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# Housing Wealth, Fertility, and Child Quality

**Mingzhe Tang**
School of Economics, Shandong University. Email: mingzhetang@sdu.edu.cn

**N. Edward Coulson***
Paul Merage School of Business, University of California, Irvine. Email: ncoulson@uci.edu.

We use changes in wealth due to house price changes to test the effect of wealth on fertility and child quality in the context of Chinese fertility policies. We find, even in those situations where the one-child policy is not in effect, that wealth increases do not lead to increased fertility in urban areas, and have only a minuscule effect in the rural areas. However, a rise in housing wealth leads to increased expenditure on the education of children for households in both rural and urban areas (although different types of expenditure) and increased height of children in rural areas. Following Becker (1960), increased wealth shifts the tradeoff between child quality and quantity in favor of the former.

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**JEL**: J13, R31, I15

* Corresponding author

# 1. Introduction

Becker (1960) notes the paradox of the relationship between household fertility and household income. Children are a normal good, so the number of children in a household ought to increase with the ability to support them. However, research that examines the fertility rates of countries or regions as economic development takes place has generally found that fertility falls with higher levels of development (Jones and Tertlit, 2006; see also Clark and Cummins, 2009). The paradox is somewhat resolved, as Becker (1960) notes, by recognizing that the utility from children arises not only from their quantity, but also their quality. Thus, as income or wealth rises, the ability to invest in the outcomes of children also increases and the parents can substitute quantity with quality. Cross-country studies (e.g. Lawson et al., 2012) have indeed found a negative correlation between child educational expenditure and family size. Microeconometric analyses have studied family fertility and child quality decisions in the face of variation in family resources and generally find that there is a tradeoff that favors quality over quantity as income rises. Studies in this area for developing countries go back at least to Behrman and Wolfe (1987) for Nicaragua and include Dang and Rogers (2016) for Vietnam, Ponczek and Souza (2012) for Brazil, and others.

There are a couple of challenges for causal identification in these studies. Unobserved family or person-specific heterogeneity is of course an issue. Microeconometric studies (including some of the above papers) use the birth of twins as an exogenous shock to family size, while Dang and Rogers (2016) use distance to the nearest family planning center, neither of which completely resolves the issue. Another overriding concern is the endogeneity of income with respect to both fertility decisions and child expenditure. For example, the negative correlation between income and fertility may be due to the fact that higher wages for women increase the opportunity cost of childbirth and childcare. Concern on this dimension is prevalent in US studies of the quality-quantity tradeoff, including Lindo (2010) and Black et al. (2013). In the latter study, the price of coal is used as an exogenous shifter, given that coal mining almost exclusively employs males.

Although this approach yields a positive relationship between fertility and income, its limited geographic scope raises questions about its external validity (Lovenheim and Mumford, 2013). An important step forward is the use of changes in US home prices to assess the impact of wealth changes on fertility (although not child quality measures) in Dettling and Kearney (2014) and Lovenheim and Mumford, 2013). This is part of the larger literature that investigates the effects of home price increases on consumption in general (Bostic et al., 2009; Gan, 2010; Browning et al., 2013). House price changes are perhaps the most important means by which households increase wealth and more importantly, plausibly exogenous to fertility decisions, unless one believes that households move to locations that are anticipated to have large

growth in home prices for the purpose of enhancing one's ability to have children. Both of these papers indeed find that fertility increased in the year following a house price rise.

In this paper, we analyze the effects of housing wealth on both fertility and child quality decisions in China, and attempt to overcome the challenges to causal claims by (a) focusing on housing wealth as the principal source of wealth, and (b) using panel data, person fixed effects, and local home price movements to purge the estimates of bias from unobservable personal and location characteristics.

The analysis of fertility in households in China is especially important, underscored as it is not only by the size and importance of the country, but also the institution of the one-child policy. Concerned about its rising population, the Chinese government announced a policy in 1979 that limited most families in China to one child. Weakening of these regulations (they were never formalized into Chinese law (Feng et al., 2013)) began to occur in 1984, as a result of gender preferences among rural Chinese households, so that a second child was allowed if the first child in the family was a girl. Also, households where both parents are the only child were exempted from the policy and are allowed to have two children since the late 1990s. Whatever the exemptions to the policy, it also seems clear that the implementation of the one child rule varied across the provinces (Li and Zhang, 2017)). The assembly of evidence in Zhang (2017) provides suggestive evidence that despite the various exceptions, the one-child policy did succeed in reducing Chinese fertility rates.

The standard theory from Becker (1960) would then suggest that exogenously limiting the number of children would increase the expenditure on the children that are born. Certainly, popular reaction has stressed the theme of the "little emperor" -- the only child, often sons, of Chinese households on whom lavish spending is bestowed (e.g. Gao, 2017, Cameron et al., 2013). Evidence on this point would, at its best, use exogenous variation in the exceptions in, and enforcement of, fertility policy by using the interaction of location and sex of the first child to examine the quality-quantity tradeoff. In addition to our other estimation strategies, we take into account the exceptions to the one-child rule as well. It is of interest to note, however, that Qian (2017) finds that having a second child *increases* the amount of education of the first child, which would seem to contradict the notion that the quality and quantity of children trade off against each other. Li and Zhang (2017) create an index that measures, at the provincial level, the assiduousness of enforcement of the one-child policy. This serves as an instrument for family size, and the authors find that there is indeed a tradeoff between quality and quantity of children, even though the effects are modest. A similar approach is taken by Liu (2014) who uses not only education level, but also the height of the child to measure child quality. The effects on the latter variable from reduced fertility are, in fact, higher than those on

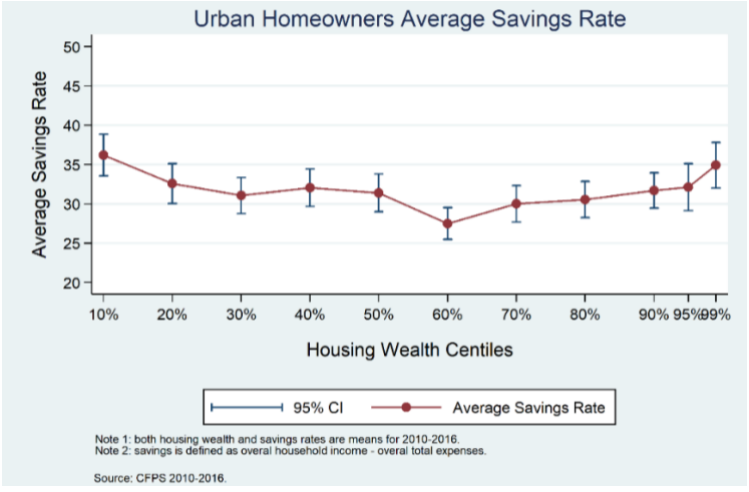
education. However, none of this research directly addresses the quality-quantity tradeoff, or the impact of wealth, which is an especially important topic in light of the increased prosperity of China.

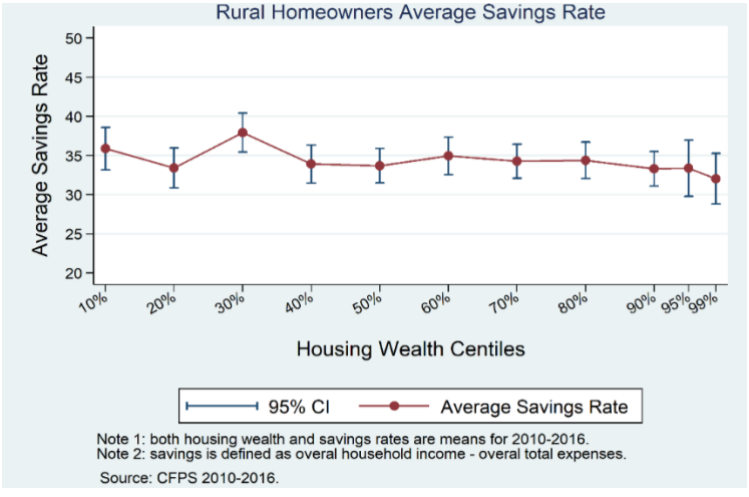
The use of housing wealth as the shock to family resources is of particular interest given the simultaneous transformation of the housing market in China. Since private ownership was established in the housing reforms of 1988, an increasing number of households have left state and employer-owned flats and become homeowners (Coulson and Tang, 2013). The government has encouraged this pursuit, and programs such as the Housing Provident Fund (Tang and Coulson, 2017) have provided additional means with which to attain ownership. Indeed, given the lack of other domestic investment opportunities, residential housing has become a leading investment vehicle for many Chinese individuals (Meng, 2007, Xie and Jin, 2015) even more so than in the US and other Organisation for Economic Co-operation and Development (OECD) countries.

Interest in residential investment has led to what many would characterize as speculation and bubble-like behavior (Feng and Wu, 2015). Whether or not bubbles are part of the process, it is abundantly clear that house prices in most Chinese areas have risen substantially over the past few decades (Wu et al., 2012). This has led to a new research paradigm on the effect that higher housing prices might have on consumption patterns (following research such as Bostic et al., 2009) for the US. The elasticity of consumption with respect to housing wealth in China has been found to be larger than in most developed economies (Chen et al., 2010, Chen et al., 2020). This is somewhat of a puzzle since the ability to make housing wealth liquid is rather limited in China, given the relative absence of home equity loans and similar instruments. Note, however, Figure 1, which displays the savings rates out of income as a function of the centile of housing wealth. For the lower percentiles, it is important to note that saving rates decline as housing wealth increases—exactly what one would predict if housing wealth increases consumption in a world without extensive consumer credit. However, this trend is reversed for the upper half of the wealth distribution. This, too, is not unexpected if the marginal rate of substitution between current and future consumption is decreasing. At some level of wealth, there is little need to proportionally consume out of housing wealth.

Given its putative role in determining overall consumption, it is of interest to see if housing wealth plays a role in fertility and child quality in the manner suggested by Becker (1960). A first look at the data suggests that it does not have a particular impact on fertility. Figure 2 plots, over the sample period of our data, both the aggregate fertility rates, and the land price index developed by the Wharton School of the University of Pennsylvania and Tsinghua University. We observe in this data the well-known rise in home prices in China, with particular acceleration toward the latter part of the sample.

**Figure 1 Urban and Rural Savings Rates as a Function of Housing Wealth Centile**




The fertility rate appears to be quite stable, again, in part due to policies pursued by the government. Remarkably, the fertility rate plunges in 2015-2016 which is the time when housing wealth increases are at their peak, and more remarkably, this rapid decline comes just at the point when the Chinese government, for all intents and purposes, removed almost all fertility restrictions for the entire country[1]. Recent journalistic evidence (Fifield, 2019) suggests that the expense of child-raising has much to do with this decline.

[1] Now that the Chinese government has formally allowed a couple to bear two children, there is strong evidence in support of further lift of such a restriction as soon as possible.

**Figure 2 Residential Land Price and Birth Rate in China**


We use the Chinese Family Panel Survey (CFPS) to estimate models of both fertility (i.e. new births) and measures of child quality as a function of various demographic characteristics as well as changes in housing wealth over the period of the survey. Following the previous literature, we ask whether the fertility responses vary with the application of the one-child policy, and whether, as theory might suggest, the elasticity of expenditure on child quality is greater if the fertility choice is constrained. As in Liu (2014), we use both height and education expenditure as measures of quality.

We are able to employ women-specific fixed effects in the fertility equation, and child-specific fixed effects in the quality equation because we have repeated observations of the same household over the waves of the panel. Thus, our identification proceeds from looking at (say) the difference in educational expenditure over different two-year periods (the survey is conducted every two years) as the change in housing wealth (as measured by the change in self-evaluated home prices) across biennial periods. Additionally, we employ a large number of controls in our models, including numerous demographic characteristics of the household, and controls that measure variation in fertility policy across families and over time. More importantly, we include a measure of local house prices (Peng et al., 2019). This measure will control for unobserved local attributes that may influence both fertility and factors that affect the quality of life and in turn, fertility. Among these might include local prosperity, school quality and environmental measures. With these controls and the fixed effects, we can be relatively confident that our results suggest causal relationships between housing wealth and the outcomes of interest.

The results suggest an interesting, though somewhat expected, variation in those relationships. Housing wealth almost never has an impact on fertility. In part, it might be expected that this is the result of the constraints imposed by the one-child policy, but in our use of putatively exogenous shifts in this policy across households, we do not find any association between the effect of housing wealth and the number of births. We do, however, find some strong associations between housing wealth and child quality. This manifests itself in a strong elasticity between housing wealth and education expenditures in urban areas, and a strong relationship between housing wealth and child height in rural locations. In rural areas, where schools are of lower quality, we find that housing wealth leads to higher expenditure on supplemental educational expenditures. This is in line with a saying that says 'the cost of quality matters'. In rural areas, obtaining high quality educational resources is very difficult, while in urban areas, it can be expensive, but at least is available (Ayoroa et al., 2010). A less expensive way to increase child quality in rural areas would be to provide better nutrition.

This paper is organized as follows. In the next section, we will provide a conceptual framework of household demand for children followed by the data section where we describe the data used in this study from the CFPS. Section 4 describes our modeling procedures and model estimates, and Section 5 concludes.

## 2. Conceptual Framework

We adopt the consumer good perspective to examine the child-bearing decision of a household as discussed extensively in Becker (1960). The seminal model, developed in Galor and Moav (2002) and simplified by Becker et al., (2010), illustrates the main features of the theory of household demand for children that is closely related to the empirical facts that we have identified in the data. In this framework, the household has full control over its fertility decisions given contraception technology. Assume that the lifetime utility of a household consists of two parts: $u_1(n, e; \beta)$, the utility that the household draws from having $n$ number of children with quality $e$; parameter β which governs its preference between quantity and quality of children; and $u_2(c)$ , the utility from consumption of all other goods. Quality here merely represents part of the childhood experience that can be improved with financial resources from the parents and may be derived from a wide variety of interventions.

