Housing Wealth, Fertility, and Child Quality

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Abstract

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 tiny effect in rural. However, a rise in housing wealth does lead to increased expenditure on a child's education for households in both rural and urban areas (although of different types of expenditure) and increased child's height in rural areas. In terms of Becker (1960), increased wealth tilts the tradeoff between child quality and quantity in favor of the former.

Keywords: China, fertility, wealth, housing values, one child policy, quality-quantity tradeoff
JEL Codes: J13, R31, I15
* Corresponding author (ncoulson@uci.edu). We would like to thank participants of the 2019 International Symposium on Labor Economics at Chinese University of Hong Kong (Shenzhen). Yanping Qin, Dianlan Zhang, and Jianchao Gao provided outstanding research assistance. Financial support from the Future Scholar Plan of Shandong University, the Humanity and Social Sciences Research Grant from Shandong University (IFYT18022), and the Key Essential Research Project Grant of the National Social Science Foundation of China(17ZDA038) are greatly acknowledged.

I. Introduction

Becker (1960) noted the paradox of the relationship between household fertility and household income. Children are a normal good, so that 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 have 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) noted, by the recognition 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 child's outcomes also increases and the parents can substitute quantity with quality. Cross-country studies (e.g. Lawson, Alvergne and Gibson (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 found that there is a tradeoff which favors quality over quantity as income rises. Studies in this area for developing countries go back at least to Wolfe and Behrman (Nicaragua, 1987) and include Dang and Rogers (Vietnam, 2015), Ponczek and Souza (Brazil, 2012)) and others.

There are a couple of challenges to 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 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 women's wages 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 did yield 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 by Dettlling and Kearney (2014) and Lovenheim and Mumford (2013) of changes in US home prices to assess the impact of wealth changes on fertility (though not child quality measures). This is part of a larger literature that investigates the effects of home price increases on consumption in general (Bostic et al (2009), Gan (2010), Browning et al (2012)). House price changes are perhaps the most important means by which household increases wealth and more importantly, they are plausibly exogenous to fertility decisions, unless one believed that households move to locations that are anticipated to have large growth in home prices for the purpose of raising one's ability to have children. Both of these papers indeed found 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; (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 by the institution of the one-child policy. Concerned about its rising population, the Chinese government in 1979 announced a policy limiting 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 family's first child was a girl. Also, households where both parents are only children were exempted from the policy and were able 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 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 those children that are born. Certainly, popular reaction has stressed the theme of the "little emperor" -- the only children, 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 account of the exceptions to the one-child rule as well. It is of interest to note, however, that Qian (2017) found that having a second child *increases* the amount of education of the first child, which would seem to contradict the notion that 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, though the effects are modest. A similar approach is taken by Liu (2014) who uses not only education level, but also the child's height to measure child quality. The effects on the latter variable from reduced fertility are, in fact, stronger 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 China's increased prosperity.

The use of housing wealth as the shock to family resources is of particular interest given the simultaneous transformation of China's housing market. 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 (2015)) 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 OECD countries.

The 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 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 (2009), Chen et al (2018)). This is something 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 savings rates out of income as a function of housing wealth centile. For the lower percentiles, it is of significance to note that savings rate declines 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 not as much need to proportionally consume out of housing wealth.

[Figure 1 inserted here]

Given its putative role in determining overall consumption, it is of interest to see if it 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 aggregate fertility rates, and the land price index developed by Wharton Business School and Tsinghua University. We observe in this data the well-known rise in China's home prices, with particular acceleration toward the latter part of the sample. 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 at 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

[Figure 2 inserted here]

We use the China Family Panel Survey 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 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.

Because we have repeated observations of the same household over the waves of the panel we are able to employ women-specific fixed effects in the fertility equation, and child-specific fixed effects in the quality equation, 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)

[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 restriction as soon as possible.

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. 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 quality of life and in turn fertility. Among these might local prosperity, school quality and environmental measures. With these controls and the fixed effects, we can be relatively confident that our results suggest causal relationship between housing wealth and the outcomes of interest.

These 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 employment 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 do find that housing wealth does lead to greater expenditure on supplemental educational expenditure. This is congruent with a story that says that the cost of quality matters. In rural areas, obtaining high quality educational resources is very difficult, while in urban areas, it is not cheap, but it is at least available (Ayoroa etc, 2010). A cheaper way to increase child quality in rural areas is to provide better nutrition.

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

II. Conceptual Framework

We adopt the consumer good perspective to examine the household's child-bearing decision as discussed extensively in Becker (1960). The seminal model, developed in Galor and Moav (2002) and simplified by Becker etc. (2010), illustrates the main features of the theory of household demand for children that is closely related to the empirical facts we have identified in the data. In this framework, the household has full control over their fertility decisions given contraception technology. Assume a household's lifetime utility 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 governing the household's preference between quantity and quality of children; and $u_2(c)$, the utility from consumption of all other goods. Quality here merely represents that 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),

$$U = \gamma \cdot u_1 + (1-\gamma) \cdot u_2 = \gamma \cdot (\ln n + \beta \ln e) + (1-\gamma) \cdot \ln c$$

where $0 < \gamma < 1$ is the household's preference parameter toward children including both quantity and quality, $0 < \beta < 1$ is the weight of quality. Let I be thelifetime 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 children's quality. 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 children's quality is a concave function of the quantity[2].. This assumption is for simplification purposes, but it recognizes that there is a tradeoff between quality and quantity of children. The third share is the expenditure on household's other consumption.

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

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

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

and

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

Based on the derived household's optimal choice set, we make following observations. First, both quantity and quality of children depends 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 increases faster than the wealth increase, the optimal number of children for the household will fall. In fact, in many developing countries, rapid urbanization and industrialization has greatly increased wealth accumulation, yet it has also significantly raised the 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.

[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 thus is considered by the parents as savings for the future.

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 a 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 areas than in urban, while it is cheaper 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 greater in rural than that in urban whereas the quality of the former is less than the later.

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

Fourth, the lumpy adjustment of children's quantity leads to an 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 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 increases in quality and in 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, it requires the minimum wealth increment at least $\kappa \cdot p_n$, 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 they will allocate this incremental wealth between consumption of other goods and the quality of current children to maximize their utility. Their new maximization problem is

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

subject to

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

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

[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.

