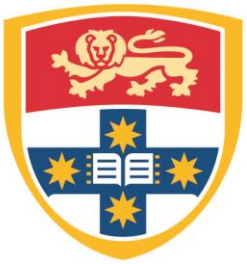

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Housing Wealth and Fertility: Australian Evidence

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Abstract: This paper examines the impact of housing wealth on fertility related decisions by exploiting geographic variation in house price changes in Australia. Using data from the Household Income and Labour Dynamics in Australia (HILDA) survey, we find changes in house prices significantly affect the household decisions around fertility outcomes and fertility intentions. Our estimates indicate that, among home owners, a $100,000 increase in house prices increases the likelihood of having a child by a 7.5 percent. An increase in house prices of this order leads to an increase in the intention to have a child, measured on a scale of 0-10, by a 2.5 percent. We show that the positive housing wealth effect on fertility is largely driven by females in their early 30s, with at least one child, and within a formally married relationship.

Keywords: house prices, housing wealth, fertility choice, fertility intention

1 Introduction

Australia has experienced relatively rapid growth in house prices over the past few decades, with steady increases in prices being punctuated by periods of rapid housing growth. It is in the context that increasing attention has been turned to considering how house prices and housing wealth impact on a range of socio-economic behaviours and outcomes including those related to household consumption, retirement plans, and more recently fertility. Like many other countries, the fertility rate in Australia has trended downwards over the years. The analysis in this paper attempts to explore how intentions and outcomes related to fertility may be linked to house prices.

From a theoretical perspective, there are strong reasons to believe that house prices and fertility decision are closely related (Becker, 1960; **?**, 1965; **?**). According to the economic theory of fertility behaviour, parents maximise their expected lifetime level of utility subject to budget and time constraint. The price of housing enters the child production function as one of the major costs of raising children and therefore represents an important determinant of fertility. House price inflation may affect fertility decisions through a number of pathways. First, an increase in house prices effectively increases the cost of children leading to a decline in the demand for children through a substitution effect. At the same time, the increase in house prices may induce a positive wealth effect in the form of increased housing wealth that in turn relaxes borrowing constraints and increases child-related consumption. Overall, the net effect of increases in house price on fertility is ambiguous.

Recently a number of empirical studies have begun to explore the connection between childbearing decision and the price of housing. Lovenheim and Mumford (2013) investigate the effect of housing wealth on the fertility decisions over the period 1985-2007 for the United States. They find a significant and positive housing wealth effect on fertility with a $100,000 increase in house prices causing an 18 percent increase in the likelihood of having a child. Mizutani (2015) considers the experience of Japan over the period 1993-2011 when the economy underwent a prolonged economic downturn and finds a 10-million-yen increase in the housing wealth increases the probability of childbirth by 21.5 percent for home owners with home loans. Importantly, both studies use individual self-assessed home values in their analysis of

fertility behaviours.

Other studies have used aggregate data to examine how house price changes impact on fertility outcomes. Employing a specification that includes a home ownership interaction term, Dettling and Kearney (2014) investigate the impact of Metropolitan Statistical Area-level house prices on Metropolitan Statistical Area-level fertility rates in the United States. Their results imply that a $10,000 increase in house prices leads to a 5 percent increase in fertility rates among owners and a 2.4 percent decrease among non-owners. Following Dettling and Kearney (2014)'s specification, Aksoy (2016) explores the effect of house prices on fertility rates using data from English counties during the period 1996-2014. Their estimates indicate that a 10 percent increase in house prices is associated with a 2.8 percent increase in birth rates for home owners and a 4.9 percent decrease for renters. Clark and Ferrer (2016) examine how changes in house prices at the real estate board level affect household fertility decisions using panel information about Canadian households from 1994 to 2010 finding a small but nonetheless positive impact of house price changes on the probability of giving birth. These studies have invariably suggested that housing price and housing wealth do affect childbearing.

The key question addressed in this paper is the relationship between house prices and decisions around fertility outcomes and intentions. We examine this relationship for Australia using the Household Income and Labour Dynamics in Australia (HILDA) survey. Similar to the approach adopted in Lovenheim and Mumford (2013) , the analysis quantifies the housing wealth effect as the change in house prices using self-assessed property values reported by home owners. The one-year house price change, along with detailed individual background and geographic information, allows the identification of a conditionally exogenous housing wealth effect on fertility decision of households. The key assumption of the study is that the magnitude and timing of house prices changes across geographical regions in Australia are not endogenously determined with individual fertility behaviour, conditional on the observables in the specification. Exploiting the arguably exogenous geographic heterogeneity in house price changes enables our estimates to overcome the inherent endogeneity between housing selection and decisions around childbearing, and to isolate out the causal effect of house prices on fertility.

This paper makes several contributions to the existing empirical literature on fertility-housing relationship. We provide the first evidence in Australia that investigates the impact of house price variation on fertility related decisions. The substantial variation in the magnitude and timing of house price changes across geographic regions in recent years in Australia provides a valuable source of exogenous variation in house prices and wealth that facilitates the identification of a causal interpretation. Unlike studies such as Dettling and Kearney (2014), Aksoy (2016) and Clark and Ferrer (2016), the availability of self-reported house prices obviates the need to reply on aggregate or regional data. Arguably, changes in housing wealth derived from self-assessed home values provides an exogenous measure of house price and wealth that considered to be more pertinent to individual household behaviour as it is the perceived increase in home values that expectedly drives the fertility decisions.

Further, to underline the connection between fertility and housing markets, we include both fertility outcome and fertility intention measures in our study. Such analysis is novel in the literature on housing-fertility relationship. The availability of detailed information on fertility history and fertility intention enables a better elucidation of women's childbearing behaviour. Much evidence in the existing literature has accentuated the informativeness of fertility intention as a predictor on women's actual fertility behaviour. The intention to have children, rather than birth outcomes, are not subject to external factors such as miscarriages and thereby provides a useful indicator of the impact of house prices on fertility related behaviours (Risse, 2010). The analysis on fertility intention effectively enriches the understanding on housing market's impact on fertility.

The analysis indicates that house prices have potentially important implications on fertility outcomes and intentions. In particular, we find that a $100,000 increase in home prices over the past year increases the probability of having a child by a 0.0061 percentage point, or 7.5 percent. In terms of fertility intentions, an increase in house prices of this order leads to an increase in the intention to have a child, measured on a scale from 0 to 10, by 0.0738, or 2.5 percent. The empirical specifications control for a range of demographic and socio-economic characteristics, local macroeconomic conditions, and spatial and time fixed effects. The results suggest that the positive housing wealth effect on fertility is primarily driven by female home owners in their

early 30s, those already with at least one child, and those in a married relationship. In comparison, renters and other demographic groups are not significantly responsive to home price changes.

The remainder of the paper is organised as follows. The next section reviews the literature that examines the relationship between housing market and fertility decisions. Following this, in section three, data used in the present study are described. Next, the empirical strategy is set out. In Section five, estimation results are presented along with the discussion of implications of the analysis. A concluding section summarises the key findings.

