

# Does Housing Wealth Affect Family Investment in Human Capital: Evidence from China

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## Abstract

**This paper investigates the effect of housing wealth on household spending on education using data from 2014 China Family Panel Studies. By exploiting the same strategy of Fu, Liao, and Zhang (2016), I use the average housing wealth change of other households in the same community as instrument for household housing wealth. Then I find no evidence that housing wealth has a large impact on household decision on children's education spending, which contradicts the findings of Chen, Jiafeng, and Yupeng (2014). And four types of robustness checks support the idea.**

## Keywords

**Housing wealth, household education expenditure, human capital investment.**

## 1. Introduction

Human capital, proposed by Schultz (1977), has been proved to be playing a decisive role in economic growth. According to Heckman (2005), human capital is not only effective to raise workers' skill, but also improves adaptability and allocative efficiency. Owing to the advantages of human capital, most governments across the world are placing greater value on human capital, and willing to pour a large amount of money on human capital investment. From government's perspective, investing in human capital means building more schools, subsidizing tuition fee, providing with more teaching equipment etc. And in developed countries, the financial spending in education accounts for over 4% of national GDP. But in China, although the financial expenditure in education grows rapidly, yet the public support for education in China is still relatively low. It is reported that the ratio of financial education expenditure over GDP has reached 5% recently, but it is still lower than the average level of world. Because of the low public spending in education, the families have to pay a lot for their kids' schooling. And it is estimated that the total household educational expenditure at elementary education is nearly 2000 billion yuan in 2016, accounting for 2.5% of GDP. In addition, the elementary educational expenditure for each student within family is over 8000 yuan, which varies a lot by urban and rural residents.

The relation of financial expenditure in education and household education spending is still under question. Someone argues that household expenditures on higher education is complementary to government spendings (Sarkar 2017) in India. But Yuan and Zhang (2015) find that the private education spending is a substitution good for public expenditure in urban China. Specifically, an increase in public spending on basic education would lead to significant reductions in household private spending. It is worth noting that the demand for education varies greatly by families. In terms of poor families, the expenditure for tuition fee and books may account for a relatively large part of their total educational spending. On the contrary, the wealthier families tend to invest a quantity of money on education outside school such as private tutoring. Hence, the increasing household education expenditure could be partly attributed to the rising spending on outside school education in China (Chi and Qian 2016). But what drives the rising expenditure in education lies at the increasing family income. By using

data from NLSY79 and NLSY97, Belley and Lochner (2011) and (Kinsler and Pavan 2011) suggest that the family income effect has experienced a dramatic increase, and it also plays a key role in determining the quality of postsecondary institution attended and the opportunity of attending college for average-ability individuals.

Apart from the family income effect, the borrowing constraint, in a theoretical framework, is another factor that may impact the family decision in college going. Because it is highly admitted that the educational cost, especially the cost for college, is a big financial burden for most families. Then some people have to go to college by borrowing from banks. In other words, the relaxation of borrowing constraints would be beneficial to the families with members under college-going year. However, prior empirical research show little or even no effect of the relieve of borrowing constraint on college attendance (Keane and Wolpin 2001; Keane 2002; Cameron and Taber 2004). The policy implication of the finding is that such policy aiming at improving credit access have little effect on schooling attainment.

One interesting point I need to mention is that the relaxation of borrowing constraint comes primarily from windfall of household wealth. Therefore, although the borrowing constraints have been proved to be noneffective on the educational attainment, we cannot ignore the role of family wealth. Because the family wealth is the main force that drives family investment in children's human capital. In reality, human capital investment is a long term process, and the decision on college-going is determined by previous accumulation of human capital. As they place a much higher value on the long-term family effect which is closely related with the family income than the short-run borrowing constraints during college years. Thanks to the high dispersion of family wealth, the divergent accumulation of human-capital prior to college-going age leads to inequality in society today (Keane 2002). Then recent studies start to estimate the wealth effect on education. Cruz and Ziegelhofer (2014) exploit the Conditional Cash Transfer (CCT) program as a natural experiment, and estimate its effect on educational spending. Their findings show that household would increase their expenditure in education and food disproportionately when they receive a quantity of cash. Moreover, Lovenheim et al. (2011) and Lovenheim and Reynolds (2012) use the change of housing wealth as an exogenous source of family wealth, and estimate the effect on college enrollment and choice. They show that an unexpected increase in family's housing wealth would significantly boost the chance of college enrollment and attending at a flagship college.