The new conditions for optimal quality and consumption are:

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

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

Let $I^1 = I^0 + \theta \cdot p_n$, as long as $\theta < \kappa$, the household will continue choose their optimal consumption and quality of children according to equations (4) and (5) and their utility also increases as θ increases. This is a situation in which we observe positive wealth effect on both the household's consumption and children's quality, 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. Depending on their utility parameters, some households may stay with n^0, and others may decide to have additional child[5]. Those who decide to have one more child must have much 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 utility of , $\gamma \cdot (\ln(n^0 + 1) - \ln n^0)$, at the same time delivering a fall in child quality (and consumption).[6] Therefore, unless the increase in utility from quantity of children is greater than the reduction from quality and consumption, bearing an additional child is not an attractive choice to the household.

Lastly, combining all previous claims, consider the situation when birth control policy limits the freedom of a household's fertility choice, an increase in wealth does not necessarily result in an increase in children quantity even relaxing such policy. The lumpy adjustment of quantity requires much bigger rise in wealth and stronger quantity preference to result in more children. Moreover, any change of relative price between quantity and quality will certainly diminish household's willingness to bear more children. For households with very high β and low γ whose optimal quantity of children is far below the policy cap, neither increasing wealth nor an removal of the policy cap would lead to an increase in quantity of children. Only households whose optimal quantity of children is over the policy cap would observe an increase in quantity after the cap is eliminated. But 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 the quantity of children increase.

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 on consumption. The trade-off between 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

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[5] Obviously we ignore the occasions when 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.

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 γ, causing more households to bear fewer children. In our following empirical analysis, we use the exogenous housing wealth change as measure for the wealth change to test the wealth effect on the quantity and quality of children.

III. Data

To conduct the empirical analysis, we employ waves of the China Family Panel Survey (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 interviewed a nationally representative sample of 14,960 households, 33,600 adult individuals and 8,890 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 family members aged 9 years old and over, while children under age 9 have their parents help with the survey questions. The questionnaire design and implementation of CFPS has mimicked 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 piece of empirical analysis examines the correlation between household housing wealth and a female household member's fertility decision. Accordingly, our data include, at the household level, the purchase price or construction cost of housing, current housing value, household income and savings, and at the individual level, all female household members between 16 and 51 years of age 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 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 births 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 7,284 women from 7,165 households, and around 28,000 female-year observations in total. The average female age is 34 and average number of children is 1.37. The majority of these women, over 60%, obtained education of no more than high-school level and over a half live in a rural area. Other important

[7]The CFPS survey samples from 25 provinces and provincial metropolitan cities.

[8]For more information about 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 aged beyond 45 in the sample because the advancement of fertility technology allows women beyond 45 able to have babies and the relaxation and final elimination of 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 marriage age for woman in China is 20, we observe the minimal age of bearing a child in our sample is 16. Since in China family has much stronger influence upon woman's fertility decision particularly in rural, we consider the lower bound of the woman's age in our sample is 16.

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

factors that potentially affect a woman's fertility decision include ethnicity, whether they are employed in government institutions or state-owned enterprises, and whether they are a migrant or not.

As for household housing wealth, we observe that 84.7% of 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[11]. In our sample, the households' main housing wealth is the owner-occupied primary dwelling unit. Although 15.3% of homeowners own more than one unit, on average the market value of primary dwelling unit consists of 93% of total housing wealth of all households.

[Table 1 inserted here]

As mentioned in the introduction, the degree of strictness of one-child policy implementation has always varied across regions according to the couples' demographic characteristics. In general, it is much stricter in cities than in villages, and in work units of government institutions and state-owned enterprises, than in private or foreign entities[12]. Since housing prices rise much faster in urban than rural areas, we compare the fertility of the urban and the rural households alongside household housing wealth[13]. 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 displays a decreasing average birth rate by the sample female household members and rising housing wealth level of these households between 2010 and 2016. By all measures, the data has shown a clear pattern of consistent increasing housing wealth by Chinese households on average. The household average housing wealth level measured by their primary dwelling unit has doubled from 172,800 yuan to 366,300 yuan and the overall housing wealth level has almost tripled by 2016. Meanwhile the community average housing price has increased from around 1,068 yuan per squared meter to over 2,784 yuan per squared 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 decreases from 0.089 to 0.061, a 31% drop from 2010.

[Table 2 inserted here]

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[11] While self-estimates of home values are potentially biased upwards, the fertility and other decisions we examine are based on those self-estimates.

[12] 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, Li & Feldman, 2013; Ren, 2012.)

[13] 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.

The second piece of our empirical study concerns the relationship between housing wealth and child quality through the correlation between child's education expenditure, health outcome and household housing wealth change. 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 for every child, so that the education attainment level relates more to a child's age than household's wealth. 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 China provided legal grounds for private educational business development. Such enterprises offer education from kindergarten to college. Households can send their children to these private schools. According to the national statistics, the overall enrollment in non-state education facilities increased from 10 million to 48 million between 2002 and 2016, which accounts 18.94% of all students nationwide, up from 5.34% in 2002[14].

Hence, we collect the data on educational expenditure from CFPS for each child under the age of 16 for all homeowners, between 2010 and 2016. Data collected include the child's age, school attainment level, gender, current height, hukou status, urban residency status and educational expenditures on this specific child. We have 13,159 children from 8,486 households, resulting in an unbalanced panel of 29,837 child-year observations.

Table 3a shows the summary statistics of educational expenditures, other demographics for these children as well as their family's housing wealth and the parents' key demographics. The average child's height is 115.5 cm (about 3.8 feet tall). The average education expenditure per child is 1,977 yuan, about 4.4% of 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 display the summary statistics for this supplementary education expenditure as well. About 12.8% of children have such expenditures paid by their families. The overall average is 289.5 yuan with a substantial standard deviation of 1,673 yuan. If we only consider households with positive figures, the average increases to 1,997 yuan with a standard deviation of 3,990 yuan.

Nearly 58% of children attend kindergartens, 31.2% attend elementary schools and 10.7% attend middle schools. In addition to school levels, we have three variables measuring the quality of school or education that the child has 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* that the attended school or class being 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 faculty are from overseas. These three variables are very important for measuring the educational quality because in China such a school or a class with any of these features generally has much better teachers and other resources than those that are not (Dong & 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

[14] Source: the Ministry of Education of China, retrieved on May 22, 2019, from the government official website: http://www.moe.gov.cn/s78/A03/ghs_left/s182/moe_633/

local house price measure)[15]. In our sample, 11.5% of the observed children attend a key school or a key class, 8.24% attend a school in provincial capital city or a provincial-level metropolitan city, and 0.11% attend an international school.

