The asymmetric housing wealth effect on childbirth

Shinichiro Iwata

Faculty of Economics, University of Toyama

Michio Naoi

Faculty of Economics, Keio University

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Abstract

The existing literature has shown that increases in housing wealth, driven by unexpected house price shocks, have a positive effect on birth rates of homeowners. According the canonical model, a decrease in housing wealth has a symmetric negative impact on fertility behavior of households. That is, housing gains and losses of the same size should have identical quantitative effects (in an absolute sense) on fertility. In comparison, the theory of reference-dependent preferences suggests that people care more about housing losses than about equivalent gains, leading to an asymmetric housing wealth effect on a fertility decision. In our model, a utility from having a baby is weighted by a utility from house price where reference levels based on the house price in the prior years. The theoretical model suggests that the probability of giving birth is kinked at a reference housing wealth level and the wealth effects are discontinuously larger below the kink than above the kink. This theoretical prediction is tested using the recent survey data of Japanese households (Keio Household Panel Survey, KHPS). The KHPS is a nationally-representative, large-scale panel data started in 2004 with initial sample of approximately 4,000 households. Our empirical results suggest that, consistent with the theoretical prediction, homeowners' fertility responses are substantially larger when their housing wealth is below its reference level than when housing wealth is above reference level. Specifically, while estimated marginal effect is significantly positive when housing wealth is below its reference level, it is still positive but insignificant when housing wealth is above reference level. Furthermore, we also find that asymmetric wealth effects are robust to a number of alternative specifications, including controlling for possible measurement errors and unobserved heterogeneity of households.

Key words: childbirth; housing price; wealth; home ownership; reference-dependent preferences; loss aversion

1 Introduction

Recent empirical evidence has demonstrated that an increase in house prices tend to increase available housing wealth, leading to a positive income effect on fertility decisions of homeowners. The question then whether a decrease in housing wealth has a symmetric negative impact on fertility. The purpose of this paper is to empirically examine to this question, using the recent survey data of Japanese households.

Dettling and Kearney (2013) and Lovenheim and Mumford (2013) suggested that increases in housing prices tend to have a negative substitution effect on the demand for children when the association between children and housing are complements. This could be true especially for prospective homeowners who would buy a house with the addition of a child. However, as mentioned above, rising home values implies a boost in wealth for homeowners, and consequently they could afford to have a child when children are normal goods. Even though homeowners do not intend to resale their housing, they can use the rising equity to fund their childbearing goals. Lovenheim and Mumford (2013) investigated this hypotheses using US individual-level data from the Panel Study of Income Dynamics from 1990-2007. They estimated linear probability models of the probability that families give birth in a given year as a function of two and four year changes in the self-reported home values. Indeed, empirical results demonstrated that a $100,000 increase in an individual's real housing wealth is associated with a 16.4% increase in the probability of having a child among homeowners. Among renters, however, the Metropolitan Statistical Area (MSA)-level housing price grows have no significant effect on the current fertilely.

Dettling and Kearney (2013) estimated instrumental variables (IV) regression of MSA-level fertility rates on MSA-level housing prices during the 1997-2006 housing boom period. Their IV estimates demonstrated short-term increases in house prices lead to a decline in births where a non-owners rate is relatively high. This drop, however, is outweighed by an increase in births where an ownershup rate is relatevely high. Namely, similar to Lovenheim and Mumford (2013), fertility rates for homeowners are positively associated with short-term increases in house prices. In sum, at the mean U.S. home ownership rate in their sample period, the net effect of a $10,000 increase in house prices produce a 0.8% increase in fertility rates. They also confirmed the story told by aggregate level data using individual-level Current Population Survey data.