2 Literature Review

The nexus between housing and fertility has been long investigated in the literature on family formation and fertility behaviours more generally. Early empirical studies relate the demand for children to housing tenure (Kendig, 1984; Murphy and Sullivan, 1985; Rudel, 1987; Åsberg, 1999; Mulder and Billari, 2010) and housing type (Felson and Solaún, 1975; Haurin et al., 1994; Kulu and Vikat, 2008; Ström, 2010; Öst, 2012; Kulu and Steele, 2013). Recent developments in housing markets have drawn attention of demographic and economic researchers to the question of the relationship between house prices and family events including household formation (Börsch-Supan, 1986; Rudel, 1987; Ermisch and Di Salvo, 1997; Ermisch, 1999; Mulder and Clark, 2000; Hughes, 2003; Clark, 2012), divorce (Rainer and Smith, 2010; Farnham et al., 2011; Milosch, 2014) and fertility (Simon and Tamura, 2009; Yi and Zhang, 2010; Pan and Xu, 2012; Dettling and Kearney, 2014; Lovenheim and Mumford, 2013; Mizutani, 2015; Liu and Clark, 2016; Clark and Ferrer, 2016; Aksoy, 2016; Laeven and Popov, 2016).

The debate as to whether house prices has any impact on childbearing has emerged as fertility rates have been declining across a number of advanced economics. Intuitively, housing represents a significant cost associated with having children. Several studies have attempted to examine the connection between house prices and fertility using a variety of data source across countries. These studies have employed cross-section data (Simon and Tamura, 2009; Pan and Xu, 2012), time-series data (Yi and

Zhang, 2010), and panel data (Curtis and Waldfogel, 2009). The analyses are consistently suggestive of a negative correlation between the price of housing and fertility. In general, however, it is difficult to attach a causal interpretation to the estimates and the estimates do not distinguish between individuals in different housing tenures.

The importance of discussion home owners and renters separately is highlighted by the accessibility of housing wealth. To identify the different effects between housing tenures, Dettling and Kearney (2014) set out a specification that includes lagged home values and an interaction term between lagged house prices and baseline home ownership rates. Using aggregate data at the Metropolitan Statistical Area (MSA)-level in the United States during 1997-2006, they find a decline in birth rates among non-owners and a net increase among owners associated with a short-term increase in house prices. With a similar specification, Aksoy (2016) confirms Dettling and Kearney (2014)'s finding using data from English counties from 1996 to 2014. Controlling for individual fixed effects that take into account unobserved characteristics of women, Clark and Ferrer (2016) estimate the effect of lagged housing prices on marginal and total fertility using the Canadian Survey of Income and Labour Dynamics (SLID) combined with housing price data at real estate board level from 1994 to 2010. Their study also supports the previous finding that a positive housing wealth effect dominates any negative price effect among home owners.

A key issue in unravelling the relationship between fertility rates and home prices hinges on the identification of an exogenous housing price measure. Without an exogenous measure of house price variation, a causal interpretation can be ambivalent. At microeconomic level, housing selection is potentially endogenously determined with childbearing decisions. At the macroeconomic level, both fertility rates and housing market are closely related to local economic dynamics. The presence of simultaneity and selection will cause biased estimates of the effect of housing prices on fertility decisions. The concerns over the potential endogeneity of housing prices that thwarts the identification of a causal relationship has been widely acknowledged in the literature (Simon and Tamura, 2009; Dettling and Kearney, 2014; Clark and Ferrer, 2016; Aksoy, 2016; Laeven and Popov, 2016).

Another stream of literature explores the differential effects of house prices on fertility decisions between home owner and renters by differencing home values. The

approach provides an advantage by exploiting heterogeneous housing market growth rates across localities to induce an exogenous variation in housing prices. The key underlying assumption is that the geographic variation in the size and timing of the house price movement are conditionally exogenous to household child-bearing decisions. Lovenheim and Mumford (2013) analyse the effect of housing wealth changes driven by house price growth on fertility decisions using the Panel Study of Income Dynamics (PISD) during 1985 and 2007. They find that a $100,000 increase in housing wealth among home owners causes a 17.8 percent increase in the probability of having a child using four-year home value changes. Focusing on a period during which housing prices stagnated or fell, Mizutani (2015) investigates the changes in fertility decisions in response to housing market in Japan. Using data from the Japanese Panel Survey of Consumers between 1993 and 2011, they show that a 10-million-yen decrease in the two-year change in home value leads to a 21.5 percent decrease in the probability of childbirth among home owners with home loans. Like the analysis in this paper, Lovenheim and Mumford (2013) and Mizutani (2015) use self-reported home values to measure perceived housing wealth of households.

Arguably, fertility behaviour can be better elucidated by examining both intentions and outcomes. Fertility intention has been long documented as a useful predictor of future fertility behaviour. Following the work of Ajzen (1991) that provides a theoretical structure of the transition of fertility intentions to actual behaviour, much empirical evidence has demonstrated a high congruence between intentions to have a child and future birth outcomes (Westoff and Ryder, 1977; Rindfuss et al., 1988; Tan and Tey, 1994; Miller and Pasta, 1995; Thomson, 1997; Schoen et al., 1999; **?**; Islam and Bairagi, 2003; Quesnel-Vallée and Morgan, 2003; Morgan and Rackin, 2010; Ajzen and Klobas, 2013). This is the case notwithstanding that there appears to be some under-and-overestimation of the congruence between intentions and outcomes among some socio-demographic groups (Beckman, 1984; Monnier, 1989; Berrington, 2004; Lampic et al., 2006; Rossier and Bernardi, 2009). Fertility intention also has an advantage of indicating deliberate choices that are not subject to factor of chance such as unplanned pregnancies or miscarriages (Risse, 2010). In the emerging research on the relationship between house prices and fertility, little has been discussed in terms of how the housing market movement influences women' childbearing inten-

tions. In this dimension, the current study provides a valuable addition to the study on childbearing behaviour.

3 Theoretical Discussion

The theoretical model of fertility behaviour is first developed by Becker (1960), and has been extended by **?**, Becker (1965), and **?**. Their approach to the economic theory of fertility provides a framework within which a consumer theory is applied to analyse the link between fertility, labour supply and time allocation. Under the utility-maximising framework, parents act as a decision maker choosing the optimal number of children and other consumption activities to maximise their expected lifetime level of the utility, subject to the full wealth constraint that includes their lifetime market earnings and non-labour money wealth, and the total time constraint. Assuming that children are normal goods and recognising that housing constitutes a relatively large proportion of the cost of childbearing, the total effect of house prices on fertility is decomposed into a positive income effect and a negative substitution effect. The complementarity between children and housing implies that house price inflation will cause families to substitute away from children to other goods. At the same time, with the access to housing equity stored, the increase in the price of housing increase the perceived lifetime wealth that can increase the demand on children.

Importantly, changes in house prices are likely to have nuanced implications for households residing in different tenures and experiencing different housing conditions. With higher house prices, renters most likely face a higher rental cost driven by housing market growth. For renters who stay in the rental market with no intention to enter home ownership, the rise in house prices will increase the cost of raising children, causing renters to substitute away from children to other goods. For renters who intend to purchase a home in the future, house price increase will generate a negative substitution effect as well as a negative lifetime wealth effect. In general, we may expect house price inflation causes renters to desire fewer children. In contrast, higher house price provides an ambiguous effect on child demand among home owners. Home owners whose current housing condition are not sufficient or whose residential

location are not favourable for childbearing aspiration may sell their current home and relocate to a larger house or a house close to child-friendly amenities such as good schools. Either trading up or down, for these potential movers, the rise in house prices can negatively affect their childbearing decisions. At the same time, these home owners can capitalise on the stored housing equity via refinancing or line of credit if they have previously experienced house price growth, which increases their borrowing capability and allows them to fund desired child-related consumption. The total effect of house price among those home owners who plan for a child-motivated residential move is thus ambiguous. Increase in house prices will drive up their fertility if the positive wealth effect outweighs the negative substitution effect. Home owners who have sufficient housing with no intention to move, on the other hand, only face a positive wealth effect and a priori would be expected to increase total fertility following an increase in house prices. Overall, however, the effect of a change in house prices among home owners will be ambiguous.