The previous findings have presented a quantity of evidence about family investment in human capital. But whether household wealth, especially the housing wealth, have impact on family education expenditure is still under question. And Lovenheim et al. (2011) and Lovenheim and Reynolds (2012) only estimate the effect on college enrollment and the choice, however, they do not take into account the housing wealth effect on family education expenditure which plays a key role in future college decision. As a result, this paper will present new evidence on the effect of housing wealth on family investment in human capital. One recent research has investigated the effect of housing wealth on the household education expenditure in urban China (Chen, Jiafeng, and Yupeng 2014), and the findings show a significant and positive effect of housing wealth. Nevertheless, they do not consider the effect of children attributes and children ability which would bias the estimate. In this paper, I address the issue by doing the regression at family level and children level, which allows me to include children's features as controls.

Another issue in the work of Chen, Jiafeng, and Yupeng (2014) is the validity of instrumental variables. They use the differential between purchase or construction of house and the present value as an instrument for housing wealth. Nevertheless, although the housing wealth change is closely correlated with housing wealth, yet it does not guarantee the exclusion restriction because the change of housing wealth also has a direct influence on family's expenditure on education, which bias the estimates. Then in this paper, I construct a new instrumental variable

for housing wealth to alleviate the endogeneity. The method is based on the work of Fu, Liao, and Zhang (2016). They use the average housing wealth change in the same community as an instrument for housing wealth to estimate the effect on labor supply decision. Thereafter my construction of instrument is the change of housing wealth in neighborhood. There are two advantages for such instrument. Firstly, when someone lives in the same community, they share the same amenities and similar housing environment, which affirms the correlation between instrumental variables and endogenous variable. The second reason is that the change in neighboring housing wealth has no impact on family's decision on education expenditure directly, and it can only work through the channel of family's housing wealth. This is my contribution to the existing literature.

In this paper, the baseline regression results and 2SLS results using instrument show that housing wealth has little or no impact on family expenditure on children's education. In order to confirm the idea, I do four types of robustness checks. First of all, considering the fact that the housing market was not established until 1990, hence, the housing capital gains of those units that purchased before 1990 could not represent true market value. Then I exclude the housing unit that was built or purchased before 1990 in my sample. Secondly, household's decision on educational expenditure is subjected to their neighbors, hence, I control the neighboring educational expenditure. The third robustness check is to include school district dummy as control. The school district dummy is set one for those whose child goes to school in the neighborhood. Lastly, I calculate the average housing wealth change of other households at county level, and then exploit it as an instrument for housing wealth. All of the results in the robustness checks are consistent with baseline.

The paper is organized as follows. Section 2 is the literature review about family education expenditure and the effect of housing wealth. Then I describe my data and my empirical strategy in section 3. And I present my main results and robust checks in Section 4 and 5. Section 6 concludes.

## 2. Literature Review

Because of the importance of education, the households are willing to invest a large amount of resource on their kids' school attainment. But researchers have found that the family decision on children's schooling are subjected to many factors. In Becker's quantity-quality model, the investment in children would decrease when the family size grows. And the empirical evidence support the negative relation between child investment and family size (Black, Devereux, and Salvanes 2010; Cáceres-Delpiano 2006; Dang and Halsey Rogers 2016; Kang 2011; Rosenzweig and Zhang 2009; Souza and Ponczek 2012). Specifically, using multiple births as an instrument for family size, Cáceres-Delpiano (2006) find that a the probability of older children attending private school decrease in a larger family generated by twins in later births. Considering the heterogenous effect on boys and girls, Kang (2011) suggest that large family size have a nonnegligible effect on educational investments for girls, but a little or even no impact on those for boys. Also, it is worth noting that Rosenzweig and Zhang (2009) find that growing family size by an extra child at parity one or at parity two would significantly reduce the human capital investment in child including schooling progress, the expected college enrolment, grades in school. Consequently, they argue that one-child policy in China makes contribution to the development of human capital investement to some extent.