These estimates to predict that the effect of a housing market decline may have a symmetric negative impact on fertility. If this is true, it may help to understand that the recent severe declines in the housing market could be one of the reasons of the fairly sharp drop in the US birth rate. To examine this hypothesis, Lovenheim and Mumford (2013) used 16.8% of the subsample that experiences price declines, although they found some evidence that the response is not symmetric. Namely, the effect of a decrease in home value is not statistically different from 0. This indicates that fertility decisions are less likely to response to housing market variation during the period of house price declines, perhaps an increase in housing wealth may lead households move up their period of childbearing to a greater extent than a decrease in housing wealth may lead households to delay, as suggested by Dettling and Kearney (2013). On the other hand, Dettling and Kearney (2013) used data from housing bust period, 1990-1996, and attempted to conduct the same exercises. Empirical results of this period are similar to the housing boom period, supporting a symmetric negative impact. They also confirmed the same results during the recent housing bust period, 2007-2009: although only individual level data is used because MSA-level fertility rates are not available after 2006.

The first contribution of this paper is used data from housing bust period in more detail to examine the impact of the depressed housing price on childbirth. Lovenheim and Mumford (2013) suggested that more work examining the effect of the housing bust on fertility is needed in the future when data from the period of the housing bust become available. We use the data from Japan because the Japanese housing market has experienced two decades of price decline. Our empirical result appears to confirm that fertility is positively affected by housing wealth even when a period of history characterized by declining house prices.

The second contribution of this paper is to examine an asymmetric housing wealth effect on the decision to have a child. If we consider the housing wealth effect on childbirth only through the budget constraint, we cannot drive the asymmetric effect. However, if we apply the theory of reference-dependent preferences, it suggests that families care more about housing wealth losses than equivalent gains through the utility function, leading to an asymmetric housing wealth effect on a fertility decision. In our model, a utility from having a baby is weighted by a utility from house price where reference levels based on the price in the prior years. The theoretical model suggests that the probability of giving birth is kinked at a reference housing wealth level and the wealth effects are discontinuously larger below the kink than above the kink. This theoretical prediction is tested using the recent survey data of Japanese households (Keio Household Panel Survey, KHPS). The KHPS is a nationally-representative, large-scale panel data started in 2004 with initial sample of approximately 4,000 households. Our empirical results suggest that, consistent with the theoretical prediction, homeowners' fertility responses are substantially larger when their housing wealth is below its reference level than when housing wealth is above reference level. These results are inconsistent with Dettling and Kearney (2013), which suggested that fertility are more likely to responses when house prices increase than decline, and Lovenheim and Mumford (2013), which suggested that fertility responses tend to be symmetric regardless of rise and fall of house prices.

The rest of the paper is organized as follows. Section 2 presents a simple theoretical model that leads to asymmetric responses of childbirth. Based on our empirically testable predictions, Section 3 sets up our empirical model and describes the data. Section 3 also presents our empirical results. Section 4 concludes the paper.

2 The theory of childbirth and housing wealth

Let us define B as a parameter registering the propensity to give a birth, which is endogenously selected by families who dwell in owner-occupied housings. If families do not have a baby, then $B = 0$, whereas if they have one, then $B = 1$. We treat B as a continuous variable that ranges from zero to one, because it allows us to differentiate a object function, which is shown below. Therefore, B represents the probability to childbirth in our context. Let us define $U(B)$ as the utility from expecting to have a child whereas $C(B)$ as the cost function. Assume that $U'(B) > 0$, $U''(B) < 0$, $C'(B) > 0$, and $C''(B) = 0$. The households' surplus from having a child then can be written as $U(B) - C(B)$. To introduce the housing wealth impact on the utility, assume that the utility function $U(B)$ is weighted by a value function which depends on current housing wealth, W. In this paper, W is assumed to be exogenous to the families. The value function captures that the mind of family members is affected by the estimated value of their housing. Let us define W^* as a reference wealth level. For example, the house price at the time of purchase or the market price in the prior years might be suitable indicator for W^*. To apply the theory of reference-dependant preferences, the optimal level of B is then chosen by maximizing the following modified surplus functions:

$$\begin{array}{ll} U(B)\Phi(W) - C(B) & \text{if} \quad W \geq W^*, \\ U(B)\Psi(W) - C(B) & \text{if} \quad W \leq W^*, \end{array}$$

where $\Phi(W)$ and $\Psi(W)$ represent the value functions. The value functions are assumed to follow diminishing marginal utility over wealth. Namely, $\Phi'(W) > 0$, $\Phi''(W) < 0$, $\Psi'(W) > 0$, and $\Psi''(W) < 0$.