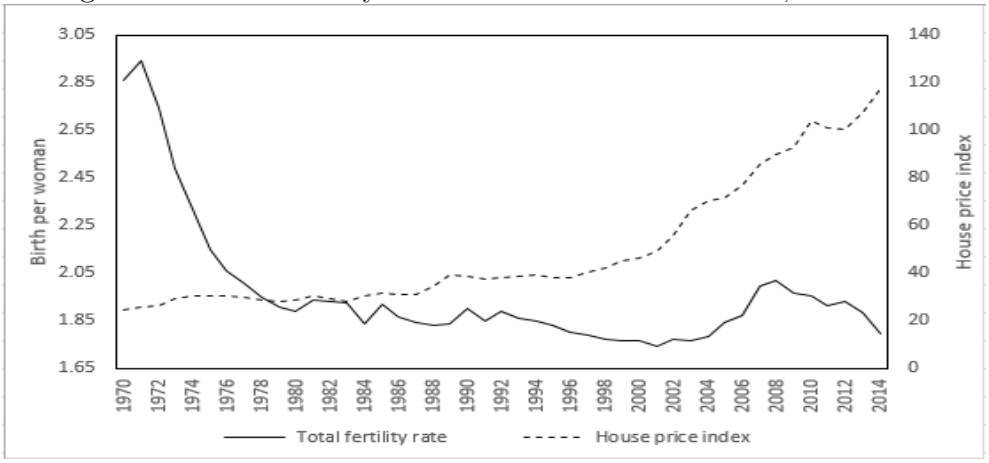
4 Data

We begin by presenting the historical patterns of fertility rates and house prices at the aggregate level during the period 1970-2014 using the time series from the Australian Bureau of Statistics (ABS, 2015, 2016c). Total fertility rates measure the average number of babies born to a woman throughout her reproductive lifetime in each year, and house price index indicate the price changes in all established detached houses within the eight capital cities between two periods. The national fertility rates and house prices changes over time are illustrated in Figure 1. The time series plot suggests a negative aggregate correlation between fertility and house price variation.

The microdata used for our analysis are drawn from the fourteen waves of the Household, Income and Labour Dynamics in Australia (HILDA) survey between 2001 and 2014.[1] The HILDA survey is a household-based panel survey with a nationally representative sample of Australian households. Commencing in 2001, the HILDA

[1]The Household, Income and Labour Dynamics in Australia (HILDA) Survey was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views based on these data should not be attributed to either DSS or the Melbourne Institute.

Figure 1: Total Fertility Rate And House Price Index, 1970-2014



Source: The annual time series of total fertility rates and house price index for the period 1970-2014 are from the Australian Bureau of Statistics (ABS, 2015, 2016c). The house price index predating 2002 are provided in Abelson and Chung (2005).

survey covers a broad range of socio-economic domains, with particular focus on family and household formation, income and work. Participating households and individual household members are interviewed approximately one year apart. The interviews are administered to all members of the responding households aged 15 years and over, including original residents and all other new entrants who reside with the original household members. The joiners are followed for as long as they share a household with the original members and dropped out of the sample if they no longer cohabitate with the original member. The 19,914 people interviewed in wave 1 form the basis of the panel and new household members have been gradually added into the sample in the subsequent waves as a result of the family composition changes.

Respondents in HILDA are asked of detailed questions about their past and future fertility, such as the total number of children they have had and the intention to have a child/more children in the future measured on a zero to ten point scale. Birth outcome, our first measure of fertility, is constructed by differencing the number of children a woman reports having across waves. This dichotomous indicator takes the value of one if the total number of children born to a woman in the current wave has increased from the last wave and zero otherwise. The second fertility measure

– fertility intention is measured using the question *"How likely are you to have a child/more children in the future"*, asked of all responding individuals aged 55 and less. Respondents indicate that they are very unlikely (zero) to very likely (ten) to have a child/more children in the future. The question didn't specify the timing of future children or the parity of children. For the purpose of empirical analysis, the self-reported intention variable is treated as a continuous variable. A similar approach has been adopted in Drago et al. (2009) and Bassford and Fisher (2016).

The tenure of the respondent' dwelling is asked in each wave. Respondents (or any other member of the household) reports to own (with or without mortgage) or rent their home (including those in the rent-buy scheme). An important feature of the HILDA dataset is that those who are residing in an owner-occupied house are asked about the value of the dwelling in each wave. The availability of a home owner's self-assessed property values which have been recorded consistently across waves is an important advantage over some other studies that have examined the relationship between house prices and fertility. Arguably, it is the perceived housing wealth as measured by self-assessed house values that are likely to be more pertinent for fertility related decisions compared to aggregate measures of house prices such as those used in Clark and Ferrer (2016) and Aksoy (2016). To the extent that fertility choices are based on self-assessed house values, we believe home values reported by the household are a measure of substantial relevance in this study. One potential concern with such a measure is that it may contain substantial measurement error. Melser (2013) investigates the potential estimation bias in the self-reported home values in the HILDA and concludes that the estimation errors seem to be mostly independent to the characteristics of the home and the household. Moreover, similar measures have been used in a number of studies such as Lovenheim (2011), Lovenheim and Mumford (2013) and Atalay et al. (2014). The existing evidence has suggested that such data provide a reasonably accurate measure of actual house values. The market home values of renters are generated by averaging the self-reported home values of home owners in the sample in their Local Government Area (LGA)[2] and survey year,

[2]Local Government Areas (LGA) cover administrative regions of local governing bodies that represent legally designated parts of a State or Territory in Australia. As in the 2016 Australian Statistical Geography Standard (ASGS), there are 564 Australian Bureau of Statistics defined Local Government areas (ABS, 2016a). Due to the data construction, 370 LGAs in total are included in

the same approach taken in the Lovenheim and Mumford (2013).

The empirical specifications also include a range of demographic and socio-economic characteristics to control for the differential fertility preference and children demand of families. Existing evidence highlights the importance of age, education levels, family income, marital status, and total numbers of children born to a woman as key determinants in family formation. Given labour force participation tends to be simultaneously determined with childbearing plans, family income is potentially endogenous and thus causal interpretation of the variable warrants caution. The information on survey year and residential spatiality facilities the control for any common unobserved factors within year and location. The study uses the LGA identifier contained in the unconfidentialised data to control for the correlation of housing growth rates within each LGA.