In China, local registered residency, called *hukou*, is very important to households who live in an urban area. *Hukou* affects local residents' access 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 their children's education, it is often necessary to send their kids back to their rural hometowns for schooling. In our sample, 36.2% of children live in an urban area while only 17.7% have urban hukou. *Hukou* also has potentially a large impact upon households' housing wealth. Given 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 qualifications of potential buyers (Coulson and Tang, 2017). Therefore, we construct a *migrantkid* variable, indicating whether the child's parent is a migrant without local hukou[16]. Although 80.1% of children for whom neither parents is a migrant, there still remain 20% of children whose parents are migrants. Among them, 7.37% have parents are both migrants, and 12.5% have one migrant parent. This variable aims to control for unobserved household heterogeneity that affect both their child's access to good education as well as the household's access to housing.

Table 3b shows the difference in quality measures of children between urban and rural in households. The differences are very large. Although the mean age from these two subsamples are similar, children living in the urban area are 5 cm (almost 2 inches) taller, and less likely to have any sibling. Urban children also have much bigger 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.

IV. 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.

A. Fertility Regression

We adopt a linear probability fixed effect regression model similar to Loveheim & Mumford (2012) and specify our benchmark fertility econometric regression as the following:

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[15] We do not distinguish whether the attended school is public or private, because CFPS does not carry the question consistently in these surveys across our sample periods.

[16] In China, a child's hukou status does not depend on the place of birth, but in most cases determined by the parents' hukou status.

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

where $\boldsymbol{Z_{it}}$ is the vector of individual and household characteristics in year $\boldsymbol{t}$, including age, age square, marriage status, education attainment, possession of an urban hukou, migrant status, employment in a government agency or state-owned enterprise, household income, savings, average community housing price and current provincial residence when the interview took place. The $\mathrm{f}(.)$ function is a linear function of set of variables, with interactions, including: a vector $\boldsymbol{KidN}_{it}$,the female household member's birth history, namely whether she has already had 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 a two-child policy; and ΔHW_{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 reply 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 community housing price 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 household's fertility decision as well. For most households, fertility choice is separated from housing location choice as it is hard to consider 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 good education for their child will buy a home in a preferred-school district where we observe significant increase in housing price. Yet since there usually are a few years before the newborn to be eligible for any formal schooling, the parents do not have to do so when the child is born. In our later robustness check, we restrict our sample to those who never moved to circumvent possible endogeneity problem due to this reason.

i. 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 results for the urban sample, and table 5 for the rural sample. The first three columns of both tables show the baseline fixed effect regression results for women's fertility decisions. To identify the housing wealth effect, we employ a set of controls to capture a woman's fertility preference such as age, education, marriage status, and provincial location. We also use 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 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 housing wealth effect on fertility decision, we have included the quadratic term of ΔHW_{it} in our baseline regression as well as all possible interaction terms between ΔHW_{it}, the woman's birth history and the policy shift.

[Table 4 and table 5 inserted her

Comparing the results from first columns of table 4 and table 5, we do not find any meaningful empirical evidence to support the idea that housing wealth increases a woman's fertility rate 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 housing wealth effect. . The quadratic term of housing wealth increase in table 4 in all specifications for urban sample all have positive coefficient estimates though with very small magnitudes. This implies that only when the household observe a significantly very 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 household's housing wealth increase is greater than 3.07 million yuan before 2015, and 4.18 million yuan after 2015. Recall the mean of housing wealth change in urban sample is around 0.3 million yuan. Such a hypothetical housing wealth increase lies in the top 3% households in our urban sample. (In our rural sample,of the quadratic housing wealth term is statistically insignificant and substantively neglible,,so we only report the results with the linear term.)

In rural areas, a 10,000 yuan increase of housing wealth before 2015 will drive up a woman's birth probability by 0.177 percentage point if she is at that time childless. Given 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 yuan leads to a fertility increase on average just by 0.032 percentage point in urban and by 0.029 percentage point in rural areas. Household's total annual income instead reduces fertility significantly in rural locations, however this is negligible in magnitude as the coefficient is as low as -0.005. Increasing a household's total income by 1% is associated with a reduction in the woman's 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 woman's probability of bearing 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 upon the woman's fertility in the urban area, but not so in the rural[17]. 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 the government institution or state-owned enterprise has significantly affected the fertility, though the sign is positive in the urban but negative in the rural. The insignificance may be driven by this

[17] The birth planning policies are applied discriminatorily according to a woman's hukou status. Yet the policy implementation is conducted by local government agency and the strictness differs between the urban and the rural in general. A woman can have an urban hukou yet live in rural. Thus according to the hukou status, she normally cannot have more than one child, yet she possibly could have more if she or her close family lives in rural and thus faces less scrutiny.

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

Since by law China's birth planning policies have largely limited the maximum number of children a couple can have, the fertility choice may become a choice only to a woman who has not had already reached the birth limit. Therefore, in Columns 2 and 3 of Tables 4 and 5 we limit our sample to women with zero or 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 rural areas. Though the joint test for urban women without any child sample 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 from table 4 are close to zero, yet it is 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[18]. It seems that the housing wealth effect on fertility for rural women if any is not related to their birth history.

ii. Robustness Check

Given the rapid housing price increase during this short time period 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 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 household's housing wealth and also their fertility decisions. Although our measure of housing wealth is meant to capture unexpected housing wealth change, endogeneity could still arise if households have better knowledge of 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's 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. Since the late 1990s, Chinese government began to allow couples in which both husband and wife were of only-child families to have two children. Provincial governments had full discretion with respect to this policy's implementation, but by 2011, all provinces had adopted this policy. In late 2013, during the Third Plenary Session of the 18th CPC Central Committee, the government relaxed the aforementioned policy to all couples where even one spouse is from an only-child family. 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 woman's probability to have more than one child under all these policy adjustments. Thus the presence or absence of siblings potentially affects women's fertility decision through her

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

preferences (Morosow & Kolk,2020)[19]. 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 strictness in the implementation of birth planning policies between urban and rural regions, we again examine these two groups separately as well. We run the same set of regressions for these different samples. The last three columns in table 4 and table 5 show the results. Again we find that the results are quite consistent with our baseline models. Table 4 does show a rather stronger negative (though still very small in magnitude) housing wealth effect for women without any siblings those with siblings for almost all range of housing wealth increase in the urban area as the joint test of housing wealth effect for the former yields a p-value of 0.097. As a point of comparison, we compute the marginal effect when a household's housing wealth increases by 3,000,000 yuan, 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, over 3 million yuan, will the marginal effect for women without siblings and only one kid be positive, and even then this remains quite small in magnitude[20].