To maximize total utility, the household decides how many children to raise, the quality of these children as well as the optimal amount of consumption, given prices and various constraints faced by the household.

Assume the utility takes a log-linear specification as in Galor and Moav (2002),

$$U = \gamma \cdot \mathrm{u}_1 + (1-\gamma) \cdot u_2 = \gamma \cdot (\ln n + \beta \ln e) + (1-\gamma) \cdot \ln c$$

where $0 < \gamma < 1$ is the preference parameter of the household toward children including both quantity and quality, and $0 < \beta < 1$ is the weight of quality. Let $I$ be the lifetime wealth that the household can accumulate through labor income and asset dividends. Then the general budget constraint faced by the household is given by

$$n \cdot p_n + \left(\sqrt{n} \cdot e\right) \cdot p_e + c \cdot p_c = I$$

where $p_n$ is the price of raising a child, $p_e$ is the price of obtaining one unit of quality from a child, and $p_c$ is the price index of all other goods. Lifetime wealth is thus divided into three shares. The first share is base expenditure related to raising a child, which does not contain any quality aspect of those children. The second share is about the quality of the child. We assume that in order to obtain $e$ quality that is passed onto utility, the household has to invest in all $n$ children and due to economy of scale in home production, the total expenditure on the quality of children is a concave function of the quantity[2]. This assumption is for simplification purposes, but recognizes that there is a tradeoff between quality and quantity of children. The third share is the expenditure on other consumptions of the household.

Solving the household utility maximization problem, we obtain the following results:

$$\mathrm{c} = (1-\gamma)\frac{I}{p_c}, \tag{1}$$

$$\mathrm{n} = \gamma(1-\beta)\frac{I}{p_n}, \tag{2}$$

and

$$\mathrm{e} = \frac{\beta}{(1-\beta)} \cdot \frac{p_n}{p_e}\sqrt{n} = \frac{\beta}{p_e} \cdot \left(\frac{p_n \cdot \gamma \cdot I}{1-\beta}\right)^{\frac{1}{2}} \tag{3}$$

Based on the derived set of optimal choices of the household, we make the following observations. First, both the quantity and quality of children depend on the total resources available to the household as well as price conditions. If wealth increases more than the price, the household has more resources to raise children and invest in their quality. However, if the price of raising a child

[2] The assumption of expenditure shares of quantity and quality in fact implies the difference between quantity and quality in home production of children. Unlike for consumption of other goods, the household can be considered as a production unit for children. This is another perspective of perceiving household fertility decisions in the literature in which children usually generate income to the parents later and having children is thus considered by the parents as savings for the future.

increases faster than the wealth increases, the optimal number of children for the household will fall. In fact, rapid urbanization and industrialization have greatly increased wealth accumulation in many developing countries, yet also significantly raised living costs. Fifield (2019) has evidence to suggest that this increase in the cost of living is behind the decline in fertility in China even after the removal of the one-child policy.

Second, the optimal quality of children also depends on the relative price of quality to quantity. Equation (3) shows that holding wealth and the cost of quality constant, increase in price of quantity $p_n$ will result in an increase in the quality of children. This is one possible reason for the observed trade-off between quality and quantity. For example, in many developing countries, good education is more expensive (i.e. less available) in rural than in urban areas, while it is less expensive for parents to provide for a child in rural than in urban locations. Therefore, even for households with the same wealth level, the optimal quantity of children is higher in rural than urban areas whereas the quality of the former is lower than the latter.

Third, the wealth effect on the quantity and quality of children diverges as the weight of quality $\beta$ increases. Given Equations (2) and (3), it is easy to see that the wealth effect on quantity decreases when $\beta$ increases, but the wealth effect on quality increases as $\beta$ increases.

Fourth, the lumpy adjustment of the quantity of children leads to the inertial sensitivity of quantity toward wealth change compared with the choices on quality and consumption[3]. The above optimal choice set is derived under the assumption of the utility function being differentiable in all choice variables. Since in reality, quantity is discrete and costly to adjust, a mild increase in wealth does not necessarily lead to an increase in quantity but more likely to an increase in quality and consumption of all other goods. This point has been discussed in Becker (1960) where he links the similarity of the demand for children to the demand for durable consumer goods such as large home appliances and cars. Having one more child means a large expenditure increase for the household, not only from the additional child, but also from the total quality expenditure. Thus, a household is more cautious about fertility and reluctant to act even when wealth increases.

Let $n^0$ be the optimal quantity of children given wealth $I^0$ and prices, as well as utility preference parameters. If bearing one more child is better than $n^0$, then this requires the minimum wealth increment to be at least $\kappa \cdot$

[3] In the literature (Becker, 1960, Galor and Moav, 2002, Becker et al., 2010), this lumpy adjustment of quantity of children toward wealth change is often referred to as the income elasticity of quantity of children. Considering the discreteness of quantity, we prefer the current terminology under our framework.

$p_n$, where $\kappa = 1/\big(\gamma \cdot (1-\beta)\big) > 1$ [4]. If a wealth increment is less than this minimum requirement, the household will not choose to bear the additional child. Instead, it will allocate this incremental wealth between the consumption of other goods and quality of the current children to maximize its utility. The new maximization problem is:

$$\max_{e,c} V = \gamma \cdot \beta \ln e + (1-\gamma) \cdot \ln c$$

which is subject to

$$\left(\sqrt{n^0} \cdot e\right) \cdot p_e + c \cdot p_c = I - n^0 p_n = I_{-n}$$

The new conditions for optimal quality and consumption are:

$$c_v^* = \frac{I_{-n}}{p_c} \cdot \frac{\sqrt{n^0} \cdot (1-\gamma)}{\sqrt{n^0} \cdot (1-\gamma) + \gamma \cdot \beta} \tag{4}$$

$$e_v^* = \frac{I_{-n}}{p_e} \cdot \frac{\gamma \cdot \beta}{\gamma \cdot \beta + \sqrt{n^0} \cdot (1-\gamma)} \tag{5}$$

Let $I^1 = I^0 + \theta \cdot p_n$, as long as $\theta < \kappa$, the household will continue to choose its optimal consumption and quality of children according to Equations (4) and (5) and its utility also increases as θ increases. This is a situation in which we observe a positive wealth effect on both the consumption of the household and quality of the children, but not with fertility. The critical value is at $\theta = \kappa$, when bearing an additional child becomes feasible and optimal. At this point, households can end up with much different choices, depending on their utility parameters. Some households may stay with $n^0$, and others may decide to have an additional child[5]. Those who decide to have one more child must have much a stronger preference toward children and relatively lower weight on quality. Comparing their utility when $\theta < \kappa$ but sufficiently close, the new utility with marginal wealth increment delivers an increase in the utility of child quality, $\gamma \cdot (\ln(n^0+1) - \ln n^0)$, and at the same time, delivers a fall in child quality (and consumption).[6] Therefore, unless the increase in utility from the quantity of children is higher than the reduction from quality and consumption, bearing an additional child is not an attractive choice to the household.

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[4] This is derived by setting $n^0 + 1 = (1-\beta) \cdot \gamma \cdot \left(\frac{I^0}{p_n}\right) + 1 = (1-\beta) \cdot \gamma \cdot \frac{I^1}{p_n}$, and solving for $I^1$.

[5] Obviously we ignore the occasions when the household has twins.

[6] Take consumption for example. Under $I^\kappa = I^0 + \kappa \cdot p_n$, the optimal consumption is $c_u^* = (1-\gamma) \cdot \frac{I^\kappa}{p_c}$. While under $I^\theta = I^0 + \theta \cdot p_n$, since $\theta \to \kappa$, $c_v^* = (1-\gamma) \cdot \frac{I^\theta - n^0 p_n}{p_c} \cdot \frac{\sqrt{n^0}}{(1-\gamma)\cdot\sqrt{n^0}+\gamma\cdot\beta}$. It can be shown that there are many parameter values γ, β, that can satisfy $c_v^*/c_u^* > 1$. The same is true for quality of children.

Lastly, combining all previous claims, consider the situation where the birth control policy limits the freedom of a household to make fertility choices. An increase in wealth does not necessarily result in an increase in the quantity of children, even after relaxing this policy. The lumpy adjustment of quantity requires a much bigger increase in wealth and stronger preference for quantity to result in more children. Moreover, any change in the relative price between quantity and quality will certainly diminish the willingness of the household to bear more children. For households with very high $\beta$ and low $\gamma$ whose optimal quantity of children is far below the policy cap, neither increasing wealth nor the removal of the policy cap would lead to more children. Only households whose optimal quantity of children is over the policy cap would an increase be observed in their quantity after the cap is eliminated. However, this occurs even without any wealth effect. If, however, wealth growth accompanies the rapid price increase of raising a child, it is again possible not to observe an increase in the quantity of children.

As a result, our model does not deliver a definitive positive wealth effect on household fertility but a more definite wealth effect on quality of children and consumption. The trade-off between the quantity and quality of children is mainly affected by three factors: the relative price of quantity to quality, the relative importance of quality in the utility function, and the lumpy adjustment of quantity. In fact, as the economy grows, the utility a household can draw from raising children has decreased significantly since more services can be purchased from the market. This lowers $\gamma$, which causes more households to bear fewer children. In our following empirical analysis, we use the exogenous housing wealth change as the measure for the wealth change to test the wealth effect on the quantity and quality of children.

## 3. Data

To conduct the empirical analysis, we use waves of the CFPS data between 2010 and 2016. The CFPS is a nationally representative longitudinal survey of Chinese communities, families and individuals initiated in 2010, and conducted every other year since then[7]. The CFPS baseline survey successfully

[7]The CFPS survey samples from 25 provinces and provincial metropolitan cities. The community is defined following the last layer of the probability-proportional-to-size (PPS) sampling procedure of the CFPS. The documentation of CFPS states that the last sampling is conducted at the level of community in urban areas or village in rural areas. The survey interviewers conduct geographical mapping of the community or village first and interview the people in charge on questions such as the total population, total number of households, local urban residents, housing prices, employment, wages, income, medical facilities, family planning policies, local government fiscal expenditures, etc. The CFPS tries to keep the size of the community or village to no more than 10,000 people. If a community or village has more than 10,000 people, the

interviewed a nationally representative sample of 14,960 households, 33,600 adult individuals and 8890 children in 2010. There are three waves of comprehensive follow-up interviews of these households and individuals between 2012 and 2016[8]. CFPS interviewed all of the family members aged 9 years old and over, while children under 9 had their parents help with the survey questions. The questionnaire design and implementation of CFPS replicate in many ways the Panel Study of Income Dynamics, National Longitudinal Surveys of Youth, and the Health and Retirement Study in the US. Questions cover individual demographics and household characteristics. For the purpose of this analysis, we collect information on homeowners and their children. Our first empirical analysis examines the correlation between the housing wealth of the household and the fertility decision of a female household member. Accordingly, our data include, at the household level, the purchase price or construction cost of housing, current housing value, and household income and savings. At the individual level, the data include all female household members between 16 and 51 years old in 2010, detailed records of children to whom she has given birth, and her age, education, marriage, employment, and hukou status as well[9]. Since the CFPS surveys do not directly ask whether a female adult household member gave birth during the past year or so, we construct the fertility variable *birth* by examining the dates of birth of all her surviving children and consider only those born between two survey years as newborns[10].

Table 1 presents the summary statistics for the characteristics of these female household members and household housing wealth measures used in the study. We have 7284 women from 7165 households, and around 28,000 female-year

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CFPS will break the population into several segments and randomly choose one to be included in the sample. The selected community needs to have a population of no less than 4,000 people. For the related official description, please refer to the CFPS survey documentation (only available in Chinese) at: http://www.isss.pku.edu.cn/cfps/docs/20180927132959246462.pdf?CSRFT=7LIW-TC6H-2IKX-7GC9-ABI4-QSZ5-E0MT-K0NU. See page 6 for details.

[8]For more information about the CFPS data, please refer to the *Chinese Family Panel Survey User Manual (3rd edition)* available at http://www.isss.pku.edu.cn/cfps/docs/20180928161838082277.pdf.

[9] We keep the women over 45 in the sample because the advancement of fertility technology allows women beyond 45 to have babies and the relaxation and final elimination of the one-child policy in China presents the opportunity for these households who wish to have more than one child even at a very advanced age. Although the legal age of marriage for woman in China is 20, we observe that the minimal age of bearing a child in our sample is 16. Since the family in China has much stronger influence on the fertility decision of women, particularly in the rural areas, we consider the lower bound of the age of the women in our sample to be 16.

[10] In order to have a balanced complete panel, we only keep track of female household members whose first appearance in the sample was in 2010 and completed their individual survey. This is because the CFPS marked them as core household members and would continue to follow up with these women in the later rounds of surveys. We omit women who join the households in later years through marriage.