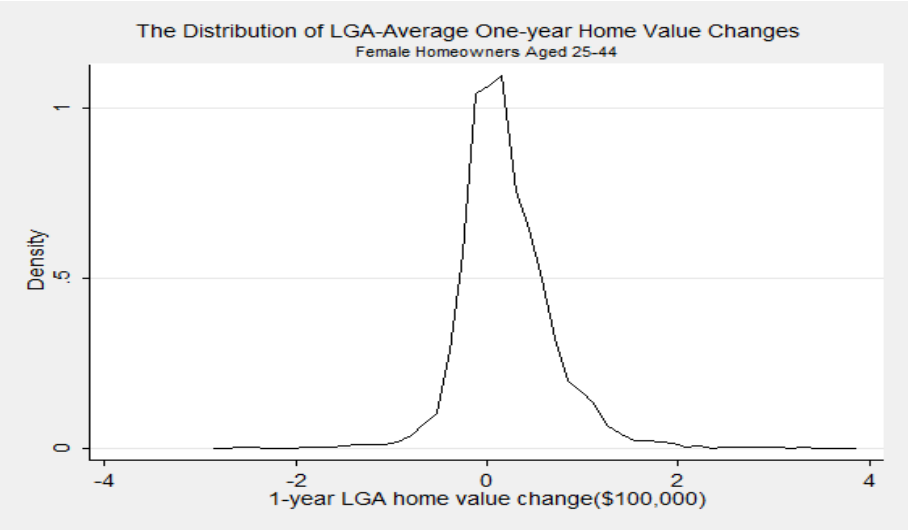
The analysis sample is comprised of responding women aged 25-44 years in at least one of the 14 waves of data collected between 2001 and 2014. The age distribution covers the prime period of fertility planning and childbearing and excludes the ages with generally low birth rates.[3] During the period covered by the analysis, the housing market in Australia experienced significant house price variations across LGAs. While the national house price had been trending upwards, regional housing markets had shown marked variations. There had been a rapid growth in house prices in Sydney and Melbourne – Australia's two largest housing markets in early 2000s and early 2010s, and in Perth for their mining boom in 2005. As shown in Figure 2, the distribution of LGA-average one-year home value changes among female home owners aged 25-44 during 2010-2014 indicates that there is clear evidence of substantial variation in one-year house price changes across the analysis sample.

The analysis distinguishes between home owners and renters. The sample of home owners contains females who legally own the property, share the ownership with other household members, or live with the legal owner of the property. Renters are defined as females who currently rent the property, including those in the rent-buy scheme. The construction of birth probability and housing wealth results in

our sample.

[3]The restriction on age selection is also driven by the data limitation that only females aged between 18-55 years of age are asked about fertility intention. Moreover, existing evidence highlights that fertility rates fall significantly after age 45.

Figure 2: The Distribution of LGA Average One-Year Home Value Changes Among Female Homeowners Ages 25-44



the loss of one wave of data. Observations who remained in the same residence across consecutive waves are used to generate the measure of home value changes. Observations recording missing information on education attainment, marital status and geographic identifiers are also dropped from the sample.[4] All home values and family income variables are inflated to real 2014 dollars.

Summary statistics of the sample of home owners and renters used in the empirical analysis are presented in Table 1. Home owners exhibit slightly higher birth rates than renters, with approximately 82 per 1000 female home owners giving birth in the prior survey year compared to 74 female renters. Conversely, home owners report a lower intention to have children (2.9) than renters (3.7). As expected a priori, relative to renters, home owners are more likely to be married, older, and more educated, and they tend to have larger total numbers of children. Home owners tend to have higher incomes compared to those residing in rental properties. Among home owners, the average self-reported value of residential property is around $538,000. The one-year

[4]The outlying values of home value changes, which are extremely distant from the sample mean and are believed to be unrealistic information reported by the respondents, are also removed from the sample. These unreliable outlier points can cause misleading results of the estimates. The outliers are defined as the observations that fall in the top 1 percentile (-62.1307, -2.8452) and the bottom 99 percentiles (3.8719, 60.6831) of the one-year home value changes.

home value change has a mean of $21,000 and exhibits considerable variation, with the standard deviation significantly larger than the mean.

Table 1: Summary Statistics

	Mean	S.D.	Minimum	Maximum	Count
Birth Outcome					
Homeowners					
Birth	0.0818	0.2741	0	1	16906
InttoKid	2.9294	3.8290	0	10	17604
Self-reported home value($100,000)	5.2263	3.3103	0	70.7848	19383
1-year home value change($100,000)	0.2068	0.7909	-2.8433	3.8688	16410
Total children	1.7062	1.3216	0	13	19383
Family income($100,000)	1.2920	0.8994	-11.6427	30.6872	19383
Married	0.7082	0.4546	0	1	19383
Age 25-29	0.1518	0.3588	0	1	19383
Age 30-34	0.2136	0.4099	0	1	19383
Age 35-39	0.2914	0.4544	0	1	19383
Age 40-44	0.3431	0.4748	0	1	19383
University	0.3602	0.4801	0	1	19383
Diploma	0.2676	0.4427	0	1	19383
$\leq$Year12	0.3722	0.4834	0	1	19383
Renters					
Birth	0.0741	0.2620	0	1	7177
InttoKid	3.7185	3.9511	0	10	7851
LGA average home value($100,000)	2.9082	1.8533	0	17.5432	8474
1-year LGA home value change($100,000)	0.1722	0.4924	-2.5850	2.9658	6776
Total children	1.5857	1.5650	0	12	8474
Family income($100,000)	0.8552	0.5482	-0.7915	7.0057	8474
Married	0.3550	0.4785	0	1	8474
Age 25-29	0.3032	0.4597	0	1	8474
Age 30-34	0.2621	0.4398	0	1	8474
Age 35-39	0.2321	0.4222	0	1	8474
Age 40-44	0.2026	0.4020	0	1	8474
University	0.2594	0.4383	0	1	8474
Diploma	0.2699	0.4439	0	1	8474
$\leq$Year12	0.4707	0.4992	0	1	8474

5 Empirical Methodology

Like Lovenheim and Mumford (2013), fertility outcomes and fertility intentions are estimated using ordinary least squares using the following specification:

$$Pr(Birth_{iat} = 1) = \beta_0 + \beta_1 \Delta P_{iat} + \beta_2 X_{iat} + \theta_a + \gamma_t + u_{iat} \quad (1)$$

$$Intention_{iat} = \beta_0 + \beta_1 \Delta P_{iat} + \beta_2 X_{iat} + \theta_a + \gamma_t + u_{iat} \quad (2)$$

where i indexes the individual, a indexes the local government area, and t indexes the survey year. The variable P represents self-reported home values, and X is a vector of observable characteristics including key demographic and socio-economic determinants of fertility such as age, education attainment, family income and family size, and a set of variables capturing local economic conditions such as unemployment rate and average wage in the correspondent local area. In addition, θ represents the LGA fixed effects, γ time fixed effects, and u is the error term.

The identification of an exogenous source of variation in house prices is central to understanding the link between house prices and fertility. At the individual level, housing purchase and decisions to have a child are likely to be inextricably linked. Families may sort on unobserved preferences that are correlated with both childbearing plans and housing selection, which can confound the causal interpretation of the relationship. The direction of the bias can be either positive or negative, depending on the fertility aspiration of the family. The bias might be positive if families having strong preferences for child quality select into areas with good schools and thus higher house prices. Conversely, the estimate may be biased downwards if couples with low demand for children select into city areas with relatively high priced housing. At the macro level, both fertility and housing prices are likely to be driven by the local economic dynamics. Due to the endogeneity concern, the estimate on home value levels is not used for casual interpretation.

To explore an exogenous measure of house prices, the one-year home value change over the past year defined as ΔP is constructed by first differencing the estimated values of the home reported by the home occupier. During the period of analysis, there had been large changes in house prices at the local level in Australia, with a number of

regions experiencing rapid house price increases in some periods. Such unanticipated changes in house prices are arguably exogenous to the fertility related decisions for existing home owners, facilitating the identification of a causal relationship between house prices and fertility. The key identification assumption is that the magnitude and timing of home price variation are reasonably random and sufficiently different across geographic regions in Australia during the period 2001-2014, and that it is less likely for households to select on such exogenous house price measure. The constructed one-year home value change has an advantage of exploiting a housing market shock that is exogenously determined with individual fertility behaviour, conditional on the observables.