Assume that (A1) $\Phi(W^*) = \Psi(W^*)$. This assumption ensures that the value functions take the same value at the reference point. Assume also that (A2) $\Phi'(W^*) < \Psi'(W^*)$. This assumption reflects that families are loss averse: they are more likely to sensitive to losses than to gains, resulting in a greater marginal utility for losses.

The first-order condition for the above problems are given by:

$$\begin{array}{ll} U'(B)\Phi(W) - C'(B) & \text{if} \quad W \geq W^*, \\ U'(B)\Psi(W) - C'(B) & \text{if} \quad W \leq W^*. \end{array}$$

Let us denote B^* as the optimal level at $W = W^*$. Differentiating the first-order condition with respect to housing wealth at $W = W^*$ can be written as

$$\left.\frac{dB^*}{dW}\right|_{W=W^*} = \begin{cases} -\dfrac{U'(B^*)}{U''(B^*)}\dfrac{\Phi'(W^*)}{\Phi(W^*)} > 0 & \text{if} \quad W \geq W^*, \\ -\dfrac{U'(B^*)}{U''(B^*)}\dfrac{\Psi'(W^*)}{\Psi(W^*)} > 0 & \text{if} \quad W \leq W^*. \end{cases} \tag{1}$$

Because $\Phi'(W^*)/\Phi(W^*) < \Psi'(W^*)/\Psi(W^*)$ by assumptions (A1) and (A2), equation (1) demonstrates that the optimal propensity to have a child is kinked at the reference housing wealth and that the marginal propensity with respect to an exogenous increase in housing wealth is discontinuously higher below the kink than above the kink. This suggests that a negative effect on fertility because of a decline in house prices from the reference point is more pronounced than a positive effect on fertility, which is derived from a rise in house prices.

3 Empirical Analysis

3.1 Data and Variables

Our empirical analysis draws on the Keio Household Panel Survey (KHPS) to examine the relationship between housing wealth and fertility decision among homeowners. The KHPS, sponsored by the Japanese Ministry of Education, is a nationally-representative, large-scale longitudinal survey of Japanese households started in 2004 with initial sample of approximately 4,000 households.[1] In the following analysis, we use eight waves of the KHPS from 2004 to 2011. The KHPS is particularly suited to address the research questions in this paper because it contains detailed information on household's demographic events including childbirth, financial and housing wealth, and a rich set of family background characteristics.

In the following analysis, a dichotomous variable of childbirth is used as the dependent variable. This variable takes the value of one if the respondent's family had a new baby in the last 12 months, and zero otherwise. As a result, we have a total of 223 births in our dataset during the sample period. The KHPS also provides information on the value of the home if it is owned. Our housing wealth measure is constructed based on self-reported information in the survey ("*How much do you think the house and lot would sell for on today's market?*").[2] In addition to the above variables, we construct a number of important economic and demographic characteristics from the KHPS. These include the duration of current marriage, the number of existing children (prior to the new childbirth in question), household annual income, female respondent's age, the level of completed education (high school, technical college, two-year college, four-year college, and any postgraduate school), employment status (not employed, employed part-time, and employed full-time)[3], and female respondent's labor earnings. We also control for regions and the size of cities in each of our estimations. All monetary variables are converted to the 2005 prices using the Consumer Price Index (CPI).

[1] In 2007, the survey added a random refreshment sample of approximately 1,400 new respondents to cope with panel attrition.