**Table 1 Housing Wealth, Fertility Rate and Women Characteristics**

| Variable | Description | (1) N | (2) mean | (3) sd | (4) min | (5) max |
|---|---|---|---|---|---|---|
| alltimehomeowner | homeowners throughout sample period | 28,275 | 0.821 | 0.383 | 0 | 1 |
| hwealthdiff* | primary housing wealth change | 26,263 | 17.24 | 47.19 | -77 | 1,470 |
| hwealth_primd* | primary housing wealth | 26,469 | 26.49 | 54.48 | 0.010 | 1,500 |
| hwealth_tot* | Total housing wealth | 28,006 | 31.50 | 78.86 | 0 | 5,020 |
| buycost* | Purchase cost for primary housing unit | 28,069 | 9.154 | 16.32 | 0 | 700 |
| hunits | Number of housing units | 28,275 | 1.181 | 0.486 | 1 | 12 |
| multiplhunits | Multiple unit owners | 28,275 | 0.153 | 0.360 | 0 | 1 |
| singlehunits | Single unit owner | 28,275 | 0.847 | 0.360 | 0 | 1 |
| Communityprice* | Average housing price in the community | 29,030 | 0.185 | 0.381 | 0.0001 | 16.67 |
| savings* | Household cash deposit& savings | 28,188 | 2.808 | 10.28 | 0 | 400 |
| fincome* | Household income | 27,056 | 4.786 | 8.732 | 0.0001 | 1,039 |
| hhtotaldebts* | Household debt | 27,979 | 2.547 | 10.28 | 0 | 400 |
| birth | Any new birth between survey years | 28,275 | 0.077 | 0.266 | 0 | 1 |

***(Continued…)***

**(Table 1 Continued)**

| | | | | | | |
|---|---|---|---|---|---|---|
| birth0 | Any newborn for women with 0 children | 6,795 | 0.156 | 0.363 | 0 | 1 |
| birth1 | Any newborn for women with 1 child | 10,034 | 0.093 | 0.291 | 0 | 1 |
| birth2 | Any newborn for women with 2 or more children | 11,935 | 0.018 | 0.133 | 0 | 1 |
| lagchildn | No. of children prior to year | 27,491 | 1.308 | 1.043 | 0 | 10 |
| childnm_tot | Total number of children | 27,490 | 1.375 | 0.971 | 0 | 7 |
| age | Age | 28,275 | 34.61 | 9.226 | 16 | 51 |
| married | Married or not | 28,275 | 0.705 | 0.456 | 0 | 1 |
| eduobtained | Education obtained | 23,657 | 2.671 | 1.347 | 1 | 8 |
| hkurban | Urban hukou | 28,275 | 0.196 | 0.397 | 0 | 1 |
| urban | Living in urban area | 23,201 | 0.417 | 0.493 | 0 | 1 |
| migrant | Migrant status | 27,978 | 0.158 | 0.365 | 0 | 1 |
| emplgovsoe | Employed in government/SOE | 23,787 | 0.083 | 0.275 | 0 | 1 |
| workhours | Work hours per week | 13,943 | 41.41 | 28.34 | 0 | 168 |
| han | Han ethnic | 28,275 | 0.893 | 0.309 | 0 | 1 |
| Childsexr_tot | Boys ratio | 22,105 | 0.546 | 0.397 | 0 | 1 |

***Notes***: * variables with asterisks are measured in 10,000 RMB. 1 USD is approximately 6.15 to 6.77 RMB between 2010 and 2017. 6.15-6.77. The exchange rates vary year by year during the sample period, so we use 6.45 as the average throughout the sample period.
Source: household level information concerning housing wealth are collected from household surveys for homeowners with full ownership rights, and female household members information are from individual adult surveys from CFPS 2010, 2012, 2014, and 2016.

observations in total. Removing women of co-residence in the same household, we then have 5338 women and 19,627 female-year observations. The average female age is 34 and average number of children is 1.37[11]. The overall birth rate is 77 per 1000 women, with the highest of 156 births for women without any child, 93 births for women with 1 child already and 18 births for women with 2 or more children.[12] The majority of these women (over 60%) obtained an education of no more than high-school level and over half live in a rural area. Other important factors that potentially affect the fertility decision of these women include ethnicity, whether they are employed in a government institution or state-owned enterprise, and whether they are a migrant.

As for household housing wealth, we observe that 84.7% of the households in our sample own one housing unit and the average number of owned property units is 1.18. To measure the change in household housing wealth, we use the difference between the current self-estimated value of the owner-occupied primary dwelling and the purchase or construction cost of that same unit[13]. In our sample, the primary housing wealth of the households is the owner-occupied primary dwelling unit. Although 15.3% of homeowners own more than one unit, the market value of the primary dwelling unit on average consists of 93% of the total housing wealth of all households.

As mentioned in the introduction, the degree of stringency of the one-child policy implementation has always varied across regions according to the demographic characteristics of the couple. In general, it is much more stringent in cities than villages, and work units of government institutions and state-

[11] The most recent total fertility rate released by the Chinese government after the seventh national population census is 1.3 in 2020. The estimate by the World Bank is 1.69 in 2019. Source: http://www.china.org.cn/china/2021-05/13/content_77495036_11.htm. and https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=CN.

[12] We calculate the birth rate as the share of women in our sample who delivered babies between survey years. As the woman may give birth to a child any time between the previous survey interview and the next one, the calculated birth rate is thus much higher than the annual birth rate reported by the Chinese National Bureau of Statistics, which is measured as the number of births per 1000 people. The most recent released data on birth rate in China is 8.52 per 1000 in 2020, the first time that it has fallen below 10. (https://www.chinadaily.com.cn/a/202112/29/WS61cba9c5a310cdd39bc7dfc2.html.) One can divide our birth rate by 6 to obtain a approximate estimate of birth rate comparable to the government reported number.

[13] While self-estimates of home values are potentially biased upwards, the fertility and other decisions we examine are based on those self-estimates. In the examination of personal consumption decisions, Coulson and Grieco (2013) find the self-assessment of households of their housing wealth should be the primary measure of that wealth, since this is what their actions will be based upon.

owned enterprises, than private or foreign entities[14]. Since housing prices rise much faster in urban areas, we compare the fertility of the urban and the rural households alongside household housing wealth[15]. Panel A of Table 2 shows the summary statistics for these variables. In general, women in rural households have more children, higher fertility rates, and more siblings than their counterparts in urban households, but less housing wealth. We find that all mean comparison tests across these two groups give very strong evidence of urban and rural differences.

Panel B of Table 2 shows a decreasing average birth rate by the sample female household members and increasing level of housing wealth of these households between 2010 and 2016. By all measures, the data show a clear pattern of consistent increase in housing wealth of Chinese households on average. The average level of housing wealth of households measured by their primary dwelling unit had doubled from 172,800 renminbi (RMB) to 366,300 RMB and the overall housing wealth level had almost tripled in 2016[16]. Meanwhile, the average housing price at the community level increased from around 1068 RMB per square meter to over 2784 RMB per square meter. Chinese households own more and more housing over time and the proportion of households with negative housing wealth change also decreases from 13.8% to 8% as shown in the last column of Table 2. At the same time, however, the average birth probability of eligible women has decreased from 0.089 to 0.061, a 31% drop from 2010.

The second component of our empirical study concerns the relationship between housing wealth and child quality through the correlations among the education expenditure of the child, health outcome and change in household housing wealth. Liu (2014) uses height and education attainment as the quality measures for the child to test the quantity-quality trade-off hypothesis. In China, the law requires nine years of compulsory education so that education attainment level is more related to the age of the child than wealth of the household. We therefore employ educational expenditures instead as a better measure of quality. The 1993 Outlines of China's Education Reform and Development, issued by the central government, and the 2002 Non-State Education Promotion Law of the People's Republic of China provided the legal grounds for the development of private educational businesses.

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[14] Job loss from violating the one-child policy is more likely for a couple employed by a government institution or a state-owned enterprise. This is called one-vote-veto mechanism (Jiang et al., 2013; Ren, 2012).

[15] In China, there is a clear difference in property ownership rights between rural and urban. By laws, rural villagers cannot sell and lease their properties built on the assigned home-lots (*zhaijidi*) to village outsiders. However, due to the rapid urbanization, many former villages have been incorporated into suburban or urban areas and thus properties of these villages can be traded on the market as urban homes.

[16] We take 6.45 RMB as the average exchange rate for 1 USD. The average housing wealth has increased from 26,790 USD to 56,790 USD.

**Table 2 Women's Fertility and Housing Wealth**

| **A. Differences between Urban and Rural Homeowners** | | | | |
|---|---|---|---|---|
| | Urban | | Rural | |
| VARIABLE | mean | sd | mean | sd |
| Number of surviving children | 1.148 | 0.843 | 1.467 | 1.008 |
| Birth | 0.0838 | 0.277 | 0.0993 | 0.299 |
| Number of siblings in 2010 | 2.183 | 1.651 | 2.598 | 1.593 |
| Housing wealth | 31.46 | 64.15 | 7.370 | 26.16 |

| **B. Sample Means of Fertility and Housing Wealth Over Time** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| YEAR | birth | child nm_a liv | hweal th_pri md | hweal thdiff | hun its | hweal th_tot | hweal thdiff <0 | Com munit y_pri ce* |
| 2010 | 0.089 | 1.213 | 17.28 | 10.35 | 1.17 | 16.27 | 0.132 | 1068 |
| 2012 | 0.088 | 1.334 | 20.89 | 13.50 | 1.16 | 25.00 | 0.138 | 1508 |
| 2014 | 0.072 | 1.428 | 28.75 | 19.39 | 1.18 | 35.99 | 0.057 | 2112 |
| 2016 | 0.061 | 1.524 | 36.63 | 24.16 | 1.21 | 48.10 | 0.080 | 2784 |

***Note***: * average housing price in the community is measured in 1 RMB. The housing wealth measures are in 10,000 RMB.
Source: 2010, 2012, 2014, and 2016 CFPS data composed by the authors, homeowners with full ownership, birth rate is calculated as the share of women aged 16-51 in 2010 who delivered babies between survey years.

These enterprises offer education from kindergarten to college. Households can send their children to these private schools. According to national statistics, the overall enrollment in non-state education facilities increased from 10 million to 48 million between 2002 and 2016, which accounts for 18.94% of all students nationwide, up from 5.34% in 2002[17].

Hence, we collect data on educational expenditures from the CFPS for each child under the age of 16 for all homeowners between 2010 and 2016. Data collected include the age of the child, school attainment level, gender, current height, hukou status, urban residency status and educational expenditures on this specific child. We obtain 13,159 children from 8486 households, thus resulting in an unbalanced panel of 29,837 child-year observations.

Table 3a shows the summary statistics of the educational expenditures, other demographics for these children as well as the housing wealth of their family and the key demographics of their parents. The average height of the children

[17] Source: The Ministry of Education of China, retrieved on May 22, 2019, from the government official website: http://www.moe.gov.cn/jyb_sjzl/moe_560/2020/

is 115.5 cm (about 3.8 feet tall). The average education expenditure per child is 1977 RMB, which is about 4.4% of the household total income. This expenditure includes all school expenses, tuition and supplementary education expenditures such as hiring a tutor or attending extracurricular activities or lessons. We show the summary statistics for this supplementary education expenditure as well. About 12.8% of the children have such expenditures paid by their families. The overall average is 289.5 RMB with a substantial standard deviation of 1673 RMB. If we only consider households with positive figures, the average increases to 1997 RMB with a standard deviation of 3990 RMB.

**Table 3a Summary Statistics for Housing Wealth Change, Education Expenditures, and Characteristics of Children and Parents**

| Variable | Description | mean | sd | min | max |
|---|---|---|---|---|---|
| hwealthdiff | Housing wealth change (in 10,000 RMB) | 15.59 | 47.33 | -158.9 | 1,993 |
| fincome | Household income (in 10,000 RMB) | 4.58 | 10.54 | 0.0001 | 1,039 |
| Eduexptotal | Total education expenditure (in 1 RMB) | 1,977 | 3898 | 0 | 100,800 |
| Anyextraeduexp | Any supplementary education expenditure | 0.128 | 0.334 | 0 | 1 |
| Extraeduexp | Supplementary education expenditures (in 1 RMB) | 289.5 | 1,673 | 0 | 100,000 |
| Avefood | Food consumption expenditure (per person; 1 RMB) | 3064.14 | 3215.28 | 0 | 135000 |
| **Child profile** | | | | | |
| Gender | Gender:0-girl, 1-boy | 0.528 | 0.499 | 0 | 1 |
| Age | | 7.334 | 4.507 | 0 | 15 |
| Height | Current height (in cm) | 115.5 | 32.50 | 21 | 215 |
| Hkurban | Urban hukou | 0.177 | 0.381 | 0 | 1 |
| Urban | Urban residence | 0.362 | 0.481 | 0 | 1 |
| Keyschclass | Key school/class | 0.115 | 0.319 | 0 | 1 |

***(Continued…)***

**(Table 3a Continued)**

| | | | | | |
|---|---|---|---|---|---|
| schcity | School in provincial city | 0.0824 | 0.275 | 0 | 1 |
| schinternat | International school | 0.00114 | 0.0337 | 0 | 1 |
| **School level of child** | | | | | |
| childrenschlevel1 | Kindergarten | 0.575 | 0.494 | 0 | 1 |
| childrenschlevel2 | Elementary | 0.312 | 0.463 | 0 | 1 |
| childrenschlevel3 | Middle school | 0.107 | 0.309 | 0 | 1 |
| childrenschlevel4 | Highschool | 0.00664 | 0.0812 | 0 | 1 |
| **Parent Attributes** | | | | | |
| age | | 35.92 | 6.996 | 17 | 83 |
| leader | Leadership in work units | 0.195 | 0.396 | 0 | 1 |
| **Education level** | | | | | |
| illiterate | | 0.132 | 0.338 | 0 | 1 |
| Elementary | | 0.219 | 0.414 | 0 | 1 |
| middle-school | | 0.389 | 0.488 | 0 | 1 |
| high-school | | 0.152 | 0.359 | 0 | 1 |
| Associate | | 0.0622 | 0.242 | 0 | 1 |
| 4-years College | | 0.0427 | 0.202 | 0 | 1 |
| Master's Graduate | | 0.00349 | 0.0590 | 0 | 1 |
| PhD. | | 0.00023 | 0.0150 | 0 | 1 |
| migrchild1 | Both parents not migrant | 0.801 | 0.399 | 0 | 1 |
| migrchild2 | Either mom or dad migrant | 0.125 | 0.331 | 0 | 1 |
| migrchild3 | Both parents migrant | 0.0737 | 0.261 | 0 | 1 |

***Source***: CFPS 2010, 2012, 2014, and 2016, cleaned and calculated by authors.

Nearly 58% of children attend kindergarten, 31.2% attend elementary school and 10.7% attend middle school. In addition to school level, we have three variables that measure the quality of school or education received. First is the school location, a dummy variable *schcity* if the attended school is located in a provincial capital city or a provincial level metropolitan city. Second is a dummy variable *schquality* if the attended school or class is a key school or a key class. The last one is a dummy variable *schinternational* if the attended school is an international school where teaching is bilingual and most of the faculty are from overseas. These three variables are very important for measuring the educational quality because in China, a school or a class with any of these features generally has much better teachers and other resources

(Dong and Li, 2019; You, 2007). These schools could also be more expensive and the household expenditure may, on that account, be correlated with home price changes (thus the importance of our local house price measure)[18]. In our sample, 11.5% of the observed children attend a key school or a key class, 8.24% attend a school in a provincial capital city or a provincial-level metropolitan city, and 0.11% attend an international school.