For home owning households, an increase in house prices leads to an unanticipated increase in wealth. The change in owners' estimated value of their homes measures a housing wealth effect that can potentially increase household consumption. An important mechanism via which changes in housing wealth can increase household consumption occurs in the form of mortgage equity withdrawal. In Australia, mortgage equity withdrawal is the dominant form of housing equity withdrawal in the last decades especially among those under pension age (Ong, 2013). Home owners can release home equity to renovate their current dwelling, accumulate a deposit for the next property, fund child-related expenses, or serve as financial insurance in meeting future child-related cost outlays (Wood and Nygaard, 2010), which all may contribute to an increase in fertility intentions and outcomes.

An important aspect of the analysis in this paper is that the data contains geographic details coded at a relatively fine level. Hence, it is possible to incorporate measures of LGA-year unemployment rates and LGA-year average wage levels in the specification to take into account of the fact that women may select into childbearing during economic downturns and choose to postpone having children when the opportunity cost of leaving their jobs is relatively high. The labour market information on annual unemployment rates and average employee earnings from wage and salary at the LGA level are collected from the ABS National Regional Profile series (ABS, 2016b), and merged into the HILDA data using LGA identifiers. In addition, renters are estimated as a robustness check of any confounding local economic influences.

The spatial and temporal differences of house price growth is controlled for by

adding LGA fixed effects and year fixed effects to capture any common unobserved factors within the geography and year that may be associated with fertility decisions. A series of LGA fixed effects are included to control for any time-invariant selections of families with different fertility preferences across LGAs. Year fixed effects take into account of any influences on demand for children common within a year such as child and family support policies. For example, universal cash payments in the order of $5000 on the birth of a child termed the Baby Bonus, and Paid Parental Leave schemes were introduced in 2004 and 2011 respectively in Australia.

As noted earlier, fertility outcomes are measured using a binary indicator that can be estimated using linear probability model, probit or logit functional forms. Linear probability model has the weakness of unconstrained predicted probabilities and heteroskedastic errors. However, the constant marginal effect of the explanatory variables in the OLS regression provides an easy interpretation. Our main estimation thus uses the linear probability model, although the results from the probit model are similar.[5] The women's future fertility intention is a ranking variable that scaled from 0 to 10. We treat fertility intention as a continuous variable and estimate it using ordinary least squares. Such approach avoids the complexity in the interpretation of a variable with a large number of categories using probit or logit forms, and retains all information on the fine changes between categories that would otherwise be neglected by condensing the adjacent categories.

Failing to control for the structure of the errors can lead to invalid inferences on the estimators. It is important to control for the clustering of errors at the geographic level in this study because house prices are very likely subject to the influence of common geographic elements. Given the geographic pattern of house prices, we cluster the standard errors over LGAs using the geographic identifier to produce robust results of the estimates. This method allows any correlation of errors within each LGA. Adjusting the correlation of the errors across the Major Statistical Region (MSR)[6]

[5]We estimate the birth probability and fertility intention specification using probit model and find consistent results with the OLS regression (Appendix Table 9 and 10). The positive wealth effect on fertility decision remains for both the probit birth probability estimates and the ordered probit fertility intention estimates. A similar size of the effect of change in house prices on fertility outcome is found in the estimates.

[6]One Major Statistical Regions (MSR) consists of the capital city and the balance of the State. Each of the five larger States of New South Wales, Victoria, Queensland, South Australia and

yields similar results.

6 Results

6.1 Birth Probability

The results of coefficient estimates of main interest from estimating Equation (1) and (2) are reported in Table 2 and Table 3 respectively. Full results are presented in the Appendix (Table 5 and 6). The specification in each column includes the demographic and socio-economic variates listed in the summary statistics along with the macroeconomic controls. The measure of home value levels is used in columns 1 and 3, and the measure of one-year home value changes are used in columns 2 and 4. The first two columns show the results from the baseline specification, and the final two columns present the results that include LGA fixed effects. The upper panel shows the estimates for home owners using the self-reported home values, and the lower panel shows the estimates among renters using the LGA-by-year average market house prices.

The top panel of Table 2 presents the results from estimation of Equation (1) for home owners. The results in columns 1 and 3 indicate that the correlation between contemporaneous house price levels and the birth of a child is relatively small and statistically insignificant. As discussed above, it is difficult to draw causal inferences from models that contain measure of house price levels. In columns 2 and 4, the results suggest that fertility outcomes are positively associated with the changes in house prices. The effect of home price changes on the likelihood of having a child in the previous year is positive and significant. The effect is largely unchanged after including LGA fixed effects to control for unobserved difference across LGAs. Controlling for age groups, relationship status, education level, annual family income, and the total number of children ever had, the baseline regression produces an estimate of 0.0068 significant at the 1% level. The positive and sizeable coefficient estimates are suggestive of a strong housing wealth effect on fertility that outweighs the negative

Western Australia covers two MSRs, and the other States/Territories have one MSR each covering the entire area (ABS, 2016a).

effect associated with the increase in home prices among home owners.

Table 2: LPM Estimates Of The Effect Of Housing Prices On Birth Probability

	(1)	(2)	(3)	(4)
Home Owners				
Home value($100,000)	0.0002		-0.0010	
	(0.0008)		(0.0010)	
1-year home value change($100,000)		0.0068***		0.0061**
		(0.0025)		(0.0025)
Family income($100,000)	0.0001	0.0001	0.0014	-0.0002
	(0.0031)	(0.0032)	(0.0033)	(0.0033)
LGA fixed effect	No	No	Yes	Yes
R^2	0.077	0.077	0.097	0.096
Renters				
LGA average home value($100,000)	0.0036**		0.0003	
	(0.00176)		(0.00346)	
1-year LGA home value change($100,000)		-0.00179		-0.00367
		(0.00793)		(0.00851)
Family income($100,000)	0.00145	-0.00236	0.00260	0.000245
	(0.00641)	(0.00661)	(0.00699)	(0.00716)
LGA fixed effect	No	No	Yes	Yes
R^2	0.067	0.066	0.120	0.109

Standard errors clustered at the LGA level are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Using the specification that include geographic fixed effects, a $100,000 change in house prices leads to a 0.0061 percentage point change in the likelihood of having a child in the past year, significantly at the 1% level. Relative to the mean level of birth probability of 0.0818 for female home owners aged 25-44 in the sample, a $100,000 increase in housing wealth (with mean of $20,680 and standard deviation of $79,090) implies a 7.5 percent (0.0061/0.0818) increase in the likelihood of giving birth in the following year. Given the average home equity of $317,057 in the sample, a $100,000 increase in home value gives an equivalently 31.54% increase in housing wealth. Together with the 7.5 percent increase in the probability of birth, this implies a housing wealth elasticity of fertility is approximately 0.24. Using the Panel Study of

Income Dynamics (PSID) for the period 1985-2007, Lovenheim and Mumford (2013) also find a significant housing wealth effect. There, a four-year increase in home prices in the order of $100,000 increased the probability of a birth by a 0.0082 percentage point, or 16.4 percent. The housing wealth elasticity of fertility reported in that paper is approximately 0.13.