[2] One might be skeptical about the use of self-reported house values as a proxy for market value. However, as Kiel and Zabel (1999) have shown, using the owners' valuation will result in accurate estimates of house price indexes, and therefore we believe that it will cause only a minor problem in our specific application.

[3] Women's employment careers are likely to be interrupted by childbirth and infant care, leading to a typical reverse causality issue. Therefore, for the employment status, dummy variables are constructed based on the status prior to the childbirth.

Since our purpose here is to identify the impact of self-reported house value on childbirth, we restricted our sample to homeowners that did not move during the survey period. For mover households, changes in self-reported house values cannot be interpreted as real house price changes. The sample was further restricted to households with a woman of childbearing age, i.e., a female respondent aged between 20 and 50 years. This left a total of 3,125 observations for our analysis. The descriptive statistics are presented in Table 1.

(Table 1 around here)

3.2 Econometric Model

As discussed in the previous section, our theoretical model predicts that the optimal propensity to have a child is kinked at the reference housing wealth and that the marginal propensity with respect to an exogenous increase in housing wealth is discontinuously higher below the kink than above the kink. Let B be a dichotomous variable for a childbirth, W be a self-reported housing wealth, W^* be a reference level, and X be a set of other explanatory variables. Then our benchmark econometric model can be written as

$$\Pr[B = 1] = F\left[\beta_L d_{[W<W^*]}\left(W - W^*\right) + \beta_G d_{[W \geq W^*]}\left(W - W^*\right) + \delta X\right], \tag{2}$$

where $d_{[A]}$ is the indicator function that takes the value of one if the event A is true, and takes the value of zero otherwise. Therefore, holding other things constant, the effect of a marginal increase in housing wealth W on fertility can be represented by β_L if $W < W^*$, and β_G if $W \geq W^*$. Our theoretical prediction is that $\beta_L > \beta_G$.

In order to estimate the above model, we need to know the homeowner's reference wealth level W^*. In the following analysis, we assume that the reference wealth level is defined as its status-quo, that is, the actual self-reported value in the previous year, W_{t-1}. This is a standard assumption in the literature where the reference state corresponds to the decision maker's current endowment (Tversky and Kahneman, 1991).[4]

[4] We also tested several alternative formulation of the reference wealth level. These include the initial house value in the sample period, value at the time of purchase, and the reference-point partially adjusted by the past wealth level (Bowman et al., 1999). These cases do not fundamentally change our qualitative results and are available upon request.

3.3 Empirical Results

As a preliminary step, we begin by looking at a simpler model without any asymmetric impact of housing wealth on fertility decision. Specifically, we estimated the model given by equation (2) with a restriction that $\beta_L = \beta_G$. This is estimated applying a standard logit model. Empirical results are presented in Table 2. The results presented in the first column of Table 2 (model [1]) show that short-term increases in house prices are positively associated with homeowner's probability of giving a birth in a given year. This result tends to complement previous findings by Dettling and Kearney (2013) and Lovenheim and Mumford (2013). Dettling and Kearney (2013) and Lovenheim and Mumford (2013) used data from housing boom period, while we used data from housing bust period. Significantly positive sign during housing bust period indicates that a decrease in house prices lead to a negative wealth effect on fertility decisions of homeowners.

For other demographic and family background variables, our results are summarized as follows. The female respondents' age has a significant non-linear effect on childbirth. The estimated results show that the probability of giving a birth increases through the 20s, reaching its highest at around the age 30, and then decreases throughout the 30s and 40s. Both the duration of marriage and the number of existing children are significantly and negatively associated with the probability of giving an additional birth. Female employment status is significantly associated with childbirth. As expected, the probability of giving a birth is considerably smaller for respondents working part-time or full-time. Finally, household income is significantly and positively associated with childbirth.