In table 5, we find that housing wealth matters to a woman's fertility decision for rural homeowners before the adoption of universal two-child policy if she has a sibling, but not at all for a woman if she does not have any sibling. Furthermore, column 5 in table 5 shows that the mild positive impact of housing wealth on fertility in the rural is mainly delivered by women with siblings and zero-or-only-one child prior to the survey year. Though by law that women without any siblings are allowed to have more than one child, housing wealth changes are clearly not a trigger for such women to have additional children.

[Table 6 inserted here.]

In Table 6 we consider three other subsamples of our data. First, we consider households that are homeowners throughout the sample period so that we may avoid the situation when people became homeowners and changed their housing wealth holdings so that they can get married and have a child (Wei et al, 2017). Second, we examine homeowners that have never moved during our sample period. Therefore, we circumvent the situation that 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 home price environment, which would complicate the relationship between housing wealth and child-bearing decision. Looking at debt-free homeowners circumvents this issue.

Table 6 shows the results for these three tests[21]. Again we have not found any meaningful empirical evidence to support the idea that housing wealth increases fertility. Housing wealth simply does not matter much to Chinese urban households

[19] Morosow & Kolk (2020) find that both the birth order and the size of siblings affect women's fertility.

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

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

for their fertility decisions, and not that much to rural households either. The results discussed earlier that find correlations between these variables for the US simply do not carry over to the Chinese case.

B. Expenditures on child quality

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

i. Education Expenditures

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

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

where in equation (2) α_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 siblings, school attainment level, attended school characteristics, hukou status, whether in urban environment or not, and migrant status. Vector $\boldsymbol{Z_{it}}$ gives the household characteristics and parent attributes that may affect the child's educational expenditure, including household income and savings, parent education, age, and whether holding leadership position in employment. We again include the average community housing price as an important control for local quality of life which is potentially correlated with household's housing wealth and school education quality. $year_t$ is a set of year dummies, capturing time-variant unobservables that affect educational expenditure such as the macroeconomic environment, policy shocks and so on. φ_i is the provincial dummy where the household currently resides to measure the regional differences in educational expenditure across difference provinces in China.

a) Total education expenditures

Table 7 reports the results from fixed child effect regressions of total educational expenditures on household housing wealth, a child's demographic characteristics and his or her parents' attributes[22]. The first four columns use the full sample and the remaining two columns use subsamples determined by whether the child lives in urban or rural areas. Each specification using the full sample shows a quite consistent result of the marginal effect of housing wealth upon a child's total education expenditure. Increasing housing wealth by 100,000 yuan will increase the spending on a child's education by around 48 yuan 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 yuan, the elasticity of housing wealth over total education expenditures is about 0.036. We also find that the average community housing price strongly and significantly increases the child's total educational expenditures

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

[Table 7 inserted here.]

Additional children reduce the expenditure on each child. We find a significant drop in a child's education expenditures if the parents have more than two children, but a rise if they only have two children. Household cash deposits and other savings has a much larger and significantly positive impact upon the total education expenditure. A 10,000-yuan increase in savings leads to an increase in education expenditures by 22.44 yuan, over four times that of the housing wealth effect. Though 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

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 yuan, which gives an elasticity of housing wealth over total education expenditure equal 0.06. On the other hand, the housing wealth effect, though 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, 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 incentives 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. Results shown in table 8 confirm our conjecture. The first two columns of table 8 show that housing wealth play a very limited role for households who have never moved, while it has a much bigger positive and significant impact upon those who have ever moved. Even after controlling for the child's school enrollment method in column 3, the result remains. A 100,000 yuan increase in housing wealth leads to a 77.14 yuan increase in a child's 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 even greater housing wealth effect in the urban than in the rural. We attribute such effect to the more active housing market and better education resources in urban areas than in rural.

[Table 8 inserted here.]

b) Supplementary education expenditures

Now we turn to our results that use another measure for a child's education, supplementary education expenditures. Unlike the broader total education expenditures, only 12% of the whole sample of children have supplementary education expenditure. Therefore, we first use a linear probability model with fixed child effect to examine the binary variable indicating whether the child has any supplementary education expenditure, and then we use fixed effect regression model to study the housing wealth effect upon supplementary education expenditure when there is positive expenditure. Table 9 shows the results for the first step regression and table 10 gives the results for the second step. We do not find that

housing wealth has played a role in determining whether a child has supplementary education expenditures in table 9. However, table 10 shows a very large effect of housing wealth upon the size of supplementary education expenditure when the child has received it. Increasing housing wealth by 10,000 yuan leads to an increase of 11.35 yuan in supplementary education expenditure, about 0.58% over the average of all homeowners' supplementary educational expenditure 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% larger for a rural child than for an urban child. With a mean supplementary education expenditure of 2,644 yuan for urban households, and 903 yuan for rural, the coefficient estimates of the housing wealth variable in column 2 and column 3 in 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 provided general education.

[Table 9 inserted here.]

[Table 10 inserted here.]

ii. Health Outcome

We turn to the final measure of child's quality— health outcome. We merely change the dependent variable of Equation (2) to child's current height (in cm) and on the right hand side, we add household average food consumption, 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. A child's height 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 correlate with nutrition that a child will acquire. Thus in our empirical specification here, we use the child's fixed effect to control for the innate capacity for height. As for the acquired nutrition, CFPS data does not provide a direct measure for a child's nutrition intake such as calories per meal, but it does provide household total food consumption expenditure. 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 ignore the quality of the food consumed and other unobserved factors that affect the actual nutrition intake and the child's height.. 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 the unobserved factors, such as quality of food intake and space-for-activities, that affects the child's height. In addition, we include the child's age, year effects and 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[23].

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

The first column of table 11 shows that the linear effect of housing wealth effect upon a child's current height is 0.0228, that is to say, a 100,000-yuan increase in housing wealth leads to a 0.2 cm. increment on a child's height, but that incremental effect decreases with the child's age by about 0.02 cm. For example, the marginal effect of housing wealth increase of 100,000 yuan on a child's height for a 7-year-old child is 0.09cm, and the marginal effect for an 8-year-old child reduces to 0.07cm. In addition, increasing the household per-capita food consumption by 1,000 yuan can raise the child' height by 0.2 cm significantly. When splitting the sample into rural and urban, we find that almost all 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 upon a child's height in rural, and these effects basically disappear in urban. In a rural area, for a 7-year-old child, a 100,000-yuan increase in housing wealth will raise the child's height by 0.10 cm, and a similar effect is observed for a 1,000-yuan increase in household food consumption per capita. In an urban area, the marginal effect of housing wealth for a 7-year-old child on his or her height is 0.07 cm. We interpret such 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 these factors than a rural child.