The family income coefficients are insignificant in all specifications, suggesting that family income is not associated with fertility decisions once housing wealth and individual background are controlled. All of the demographic variables are statistically significant with expected signs (Appendix Table 5). Women who are married and with higher education attainment are more likely to have a child, and the probability of childbearing declines as women grow older. We find a statistically insignificant relationship between fertility and unemployment rates as well as average income in the full specification.

Fertility responses of individuals residing in rental tenures are reported in the bottom panel of Table 2. The regressions for renters are estimated as a robustness check to examine whether any unobserved local macroeconomic conditions cause bias on housing wealth estimates. The results do not show any evidence that females in rental tenures respond to changes in local house prices by increasing their fertility (column 2 and 4). This suggests that the effect identified for home owners is not biased by unobserved macroeconomic conditions. The positive effect of house price increase on fertility among home owners is also found in the other similar studies in the United States (Lovenheim and Mumford, 2013; Dettling and Kearney, 2014), Japan (Mizutani, 2015), Canada (Clark and Ferrer, 2016) and England (Aksoy, 2016).

6.2 Fertility Intention

Table 3 reports the result from estimating Equation (2) for home owners (upper panel) and renters (lower panel). Similar to the estimates of birth probability in Table 2, no significant relationships between home value levels and fertility intention are observed (column 1 and 3). In contrast, the point estimates of the effect of one-year home value changes on fertility intention among female home owners are positive and highly significant. Recall that fertility intentions are the likelihood rated

by the respondents to indicate how likely they are to have more children in the future, measured on a scale from 0 (very unlikely) to 10 (highly likely). The estimate indicates that a $100,000 increase in house prices is associated with a 0.0913 increase in fertility intention prior to including LGA controls (column 2) and a 0.0738 increase in fertility intention after controlling for the geographic selection across LGAs (column 4).[7] That is, the intention to have a child in the future increases in housing wealth. Note that when examining the effect of paid parental leave on the fertility desires and intentions of working women in Australia, Bassford and Fisher (2016) find women with access to paid parental leave increase fertility intention by 0.202 using the same intention measure. Compared to the average intention of 2.9, a $100,000 increase in housing wealth leads to an increase in fertility intention of female home owners by a 2.5 percent.

As expected, family income is an important determinant in women's childbearing intention. Women from higher-income families are found to have stronger childbearing intentions. The estimates indicate a significant and positive relationship between fertility intention and family income that is similar in magnitude to that associated with changes in housing wealth. The estimated coefficients on a series of other socio-demographic characteristics are generally consistent with a priori expectations. For example, fertility intention decreases with the existing number of children, while females who are younger, married, and more educated tend to have stronger fertility intentions (Appendix Table 7 and 8). The estimates of birth intention among renters are reported in the lower panel of Table 3 as a robustness check. Similar to the results in the fertility outcome estimates, housing wealth changes do not affect the fertility intention of renters.

The existing evidence suggests that fertility intention is closely correlated to fertility outcome, hence providing an informative implication on childbearing behaviour. Fertility intention is of central importance in the discussion of the impact of perceived

[7]In wave 5, 8, and 11, the respondents are asked whether they themselves or their partners have had a sterilised operation or have physical or health difficulties in having children. In these three waves, only couples who are not being unsterilised had been asked to report their fertility intentions. The women in wave 5, 8 and 11 will thus show higher fertility intention rates than women in other waves. In light of the incomparability of responses between these three waves and the rest of waves, a sample that excludes wave 5, 8, and 11 are also estimated as a robustness check. The results are similar.

Table 3: OLS Estimates Of The Effect Of Housing Prices On Fertility Intention

	(1)	(2)	(3)	(4)
Home Owners				
Home value($100,000)	0.0068		-0.0174	
	(0.0123)		(0.0143)	
1-year home value change($100,000)		0.0913***		0.0738***
		(0.0255)		(0.0259)
Family income($100,000)	0.1150***	0.1200***	0.1320***	0.1070***
	(0.0367)	(0.0358)	(0.0353)	(0.0356)
LGA fixed effect	No	No	Yes	Yes
R^2	0.446	0.446	0.482	0.486
Renters				
LGA average home value($100,000)	0.0382		-0.0031	
	(0.0326)		(0.0382)	
1-year LGA home value change($100,000)		-0.0133		-0.1070
		(0.0883)		(0.0848)
Family income($100,000)	0.3790***	0.4400***	0.4130***	0.5220***
	(0.1070)	(0.1180)	(0.1110)	(0.1190)
LGA fixed effect	No	No	Yes	Yes
R^2	0.398	0.394	0.466	0.466

Standard errors clustered at the LGA level are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

housing wealth. We examine both fertility intention and fertility outcome in this section and find substantial relevance of these two measures. Significant housing wealth effects are found in both fertility intentions and outcomes.

6.3 Response Heterogeneity

Table 4 reports from estimates of the fertility specifications 1 and 2 across individuals within different age groups and by birth parity. Heterogeneous responses of women across demographic subgroups can shed light on the different responsiveness of women at different stages of life cycle and their adjustment on fertility timing.

The results in the first panel of Table 4 suggest that although the coefficient estimates of all women in childbearing age have positive signs, the response of fertility decision is most striking for women in the 30-34 age group. The increase in fertility outcomes are effectively driven by women aged 30-34 years. The point estimate for women aged 30-34 years is 0.0276, statistically significant at the 1% level, implying that a $100,000 increase in housing wealth increases the likelihood of giving birth among women aged 30-34 years by a 0.0276 percentage point. This represents an increase of 18.1 percent based on a mean birth rate of 0.1529. In contrast, there is little evidence that women in remaining age groups respond to changes in house prices. While similar in magnitude, the estimated effects for other age groups are insignificant at standard levels of significance. This pattern may be associated more generally with the housing careers experienced by individuals in Australia. Traditionally, home ownership was entered into during the twenties, though more recently entry into homeownership has been delayed for a variety of socio-economic reasons. Females in their early thirties generally have accumulated significant equity relative to those aged 25-29 who are likely to be new home owners. Arguably, they also have higher borrowing capability than younger groups. At the same time, compared to older groups who tend to have completed fertility, those aged 30-34 are less constrained in fertility timing. The strong response for women in their early 30s reflects the distinctive financial conditions, housing portfolios, borrowing capabilities and fertility aspirations of women at different stages of the life cycle.

Consistent with the results from fertility outcomes, fertility intention estimates for

Table 4: LPM Estimates Of The Effect Of Housing Prices On Fertility, By Age, Parity, And Relationship

	Fertility Outcomes	Fertility Intentions
Age groups		
25-29	0.0028	0.0810
	(0.0062)	(0.0756)
30-34	0.0276**	0.1120
	(0.0088)	(0.0722)
35-39	0.0028	0.0770
	(0.0054)	(0.0499)
40-44	0.0028	0.0240
	(0.0024)	(0.0302)
Birth parity		
0 children	0.0093	0.1120**
	(0.0067)	(0.0548)
1+ children	0.0058**	0.0303
	(0.0026)	(0.0281)
Marital status		
Married	0.0057*	0.0632**
	(0.0031)	(0.0295)
Defacto	0.0169	-0.0172
	(0.0123)	(0.0868)
Divorced, Separated,	0.0054	0.1150
or Widowed	(0.0084)	(0.110)
Single	0.0036	0.1170
	(0.0039)	(0.0709)

Standard errors clustered at the LGA level are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

different age groups suggest that women aged 30-34 years old exhibit the strongest housing wealth effect, despite the insignificant estimates across age groups. Women in 30-34 years old remains the most responsive age group with the highest statistical significance (t statistic of 1.55 and p-value of 0.12), followed by those aged 25-29, 35-39, and 40-44.