(Table 2 around here)

Given these preliminary results, we test the asymmetric impact of housing wealth on fertility decision. The results are presented in the second column of Table 2 (model [2]). The null hypothesis of equal wealth coefficients, $H_0 : \beta_L = \beta_G$, is tested against the one-sided alternative $H_1 : \beta_L > \beta_G$. It is found that estimated coefficient on self-reported house value is significantly positive when $W < W^*$ (coef. = 0.4196), whereas it is still positive but statistically insignificant when $W \geq W^*$ (coef. = 0.0454). This is consistent with our theoretical prediction homeowners' fertility responses are substantially larger when their housing wealth is below its reference level than when housing wealth is above reference level. In terms of marginal effects, when $W < W^*$, the probability of giving a birth gets larger by 0.9 percentage point for 10 million JPY increase in house value. On the other hand, when $W \geq W^*$, marginal effect is mere 0.1 percentage point. Furthermore, the null hypothesis of equal wealth coefficients, $H_0 : \beta_L = \beta_G$, is strongly rejected with $p = 0.0437$.

The remainder of this section reports the results of additional specifications in order to assess the robustness of our main findings. Two alternative models are estimated in addition to our benchmark model.

Since we assume that the reference wealth level coincides with its status-quo ($W^* = W_{t-1}$), any measurement errors in the past house value can bias our result. Presumably, measurement error in past house values pose a particularly serious problem if the current housing wealth is not so different from the reference wealth level (i.e., $W_t \approx W_{t-1}$), because in this case only a small amount of measurement error in the past house value can change the status whether or not the particular household has a housing wealth above (or below) the reference level. Therefore, in model [3], we exclude households that report the same self-reported house values across adjacent years, i.e., $W_t = W_{t-1}$. Since about 18% of households ($N = 565$) reported exactly the same house values across adjacent years, this significantly reduces our sample size. The estimated results presented in the second column, however, are qualitatively unchanged from our benchmark results. We therefore believe that measurement error issues do not pose serious problems in our estimation.

In addition, we also estimate the model with the random effects specification in order to take into account the potential heterogeneity. The estimation results are presented in the fourth column of Table 2 (model [4]). Although we cannot reject the null hypothesis of $\beta_L = \beta_G$ at conventional significance levels ($p = 0.134$), the estimated coefficient difference is broadly consistent with asymmetric fertility responses to wealth changes. In fact, estimated coefficient on self-reported house value is significantly positive when $W < W^*$ (coef. = 0.4540), while it is still positive but insignificant when $W \geq W^*$ (coef. = 0.0446).

4 Conclusion

This paper estimated the responses of homeowners' childbirth to a change in housing wealth using the recent longitudinal data of Japanese households. The main contribution of our analysis is to highlight the role of reference-dependent preferences in explaining household fertility decisions and its relationship with housing wealth changes. With the empirical specifications commonly used in previous studies, we found that the propensity to have a child is positively associated with housing wealth changes. This result suggests that a decrease in housing wealth has a symmetric negative impact on fertility decisions. However, our empirical specifications, which allow a different impact on childbirth against housing price gains and losses, supported that homeowners' fertility responses are substantially larger when their housing wealth is below its reference level than when housing wealth is above reference level. This is consistent with the theoretical model of reference-dependent preferences that predicts disproportionately higher wealth effects on childbirth when housing prices falls below some reference level. These empirical findings are robust to an alternative specifications. Our empirical findings thus appear to indicate that two decades of house price declines may have a substantially negative effect on fertility decisions of households in Japan.

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Table 1: Summary Statistics

	Mean	(S.D.)
Childbirth (1 if yes)	0.0301	(0.1708)
Duration of current marriage in years	16.3238	(6.1633)
Number of existing children	1.9862	(0.8777)
Age of female respondent	40.8925	(5.5098)
Education of female respondent		
High school	0.4522	(0.4978)
Technical college	0.0736	(0.2612)
Two-year college	0.3114	(0.4631)
Four-year college	0.1600	(0.3667)
Any postgraduate education	0.0029	(0.0536)
Employment status of female respondent		
Employed full-time	0.3018	(0.4591)
Employed part-time	0.3670	(0.4821)
Not employed	0.3312	(0.4707)
Household annual income (in mil. JPY)	793.71	(367.66)
Husband's labor income (in mil. JPY)	641.72	(311.41)
Self-reported house value (in 10 thousand JPY)	2306.63	(2022.78)
Diff. between actual and reference wealth levels ($W - W^*$)	-92.15	(1258.77)
N	3,125	