Family size affects the investment of children through the way of reallocating the family resources. Then the change of family resource would have a arguably direct impact on the quality of children. A large strand of literate have found that family income plays a vital role in determining household education expenditure (Belley and Lochner 2011; Lazear, Michael, and Michael 1988; Kinsler and Pavan 2011). The empirical evidence shows that education

expenditure disproportionately increases with family income (Chi and Qian 2016). By using data from NLSY79 and NLSY97 to estimate the effect of family income on the quality of institution attended, Belley and Lochner (2011) and Kinsler and Pavan (2011) all prove the significant effect of family income, especially, the importance of family income varies considerably across the ability spectrum (Kinsler and Pavan 2011). However, some researchers argue that the impact of family income are not significant after controlling for ability formed by the mid teenage years (Carneiro and Heckman 2002).

Although a large literature investigate the impact of family income on educational expenditure, less discuss about the effect of household wealth especially housing wealth. Lovenheim et al. (2011) and Lovenheim and Reynolds (2012) estimate the effect of housing wealth on college enrolment and college choice. Their findings indicate that a \$10,000 increase in home equity raises college enrollment by 0.7% and the likelihood of attending at a flagship college by 0.2%. Lovenheim et al. (2011) also argue that the positive effect of housing wealth on college enrollment could be attributed to the relaxation of credit constraints. However, the outcome in the work of Lovenheim et al. (2011) and Lovenheim and Reynolds (2012) is the college enrolment and college choice, which I think is the result of long-term accumulated human capital rather than the human capital investment. Most importantly, the way of rising housing wealth affecting the decision of college is to invest in human capital before college going. As Keane (2002) mention, it is the unequal human capital accumulation prior to college-going age that drives most inequality. Also, little evidence implies that the relaxation of credit constraints plays a key role in determining the school attainment (Keane 2002; Dynarski 2003; Cameron and Taber 2004; Keane and Wolpin 2001).

The literature aforementioned indicates that family investment in children is influenced by family size, family income and household wealth, however, little literature investigates the effect of housing wealth on family education expenditure on children. The most related study is from Chen, Jiafeng, and Yupeng (2014). They use CFPS2010 data to estimate how much the educational expenditure responds to the appreciation of housing wealth. Their findings show that housing wealth has a large and significant effect on the household education expenditure. Nonetheless, they do not control children attributes and children ability, which also affect family expenditure on education. Also, they exploit housing wealth change as an instrument to address the endogeneity issue. But the housing wealth change in a family could not guarantee the exclusion restriction because one's housing capital gains also affect family's decision on educational spending directly. Hence, this paper investigates the effect of housing wealth on educational expenditure at household level and individual level, respectively. The detail information of children from data allows me to control children's features and their ability. More importantly, I construct a new instrument variable by using an exogenous shift in neighboring housing wealth. The advantages for such instrument are presented below. On the one hand, those live in the same community share the same amenities and similar housing environment resulting in the synchronize of their housing capital gains. On the other hand, the change in neighboring housing wealth could not impact family's decision on education expenditure directly, and it can only work through the change of family's housing wealth.

### 3. Data and Empirical Strategy

#### 3.1. Data

My main data is from 2014 China Family Panel Studies (CFPS 2014). CFPS was conducted by the Institute of Social Science Survey at Peking University, jointly with the Survey Research Center at University of Michigan. It is a nationally-representative household survey that contains rich socioeconomic information, including household wealth, family expenditure and family's attributes. In particular, detailed questions about children education level In order to

estimate the effect of housing wealth on family education expenditure. In order to estimate the housing wealth effect, I select the sample at family level and individual level, respectively.