In China, the local registered residency which is called *hukou*, is very important to households who live in an urban area. *Hukou* affects the access of local residents to public school education, medication, housing, and even employment. As most schools are largely funded by local municipalities, children without local hukou in general face much higher tuition. For many migrant workers in cities with limited public resources for the education of their children, it is often necessary to send them back to their rural hometown for schooling. In our sample, 36.2% of the children live in an urban area while only 17.7% have urban hukou. *Hukou* also has a potentially large impact on the housing wealth of households. Given the rapid rising housing prices during the past decade, *hukou* has been often used by the local government as an important policy instrument to regulate the housing market by restricting the qualifications of potential buyers (Tang and Coulson, 2017). Therefore, we construct a *migrantchild* variable, which indicates whether the parent of a child is a migrant without local hukou[19]. Although neither parent of 80.1% of the children is a migrant, there still remains 20% whose parents are migrants. Among them, 7.37% have parents who are both migrants, and 12.5% have one migrant parent. This variable aims to control for unobserved household heterogeneity that affects both the access of the child to a good education as well as the access of the household to housing.

Table 3b shows the differences in the quality measures of children in urban and rural households. The differences are very large. Although the mean age from these two subsamples is similar, children who are living in the urban areas are 5 cm (almost 2 inches) taller, and less likely to have any sibling. Urban children also have a much larger total education expenditure, more than double that of rural children, and their household food consumption expenditure per person is 78% higher than their rural counterparts. However, if we examine the across period height changes for each child between urban and rural, the mean for rural is 17.54 cm and 16.5 cm for urban, and the mean difference test rejects the null that they are the same.

[18] We do not distinguish whether the attended school is public or private because the CFPS does not carry the question consistently in their surveys across our sample periods.
[19] In China, the hukou status of a child does not depend on the place of birth, but in most cases determined by the hukou status of the parents.

**Table 3b Quality Measure Differences between Urban and Rural**

| | age | height | dheight | eduexptotal | anyextraeduexp | siblings | avefood |
|---|---|---|---|---|---|---|---|
| Urban | 7.38 | 119.45 | 16.51 | 3070.8 | 0.218 | 0.736 | 4265.2 |
| Rural | 7.29 | 114.56 | 17.54 | 1375.5 | 0.077 | 1.05 | 2391.1 |

# 4. Results

In this section, we report our findings on the quantity-quality trade-off hypothesis in two steps. First, we will present the results from our models of fertility as a function of housing wealth and other covariates. Second, we will present estimates of the effect of housing wealth on child quality. The panel nature of our survey allows us to use fixed person effects, so that identification of the housing wealth effect comes from the within-change of year-to-year housing market value, holding neighborhood prices constant, and the within-change of related quantity or quality measures of children for a household.

## 4.1 Fertility Regression

We adopt a linear probability regression model of the fixed effects similar to that in Lovenheim and Mumford (2013) and specify our econometric regression for benchmark fertility as the following:

$$Pr(birth_{i,t}) = \alpha_i + \boldsymbol{\theta}'\boldsymbol{Z}_{it} + f(\boldsymbol{KidN_{it}}, Policy_t, \Delta HW_{it}) + \epsilon_{it} \quad (1)$$

where $\boldsymbol{Z_{it}}$ is the vector of individual and household characteristics in year $\boldsymbol{t}$, including age, age squared, marriage status, education attainment, possession of an urban hukou, migrant status, employment in a government agency or state-owned enterprise, household income, savings, average housing price at the community level and current provincial residence when the interview took place. The f(.) function is a linear function of the set of variables, with interactions, including: a vector $\boldsymbol{KidN}_{it}$; the birth history of the female household member, namely whether she already has one or two (or even more) surviving children at the time of the interview; $Policy_t$, a regime-shift dummy that references the one-child policy and its replacement with the two-child policy; and $\Delta HW_{it}$, which denotes the current housing wealth of the household, obtained by subtracting the purchase or building cost of the unit from the current self-assessed housing market value.

Again, we rely on the plausible exogeneity of this measure of housing wealth to obtain consistent estimates of housing wealth related coefficients. To eliminate the possible endogeneity, we include the average housing price at the community level to control for local housing market specifics and costs and quality of livelihood that are correlated with the household housing wealth and might affect the fertility decision of the household as well. For most households,

fertility choice is separated from housing location choice as it is difficult to consider that households choose to live in a place to bear a child because the housing price there increases more. However, it is possible that a household who wants to bear a child soon and values a good education for their child will buy a home in a preferred-school district where we observe significant increase in housing price. Nevertheless, since there are usually a few years before the newborn is eligible for any type of formal schooling, the parents do not have to do this when the child is born. In our later robustness check, we restrict our sample to those who never moved to circumvent any possible endogeneity problem due to this reason.

### 4.1.1 Baseline Results

Due to the differential level of enforcement of birth planning policies between urban and rural locations, we assume that this institutional difference implies a different data generating process across women in these two areas. Therefore, we estimate our models for urban and rural households separately. Table 4 presents the results for the urban sample, and Table 5 for the rural sample. The first three columns of both tables show the baseline regression results for the fixed effect of the fertility decisions of women. To identify the housing wealth effect, we employ a set of controls to capture the fertility preference of women such as age, education, marriage status, and provincial location. We also use a policy-year dummy to capture the effect of replacing the one-child policy with a national two-child policy. Since the two-child policy allows a couple to have up to two children, we control both the number of children that the woman has given birth to prior to the survey year as well as its interaction with the policy-year dummy to see if such a change causes any shift in fertility. We do the same with the housing wealth variable. To accommodate the possible nonlinearity of the housing wealth effect on fertility decisions, we include the quadratic term of $\Delta HW_{it}$ in our baseline regression as well as all possible interaction terms between $\Delta HW_{it}$, the birth history of the woman and policy shift.

In comparing the results of the first columns of Tables 4 and 5, we do not find any meaningful empirical evidence to support the idea that housing wealth increases the fertility rate of a woman for almost all households in urban environments. However, there is a positive, but very limited impact in rural areas, mainly *before* 2015. Nevertheless, the results for the urban sample confirm the nonlinearity of the housing wealth effect. The quadratic term of housing wealth increase in Table 4 in all specifications for the urban sample have positive coefficient estimates although of very small magnitudes. This implies that only when the household observes a very significantly large increase in their housing wealth will they be more likely to have more children. This is consistent with our discussion in Section 2. For example, Column 1 shows that for women with only 1 child, the housing wealth effect on fertility would be positive if the housing wealth of the household increase is greater than 3.07 million RMB before 2015, and 4.18 million RMB after 2015.

**Table 4 Fertility for Women in Urban Area**

| Variable | (1) All | (2) With 0/1 lagchildren | (3) With 0 lagchildren | (4) Women with Siblings | (5) Women with Siblings/0-1 children | (6) Women without Siblings | (7) HH with 1 Woman |
|---|---|---|---|---|---|---|---|
| #Children prior: 1 | -0.525*** | -0.589*** | | -0.540*** | -0.602*** | -0.504*** | -0.546*** |
| | (0.0178) | (0.019) | | (0.0190) | (0.0206) | (0.0566) | (0.0212) |
| #Children prior: 2 or more | -1.047*** | | | -1.073*** | | -0.726*** | -1.072*** |
| | (0.0257) | | | (0.0263) | | (0.130) | (0.0300) |
| Policy2:after 2015 | 0.124*** | 0.169*** | 0.362*** | 0.104*** | 0.148*** | 0.182*** | 0.135*** |
| | (0.0205) | (0.0225) | (0.0410) | (0.0227) | (0.0252) | (0.0617) | (0.0286) |
| #Children # Policy 2 1 & after '15 | -0.0609*** | -0.0526** | | -0.0420* | -0.0366 | -0.123* | -0.0701** |
| | (0.0209) | (0.0219) | | (0.0231) | (0.0246) | (0.0681) | (0.0291) |
| 2 or more after '15 | -0.145*** | | | -0.118*** | | -0.343*** | -0.144*** |
| | (0.0216) | | | (0.0237) | | (0.102) | (0.0306) |
| housing wealth | -9.30e-05 | -0.00019 | -0.00105** | -8.04e-05 | -0.000188 | -0.000564 | -1.09e-05 |
| | (0.000219) | (0.00024) | (0.000422) | (0.000253) | (0.000272) | (0.000619) | (0.00028) |
| Housing wealth squared | 6.23e-07** | 5.13e-07 | 2.57e-06*** | 2.74e-07 | 1.96e-07 | 2.38e-06** | 5.07e-07 |
| | (2.75e-07) | (3.33e-07) | (8.64e-07) | (2.98e-07) | (3.68e-07) | (1.01e-06) | (3.18e-07) |
| **Housing wealth after 2015** | -0.00053** | -0.000473** | -0.000971** | -0.000289 | -0.000324 | -0.00145*** | -0.00052* |
| | (0.00022) | (0.00023) | (0.000378) | (0.000310) | (0.000325) | (0.000499) | (0.00031) |

***(Continued…)***

**(Table 4 Continued)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Housing wealth:** | | | | | | | |
| Before 2015, only 1 child | -0.00029 | -0.000225 | | -0.000110 | -7.56e-05 | -0.000443 | -0.00038 |
| | (0.00023) | (0.00024) | | (0.000266) | (0.000284) | (0.000600) | (0.00029) |
| Before 2015, 2 or more children | -0.00040 | | | -0.000255 | | -0.00150* | -0.00040 |
| | (0.00027) | | | (0.000305) | | (0.000884) | (0.00033) |
| After 2015, only 1 child | 9.92e-05 | 0.000162 | | 0.000102 | 0.000232 | 0.000967* | 4.10e-05 |
| | (0.00020) | (0.000211) | | (0.000298) | (0.000313) | (0.000518) | (0.0003) |
| After 2015, 2 or more children | 0.00028 | | | 7.28e-05 | | 0.000550 | 0.00042 |
| | (0.00025) | | | (0.000335) | | (0.000569) | (0.00035) |
| Housing price at community level | 0.0188 | 0.0135 | 0.0183 | -0.00435 | -0.00634 | 0.0532 | 0.0173 |
| | (0.0125) | (0.0138) | (0.0327) | (0.0145) | (0.0161) | (0.0336) | (0.0135) |
| Women's age group | | | | | | | |
| Below 30 | 0.0544*** | 0.0540** | -0.0288 | 0.0623*** | 0.0674*** | 0.0462 | 0.108*** |
| | (0.0194) | (0.0221) | (0.0319) | (0.0210) | (0.0246) | (0.0558) | (0.0406) |
| 30-35 | 0.105*** | 0.118*** | 0.0350 | 0.0965*** | 0.124*** | 0.151* | 0.165*** |
| | (0.0263) | (0.0306) | (0.0686) | (0.0281) | (0.0339) | (0.0795) | (0.0456) |
| 35- 40 | 0.120*** | 0.113*** | 0.0821 | 0.122*** | 0.134*** | 0.0836 | 0.180*** |
| | (0.0318) | (0.0379) | (0.112) | (0.0336) | (0.0414) | (0.107) | (0.0501) |
| 40 & above | 0.101*** | 0.0614 | -0.0207 | 0.105*** | 0.0885* | 0.0487 | 0.153*** |
| | (0.0370) | (0.0452) | (0.162) | (0.0385) | (0.0484) | (0.156) | (0.0548) |

***(Continued…)***

**(Table 4 Continued)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| savings | 0.00032 | 0.00030 | 0.00102* | 6.68e-05 | 4.86e-05 | 0.00089 | 0.00035 |
| | (0.00023) | (0.00027) | (0.000601) | (0.00027) | (0.00032) | (0.00057) | (0.00027) |
| logged family income | 2.39e-05 | 0.0006 | 0.0136 | 0.00080 | 0.00073 | -0.00595 | 0.00231 |
| | (0.0032) | (0.0046) | (0.0113) | (0.0033) | (0.0047) | (0.0142) | (0.00385) |
| married | 0.274*** | 0.285*** | 0.246*** | 0.244*** | 0.262*** | 0.359*** | 0.231*** |
| | (0.0183) | (0.0200) | (0.0307) | (0.0199) | (0.0223) | (0.0516) | (0.0251) |
| urban hukou | -0.0392** | -0.0460** | -0.0277 | -0.0308 | -0.0326 | -0.0935 | -0.0513** |
| | (0.0186) | (0.0226) | (0.0481) | (0.0187) | (0.0233) | (0.0832) | (0.0235) |
| migrant, | -0.0414** | -0.0390* | -0.0177 | -0.0467*** | -0.0412* | -0.0127 | -0.0453** |
| | (0.0178) | (0.0221) | (0.0447) | (0.0178) | (0.0226) | (0.0842) | (0.0224) |
| urbanHukou&migrant | 0.0411 | 0.0525* | 0.0155 | 0.0388 | 0.0328 | 0.0129 | 0.0536* |
| | (0.0258) | (0.0303) | (0.0584) | (0.0270) | (0.0325) | (0.0969) | (0.0316) |
| Employed gov/soe | 0.0152 | 0.0113 | 0.0297 | 0.0091 | 0.00895 | 0.0361 | 0.0172 |
| | (0.014) | (0.0155) | (0.0343) | (0.015) | (0.0168) | (0.0445) | (0.0167) |
| year = 2012 | 0.0157* | 0.0491*** | 0.161*** | 0.0171** | 0.0482*** | 0.00257 | 0.0301*** |
| | (0.0084) | (0.0103) | (0.0244) | (0.0086) | (0.0110) | (0.0303) | (0.010) |
| year = 2014 | 0.0122 | 0.0685*** | 0.229*** | 0.0123 | 0.0654*** | 0.00134 | 0.0184 |
| | (0.0096) | (0.0121) | (0.0316) | (0.010) | (0.013) | (0.0368) | (0.0116) |
| Observations | 8,612 | 5,944 | 1,879 | 7,675 | 5,090 | 937 | 5,835 |
| R-squared | 0.323 | 0.296 | 0.269 | 0.335 | 0.291 | 0.311 | 0.338 |
| F-test | 1.674 | 1.643 | 3.698 | 0.552 | 0.759 | 1.740 | 1.279 |
| Prob>F | 0.111 | 0.145 | 0.0115 | 0.795 | 0.579 | 0.0972 | 0.256 |

***Note***: (1) Standard errors in parentheses,*** p<0.01, ** p<0.05, and * p<0.1, (2) F-test refers to joint test of housing wealth variables, (3) All regressions have controlled provincial and individual fixed effects as well as all other covariates.