Table 2: Logit Estimates for a Childbirth

	[1]			[2]			[3]			[4]		
Dependent variable:	Logit			Logit			Logit			Random Effects Logit		
Childbirth (1 if any childbirth in the last 12 months)	Coef.	(Robust S.E.)		Coef.	(Robust S.E.)		Coef.	(Robust S.E.)		Coef.	(Bootstrap S.E.	
Duration of current marriage in years	-0.1090	(0.0496)	*	-0.1163	(0.0496)	*	-0.1190	(0.0520)	*	-0.1187	(0.0568)	*
Number of existing children	-0.6718	(0.2348)	**	-0.6839	(0.2385)	**	-0.6569	(0.2618)	*	-0.7116	(0.2552)	**
Age of female respondent	1.3119	(0.4989)	**	1.2641	(0.4837)	**	1.4817	(0.5975)	*	1.2794	(0.6108)	*
$(Age/10)^2$	-2.1468	(0.7320)	**	-2.0762	(0.7093)	**	-2.3410	(0.8706)	**	-2.0996	(0.8832)	*
Employment status of female respondent in *t* - 1												
Not employed	(Omitted Category)			(Omitted Category)			(Omitted Category)			(Omitted Category)		
Employed part-time	-2.2883	(0.4686)	**	-2.2860	(0.4669)	**	-2.7155	(0.5780)	**	-2.3175	(0.5777)	**
Employed full-time	-2.2783	(0.4394)	**	-2.2585	(0.4353)	**	-2.1660	(0.4525)	**	-2.3578	(0.4359)	**
Household annual income (in 10 mil. JPY)	1.0729	(0.3034)	**	1.0812	(0.3035)	**	1.0800	(0.3420)	**	1.0851	(0.5901)	+
Husband's labor income (in mil. JPY)	-0.1172	(0.0614)	+	-0.1187	(0.0603)	*	-0.1373	(0.0673)	*	-0.1276	(0.0943)	
Self-reported house value (in 10 mil. JPY)												
Diff. between actual and reference levels ($W - W^*$)	0.0932	(0.0563)	+	----------			----------			----------		
$d_{[W<W*]} \times (W - W^*)$: β_L	----------			0.4196	(0.2035)	*	0.4372	(0.2133)	*	0.4540	(0.2252)	*
$d_{[W\geq W*]} \times (W - W^*)$: β_G	----------			0.0454	(0.0649)		0.0606	(0.0694)		0.0446	(0.2184)	
Region	Yes			Yes			Yes			Yes		
City size	Yes			Yes			Yes			Yes		
H_0: $\beta_L = \beta_G$												
$\chi^2(1)$	----------			2.92			2.69			1.23		
(p-value)	(----------)			(0.0437)			(0.0505)			(0.1339)		
Log likelihood	-261.39			-260.92			-219.98			-260.67		
Pseudo R^2	0.3805			0.3816			0.3937			———		
N	3,125			3,125			2,560			3,125		

Notes : **, *, and + indicate that the estimated coefficients are significant at the 0.01, 0.05, and 0.10 levels, respectively. The reference wealth levels are defined as the self-reported house value in the previous year. In model [2], households reporting the same house values as in previous year, i.e., $W_t = W_{t-1}$, are excluded from the sample. In model [3], random effect logit model is fitted with the maximum likelihood estimator (RE-MLE). The null hypothesis of $\beta_G < \beta_L$ is tested by conducting likelihood ratio tests. Robust standard errors are reported in parentheses (models [1] and [2]). Bootstrap standard errors are reported in parentheses (model [3]).