For family level, the sample I use consists of households who have the complete property of the living house. Then I restrict the family that consists of children under age of 16. When it comes to housing wealth, I measure it based on the question that asks "what is your living house value". To construct the instrumental variable, I measure the housing cost by using the question about "the purchase or construction cost when you own house", then I differentiate the housing cost and present housing value to get the housing wealth change. In terms of the family education expenditure, the questionnaire involves about family expenditure on education during last year, then I use it to measure my dependent variable. Also I keep other control variables including family assets and debts, family size, the number of elder above the age of 60. Then my sample size in family level is 1424. At children level, I use the same strategy to clean the dataset. But the big difference between children level and family level is the construction of educational expenditure. I exploit the question that involves expenditure on each children during last year to measure the family investment in each child. At the children level, no more than 1500 family report their educational expenditure on each children. As a result, my final sample size at children level is 1135.

Table 1 and Table 2 presents the summary statistics of these variables at household level and individual level, respectively. The household spending on education is 6060 yuan at household level, while the educational spending on each children within family is 4374 yuan. The housing wealth varies greatly across family, and the average is about 450 to 480 thousands, but the wealthiest house worths over 10 million. There are 2 persons at least and 14 at most in a family.

**Table 1.** Summary statistics at household level

VARIABLES	N	mean	sd	min	max
family educational cost	1,424	6,060	8,417	0	100,000
housing wealth	1,424	480,453	791,204	1,000	1.500e+07
neighboring housing wealth change at community level	1,335	80,147	1.335e+06	-1.967e+07	4.253e+06
neighboring housing wealth change at county level	1,383	96,469	698,332	-3.246e+06	2.418e+06
family size	1,424	4.612	1.604	2	14
nonhousing debts	1,394	11,549	57,739	0	1.100e+06
savings	1,424	47,937	142,233	0	4.000e+06
financial asset	1,413	70,734	270,531	0	8.000e+06
other debt	1,416	8,634	34,349	0	500,000
value of company	1,412	2.675	13.87	0	200
other asset	1,412	69,477	176,886	150	2.272e+06
family income	1,305	61,697	125,659	1	4.073e+06
total house debts	1,395	38,074	127,894	0	2.000e+06
other houses	1,424	0.190	0.393	0	1
highest educational level within family	1,424	3.876	1.251	1	8
num of child within family	1,424	1.249	0.517	1	5
number of child at kindergarten	1,424	0.373	0.553	0	3
number of child at primary school	1,424	0.598	0.592	0	3
number of child at junior high school	1,424	0.253	0.448	0	2
number of child at high school	1,424	0.0232	0.155	0	2
using years of the house	1,399	13.22	8.800	0	60

**Table 2.** Summary statistics at children level

VARIABLES	N	mean	sd	min	max
educational cost for one child	1,135	4,374	6,965	0	100,800
housing wealth	1,135	459,871	719,554	1,000	1.000e+07
community level IV	1,032	298,698	437,452	-235,000	4.700e+06
county level IV	1,112	324,184	430,225	-2,000	3.043e+06
Family size	1,135	4.625	1.650	2	14
father's education	1,134	3.250	1.261	1	8
mother's edu	1,134	3.062	1.291	1	6
child's gender;1 for male	1,135	0.505	0.500	0	1
child's hukou status	1,135	0.471	0.499	0	1
how much is it paid for child's illness	1,135	683.9	2,522	0	40,000
parents' expected education	1,135	16.10	2.570	6	22
child's education level	1,135	3.330	0.519	3	6
score for chinese test	1,135	2.998	0.898	1	4
score for math test	1,135	2.009	0.989	1	4
child's noncognitive skill	1,135	2.378	0.776	1	5
Any other housing unit owned by family members	1,135	0.181	0.385	0	1
Constructed variable: business asset (yuan)	1,126	2.500	12.87	0	200
Constructed variable: money lent out to others (yuan)	1,130	8,746	34,176	0	500,000
financial asset	1,129	62,171	166,693	0	3.400e+06
Constructed variable: house mortgage (yuan)	1,132	31,985	94,672	0	1,000,000
Constructed variable: financial debt(except house mortgage)(yuan)	1,133	11,534	61,717	0	1.100e+06
Total amount of cash & deposits (yuan)	1,135	42,864	93,210	0	1,000,000
Net family income (comparable with year 2010)	1,050	53,945	51,551	1	680,000
using years of the house	1,135	13.21	8.942	0	55
other asset	1,126	65,480	167,914	150	2.272e+06
father's age	1,134	39.54	5.128	27	70
mother's age	1,134	37.63	5.074	25	60