V. Conclusion

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

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

We find different, but perhaps expected, housing wealth effects between urban and rural areas on a child's quality measures. The urban sample reveals a much bigger impact of housing wealth on a child's overall education expenditure, while such wealth changes have an impact on supplemental expenditure in rural areas. It is possible that rural households find supplemental expenditure a more salient method of improving their child's educational quality in areas that overall lack quality schools. We also find that housing wealth has a positive impact on child height 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 that the overall higher quality of food in urban areas renders housing wealth less important for child height.

Financial support from the Future Scholar Plan of Shandong University, the Humanity and Social Sciences Research Grant from Shandong University (IFYT18022), and the Key Essential Research Project Grant of the National Social Science Foundation of China(17ZDA038) are gratefully acknowledged. The authors declare they have no conflict of interest.

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Table 1. Housing wealth, fertility rate and women characteristics

VARIABLES	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 units 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 debts	27,979	2.547	10.28	0	400
birth	Any new birth in year	28,275	0.077	0.266	0	1
lagchildn	Num. of children prior to the 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	whether being married	28,275	0.705	0.456	0	1
eduobtained	Education obtained	23,657	2.671	1.347	1	8
hkurban	if having urban hukou	28,275	0.196	0.397	0	1
urban	Living in urban area	23,201	0.417	0.493	0	1
migrant	Whether being a migrant	27,978	0.158	0.365	0	1
emplgovsoe	Whether 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	Being a han ethnic	28,275	0.893	0.309	0	1
childsexr_tot	Boys ratio	22,105	0.546	0.397	0	1

Note: * variables with asterisks are measured in 10,000 RMB yuan. 1 USD is approximately 6.5~6.8 RMB yuan between 2010 and 2017.
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.

Table 2. Women's Fertility and Housing wealth

A. Differences between urban and rural homeowners

	Urban		Rural	
VARIABLES	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 overtime

YEAR	birth	childnm_ aliv	hwealth_ primd	hwealthdiff	hunits	hwealth_tot	hwealthdiff <0	Community _price*
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: * community average housing price 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 for women aged 16-51 in 2010 and tracked down.

Table 3a. Summary Statistics for housing wealth change, education expenditures, children's characteristics and parents' characteristics

VARIABLES	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	Per person food consumption expenditure (in 1 RMB)	3064.14	3215.28	0	135000
Children's attributes:					
gender	Gender:0-girl, 1-boy	0.528	0.499	0	1
age		7.334	4.507	0	15
height	Current height (in c.m.)	115.5	32.50	21	215
hkurban	Urban hukou	0.177	0.381	0	1
urban	residency in urban	0.362	0.481	0	1
keyschclass	Key school/class	0.115	0.319	0	1
schcity	School in provincial city	0.0824	0.275	0	1
schinternat	International school	0.00114	0.0337	0	1
Children's school level					
kidsschlevel1	Kindergarden	0.575	0.494	0	1
kidsschlevel2	Elementary	0.312	0.463	0	1
kidsschlevel3	Middleschool	0.107	0.309	0	1
kidsschlevel4	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
Parent 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 graduate		0.00349	0.0590	0	1
PhD.		0.00023	0.0150	0	1
migrkid1	Both parents not migrant	0.801	0.399	0	1
migrkid2	Either mom or dad migrant	0.125	0.331	0	1
migrkid3	Both parents migrant	0.0737	0.261	0	1

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

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

Table 4. Fertility for Women in Urban Area

VARIABLES	(1) All	(2) With 0/1 lagkids	(3) With 0 lagkids	(4) Women with Siblings	(5) Women with Siblings/0-1 kids	(6) Women without Siblings
#Kids prior: 1	-0.525***	-0.589***		-0.540***	-0.602***	-0.504***
	(0.0178)	(0.0190)		(0.0190)	(0.0206)	(0.0566)
#Kids prior: 2 or more	-1.047***			-1.073***		-0.726***
	(0.0257)			(0.0263)		(0.130)
Policy2:after 2015	0.124***	0.169***	0.362***	0.104***	0.148***	0.182***
	(0.0205)	(0.0225)	(0.0410)	(0.0227)	(0.0252)	(0.0617)
#Kids # Policy 2						
1 & after '15	-0.0609***	-0.0526**		-0.0420*	-0.0366	-0.123*
	(0.0209)	(0.0219)		(0.0231)	(0.0246)	(0.0681)
2 or more after '15	-0.145***			-0.118***		-0.343***
	(0.0216)			(0.0237)		(0.102)
housing wealth	-9.30e-05	-0.000187	-0.00105**	-8.04e-05	-0.000188	-0.000564
	(0.000219)	(0.000236)	(0.000422)	(0.000253)	(0.000272)	(0.000619)
Housing wealth squared	6.23e-07**	5.13e-07	2.57e-06***	2.74e-07	1.96e-07	2.38e-06**
	(2.75e-07)	(3.33e-07)	(8.64e-07)	(2.98e-07)	(3.68e-07)	(1.01e-06)
Housing wealth after '15	-0.000528**	-0.000473**	-0.000971**	-0.000289	-0.000324	-0.00145***
	(0.000220)	(0.000233)	(0.000378)	(0.000310)	(0.000325)	(0.000499)
Housing wealth:						
Before 2015, only 1 kid	-0.000289	-0.000225		-0.000110	-7.56e-05	-0.000443
	(0.000229)	(0.000240)		(0.000266)	(0.000284)	(0.000600)
Before 2015, 2 or more	-0.000403			-0.000255		-0.00150*
	(0.000273)			(0.000305)		(0.000884)
After 2015, only 1 kid	9.92e-05	0.000162		0.000102	0.000232	0.000967*
	(0.000203)	(0.000211)		(0.000298)	(0.000313)	(0.000518)
After 2015, 2 or more	0.000276			7.28e-05		0.000550
	(0.000248)			(0.000335)		(0.000569)
Community housing price	0.0188	0.0135	0.0183	-0.00435	-0.00634	0.0532
	(0.0125)	(0.0138)	(0.0327)	(0.0145)	(0.0161)	(0.0336)
Women's age group						
Below 30	0.0544***	0.0540**	-0.0288	0.0623***	0.0674***	0.0462
	(0.0194)	(0.0221)	(0.0319)	(0.0210)	(0.0246)	(0.0558)
30-35	0.105***	0.118***	0.0350	0.0965***	0.124***	0.151*
	(0.0263)	(0.0306)	(0.0686)	(0.0281)	(0.0339)	(0.0795)
35- 40	0.120***	0.113***	0.0821	0.122***	0.134***	0.0836
	(0.0318)	(0.0379)	(0.112)	(0.0336)	(0.0414)	(0.107)
40 above	0.101***	0.0614	-0.0207	0.105***	0.0885*	0.0487
	(0.0370)	(0.0452)	(0.162)	(0.0385)	(0.0484)	(0.156)
savings	0.000316	0.000299	0.00102*	6.68e-05	4.86e-05	0.000893
	(0.000233)	(0.000267)	(0.000601)	(0.000268)	(0.000325)	(0.000569)
logged family income	2.39e-05	0.000612	0.0136	0.000802	0.000725	-0.00595
	(0.00324)	(0.00458)	(0.0113)	(0.00326)	(0.00474)	(0.0142)
married	0.274***	0.285***	0.246***	0.244***	0.262***	0.359***
	(0.0183)	(0.0200)	(0.0307)	(0.0199)	(0.0223)	(0.0516)
urban hukou	-0.0392**	-0.0460**	-0.0277	-0.0308	-0.0326	-0.0935
	(0.0186)	(0.0226)	(0.0481)	(0.0187)	(0.0233)	(0.0832)
migrant ,	-0.0414**	-0.0390*	-0.0177	-0.0467***	-0.0412*	-0.0127
	(0.0178)	(0.0221)	(0.0447)	(0.0178)	(0.0226)	(0.0842)
Hkurban&migrant	0.0411	0.0525*	0.0155	0.0388	0.0328	0.0129
	(0.0258)	(0.0303)	(0.0584)	(0.0270)	(0.0325)	(0.0969)
Employed gov/soe	0.0152	0.0113	0.0297	0.00914	0.00895	0.0361
	(0.0140)	(0.0155)	(0.0343)	(0.0148)	(0.0168)	(0.0445)