The second panel of Table 4 reports the estimating results for fertility outcome and fertility intention by parity according to the number of children already born to a woman. For those women who have no children, there is no effect of housing wealth on their birth choices. In comparison, females with at least one child present exhibit a pronounced positive and significant response. Conditional on having had at least one child, a $100,000 increase in housing wealth increases the probability of giving birth to another child by a 0.0058 percentage point, or 8.7 percent (0.0058/0.0669), at the 5% significance level. Women who do not already have a child are arguably more likely to be young households who are new owner-occupiers without sufficient wealth accumulation, thus not responding to housing wealth increases. This is consistent with the previous result of the unresponsiveness among young age group. Additionally, no response by women with no children relieves the concern of selection of families into homeownership by purchasing a home in an area where they predict higher house price growth (Lovenheim and Mumford, 2013).

The estimating results of fertility intention by parity show that the housing wealth effect on fertility intention is substantially larger for females who are yet to have a child than those who have had at least one child, where a $100,000 increase in house prices leads to a 0.1120 increase in fertility intention. The result confirms the strong childbearing intentions of women without children.

In the bottom panel of Table 4, the results of housing wealth estimates on fertility outcomes and intentions for women in differential marital status are presented. Notwithstanding an increase in fertility rates outside registered marriages, it remains the case that a majority of births occur within a formal marriage. We find that a rise in house prices induces a positive housing wealth effect on the fertility among married home owners: a $100,000 increase in home prices leads to a 0.0057 percentage point, or 5.7 percent (0.0057/0.0997) increase in the probability of having a child in the previous year. An increase in house prices of this order leads to an increase

in the fertility intention by 0.0632, or 2.4 percent (0.0632/2.6563). In comparison, cohabitating couples show no response to unanticipated increases in home values by altering their fertility decisions, in terms of births or fertility intentions.

7 Conclusion

This paper has examined the fertility response of Australian women to house price growth. The results presented indicate that house price growth is associated with an increase in fertility and fertility intentions. In this sense, the Australian experience is similar to that reported for United States (Lovenheim and Mumford, 2013; Dettling and Kearney, 2014), Japan (Mizutani, 2015), Canada (Clark and Ferrer, 2016) and England (Aksoy, 2016). An important contribution of the current paper is the availability of rich microdata that provides a measure of self-assessed home value. Arguably, such an assessment is relevant for the decision making within households. Moreover, the individual house price data provides extensive variation across spatial units and time that can be used to establish a causal link from housing wealth to childbearing decision. The analysis on fertility behaviour is enriched in this paper by the discussion of fertility intention along with fertility outcome.

Our results suggest that Australian women were significantly responsive to house price growth by increasing fertility during 2001-2014. We find a $100,000 increase in home value changes among home owners causes a 0.0061 percentage point, or 7.5 percent increase in the probability of a woman to have a child in the past year. Similarly, an increase in house prices of this magnitude increases women's intention to have a child measured on a scale from 0 to 10 by 0.0738, or 2.5 percent. The estimating results by different age groups indicate that the positive housing wealth effect is largely driven by women in their early 30s, with a 0.0276 percentage point, or 18.1 percent increase in the likelihood of giving birth in response to a $100,000 increase in home equity in the previous year. The heterogeneous responses by parity suggest no response by women who are yet to have a child and a strong response among those with at least one child. We also find that the housing wealth effect is more salient within a formally married relationship.

Our results provide consistent evidence of housing wealth effect found in other

studies in this literature. By establishing the relationship between the changes in housing values and the fertility decision of Australian women, this study suggests that the perceived changes in housing wealth produce a significant consumption incentive and financial insurance for families to pursue their fertility aspirations. The findings in this study indicate the significant response of fertility decisions to housing market that varies across housing tenures, age groups, birth parity and marital status. Our study contributes to the emerging literature in the relationship between house prices changes and fertility decision and emphasises the importance of housing market in affecting the decision-making of individual households. Childbearing decisions have strong implications on future fertility patterns. With changes to house prices and in turn household wealth, the implication of housing and finance market on household behaviour can be of the significant interest of policy makers, especially in the context of low fertility rates and ageing population.

Our study focuses on the fertility behaviour of non-movers. There could be however a considerable number of women who, in response to the changes in housing market, move to another dwelling that is more spaced, less expensive, or close to good schools and childcare facilities. Such moves can be within the same housing tenure or between different housing tenures. Residential mobility, in pursuit of their childbearing aspirations, is not explicitly discussed in the current study. Future studies can explore the role of residential mobility plays in the fertility-housing nexus. The research on the response of fertility to housing market can also be extended by including partner's characteristics and intentions. Despite the wife's preference is found to be more important than the husband's preference in affecting the subsequent births (Fan and Maitra, 2011), we acknowledge the importance of including husband's characteristics in fertility studies.

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Appendix

Table 5: LPM Estimates Of The Effect Of Housing Prices On Birth Probability Among Homeowners

	Birth	Birth	Birth	Birth
Home value($100,000)	0.000217		-0.00100	
	(0.000795)		(0.00102)	
1-year home value change($100,000)		0.00676**		0.00613*
		(0.00246)		(0.00254)
Family income($100,000)	0.000119	0.000116	0.00135	-0.000233
	(0.00306)	(0.00319)	(0.00327)	(0.00330)
Married	0.0445***	0.0438***	0.0451***	0.0437***
	(0.00493)	(0.00488)	(0.00525)	(0.00520)
Total children	0.0332***	0.0325***	0.0363***	0.0354***
	(0.00232)	(0.00227)	(0.00250)	(0.00242)
Age 25-29	0.176***	0.175***	0.178***	0.178***
	(0.00829)	(0.00857)	(0.00881)	(0.00909)
Age 30-34	0.157***	0.154***	0.157***	0.155***
	(0.00660)	(0.00687)	(0.00694)	(0.00729)
Age 35-39	0.0687***	0.0665***	0.0689***	0.0669***
	(0.00447)	(0.00459)	(0.00464)	(0.00477)
University	0.0471***	0.0481***	0.0455***	0.0465***
	(0.00487)	(0.00505)	(0.00519)	(0.00534)
Diploma	0.0167***	0.0160***	0.0147**	0.0144**
	(0.00461)	(0.00462)	(0.00488)	(0.00496)
LGA unemployment rate	0.000469	0.000629	0.000721	0.000647
	(0.00112)	(0.00116)	(0.00195)	(0.00198)
LGA average income	0.0827**	0.0835**	-0.0764	-0.0786
	(0.0302)	(0.0288)	(0.110)	(0.113)
Constant	-0.170***	-0.171***	-0.0727	-0.0976
	(0.0201)	(0.0199)	(0.0579)	(0.0606)
R^2	0.077	0.077	0.097	0.096
Observations	16906	16382	16906	16382

Standard errors clustered at the LGA level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: LPM Estimates Of The Effect Of Housing Prices On Birth Probability Among Renters