### 3.2. Empirical Strategy

To estimate the effect of housing wealth on family education expenditure, conceptually, I start with the following cross-section model at household level:

$$\ln \text{Educost}_h = \beta_0 + \beta_1 \ln \text{HousingWealth}_h + \rho \text{HouseholdAttributes}_h + e_h \quad (1)$$

Where the dependent variable  $\text{Educost}_h$  is a continuous variable that represents the household  $h$ 's spending on education. And  $\text{HousingWealth}_h$  denotes household  $h$ 's housing wealth;  $\beta_0$  is a constant, and  $e_h$  is the error term.  $\text{HouseholdAttributes}_h$  represents control variables including household-level asset, debts, attributes that may affect family's decision on educational expenditure. Household-level control variables include household size, number of children under age six, number of elderly above age 60, household income, total non-housing asset, total household debt, and number of years owning all housing units.

Then I follow the same empirical model at the individual level:

$$\ln \text{Educostih} = \beta_0 + \beta_1 \ln \text{HousingWealthh} + \beta_2 \text{ChildFeatureih} + \rho \text{HouseholdAttributesh} + \text{eih} \quad (2)$$

Where the dependent variable  $\text{Educostih}$  represent household  $h$ 's spending on children  $i$ 's education. And  $\text{ChildFeatureih}$  is children's feature including a gender dummy, age, educational level and child's chinese and math test score.  $\text{HousingWealthh}$  and  $\text{HouseholdAttributesh}$  have the same meaning as household level.

The problem of estimating (1) and (2) is that unobserved individual and household heterogeneity may correlate with both housing wealth and family human capital investment in children, biasing the estimated key coefficient  $\beta_1$ . For example, at household level, the children's ability such as their talent for learning, their test score would impact the parents' decision on their educational spending, which will bias the estimates. Then I control the children's attributes including children's age, gender, test score etc as controls at children level. Nevertheless, the endogeneity issue still exists at children level because the household who place emphasis on children's education would probably buy a house at school district, which correlate with household housing wealth. To alleviate the concern of school district, Chen, Jiafeng, and Yupeng (2014) run the regression on the sample of households who bought their houses before 1998. Their logic is that the policy about school district before 1998 had not been issued, hence the household decision on educational spending and purchasing or constructing houses would not be affected by endogenous variables. But their problem is that only about 150 households are left in the sample after employing the method, and small sample size could not guarantee the validity of the estimates. Therefore, in this paper, thanks to the question that asks about "how does your child enter the school", I regard those who go to the neighborhood school as the household who lives at the school district. In the robustness checks, I include the school district dummy which is set 1 for those going to neighborhood school as controls.

Then to identify the causal relation between housing wealth and household education expenditure, I employ an instrument variable approach to identify the endogeneity issue. Based on the work of Fu, Liao, and Zhang (2016), my instrumental variable for housing wealth is the average housing capital gains of other households living in the same community where the household in question lives. In this case, the change of one's housing wealth should be highly correlated with the change of his or her neighbor's housing simply because those who are located close to each other share the same amenity of community and the same housing environment. On the other hand, the family's decision on educational spending should not be directly affected by the housing wealth change of his or her neighbor. However, as Fu, Liao, and Zhang (2016) mention, the instrument work well when the household has only one housing unit. Fortunately, the questionnaire includes the information about the number of housing units one household owns. Then I include the number of housing unit as controls, and I restrict my sample with only one housing unit in the robust checks. It is worth to mention that I also calculate the instrumental variables at the county level as alternative instrument in the robust checks. Table show that neighboring housing wealth change at community level is divergent, the mean is about 80 thousand yuan, but the minimum and maximum is minus 20 million and 4 million, respectively. And the divergence of neighboring housing wealth change at county level reduces a lot.