year = 2012	0.0157*	0.0491***	0.161***	0.0171**	0.0482***	0.00257
	(0.00836)	(0.0103)	(0.0244)	(0.00861)	(0.0110)	(0.0303)
year = 2014	0.0122	0.0685***	0.229***	0.0123	0.0654***	0.00134
	(0.00960)	(0.0121)	(0.0316)	(0.00984)	(0.0129)	(0.0368)
Observations	8,612	5,944	1,879	7,675	5,090	937
R-squared	0.323	0.296	0.269	0.335	0.291	0.311
F-test	1.674	1.643	3.698	0.552	0.759	1.740
Prob>F	0.111	0.145	0.0115	0.795	0.579	0.0972

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.

Table 5.Fertility for Women in Rural Area

VARIABLES	(1) All	(2) With 0/1 lagkids	(3) With 0 lagkids	(4) Women with Siblings	(5) Women with Siblings/0-1 kids	(6) Women without Siblings
#Kids prior: 1	-0.409***	-0.586***		-0.397***	-0.574***	-0.650***
	(0.0165)	(0.0210)		(0.0169)	(0.0217)	(0.0832)
#Kids prior: 2 or more	-0.847***			-0.834***		-1.100***
	(0.0196)			(0.0199)		(0.119)
Policy:after 2015	0.0650***	0.223***	0.402***	0.0630***	0.218***	0.109
	(0.0211)	(0.0277)	(0.0390)	(0.0216)	(0.0285)	(0.115)
#Kids # Policy 2						
1 & after '15	-0.0101	0.0345		-0.0109	0.0340	0.0462
	(0.0224)	(0.0265)		(0.0230)	(0.0274)	(0.116)
2 or more after '15	-0.0942***			-0.0911***		-0.145
	(0.0209)			(0.0215)		(0.112)
housing wealth (b1)	0.00177***	0.00129*	-0.0004	0.0017***	0.00129*	0.0010
	(0.0005)	(0.0007)	(0.0007)	(0.0006)	(0.00073)	(0.0019)
Housing wealth after '15	-0.000786	-0.000455	-3.44e-05	-0.000667	-0.000251	-0.00124
	(0.0006)	(0.0008)	(0.0008)	(0.0008)	(0.0009)	(0.0017)
Housing wealth before'15 w:						
1 kid prior(b2)	-0.00152***	-0.00133*		-0.00139**	-0.00130	-0.000864
	(0.0006)	(0.0007)		(0.0006)	(0.0008)	(0.002)
2 or more kids prior(b3)	-0.00224***			-0.00218***		-0.00140
	(0.000652)			(0.000685)		(0.0039)
Housing wealth after '15 w						
1 kid prior	-0.00122	-0.00112		-0.00117	-0.00126	-0.000617
	(0.0008)	(0.0009)		(0.0008)	(0.00098)	(0.00247)
2 or more kids prior	-0.00114			-0.00121		0.00277
	(0.0009)			(0.0010)		(0.00454)
Community housing price	0.0393	0.0169	-0.0231	0.0247	0.00762	0.164
	(0.0434)	(0.0636)	(0.139)	(0.0450)	(0.0671)	(0.214)
Women's age group(default<21)						
21-30	0.0387**	0.0159	-0.0700**	0.0337*	0.0128	0.102
	(0.0168)	(0.0228)	(0.0277)	(0.0173)	(0.0235)	(0.0793)
30-35	0.0713***	0.0884**	-0.0390	0.0596**	0.0768**	0.283**
	(0.0236)	(0.0362)	(0.0748)	(0.0241)	(0.0373)	(0.121)
35-40	0.0803***	0.0298	-0.0441	0.0700**	0.0256	0.236
	(0.0289)	(0.0488)	(0.121)	(0.0295)	(0.0502)	(0.159)
40 above	0.0861**	-0.0957	0.0105	0.0786**	-0.0969	0.134
	(0.0336)	(0.0600)	(0.212)	(0.0342)	(0.0616)	(0.191)
savings	0.000286	0.000179	-0.00096	7.25e-05	-2.05e-05	0.000394
	(0.0006)	(0.0009)	(0.0014)	(0.0007)	(0.0011)	(0.0016)
logged family income	-0.00540*	-0.0102**	-0.00131	-0.00598**	-0.00919*	0.00349
	(0.0027)	(0.0051)	(0.009)	(0.002)	(0.005)	(0.014)
married	0.177***	0.228***	0.211***	0.169***	0.226***	0.290***
	(0.0195)	(0.0267)	(0.031)	(0.020)	(0.0277)	(0.0987)
urban hukou	0.0182	0.00396	-0.112*	0.0139	-0.000778	0.0805
	(0.0264)	(0.0395)	(0.0628)	(0.0269)	(0.0410)	(0.152)
Migrant	-0.0529***	-0.0753***	-0.0974***	-0.0549***	-0.0779***	0.0251
	(0.0114)	(0.0178)	(0.0259)	(0.0116)	(0.0183)	(0.0643)
hkurban#migrant	0.0105	0.0452	0.116	0.00293	0.0311	0.189
	(0.0398)	(0.0529)	(0.0722)	(0.0411)	(0.0553)	(0.195)
Employed in gov/soe	-0.0136	-0.0335	0.00750	-0.00842	-0.0286	-0.125
	(0.0196)	(0.030)	(0.0403)	(0.0199)	(0.0302)	(0.119)
year 2012	-0.00400	0.114***	0.280***	-0.00453	0.110***	0.0190