**Table 5 Fertility of Women in Rural Areas**

| Variable | (1) All | (2) With 0/1 lagchildren | (3) With 0 lagchildren | (4) Women w Siblings | (5) Women w Siblings/0-1 Child | (6) Women w/o Siblings | (7) HH with 1 Woman |
|---|---|---|---|---|---|---|---|
| #Children prior: 1 | -0.409*** | -0.586*** | | -0.397*** | -0.574*** | -0.650*** | -0.443*** |
| | (0.0165) | (0.0210) | | (0.0169) | (0.0217) | (0.0832) | (0.0208) |
| # Children prior: 2 or more | -0.847*** | | | -0.834*** | | -1.100*** | -0.915*** |
| | (0.0196) | | | (0.0199) | | (0.119) | (0.0242) |
| Policy:after 2015 | 0.0650*** | 0.223*** | 0.402*** | 0.0630*** | 0.218*** | 0.109 | 0.0692** |
| | (0.0211) | (0.0277) | (0.0390) | (0.0216) | (0.0285) | (0.115) | (0.0341) |
| # Children # Policy 2 | | | | | | | |
| 1 & after 2015 | -0.0101 | 0.0345 | | -0.0109 | 0.0340 | 0.0462 | -0.0245 |
| | (0.0224) | (0.0265) | | (0.0230) | (0.0274) | (0.116) | (0.0354) |
| 2 children or more after 2015 | -0.0942*** | | | -0.0911*** | | -0.145 | -0.0987*** |
| | (0.0209) | | | (0.0215) | | (0.112) | (0.0344) |
| **housing wealth (b1)** | 0.00177*** | 0.00129* | -0.0004 | 0.0017*** | 0.00129* | 0.0010 | 0.0014* |
| | (0.0005) | (0.0007) | (0.0007) | (0.0006) | (0.00073) | (0.0019) | (0.0007) |
| **Housing wealth after 2015** | -0.000786 | -0.000455 | -3.44e-05 | -0.0007 | -0.000251 | -0.00124 | 9.08e-08 |
| | (0.0006) | (0.0008) | (0.0008) | (0.0008) | (0.0009) | (0.0017) | (4.37e-07) |
| **Housing wealth before2015 w:** | | | | | | | |
| 1 child prior(b2) | -0.00152*** | -0.00133* | | -0.00139** | -0.00130 | -0.00086 | -0.0012 |
| | (0.0006) | (0.0007) | | (0.0006) | (0.0008) | (0.002) | (0.00076) |

***(Continued...)***

**(Table 5 Continued)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 or more children prior(b3) | -0.0022*** | | | -0.0022*** | | -0.0014 | -0.0010 |
| | (0.00065) | | | (0.0007) | | (0.0039) | (0.00086) |
| **Housing wealth after 2015** | | | | | | | |
| **w** | | | | | | | |
| 1 child prior | -0.00122 | -0.00112 | | -0.00117 | -0.00126 | -0.00062 | -0.00211* |
| | (0.0008) | (0.0009) | | (0.0008) | (0.00098) | (0.00247) | (0.00124) |
| 2 or more children prior | -0.00114 | | | -0.00121 | | 0.00277 | -0.00103 |
| | (0.0009) | | | (0.0010) | | (0.00454) | (0.00134) |
| Community housing price | 0.0393 | 0.0169 | -0.0231 | 0.0247 | 0.00762 | 0.164 | 0.0236 |
| | (0.0434) | (0.0636) | (0.139) | (0.0450) | (0.0671) | (0.214) | (0.0550) |
| Women's age group(default<21) | | | | | | | |
| 21-30 | 0.0387** | 0.0159 | -0.0700** | 0.0337* | 0.0128 | 0.102 | 0.0556* |
| | (0.0168) | (0.0228) | (0.0277) | (0.0173) | (0.0235) | (0.0793) | (0.0326) |
| 30-35 | 0.0713*** | 0.0884** | -0.0390 | 0.0596** | 0.0768** | 0.283** | 0.100*** |
| | (0.0236) | (0.0362) | (0.0748) | (0.0241) | (0.0373) | (0.121) | (0.0376) |
| 35-40 | 0.0803*** | 0.0298 | -0.0441 | 0.0700** | 0.0256 | 0.236 | 0.113*** |
| | (0.0289) | (0.0488) | (0.121) | (0.0295) | (0.0502) | (0.159) | (0.042) |
| 40 above | 0.0861** | -0.0957 | 0.0105 | 0.0786** | -0.0969 | 0.134 | 0.127*** |
| | (0.0336) | (0.0600) | (0.212) | (0.0342) | (0.0616) | (0.191) | (0.0466) |
| savings | 0.000286 | 0.000179 | -0.0010 | 7.25e-05 | -2.05e-05 | 0.000394 | -4.73e-05 |
| | (0.0006) | (0.0009) | (0.0014) | (0.0007) | (0.0011) | (0.0016) | (0.0007) |
| logged family income | -0.00540* | -0.0102** | -0.0013 | -0.0060** | -0.00919* | 0.00349 | -0.0069** |
| | (0.0027) | (0.0051) | (0.009) | (0.002) | (0.005) | (0.014) | (0.0033) |

***(Continued…)***

**(Table 5 Continued)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| married | 0.177*** | 0.228*** | 0.211*** | 0.169*** | 0.226*** | 0.290*** | 0.0895*** |
| | (0.0195) | (0.0267) | (0.031) | (0.020) | (0.0277) | (0.0987) | (0.029) |
| urban hukou | 0.0182 | 0.00396 | -0.112* | 0.0139 | -0.000778 | 0.0805 | 0.0357 |
| | (0.0264) | (0.0395) | (0.0628) | (0.0269) | (0.0410) | (0.152) | (0.0354) |
| Migrant | -0.0529*** | -0.0753*** | -0.0974*** | -0.055*** | -0.0779*** | 0.0251 | -0.0611*** |
| | (0.0114) | (0.0178) | (0.0259) | (0.0116) | (0.0183) | (0.0643) | (0.0148) |
| hkurban#migrant | 0.0105 | 0.0452 | 0.116 | 0.00293 | 0.0311 | 0.189 | -0.0286 |
| | (0.0398) | (0.0529) | (0.0722) | (0.0411) | (0.0553) | (0.195) | (0.0557) |
| Employed in gov/soe | -0.0136 | -0.0335 | 0.0075 | -0.00842 | -0.0286 | -0.125 | -0.0189 |
| | (0.0196) | (0.030) | (0.0403) | (0.0199) | (0.0302) | (0.119) | (0.0245) |
| year 2012 | -0.0040 | 0.114*** | 0.280*** | -0.00453 | 0.110*** | 0.0190 | 0.00026 |
| | (0.0074) | (0.013) | (0.022) | (0.007) | (0.013) | (0.042) | (0.0090) |
| year 2014 | -0.00561 | 0.193*** | 0.344*** | -0.0056 | 0.190*** | 0.0343 | -0.0113 |
| | (0.009) | (0.016) | (0.031) | (0.009) | (0.0165) | (0.0537) | (0.0106) |
| Observations | 12,595 | 5,796 | 2,244 | 12,083 | 5,500 | 512 | 8,011 |
| R-squared | 0.264 | 0.251 | 0.270 | 0.262 | 0.242 | 0.352 | 0.293 |
| F-test of housing wealth effect | 3.264 | 1.794 | 0.00175 | 2.525 | 1.376 | 0.657 | 1.429 |
| Prob>F | 0.0060 | 0.146 | 0.967 | 0.0273 | 0.248 | 0.656 | 0.189 |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) F-test refers to joint test of housing wealth variables. (3) All regressions have controlled provincial, individual fixed effects as well as all other covariates.

Recall that the mean of the housing wealth change in the urban sample is around 0.3 million RMB. This hypothetical housing wealth increase lies in the top 3% households in our urban sample (in our rural sample, the quadratic term of most the housing wealth is statistically insignificant and substantively negligible, so we only report the results with the linear term).

In rural areas, a 10,000 RMB increase in housing wealth before 2015 will drive up the probability for a woman to give birth by 0.177 percentage points if she is at the time childless[20]. Given that the average birth rate in rural areas is about 0.099, this amounts to an increase of only 1.78%. Moreover, if the woman has had a child prior to the survey year, the positive housing wealth effect diminishes considerably.

In addition, we also find that other household economic variables do not have a significant effect on fertility. Increasing household savings of cash and bank deposits by 10,000 RMB leads to an average fertility increase of just 0.032 percentage points in urban areas and 0.029 percentage points in rural areas. The total annual income of the household instead reduces fertility significantly in rural locations. However, this is negligible in magnitude as the coefficient is as low as -0.005. Increasing the total income of a household by 1% is associated with a reduction in fertility by around 0.005 percentage points.

When we examine the estimated coefficients for other demographic and institutional variables, the results are fairly sensible. Getting married greatly increases the probability that a woman will bear a child, and the number of children prior to the survey year substantially reduces her fertility. Having an urban *hukou* indicates the household is under a much stricter implementation of the one-child policy, thus we find a strong and negative effect on fertility in the urban but not the rural areas[21]. Although being a migrant may indicate an unstable livelihood for the household, thus reducing fertility, being a migrant with an urban hukou increases the probability of bearing a child. This may be attributed to a better social status (compared to rural hukou) and easy circumvention of the tougher fertility regulations. In addition, we do not find that being employed in a government institution or state-owned enterprise has significantly affected fertility, although the sign is positive in the urban but negative in the rural areas. The insignificance may be driven by this

[20] Taking 6.40 as the average exchange rate between RMB/USD during the sample period, 10,000 RMB is around 1563 USD. The result can also be understood as a 10,000 USD increase in housing wealth will increase the fertility rate of a woman by 1.13 percentage points. That is approximately 0.177 divided by 0.156.

[21] The birth planning policies are applied discriminately according to the hukou status of a woman. Yet the policy implementation is conducted by local government agency and the stringency differs between the urban and the rural in general. A woman can have an urban hukou yet live in a rural area. Thus according to the hukou status, she normally cannot have more than one child, but possibly could have more if she or her close family members live in a rural area and thus face less scrutiny.

institutional factor being possibly highly collinear with other covariates yet the opposite signs speak to the different implementation of the one-child policy rule between rural and urban in the midst of its own changes.

Since by law, the birth planning policies in China have largely limited the maximum number of children that a couple can have, the fertility choice may become a choice only to a woman who has not already reached the birth limit. Therefore, in Columns 2 and 3 of Tables 4 and 5, we limit our sample to childless women or those with one child prior to the survey year. Again, we find that housing wealth does not matter for fertility in urban areas for most households; neither does it matter in the rural areas. Although the joint test for the sample of childless urban women in Column 3 gives a p-value of 0.01, the estimated coefficients are again very small in magnitude. The estimated coefficients for housing wealth in Column 2 of Table 4 are close to zero, yet they are positive and significant in Table 5. However, the one-sided test of a positive housing wealth effect for a woman with no more than one child before the policy change from Column 2 in Table 5 yields a p-value of 0.45[22]. It seems that the housing wealth effect on fertility for rural women if any is not related to their birth history.

### 4.1.2 Endogeneity and Robustness Check

Given the rapid housing price increase during 2008-2018 and institutional features in both housing reforms and family planning policy implementation in China, we conduct a set of robustness checks on our baseline regression result to avoid any potential endogeneity that may bias our estimates, that our extensive controls may not alleviate. The endogeneity could come from those unmeasured institutional factors, and unobserved household heterogeneity that affect the housing wealth of the household and also their fertility decisions. Although our measure of housing wealth is meant to capture unexpected changes in housing wealth, endogeneity could still arise if households have better knowledge of the local housing market and birth control policies which might account for such changes. Our intent in this section is to examine subsamples of the data that circumvent such difficulties.