## 4. Results

### 4.1. Family Level Results

Firstly I estimate (1) at household level using ordinary least square. All standard errors are clustered at the county level. The results are presented in Table 3. In column (1), I only control family income, and then I include family assets, debts and family background as controls in columns (2)-(4). The family background includes family size, number of elderly, highest

educational level within family, number of kids at kindergarten, primary, junior and high school. Because of the heterogenous effect across province, I include province dummies as controls in columns (3)-(4). The results show that housing wealth does not have significant impact on family education expenditure. But the effect of family income is significantly positive, and the elasticity of family income is around 0.2. It means that one thousand yuan increase in family income would lead to 200 yuan increase in educational spending. Thanks to the unobserved effects and measurement error of housing wealth, the estimates may be biased. Then I move on the instrumental variable estimation.

**Table 3.** Effect of housing wealth on family education expenditure at family level: OLS

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS
log of housing wealth	0.0819 (0.0580)	0.0006 (0.0629)	0.0196 (0.0681)	0.0369 (0.0763)
log of family income	0.2277*** (0.0603)	0.2339*** (0.0589)	0.2090*** (0.0654)	0.1855*** (0.0695)
log of savings		0.0037 (0.0243)	0.0152 (0.0256)	0.0199 (0.0262)
log of finance asset		-0.0042 (0.0307)	-0.0130 (0.0311)	-0.0156 (0.0314)
log of other debt		0.0378* (0.0192)	0.0354* (0.0187)	0.0351* (0.0188)
log of value of company		0.1015 (0.0790)	0.0786 (0.0722)	0.0666 (0.0726)
log of other asset		0.1270** (0.0519)	0.1231** (0.0516)	0.1173** (0.0522)
log of total house debts			0.0148 (0.0122)	0.0204 (0.0135)
log of nonhousing debts			0.0109 (0.0147)	0.0114 (0.0147)
family size				0.0023 (0.0504)
highest educational level within family				0.0773 (0.0825)
using years of the house				0.0135 (0.0093)
number of child at kindergarten				-1.5141*** (0.3461)
number of child at primary school				-1.8591*** (0.3067)
number of child at junior high school				-1.6502*** (0.2903)
number of child at high school				-1.4772*** (0.5107)
Constant	4.9486*** (0.6257)	3.8282*** (0.7403)	3.3403*** (0.9424)	2.4725** (1.0060)
Observations	1,305	1,289	1,281	1,281
R-squared	0.0205	0.0397	0.0785	0.0944
Province FE	NO	NO	YES	YES

Note: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors are in parentheses. All standard errors are cluster at county level

As mentioned above, my instrumental variable is the neighboring housing wealth change at the same community. Table 4 presents the IV estimates by using two stage least squares (2sls) regressions. Comparing with the estimate of housing wealth on Table 3, the sign of the housing wealth effect change in columns (1)-(4) of Table 4, which means the housing wealth have a negative effect on family's spending on education though it is not significant. The columns (1)-(4) show that the F statistics of the first stage regression is larger than 10, which ensures the validity of instrument. But it is noted that the first stage F statistics decreases when I include more controls.

**Table 4.** Effect of housing wealth on family education expenditure at family level: 2SLS

VARIABLES	(1) IV	(2) IV	(3) IV	(4) IV
log of housing wealth	-0.0499 (0.1315)	-0.1256 (0.1481)	-0.0686 (0.2349)	-0.1108 (0.2522)
log of family income	0.2631*** (0.0785)	0.2507*** (0.0743)	0.2126*** (0.0802)	0.1939** (0.0797)
log of savings		0.0182 (0.0264)	0.0260 (0.0268)	0.0302 (0.0273)
log of finance asset		-0.0132 (0.0334)	-0.0219 (0.0330)	-0.0271 (0.0328)
log of other debt		0.0430** (0.0207)	0.0403** (0.0202)	0.0405** (0.0204)
log of value of company		0.0477 (0.0891)	0.0163 (0.0805)	0.0090 (0.0811)
log of other asset		0.1515** (0.0603)	0.1396** (0.0605)	0.1380** (0.0591)
log of total house debts			0.0085 (0.0156)	0.0115 (0.0149)
log of nonhousing debts			0.0124 (0.0154)	0.0123 (0.0156)
family size				-0.0206 (0.0535)
highest educational level within family				0.1022 (0.0929)
using years of the house				0.0069 (0.0121)
number of child at kindergarten				0.5340*** (0.1801)
number of child at primary school				0.1921 (0.1452)
number of child at junior high school				0.3918** (0.1689)
number of child at high school				0.5418 (0.4259)
Constant	4.9615*** (0.6893)	3.7603*** (0.8253)	3.5993*** (1.1689)	3.0867** (1.3459)
Observations	1,156	1,142	1,134	1,134
R-squared	0.0172	0.0356	0.0833	0.0942
Province FE	NO	NO	YES	YES
1st F stat	21.24	19.83	11.09	12.14