	(0.00744)	(0.013)	(0.022)	(0.007)	(0.013)	(0.042)
year 2014	-0.00561	0.193***	0.344***	-0.00555	0.190***	0.0343
	(0.009)	(0.016)	(0.031)	(0.009)	(0.0165)	(0.0537)
Observations	12,595	5,796	2,244	12,083	5,500	512
R-squared	0.264	0.251	0.270	0.262	0.242	0.352
F-test of housing wealth effect	3.264	1.794	0.00175	2.525	1.376	0.657
Prob>F	0.00602	0.146	0.967	0.0273	0.248	0.656

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.

Table 6. Robustness check for different household attributes

VARIABLES	(1) Urban	(2) Urban w.0/1 kid	(3) Rural	(4) Rural w.0/1 kid
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 '15	-0.000169	-0.000280	0.000863	0.000773
	(0.000207)	(0.000219)	(0.000784)	(0.000944)
Housing wealth before '15 w:				
1 kid prior (b2)	-0.000494*	-0.000426	-0.00122*	-0.00124
	(0.000257)	(0.000273)	(0.000642)	(0.000812)
2 or more kids prior (b3)	-0.000675**		-0.00196***	
	(0.000300)		(0.000703)	
Housing wealth after '15 w:				
1 kid prior (b2)	-1.81e-05	3.76e-05	-0.00106	-0.00105
	(0.000217)	(0.000227)	(0.000780)	(0.000928)
2 or more kids 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 '15	-0.000222	-4.63e-05	-0.000865	-0.000533
	(0.000267)	(0.000281)	(0.000815)	(0.000945)
Housing wealth before '15 w:				
1 kid prior (b2)	-0.000345	-0.000354	-0.00234**	-0.00136
	(0.000330)	(0.000359)	(0.00101)	(0.00116)
2 or more kids prior (b3)	-0.000475		-0.00322***	
	(0.000373)		(0.00111)	
Housing wealth after '15 w:				
1 kid prior (b2)	2.50e-05	-1.86e-05	-0.00188*	-0.00137
	(0.000255)	(0.000271)	(0.00111)	(0.00126)
2 or more kids 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)
C. Homeowners without Debts				
Housing wealth	0.0008***	0.000609**	0.00157**	0.00185**
	(0.0002)	(0.000238)	(0.000729)	(0.000896)
Housing wealth after '15	-0.00056**	-0.00059**	-0.00062	-0.0007
	(0.0002)	(0.0002)	(0.0009)	(0.001)
Housing wealth before '15 w:				
1 kid prior (b2)	-0.0009***	-0.000826***	-0.00159**	-0.00205**
	(0.0003)	(0.0003)	(0.0008)	(0.0009)
2 or more kids prior (b3)	-0.0010***		-0.0019**	
	(0.0003)		(0.0009)	
Housing wealth after '15 w:				
1 kid prior (b2)	-0.00028	-0.000158	-0.0009	-0.00122
	(0.0002)	(0.000251)	(0.0011)	(0.00128)
2 or more kids prior (b3)	-0.000385		-0.00148	
	(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

Table 7 Total Educational Expenditures

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

VARIABLES	(1) All kids	(2) All kids	(3) All kids	(4) All kids	(5) Urban kids	(6) Rural kids
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)
kid'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)
kidsschlevel2, 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)
kidsschlevel3, 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)
kidsschlevel 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)
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 parent's eldest age, education level, migrant worker or not.

Table 8. Total Education Expenditure Robustness Check (Households Moved or not)

VARIABLES	(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)
kid'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)
num. siblings : 1 sib	274.9	414.9*	156.7	571.6	-109.3
	(236.8)	(217.1)	(252.9)	(719.7)	(221.0)
num. siblings : 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)
KeySchool/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)
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 parent's eldest age, education level, migrant worker or not.

Table 9. Lineary Probability Regression for having supplementary education expenditures

Binary dep.var.: anyextraeduexp

VARIABLES	(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)
kid'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)
kidsschlevel 2, elementary	0.0110	0.00251	0.0158
	(0.00949)	(0.0206)	(0.0100)
kidsschlevel 3, middlesch	-0.0693***	-0.166***	-0.0166
	(0.0144)	(0.0303)	(0.0154)
kidsschlevel 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 parent's eldest age, education level, migrant worker or not.

Table 10. Supplementary Educational Expenditures

Dependent variable: extraeduexp (all positive values)

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)
kid'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)
kidsschlevel2, elementary	-803.3*	-1,245*	-178.2
	(472.5)	(643.4)	(416.9)
kidsschlevel3, middlesch	-736.8	-1,072	-161.0
	(634.8)	(863.6)	(548.0)
kidsschlevel4, 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 parent's eldest age, education level, migrant worker or not.