	Birth	Birth	Birth	Birth
LGA average home value($100,000)	0.00355*		0.000283	
	(0.00176)		(0.00346)	
1-year LGA home value change($100,000)		-0.00179		-0.00367
		(0.00793)		(0.00851)
Family income($100,000)	0.00145	-0.00236	0.00260	0.000245
	(0.00641)	(0.00661)	(0.00699)	(0.00716)
Married	0.0532***	0.0560***	0.0559***	0.0552***
	(0.00731)	(0.00768)	(0.00810)	(0.00835)
Total children	0.0332***	0.0333***	0.0351***	0.0355***
	(0.00309)	(0.00324)	(0.00344)	(0.00356)
Age 25-29	0.124***	0.124***	0.120***	0.123***
	(0.0102)	(0.0105)	(0.0113)	(0.0118)
Age 30-34	0.108***	0.109***	0.100***	0.105***
	(0.00956)	(0.0101)	(0.0105)	(0.0111)
Age 35-39	0.0438***	0.0481***	0.0395***	0.0431***
	(0.00661)	(0.00690)	(0.00730)	(0.00761)
University	0.0153	0.0202*	0.0215*	0.0224*
	(0.00792)	(0.00828)	(0.00953)	(0.00998)
Diploma	-0.000693	0.00472	0.00296	0.00437
	(0.00814)	(0.00872)	(0.00869)	(0.00906)
LGA unemployment rate	-0.00311	-0.00256	-0.00157	-0.00133
	(0.00180)	(0.00185)	(0.00310)	(0.00320)
LGA average income	0.00587	0.0422	0.0373	-0.0124
	(0.0372)	(0.0375)	(0.126)	(0.142)
Constant	-0.0847**	-0.0992**	-0.103	-0.0818
	(0.0296)	(0.0312)	(0.0740)	(0.0840)
R^2	0.067	0.066	0.120	0.109
Observations	7177	6512	7177	6512

Standard errors clustered at the LGA level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: OLS Estimates Of The Effect Of Housing Prices On Fertility Intention Among Homeowners

	InttoKid	InttoKid	InttoKid	InttoKid
Home value($100,000)	0.00683		-0.0174	
	(0.0123)		(0.0143)	
1-year home value change($100,000)		0.0913***		0.0738**
		(0.0255)		(0.0259)
Family income($100,000)	0.115**	0.120***	0.132***	0.107**
	(0.0367)	(0.0358)	(0.0353)	(0.0356)
Married	0.343***	0.347**	0.375***	0.387***
	(0.100)	(0.105)	(0.0996)	(0.104)
Total children	-0.831***	-0.838***	-0.840***	-0.856***
	(0.0678)	(0.0716)	(0.0738)	(0.0790)
Age 25-29	5.044***	5.031***	5.065***	5.076***
	(0.129)	(0.136)	(0.135)	(0.144)
Age 30-34	3.417***	3.444***	3.397***	3.438***
	(0.113)	(0.117)	(0.120)	(0.126)
Age 35-39	1.235***	1.240***	1.250***	1.269***
	(0.0662)	(0.0708)	(0.0676)	(0.0721)
University	0.638***	0.614***	0.563***	0.520***
	(0.107)	(0.111)	(0.111)	(0.119)
Diploma	0.115	0.0868	0.112	0.0896
	(0.0945)	(0.105)	(0.0973)	(0.111)
LGA unemployment rate	-0.00581	0.00352	-0.0119	-0.0282
	(0.0206)	(0.0215)	(0.0205)	(0.0247)
LGA average income	1.778***	1.861***	-1.346	-1.805
	(0.463)	(0.470)	(1.466)	(1.733)
Constant	0.689	0.558	2.231**	2.586**
	(0.360)	(0.389)	(0.703)	(0.889)
Observations	17604	15050	17604	15050
R^2	0.446	0.446	0.482	0.486

Standard errors clustered at the LGA level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: OLS Estimates Of The Effect Of Housing Prices On Fertility Intention Among Renters

	InttoKid	InttoKid	InttoKid	InttoKid
LGA average home value($100,000)	0.0382		-0.00310	
	(0.0326)		(0.0382)	
1-year LGA home value change($100,000)		-0.0133		-0.107
		(0.0883)		(0.0848)
Family income($100,000)	0.379***	0.440***	0.413***	0.522***
	(0.107)	(0.118)	(0.111)	(0.119)
Married	0.509***	0.582***	0.475***	0.504**
	(0.124)	(0.144)	(0.138)	(0.158)
Total children	-0.799***	-0.806***	-0.765***	-0.756***
	(0.0454)	(0.0516)	(0.0520)	(0.0566)
Age 25-29	4.429***	4.371***	4.424***	4.404***
	(0.133)	(0.146)	(0.142)	(0.151)
Age 30-34	2.954***	2.953***	2.953***	2.998***
	(0.123)	(0.143)	(0.128)	(0.148)
Age 35-39	1.237***	1.284***	1.237***	1.259***
	(0.112)	(0.128)	(0.112)	(0.123)
University	0.370*	0.352*	0.338*	0.331
	(0.155)	(0.171)	(0.171)	(0.184)
Diploma	0.0672	0.0103	0.0769	0.0701
	(0.144)	(0.164)	(0.156)	(0.172)
LGA unemployment rate	-0.0423	-0.0377	-0.0211	-0.00655
	(0.0336)	(0.0387)	(0.0391)	(0.0491)
LGA average income	0.741	0.839	-4.590*	-4.609
	(0.757)	(0.846)	(2.252)	(2.772)
Constant	1.474**	1.238*	3.752***	3.519*
	(0.488)	(0.592)	(1.083)	(1.419)
Observations	7851	6234	7851	6234
R^2	0.398	0.394	0.466	0.466

Standard errors clustered at the LGA level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Probit Estimates Of The Effect Of Housing Prices On Birth Probability

	Coefficients	Average Marginal Effects
1-year home value change($100,000)	0.0595***	0.0078***
	(0.0212)	(0.0028)
Family income($100,000)	0.0189	0.0024
	(0.0237)	(0.0031)
Married	0.4071***	0.0531***
	(0.0558)	(0.0074)
Total children	0.2934***	0.0383***
	(0.0188)	(0.0024)
Age 25-29	1.6582***	0.2164***
	(0.0921)	(0.0132)
Age 30-34	1.4247***	0.1859***
	(0.0812)	(0.0116)
Age 35-39	0.8538***	0.1114***
	(0.0686)	(0.0095)
University	0.3740***	0.0488***
	(0.0453)	(0.0060)
Diploma	0.1321***	0.0172***
	(0.0479)	(0.0063)
LGA unemployment rate	0.0044	0.0006
	(0.0175)	(0.0023)
LGA average income	-0.4431	-0.0578
	(0.7505)	(0.0976)

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Ordered Probit Estimates Of The Effect Of Housing Prices On Fertility Intention

	Coefficients	Average Marginal Effects
1-year home value change($100,000)	0.0303***	0.0003***
	(0.0106)	(0.0002)
Family income($100,000)	0.0205	0.0016
	(0.0170)	(0.0004)
Married	0.1912***	0.0016 ***
	(0.0499)	(0.0004)
Total children	-0.3615***	-0.0031***
	(0.0459)	(0.0003)
Age 25-29	1.9336***	0.0166***
	(0.0574)	(0.0015)
Age 30-34	1.4636***	0.0126***
	(0.0485)	(0.0010)
Age 35-39	0.7576***	0.0065***
	(0.0411)	(0.0005)
University	0.2250***	0.0019***
	(0.0496)	(0.0005)
Diploma	0.0622	0.0005
	(0.0524)	(0.0004)
LGA unemployment rate	-0.0115	-0.0001
	(0.0111)	(0.0001)
LGA average income	-0.2242	-0.0019
	(0.6707)	(0.0058)

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$