The first set of robustness check relates to the birth planning policy adjustment and individual demographics, namely whether a woman has any siblings. Before the universal two-child policy took effect in 2016, there had been two adjustments to the nationwide one-child policy, and both used the number of siblings of the couple as a screening rule. In the late 1990s, the Chinese government began to allow couples in which both husband and wife are of only-child families to have two children. Provincial governments had full discretion with respect to the implementation of this policy, but by 2011, all provinces had

[22] The null hypothesis is b1+b2=0, where b1 and b2 are coefficients from Table 5.

already adopted this policy. In late 2013, the government relaxed the aforementioned policy to all couples to include even one spouse from an only-child family during the Third Plenary Session of the 18th CPC Central Committee. Two years later, the universal two-child policy was in place. As a result, during our sample period, the predetermined number of siblings exogenously affects the probability that a woman would have more than one child under all these policy adjustments. Thus, the presence or absence of siblings potentially affects the fertility decision of a woman through her preferences (Morosow and Kolk, 2020)[23]. If such differences also correlate with household housing wealth, then our previous result might be biased. Therefore, we separate our sample into two groups; one for women with siblings, and the other without. Due to the differences in stringency in the implementation of birth planning policies between the urban and rural regions, we again examine these two groups separately. We run the same set of regressions for these different samples. The next three columns (4)-(6) in Tables 4 and 5 show the results. Again, we find that the results are quite consistent with our baseline models. Table 4 shows a rather higher negative (though still very small in magnitude) housing wealth effect for women without any siblings versus those with siblings for almost all ranges of housing wealth increases in the urban area as the joint test of the housing wealth effect as the former yields a p-value of 0.097. As a point of comparison, we calculate the marginal effect when a housing wealth of the household increases by 3 million RMB[24], which was the point at which the housing wealth effect turned positive in the baseline results. With the present set of coefficients, there is no positive effect on fertility. Only when the household has an extraordinary housing wealth increase, that is, over 3 million RMB, will the marginal effect for women without siblings and only one child be positive, and even then, this remains quite small in magnitude[25].

In Table 5, we find that housing wealth matters for the fertility decision of a woman for rural homeowners before the adoption of a universal two-child policy if she has a sibling, but not at all for a woman if she does not have any siblings. Furthermore, Column 5 in Table 5 shows that the mildly positive impact of housing wealth on fertility in the rural areas is mainly delivered by women with siblings and those who are childless or have one child prior to the survey year. Although women without any siblings are legally allowed to have more than one child, housing wealth changes are clearly not a trigger for them to have additional children.

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[23] Morosow and Kolk (2020) find that both the birth order and the number of siblings affect the fertility of women.

[24] At an exchange rate of 6.40 RMB, 3 million RMB is about 468,750 USD, or a little less than half a million USD.

[25] The marginal effect of housing wealth increase in this case is about 0.04 percentage points before 2015 and after 2015.

The last robustness check concerning the household demographic heterogeneity removes all women who co-reside together and share the same housing wealth. In our sample for urban households for example, 66% of woman-year observations are of single-woman-households, and 62% for rural households. These co-residing women are either siblings or mother-daughter. The housing wealth for them on average is significantly lower than that of single-woman households in urban, yet mildly lower in rural areas. As there are more complicated social and cultural factors involved in co-living households in fertility decisions and housing choices, we remove these women and only use single-woman households for regressions. The results are shown in Column 7 of both Tables 4 and 5. Comparing the first column of both tables, again we do not find anything different. The housing wealth does not affect the fertility decision of these women in a meaningful way.

Now we turn to the robustness check concerning endogeneity that arises from unobserved household heterogeneity that underlie housing wealth which might also be correlated with fertility decision. Specifically, in Table 6a, we consider three other subsamples of our data to address the issue. First, we investigate households that are homeowners throughout the sample period so that we may avoid the situation when people become homeowners and change their housing wealth holdings so that they can get married and have a child (Wei et al., 2017). Second, we examine homeowners who have never moved during our sample period. Therefore, we circumvent the situation where households move to a new housing in advance to gain access to a good school district for their children. Lastly, we look at homeowners who do not have any debt, including any mortgage debt. Homeowners as a group may be quite liquidity constrained due to high mortgage debt that accrues in a high housing price environment, which would complicate the relationship between housing wealth and child-bearing decision. Looking at debt-free homeowners circumvents this issue.

Table 6a shows the results for these three tests[26]. Again, we do not find any meaningful empirical evidence to support the idea that housing wealth increases the fertility of Chinese households in general. Similar to the baseline regressions, housing wealth simply does not matter much to Chinese urban households for their fertility decisions compared with other covariates that measure women or household preferences, and not that much to rural households either except for the debt-free rural households. The results in Panel C of Table 6a show that to the debt-free households, a 100,000 RMB addition to their housing wealth increases their fertility in rural areas by 1.57 percentage points after 2015 when the one-child policy was abolished.

[26] To make it easy to compare the results of the urban areas with those of the rural areas, we do not include the quadratic term of housing wealth change in regressions of the urban sample, yet the qualitative results and conclusions stay the same.

**Table 6a Robustness Check for Different Household Attributes**

| Variable | (1) Urban | (2) Urban w.0/1 child | (3) Rural | (4) Rural w.0/1 child |
|---|---|---|---|---|
| **A. All time homeowners** | | | | |
| Housing wealth | 0.000431* | 0.000269 | 0.00150** | 0.00125* |
| | (0.000224) | (0.000235) | (0.000594) | (0.000751) |
| Housing wealth after 2015 | -0.000169 | -0.000280 | 0.000863 | 0.000773 |
| | (0.000207) | (0.000219) | (0.000784) | (0.000944) |
| Housing wealth before 2015 w: | | | | |
| 1 child prior (b2) | -0.000494* | -0.000426 | -0.00122* | -0.00124 |
| | (0.000257) | (0.000273) | (0.000642) | (0.000812) |
| 2 or more children prior (b3) | -0.000675** | | -0.00196*** | |
| | (0.000300) | | (0.000703) | |
| Housing wealth after 2015 w: | | | | |
| 1 child prior (b2) | -1.81e-05 | 3.76e-05 | -0.00106 | -0.00105 |
| | (0.000217) | (0.000227) | (0.000780) | (0.000928) |
| 2 or more children prior (b3) | 0.000117 | | -0.00106 | |
| | (0.0002) | | (0.0009) | |
| **B. All time same home** | | | | |
| Housing wealth | 0.000112 | -0.000165 | 0.00251*** | 0.00145 |
| | (0.000290) | (0.000305) | (0.000954) | (0.00110) |
| Housing wealth after 2015 | -0.000222 | -4.63e-05 | -0.000865 | -0.000533 |
| | (0.000267) | (0.000281) | (0.000815) | (0.000945) |
| Housing wealth before 2015 w: | | | | |
| 1 child prior (b2) | -0.000345 | -0.000354 | -0.00234** | -0.00136 |
| | (0.000330) | (0.000359) | (0.00101) | (0.00116) |
| 2 or more children prior (b3) | -0.000475 | | -0.00322*** | |
| | (0.000373) | | (0.00111) | |
| Housing wealth after 2015 w: | | | | |
| 1 child prior (b2) | 2.50e-05 | -1.86e-05 | -0.00188* | -0.00137 |
| | (0.000255) | (0.000271) | (0.00111) | (0.00126) |
| 2 or more children prior (b3) | -2.88e-05 | | -0.00160 | |
| | (0.000328) | | (0.00122) | |
| Community housing price | -0.0108 | -0.0155 | 0.0281 | 0.0587 |
| | (0.0201) | (0.0228) | (0.0582) | (0.0862) |

***(Continued…)***

**(Table 6a Continued)**

| **C. Homeowners without Debt** | | | | |
|---|---|---|---|---|
| Housing wealth | 0.0008*** | 0.000609** | 0.00157** | 0.00185** |
| | (0.0002) | (0.000238) | (0.000729) | (0.000896) |
| Housing wealth | -0.00056** | -0.00059** | -0.00062 | -0.0007 |
| after 2015 | (0.0002) | (0.0002) | (0.0009) | (0.001) |
| Housing wealth before 2015 w: | | | | |
| 1 child prior (b2) | -0.0009*** | -0.000826*** | -0.00159** | -0.00205** |
| | (0.0003) | (0.0003) | (0.0008) | (0.0009) |
| 2 or more | -0.0010*** | | -0.0019** | |
| children prior (b3) | (0.0003) | | (0.0009) | |
| Housing wealth after 2015 w: | | | | |
| 1 child prior (b2) | -0.00028 | -0.000158 | -0.0009 | -0.00122 |
| | (0.0002) | (0.000251) | (0.0011) | (0.00128) |
| 2 or more | -0.000385 | | -0.00148 | |
| children prior (b3) | (0.0003) | | (0.0013) | |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) All regressions have controlled provincial, individual fixed effects as well as all other covariates

The prior birth history does not significantly reduce the likelihood of having an additional child. However, as the mean housing wealth in rural areas is only about 73,700 RMB, a 100,000 RMB increase in housing wealth is very unusual for rural households and such a rise can place the household at the top 20 percentile of the housing wealth of the household distribution. Together, our results imply that housing wealth can generate a marginally meaningful effect upon the fertility of rich rural households after the one-child policy was abolished but not to urban households.

In Table 6b, we restrict our sample to homeowners who bought or built their home before 2005, five years ahead of the first round of the CFPS survey in 2010. As our definition of the birth variable is any new birth between the survey years, the earliest new birth year could be 2010 right after the survey interview. Although we lose about one third of the sample, this approach may help to guard the fertility decision from the housing decision. The results in Table 6b further echo our previous findings. Even though the joint test of housing wealth effect on fertility decision in the urban sample delivers a very small p-value, yet housing wealth again bears no meaningful impact on fertility[27]. The results discussed earlier that find correlations between these variables for the US simply do not carry over to the Chinese case.

[27] In fact, we have conducted all sub-sample robustness checks with this restricted sample and our findings still remain unchallenged. These results can be obtained by contacting the authors.

**Table 6b Robustness Check for Households Whose Homes Bought Before 2005**

| Variable | (1) All | (2) With 0/1 lagchildren | (3) With 0 lagchildren | (4) Women with Siblings | (5) Women with Siblings/0-1 child | (6) Women without Siblings |
|---|---|---|---|---|---|---|
| **Women in Urban Area** | | | | | | |
| Housing wealth | 0.00049* | 0.00031 | -0.00134** | 0.000605* | 0.000365 | -0.000617 |
| | (0.00028) | (0.00030) | (0.00061) | (0.00033) | (0.00035) | (0.00083) |
| housing wealth$^2$ | 5.26e-07 | 5.36e-07 | 4.13e-06*** | 2.28e-07 | 2.64e-07 | 2.90e-06** |
| | (3.32e-07) | (3.99e-07) | (1.24e-06) | (3.45e-07) | (4.26e-07) | (1.45e-06) |
| Housingwealth after 2015 | -0.00082*** | -0.00075*** | -0.00128*** | -0.00092** | -0.00085** | -0.00095* |
| | (0.00027) | (0.00028) | (0.00042) | (0.00037) | (0.00038) | (0.00054) |
| **Housing wealth:** | | | | | | |
| Before 2015, only 1 child | -0.00087*** | -0.000753*** | | -0.000773** | -0.000662* | -0.00053 |
| | (0.00028) | (0.00029) | | (0.000334) | (0.000350) | (0.00064) |
| Before 2015, 2 or more children | -0.00099*** | | | -0.00093** | | -0.00142 |
| | (0.00032) | | | (0.00037) | | (0.0009) |
| After 2015, only 1 child | -0.00014 | -6.41e-05 | | 0.00011 | 0.000194 | 0.00031 |
| | (0.00026) | (0.000268) | | (0.00034) | (0.000354) | (0.00061) |
| After 2015, 2 or more children | 4.52e-05 | | | 0.00011 | | 0.0008 |
| | (0.00031) | | | (0.00038) | | (0.00079) |
| Observations | 5,754 | 3,993 | 1,291 | 5,081 | 3,375 | 673 |
| R-squared | 0.340 | 0.275 | 0.220 | 0.340 | 0.258 | 0.399 |
| Number of pid | 2,399 | 1,739 | 675 | 2,128 | 1,485 | 271 |

***(Continued…)***

**(Table 6b Continued)**

| | | | | | | |
|---|---|---|---|---|---|---|
| F-test | 2.480 | 2.265 | 4.694 | 1.311 | 1.237 | 1.460 |
| Prob>F | 0.0154 | 0.0457 | 0.00301 | 0.241 | 0.289 | 0.180 |
| **Women in Rural Area** | | | | | | |
| housing wealth | 0.00244*** | 0.00135 | 0.00093 | 0.00252*** | 0.00143 | 0.00294 |
| | (0.000806) | (0.000943) | (0.0016) | (0.0009) | (0.0011) | (0.00254) |
| housing wealth$^2$ | 1.03e-06 | 4.40e-08 | -3.65e-06 | 1.61e-06 | 1.34e-07 | -4.14e-06 |
| | (1.31e-06) | (2.03e-06) | (8.76e-06) | (1.39e-06) | (2.43e-06) | (5.52e-06) |
| Housingwealth after 2015 | -0.0012 | 2.97e-05 | 0.00056 | -0.0013 | -6.75e-05 | -0.0114 |
| | (0.0010) | (0.00117) | (0.0013) | (0.0010) | (0.0012) | (0.0192) |
| **Housing wealth:** | | | | | | |
| Before 2015, only 1 child | -0.00261*** | -0.00146 | | -0.00284*** | -0.0016 | -0.00073 |
| | (0.00085) | (0.000991) | | (0.00097) | (0.0012) | (0.0024) |
| Before 2015, 2 or more | -0.00314*** | | | -0.00342*** | | 0.00026 |
| | (0.00092) | | | (0.0010) | | (0.0057) |
| After 2015, only 1 child | -0.0014 | -0.00151 | | -0.0015 | -0.00139 | 0.0084 |
| | (0.0011) | (0.00130) | | (0.0012) | (0.00137) | (0.019) |
| After 2015, 2 or more | -0.0018 | | | -0.0019 | | 0.0081 |
| | (0.0013) | | | (0.0013) | | (0.022) |
| Observations | 8,250 | 3,949 | 1,559 | 7,927 | 3,751 | 323 |
| R-squared | 0.278 | 0.266 | 0.263 | 0.275 | 0.256 | 0.394 |
| Number of pid | 3,454 | 1,887 | 901 | 3,320 | 1,799 | 134 |
| F-test | 1.993 | 0.584 | 0.188 | 1.909 | 0.467 | 0.422 |
| Prob>F | 0.0524 | 0.713 | 0.905 | 0.0640 | 0.801 | 0.888 |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) All regressions have controlled provincial, individual fixed effects as well as all other covariates as in table 4& Table 5.

