2.29	1	
Chattanooga, TN-GA	26.4%	$119,291	66.3	2.11		
Shreveport-Bossier City, LA	25.9%	$99,810	74.3			
El Paso, TX	25.9%	$99,742	95.5	2.35		
Knoxville, TN	25.8%	$131,259	64.7	1.42		
Lexington-Fayette, KY	25.8%	$140,213	66.8	2.63		
Birmingham-Hoover, AL	24.7%	$121,813	72.7	2.14		
San Antonio-New Braunfels, TX	24.6%	$102,182	81.0	2.98		
Syracuse, NY	24.5%	$116,321	63.5	2.21	1	
Corpus Christi, TX	24.1%	$94,566	76.4	1.65	1	
Harrisburg-Carlisle, PA	23.6%	$150,613	68.4	1.63		

Metropolitan Area Name (2009 MSAD)	Percent Change Prices 97-06	Home Price 2006	Fertility Rate 2006	Elasticity of Supply	Coastal MSA	Sand MSA
Nashville-Davidson–Murfreesboro–Franklin, TN	23.2%	$161,298	72.7	2.24		
Augusta-Richmond County, GA-SC	22.9%	$109,720	74.0	3.57		
Columbia, SC	22.8%	$119,656	68.6	2.64		
Lansing-East Lansing, MI	22.4%	$133,123	58.0	2.58		
Scranton–Wilkes-Barre, PA	22.2%	$123,566	63.9	1.62		
Detroit-Livonia-Dearborn, MI	21.4%	$113,685	65.5	1.24	1	
Des Moines-West Des Moines, IA	20.0%	$129,175	80.5	3.66		
Davenport-Moline-Rock Island, IA-IL	19.4%	$105,763	73.4	4.11		
Durham-Chapel Hill, NC	19.4%	$171,002	67.9	2.11		
Dallas-Plano-Irving, TX	19.1%	$124,055	80.2	2.18		
Little Rock-North Little Rock-Conway, AR	19.0%	$108,394	74.1	2.79		
Louisville/Jefferson County, KY-IN	18.6%	$127,502	70.8	2.34		
Waco, TX	18.6%	$86,859	75.8			
Pittsburgh, PA	18.3%	$110,200	60.9	1.20		
Warren-Troy-Farmington Hills, MI	18.2%	$186,579	64.0	1.30	1	
Beaumont-Port Arthur, TX	18.1%	$76,356	79.5	2.49	1	
Grand Rapids-Wyoming, MI	16.5%	$131,715	77.5	2.39	1	
Charlotte-Gastonia-Rock Hill, NC-SC	16.3%	$151,494	77.2	3.09		
Omaha-Council Bluffs, NE-IA	16.2%	$124,335	85.0	3.47		
Kalamazoo-Portage, MI	15.7%	$127,799	67.0	2.48	1	
Fort Worth-Arlington, TX	15.7%	$108,505	81.7	2.80		
Hickory-Lenoir-Morganton, NC	15.6%	$105,663	64.7	2.41		
Cincinnati-Middletown, OH-KY-IN	15.5%	$138,971	71.8	2.51		
Lubbock, TX	15.0%	$83,529	72.7	4.33		
Peoria, IL	14.4%	$110,385	76.4	3.23		
Columbus, OH	13.8%	$146,041	73.0	2.71		
Rockford, IL	13.8%	$123,510	75.5	3.68		
Toledo, OH	13.8%	$114,567	65.4	2.21	1	
Raleigh-Cary, NC	13.7%	$178,667	76.2	2.11		
Flint, MI	13.6%	$108,328	70.2	2.75	1	
Greenville-Mauldin-Easley, SC	13.5%	$117,495	72.7	2.71		
Gary, IN	13.2%	$131,597	72.5	1.74	1	
Springfield, MO	13.1%	$114,971	71.1	3.60		
South Bend-Mishawaka, IN-MI	12.8%	$107,023	74.1	4.36	1	
Winston-Salem, NC	12.4%	$128,671	72.5	3.10		
Memphis, TN-MS-AR	11.8%	$108,828	75.7	1.76		
Wichita, KS	11.6%	$96,868	88.7	5.45		
Montgomery, AL	11.1%	$108,348	70.5	3.58		
Ogden-Clearfield, UT	10.9%	$179,163	109.0	0.75		
Saginaw-Saginaw Township North, MI	10.9%	$100,272	66.1	2.23	1	
Buffalo-Niagara Falls, NY	9.9%	$115,101	60.5	1.83	1	
Greensboro-High Point, NC	9.8%	$122,924	66.1	3.10		
Akron, OH	9.0%	$132,057	62.6	2.59	1	
Cleveland-Elyria-Mentor, OH	8.7%	$140,618	66.6	1.02	1	
Canton-Massillon, OH	8.6%	$117,865	68.9	3.03		
Fayetteville, NC	7.8%	$107,010	83.9	2.71		
Youngstown-Warren-Boardman, OH-PA	7.5%	$97,192	64.3	2.59		
Rochester, NY	7.3%	$117,940	63.9	1.40	1	
Indianapolis-Carmel, IN	7.0%	$130,473	78.3	4.00		
Spartanburg, SC	6.8%	$100,563	70.5	2.71		
Dayton, OH	3.9%	$119,761	68.0	3.71		
Fort Wayne, IN	3.3%	$101,869	81.1	5.36		
Springfield, IL	1.2%	$105,476	68.5			