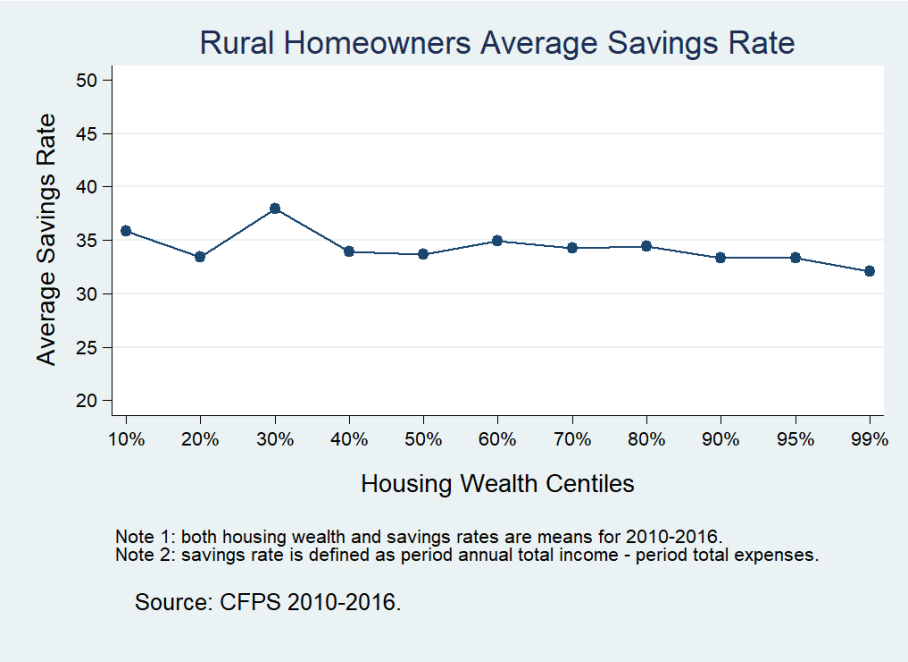
Table 11. Fixed Effect Regression for A Child's Height

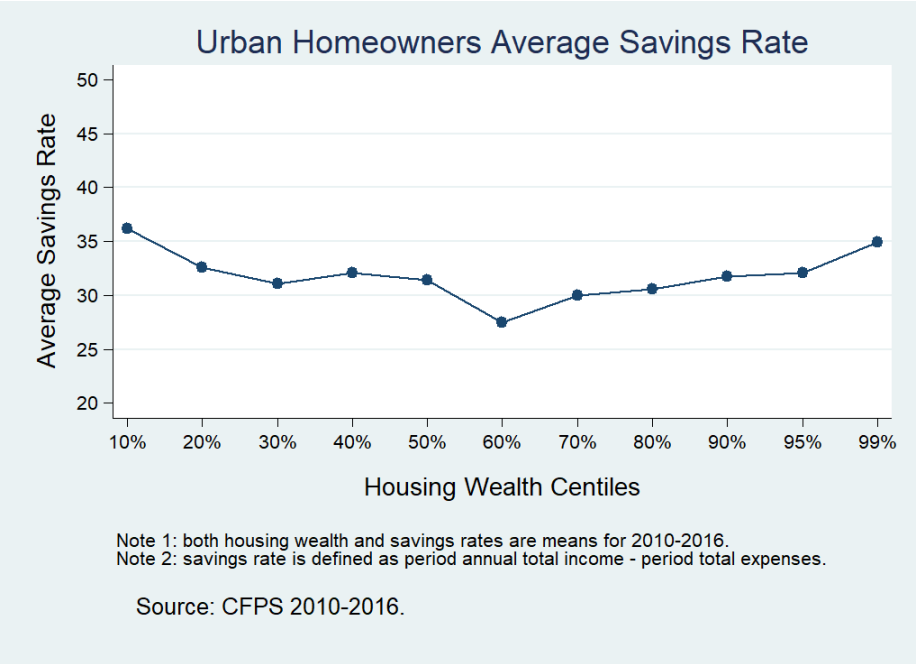
Dep.var.: height (in cm.)

VARIABLES	(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)
kid's age	5.027***	6.133***	4.537***
	(0.465)	(0.803)	(0.631)
Kid'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)
having a SMI	0.385*	0.692**	0.341
	(0.216)	(0.321)	(0.295)
having a CMI	0.862***	0.684*	0.696
	(0.302)	(0.406)	(0.442)
Observations	19,844	7,390	12,454
R-squared	0.792	0.828	0.772

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

Figure 1: Urban and rural savings rates as a function of housing wealth centile





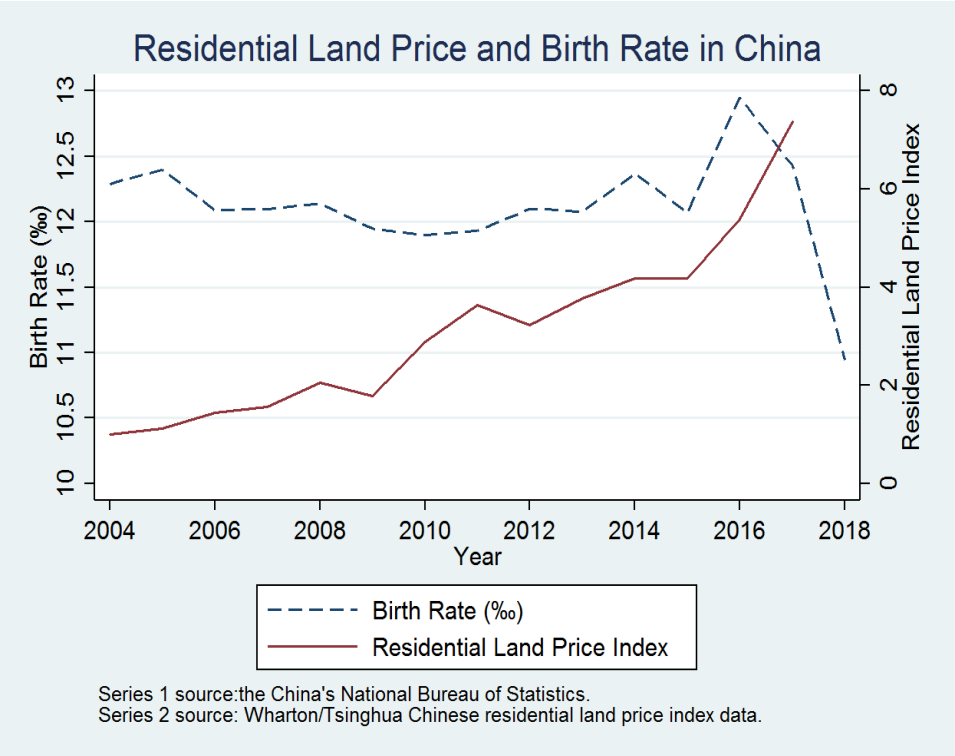


Figure 2. Residential Land Price and Birth Rate in China