Lastly, potential endogeneity could also arise if the opportunity costs of bearing an additional child are different for women of migrant and non-migrant households and factors that drive these differences are correlated with their fertility decisions and housing wealth. However, we consider that our current empirical strategies have already taken that into account. First, we only keep households that appear in every round of the survey in the sample (although there are some dropped in the regression due to missing values on some variables) and use the fixed effect to control for the unobservables that might be correlated with migration, housing and fertility decisions. We have also examined households who had never moved throughout the sample period and therefore the housing wealth change is not correlated with the migration status of the household.

In this robustness check where the migration did not occur during our sample period and the birth variable is defined as new births in the sample period, if migration is correlated with fertility, the unobserved factors that affect migration decision would have been constant throughout the sample period as no migration occurred and therefore certainly could not explain the fertility decision during the sample period if any. Of course, if the migration decision is correlated with the fertility decision due to some unobserved factors before our sample period, our choice of the sampled households could still be exposed to the endogeneity problem. Yet it is a common initial period problem for most of the panel data study[28].

## 4.2 Expenditures on Child Quality

Now we turn to the quality regression results. We use two types of measures for the quality outcomes of each child, education expenditures and the height of the child.

### 4.2.1 Education Expenditures

We use a linear regression for the fixed effect of the education expenditure of a child. Our benchmark econometric specification is as follows:

$$eduexp_{it} = \alpha_i + \beta_1 \Delta HW_{it} + \boldsymbol{\theta}' \boldsymbol{X_{it}} + \boldsymbol{\gamma}' \boldsymbol{Z_{it}} + year_t + \varphi_i + \epsilon_{it} \qquad (2)$$

where in Equation (2), $\alpha_i$ is the unobserved child specific fixed effect, $\boldsymbol{X_{it}}$ is a vector of child $i$'s observed time-variant characteristics, such as age, number of

[28] To handle the above-mentioned initial problem, we remove all migrant households from our sample and only examine non-migrant and all-in households. In our restricted sample (homeowners who bought the housing before 2005), there are less than 10% (9.67%) migrant households in our fertility regression for urban households, and about 12% migrant for rural households. We still have the similar results both qualitatively and quantitively even if we remove all of these migrant households. These results can be obtained by contacting the correspondence author.

siblings, school attainment level, attended school characteristics, hukou status, whether it is an urban environment, and migrant status. Vector $\boldsymbol{Z_{it}}$ gives the household characteristics and parent attributes that may affect the educational expenditure of the child, including household income and savings, parent education, age, and whether employment involves a leadership position. We again include the average housing price at the community level as an important control for local quality of life which is potentially correlated with the housing wealth of the household and school education quality. $year_t$ is a set of year dummies, which capture the time-variant unobservables that affect educational expenditures such as the macroeconomic environment, policy shocks and so on and so forth. $\varphi_i$ is the provincial dummy where the household currently resides to measure the regional differences in educational expenditures across different provinces in China.

a) Total Education Expenditures

Table 7 reports the results from the regressions of the fixed child effects of total educational expenditures on household housing wealth, the demographic characteristics of the child and the attributes of his or her parents[29]. The first four columns use the full sample and the remaining two columns use subsamples determined by whether the child lives in an urban or rural area. Each specification which uses the full sample shows quite a consistent result of the marginal effect of housing wealth upon the total education expenditure for a child. Increasing housing wealth by 100,000 RMB will increase the spending on the education of a child by around 48 RMB even after controlling for school quality, parent characteristics, provincial effects, and year effects. That is about 2.3% of the average total education expenditures. Given the average housing wealth in the sample of 155,900 RMB, the elasticity of housing wealth over total education expenditures is about 0.036. We also find that the average housing price at the community level greatly and significantly increases the total educational expenditures of the child.

Additional children reduce the expenditures on each child. We find a significant drop if the parents have more than two children, but a rise if they only have two children. Household cash deposits and other savings have a much larger and significantly positive impact on the total education expenditure. A 10,000 RMB increase in savings leads to an increase in education expenditures by 22.44 RMB, over four times that of the housing wealth effect. Although this coefficient estimate might be biased due to endogenous savings in anticipation of childbirth, it is possible that this could be attributed to the liquidity of this asset, relative to housing wealth.

[29] We do not find the nonlinear effect of housing wealth on educational expenditures so we only report the results from the linear specifications.

**Table 7 Total Educational Expenditures**

| Variable | (1) All children | (2) All children | (3) All children | (4) All children | (5) Urban children | (6) Rural children |
|---|---|---|---|---|---|---|
| housing wealth | 5.506*** | 4.974*** | 5.348*** | 4.869*** | 6.902*** | 0.422 |
| | (1.159) | (1.156) | (1.201) | (1.193) | (2.076) | (1.558) |
| Community housing price | 1,759*** | 1,778*** | 1,677*** | 1,731*** | 1,664*** | 868.3** |
| | (228.9) | (228.8) | (240.0) | (238.5) | (394.0) | (418.1) |
| logged family income | 21.84 | 23.63 | 18.04 | 20.81 | 99.72 | -10.30 |
| | (27.92) | (27.65) | (29.29) | (29.16) | (71.88) | (25.67) |
| deposits&cash savings | 29.47*** | 30.01*** | 24.98*** | 22.44*** | 19.46** | 13.12* |
| | (5.546) | (5.522) | (5.679) | (5.652) | (9.921) | (7.295) |
| child's age | 492.3*** | 470.3*** | 329.0*** | 357.0** | 2,088*** | -24.33 |
| | (18.74) | (18.74) | (40.88) | (153.2) | (445.5) | (135.1) |
| childrenschlevel2, elementary | -1,158*** | -1,228*** | -1,540*** | -1,890*** | -3,528*** | -1,064*** |
| | (87.45) | (88.66) | (96.11) | (100.7) | (253.4) | (87.70) |
| childrenschlevel3, middleschool | -195.9 | -276.0** | -750.8*** | -1,214*** | -3,148*** | -244.8* |
| | (134.9) | (136.4) | (146.7) | (152.0) | (369.7) | (135.1) |
| childrenschlevel 4, highschool | 2,785*** | 2,484*** | 2,075*** | 1,417*** | -1,166 | 2,989*** |
| | (398.0) | (396.6) | (415.5) | (417.6) | (852.3) | (426.5) |
| num. siblings : 1 | 199.5 | 206.1 | 341.1** | 384.7*** | 792.0** | 179.4 |
| | (136.1) | (134.9) | (144.9) | (144.1) | (363.5) | (126.1) |
| num. siblings : 2 or more | -413.5** | -390.4** | -263.7 | -132.7 | -686.9 | -32.27 |
| | (163.5) | (162.0) | (237.4) | (236.0) | (657.3) | (200.2) |

***(Continued…)***

**(Table 7 Continued)**

| | | | | | | |
|---|---|---|---|---|---|---|
| school in large city | | 2,220*** | 2,015*** | 1,885*** | 1,128** | 2,221*** |
| | | (235.7) | (248.2) | (246.6) | (458.9) | (272.7) |
| international school | | 6,705*** | 7,349*** | 7,439*** | 12,421*** | 4,679*** |
| | | (780.1) | (786.3) | (788.7) | (1,946) | (678.5) |
| Schqual:KeySchool/Class | | 345.3*** | 408.6*** | 375.7*** | 281.9 | 548.4*** |
| | | (98.13) | (101.9) | (101.3) | (237.0) | (92.91) |
| hkurban | | 1,129*** | 996.0*** | 843.6** | 1,465*** | 652.8** |
| | | (323.8) | (359.8) | (358.7) | (488.1) | (284.4) |
| urban | | -187.4 | -289.4 | -385.7** | | |
| | | (180.3) | (187.6) | (188.2) | | |
| HuKoUrban in urban | | -277.4 | 203.6 | 368.1 | | |
| | | (398.3) | (433.1) | (432.5) | | |
| Observations | 22,016 | 21,972 | 19,711 | 19,711 | 6,931 | 12,711 |
| R-squared | 0.141 | 0.156 | 0.168 | 0.183 | 0.200 | 0.227 |
| Individual FE | YES | YES | YES | YES | YES | YES |
| Parent Attributes/Migrant | | | YES | YES | YES | YES |
| Provincial FE | | | | YES | YES | YES |
| Year FE | | | | YES | YES | YES |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) Parents attributes include age of eldest parent, education level, migrant worker or not.

(2) Dep.var.: Total educational expenditures (in 1 RMB)

The last two columns of Table 7 split the sample into urban and rural. It seems that the large housing wealth effect estimated in Column 4 mainly comes from the urban sample. Column 5 shows that the housing wealth effect on education for children living in urban regions increases to 6.9 RMB, which gives an elasticity of housing wealth over total education expenditure equal to 0.06. On the other hand, the housing wealth effect, although positive, appears much smaller in rural areas. The estimated coefficient is only with a 95% confidence interval equal to [-2.631.03, 4.54]. Given a much smaller housing wealth level and education expenditures in rural regions, this estimate gives an elasticity of 0.0094, which is one tenth of the urban measure.

Given that housing wealth is highly illiquid in China and housing with good school access always enjoys a price premium, homeowners who have accumulated enough housing wealth may have strong incentive to liquefy their wealth through a home sale and move. Therefore, (as before) we examine homeowners who have never moved and those who have ever moved throughout the sample period. The results shown in Table 8 confirm our assumption. The first two columns of Table 8 show that housing wealth plays a very limited role for households who have never moved, but has a much larger positive and significant impact on those who have ever moved. Even after controlling for the school enrollment method of the child in Column 3, the result holds. A 100,000 RMB increase in housing wealth leads to a 77.14 RMB increase in total educational expenditure for homeowners who have ever moved. This is more than a 50% increase from the previous result. When we further divide these ever-moved homeowners into urban and rural, we find an even greater housing wealth effect in the urban than in the rural areas. We attribute this effect to the more active housing market and better education resources in the urban areas.

b) Supplementary Education Expenditures

Now we turn to our results that use another measure for education, that is, supplementary education expenditures. Unlike the broader total education expenditures, only 12% of the entire sample of children have supplementary education expenditures. Therefore, we first use a linear probability model with a fixed child effect to examine the binary variable to indicate whether the child has any supplementary education expenditure, and then we use a fixed effect regression model to study the housing wealth effect on supplementary education expenditure when there is a positive expenditure. Table 9 shows the results for the first step of the regression and Table 10 gives the results for the second step. We do not find that housing wealth has a role in determining whether a child has supplementary education expenditures in Table 9. However, Table 10 shows a very large effect of the housing wealth on the amount of supplementary education expenditures when the child receives supplementary education.

**Table 8 Total Education Expenditure Robustness Check (Households Moved)**

| Variable | (1) Never Moved-all | (4) Ever Moved-all | (5) Ever Moved-all Enrolment Methd | (6) Ever Moved-Urban | (7) Ever Moved-Rural |
|---|---|---|---|---|---|
| housing wealth | -0.322 | 8.487*** | 7.714*** | 10.81*** | 6.215** |
| | (1.995) | (1.715) | (1.813) | (3.238) | (2.460) |
| Community housing price | 2,512*** | 1,716*** | 1,823*** | 2,138*** | -872.3 |
| | (408.9) | (365.4) | (385.4) | (669.9) | (749.0) |
| logged family income | 10.43 | 93.53** | 56.37 | 148.5 | 8.964 |
| | (51.83) | (39.86) | (45.18) | (109.6) | (42.01) |
| deposits&cash savings | 43.47*** | 1.813 | -9.880 | -25.22 | 8.563 |
| | (9.056) | (8.393) | (9.086) | (16.32) | (13.24) |
| child's age | -14.85 | 489.5** | 173.3 | 706.6 | -177.8 |
| | (235.4) | (238.1) | (262.1) | (847.8) | (222.1) |
| School attainment level: | | | | | |
| Elementary | -1,929*** | -1,703*** | -2,023*** | -3,407*** | -1,333*** |
| | (167.6) | (142.2) | (178.1) | (490.5) | (157.6) |
| Middle-school | -947.8*** | -1,352*** | -1,966*** | -3,762*** | -985.4*** |
| | (253.2) | (218.1) | (307.1) | (811.6) | (275.0) |
| High-school | 1,828** | 2,116*** | -222.9 | -3,756** | 3,520*** |
| | (716.0) | (583.8) | (855.8) | (1,889) | (918.6) |
| Number of siblings: | | | | | |
| 1 sib | 274.9 | 414.9* | 156.7 | 571.6 | -109.3 |
| | (236.8) | (217.1) | (252.9) | (719.7) | (221.0) |
| 2 or more sib | -447.0 | 5.808 | -211.6 | -410.8 | -69.27 |
| | (407.1) | (380.9) | (444.7) | (1,305) | (376.7) |
| school in large city | 1,625*** | 2,184*** | 1,213*** | 138.8 | 2,200*** |
| | (403.8) | (339.3) | (448.0) | (860.6) | (479.0) |
| international school | 7,484*** | 8,075*** | 7,727*** | 11,534** | 7,184*** |
| | (1,202) | (1,124) | (1,300) | (4,688) | (1,037) |
| Key School/ Class | 439.2*** | 431.5*** | 307.7* | 75.65 | 623.5*** |
| | (169.5) | (143.0) | (164.2) | (400.6) | (154.0) |
| Urban hukou | 871.1** | 772.8** | 592.4 | 1,195 | 181.8 |
| | (439.3) | (381.3) | (429.3) | (883.4) | (446.4) |

***(Continued…)***

**(Table 8 Continued)**

| | | | | | |
|---|---|---|---|---|---|
| Enrollment Method: | | | | | |
| Randomly Assigned | | | 665.5 | -3,576** | 3,687*** |
| | | | (804.2) | (1,745) | (829.4) |
| Merit-Excellency | | | -343.7 | -843.4 | -224.6 |
| | | | (255.3) | (726.2) | (219.9) |
| Sponsor-fee paid | | | 1,036** | -55.54 | 1,760*** |
| | | | (504.8) | (1,479) | (437.4) |
| Social network (Guanxi) | | | -199.9 | -529.2 | -30.99 |
| | | | (325.4) | (912.9) | (284.6) |
| other | | | 224.6 | -1,790** | 741.7*** |
| | | | (303.9) | (805.3) | (273.4) |
| Observations | 6,315 | 9,235 | 7,335 | 2,422 | 4,851 |
| R-squared | 0.195 | 0.189 | 0.205 | 0.215 | 0.253 |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) All regressions have controlled provincial, individual, year fixed effects as well as parental attributes. Parental attributes include age of eldest parent, education level, migrant worker or not.

Increasing housing wealth by 10,000 RMB leads to an increase of 11.35 RMB in supplementary education expenditure, about 0.58% over the average of the supplementary educational expenditure of all homeowners on one child. Nevertheless, if we again investigate the housing wealth effect by splitting the sample into urban and rural, we find that it is 7% higher for a rural child than for an urban child. With a mean supplementary education expenditure of 2644 RMB for urban households, and 903 RMB for rural, the coefficient estimates of the housing wealth variable in Columns 2 and 3 of Table 10 indicate that the effect in rural areas is over three times larger than in an urban area on a percentage basis. If general educational resources and school quality are much more scarce or of lower quality in rural areas than in the city, this finding could imply that rural households with larger housing wealth are more willing to pay for additional education resources available for their children to compensate for the poor quality of the provided general education.

**Table 9 Linear Probability Regression for Having Supplementary Education Expenditures**

| Variable | (1) All | (2) Urban | (3) Rural |
|---|---|---|---|
| housing wealth | 0.000137 | 0.000186 | -7.27e-05 |
| | (0.000100) | (0.000152) | (0.000164) |
| Community housing price | -0.0266 | -0.0475 | -0.00960 |
| | (0.0201) | (0.0293) | (0.0421) |
| logged family income | 0.000422 | 0.00122 | 0.00105 |
| | (0.00272) | (0.00588) | (0.00288) |
| deposits&cash savings | -0.000317 | -0.000208 | -0.000862 |
| | (0.000398) | (0.000571) | (0.000824) |
| child's age | 0.00211 | 0.0301 | -0.00726 |
| | (0.0121) | (0.0343) | (0.0119) |
| have siblings | 0.0593*** | 0.117** | 0.0478** |
| | (0.0191) | (0.0550) | (0.0189) |
| Number of siblings | -0.0148 | -0.0546 | -0.00855 |
| | (0.0132) | (0.0455) | (0.0122) |
| Urban hukou | -0.00201 | 0.0252 | 0.00812 |
| | (0.0325) | (0.0387) | (0.0302) |
| Living in Urban | -0.0166 | | |
| | (0.0176) | | |
| 1.hkurban#1.urban | 0.0303 | | |
| | (0.0388) | | |
| school in large city | 0.0345 | 0.0193 | 0.0173 |
| | (0.0229) | (0.0374) | (0.0304) |
| international school | -0.115 | -0.389*** | 0.0129 |
| | (0.0710) | (0.149) | (0.0743) |
| schqual: KeySchool/Class | 0.0165* | -0.0268 | 0.0400*** |
| | (0.00958) | (0.0191) | (0.0107) |
| childrenschlevel 2, elementary | 0.0110 | 0.00251 | 0.0158 |
| | (0.00949) | (0.0206) | (0.0100) |
| childrenschlevel 3, middlesch | -0.0693*** | -0.166*** | -0.0166 |
| | (0.0144) | (0.0303) | (0.0154) |
| childrenschlevel 4, highschool | -0.166*** | -0.247*** | -0.121** |
| | (0.0394) | (0.0714) | (0.0473) |
| Observations | 21,809 | 7,768 | 13,990 |
| R-squared | 0.027 | 0.059 | 0.025 |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) All regressions have controlled provincial, individual, year fixed effects as well as parental attributes. Parental attributes include age of eldest parent, education level, migrant worker or not.
(2) Binary dep.var.: anyextraeduexp

**Table 10 Supplementary Educational Expenditures**

| Variables | (1) All | (2) Urban | (3) Rural |
|---|---|---|---|
| housing wealth | 11.35*** | 11.29** | 12.07*** |
| | (3.788) | (4.940) | (3.692) |
| Community housing price | -17.94 | -481.8 | 2,454* |
| | (696.6) | (846.9) | (1,453) |
| logged family income | -1.052 | -112.2 | 1.749 |
| | (124.5) | (191.9) | (85.08) |
| deposits&cash savings | 51.66*** | 49.29** | 50.32* |
| | (16.20) | (20.01) | (29.76) |
| child's age | -167.1 | -207.6 | -297.2 |
| | (1,254) | (1,802) | (1,021) |
| have siblings | -171.4 | -3,008 | -85.52 |
| | (1,308) | (3,848) | (781.1) |
| Number of siblings | -918.3 | 1,581 | -610.1 |
| | (1,074) | (3,710) | (498.8) |
| Hkurban | -250.8 | -1,003 | 36.32 |
| | (1,540) | (1,199) | (757.1) |
| urban | -952.6 | | |
| | (1,503) | | |
| 1.hkurban#1.urban | -342.6 | | |
| | (1,628) | | |
| school in large city | -837.6 | -498.7 | -1,514*** |
| | (636.1) | (869.5) | (515.2) |
| international school | -1,027 | -3,230 | -668.9 |
| | (2,434) | (5,182) | (1,240) |
| schqual : KeySchool/Class | 236.4 | 122.9 | 421.7* |
| | (306.6) | (435.0) | (247.8) |
| childrenschlevel2, elementary | -803.3* | -1,245* | -178.2 |
| | (472.5) | (643.4) | (416.9) |
| childrenschlevel3, middlesch | -736.8 | -1,072 | -161.0 |
| | (634.8) | (863.6) | (548.0) |
| childrenschlevel4, highschool | 1,435 | 1,157 | 2,052* |
| | (1,270) | (1,682) | (1,152) |
| Observations | 2,944 | 1,770 | 1,153 |
| R-squared | 0.201 | 0.217 | 0.355 |

***Note***: (1) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (2) All regressions have controlled provincial, individual, year fixed effects as well as parental attributes. Parental attributes include age of eldest parent, education level, migrant worker or not.
(2) Dependent variable: extraeduexp (all positive values)

### 4.2.2 Health Outcome

We turn to the final measure of the quality of a child — health outcome. We merely change the dependent variable of Equation (2) to the current height (in cm) of the child and on the right side, we add average food consumption of the household, whether the child has social medical insurance, and whether he or she has commercial medical insurance, as additional control variables.

Table 11 reports our final set of results. The height of the child is determined not only by innate capacity inherited from the parents but also by acquired nutrition intake. Wealth certainly plays a role here as it could be correlated with the nutrition that a child will acquire. Thus, in our empirical specification here, we use the fixed effect of the child to control for the innate capacity for height. As for the acquired nutrition, the CFPS data does not provide a direct measure for the nutrition intake of children, such as calories per meal, but provides total expenditure on food consumption of households. We use this variable and divide it by the number of in-house family members to obtain the per capita food consumption as a proxy variable. This variable alone may not be enough, because it may neglect the quality of the food consumed and other unobserved factors that affect the actual nutrition intake and the height of the child. Therefore, we add a set of household wealth variables, beyond the housing wealth variable, into the height function. Housing wealth could still matter here as it may capture unobserved factors, such as quality of food intake and space-for-activities, all of which affect the height of a child. In addition, we include the age of the child, and year effects provincial effects in our regression. We also consider possible nonlinear effects of the age variable by including age squared and the interaction term of age and housing wealth[30].

The first column of Table 11 shows that the linear effect of housing wealth effect on the current height of a child is 0.0228, that is to say, a 100,000 RMB increase in housing wealth leads to a 0.2 cm increment in the height of the child, but that incremental effect decreases with age by about 0.02 cm. For example, the marginal effect of housing wealth increase of 100,000 RMB on the height of a 7-year-old child is 0.09 cm, and the marginal effect for an 8-year-old child is reduced to 0.07 cm. In addition, increasing the household per-capita food consumption by 1000 RMB can significantly raise the height of a child by 0.2 cm. When splitting the sample into rural and urban, we find that almost all of the coefficients are universally larger for rural households than for urban. Both the housing wealth effect and the food consumption expenditure show a much larger and significant impact on the height of a child in the rural areas, and these effects basically disappear in urban areas. In a rural area, a 100,000 RMB increase in housing wealth will increase the height of a 7-year-old child by 0.10 cm, and a similar observation is made for a 1000 RMB increase in household

[30] The interaction term between age and average food consumption is very insignificant and small, so we drop it in the final specification.

**Table 11 Fixed Effect Regression for Height of Child**

| Variable | (1) All | (2) Urban | (3) Rural |
|---|---|---|---|
| housing wealth | 0.0228*** | 0.0136** | 0.0369*** |
| | (0.00627) | (0.00677) | (0.0130) |
| Community housing price | -0.915 | -1.013 | 1.213 |
| | (0.661) | (0.652) | (2.138) |
| logged family income | -0.110 | -0.152 | -0.110 |
| | (0.0916) | (0.136) | (0.125) |
| deposits&cash savings | 0.00453 | 0.00268 | |
| | (0.0129) | (0.0125) | |
| Avefood$^{+}$ | 0.000101** | 9.05e-05* | 0.000122** |
| | (4.03e-05) | (5.26e-05) | (6.13e-05) |
| Number of siblings | -0.524 | -0.488 | -0.318 |
| | (0.326) | (0.598) | (0.411) |
| child's age | 5.027*** | 6.133*** | 4.537*** |
| | (0.465) | (0.803) | (0.631) |
| Child's age squared | -0.168*** | -0.199*** | -0.156*** |
| | (0.00791) | (0.0122) | (0.0107) |
| age#housing wealth | -0.00196*** | -0.000874 | -0.00377** |
| | (0.000713) | (0.000738) | (0.00169) |
| have SMI | 0.385* | 0.692** | 0.341 |
| | (0.216) | (0.321) | (0.295) |
| have CMI | 0.862*** | 0.684* | 0.696 |
| | (0.302) | (0.406) | (0.442) |
| Observations | 19,844 | 7,390 | 12,454 |
| R-square | 0.792 | 0.828 | 0.772 |

***Note***: (1) SMI means social medical insurance. CMI means commercial medical insurance. (2) $^{+}$: avefood is measured in 1 RMB while housing wealth and housing price are measured in 10,000 RMB. (3) All regressions have controlled provincial, individual, year fixed effects as well as parental attributes. Parental attributes include age of eldest parent, education level, migrant worker or not. (4) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
(2) Dep.var.: height (in cm.)

food consumption per capita. In an urban area, the marginal effect of housing wealth on the height of a 7-year-old child is 0.07 cm. We interpret this systematic difference between rural and urban as a decreasing marginal contribution of these factors to height since an urban child has a much better endowment in all of these factors than a rural child.

## 5 Conclusion

We use CFPS data from 2010 to 2016 to study the housing wealth effect on fertility decisions of homeowners in China through the lens of the quantity-quality trade-off model in Becker (1960). We have found compelling empirical evidence to support Becker's theory. During our sample period, even with significant relaxation and final removal of the one-child policy, housing wealth does not play a meaningful role in increasing the fertility of homeowners, yet significantly affects their investment in the quality of their children. Using educational expenditure and height of the child to measure the quality of a child, we find that increasing the housing wealth of homeowners will lead to significant increases in these measures.

Our analysis has considered the complications of the distinct urban and rural dual systems in China in the midst of its rapid economic development for both the implementation of birth control policies as well as housing market reform. As a result, we separate the urban and rural homeowners, and conduct a number of robustness checks that concern various demographic and institutional issues that may undermine our wealth effect estimates. We confirm the existence of the Beckerian quantity and quality trade-off in the fertility decision of Chinese homeowners across urban and rural areas.

We find different, but perhaps expected housing wealth effects between the urban and rural areas on the quality measures of a child. The urban sample reveals a much larger impact of the housing wealth on the overall education expenditure of a child, while housing wealth changes have an impact on supplemental education expenditures in rural areas. It is possible that rural households find supplemental expenditure a more salient method of improving the educational quality of their child in areas that overall lack quality schools. We also find that housing wealth has a positive impact on the height of a child in rural areas, even accounting for food expenditure, but not in urban areas. It is possible that (housing) wealth creates access to higher quality food intake in rural areas, but the overall higher quality of food in urban areas renders housing wealth less important for the height of their child.

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