Note: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors are in parentheses. All standard errors are cluster at county level

The estimates of Table 3 and Table 4 are far more different from the estimates from Chen, Jiafeng, and Yupeng (2014). Their OLS and IV results show that the housing wealth has a large and significant effect on family's spending on education. As I show in 2, the instrumental variable in Chen, Jiafeng, and Yupeng (2014) does not ensure the exclusion restriction, as a result, their results might be biased. Moreover, their regression does not take children's feature into consideration, which also contaminates the estimates. In order to control children's attribute, I restrict my sample at individual level. The results are presented at 4.2

#### 4.2. Child Level Results

The estimates of housing wealth on family human capital investment in each child are showed at Table. In column (1), I run the OLS regression at children level by controlling province dummies and family background. Family background includes family's assets, debts, family size, the year of the house, dummy for other house. The estimate of housing wealth is 0.13 (statistically significant at 10% level). Further, I add parents' background including parents' age and school attainment into the regression in column (2). Then the estimate decrease and becomes nonsignificant. Considering the fact that household's decision on educational spending is determined by the children's attributes and their ability, it is important to control such effects. Children attributes include their gender, age, and present educational level. And their ability could be divided into two part. One part is cognitive skill while another is noncognitive skill. In terms of the cognitive skill, the parents are asked to make evaluation of their kids' test score for Chinese and math, where 1 is the worst and 4 represents the best. However the noncognitive skill is hard to measure. Fortunately, the parents are asked about "how much do the children focus on when they are doing something" during the survey. And the ability of focusing could partly reflect individual's noncognitive skill. Hence, I proxy noncognitive skill by children's level at focusing. After including children's attributes and ability as controls in column (3) and (4), the estimates of housing wealth decline and are not significant. More specifically, 1% appreciation of housing wealth could lead to 2% increase in the family's educational expenditure on one kid. It is worth noting that the R squared in the model at children level is much high. The R squared boosts to 0.48 after controlling more and more variables, which means that the variance of model could explain nearly half of variance of family educational spending in children.

Next I instrument for housing wealth with housing wealth change of other households at the same community and run regression using 2SLS method. Columns (1)-(2) show that the housing wealth has a positive but insignificant impact on family human capital investment in children. And the first stage F statistics in columns (1) and (2) show that the neighboring housing wealth change is a valid instrument. However, when I include child's attributes and child's ability as controls, the estimates of log of housing wealth become negative and they stay insignificant. What's more, the first stage F statistics in columns (3) and (4) are slightly less than 10, which means that the neighboring housing wealth change at community level is probably a weak instrument.

**Table 5.** Effect of housing wealth on family education expenditure at children level: OLS

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS
log of housing wealth	0.1288* (0.0697)	0.0769 (0.0754)	0.0215 (0.0680)	0.0189 (0.0683)
Constant	6.3218*** (0.6543)	5.2064*** (0.6746)	4.6794*** (0.6038)	4.6312*** (0.6627)
Observations	1,035	1,034	1,034	1,034
R-squared	0.2309	0.2488	0.4780	0.4795
Province FE	Yes	Yes	Yes	Yes
Family background	Yes	Yes	Yes	Yes
Parents' background	No	Yes	Yes	Yes
Child's feature	No	No	Yes	Yes
Child's ability	No	No	No	Yes

Note: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors are in parentheses. All standard errors are cluster at county level

**Table 6.** Effect of housing wealth on family education expenditure at children level: 2SLS

VARIABLES	(1) IV	(2) IV	(3) IV	(4) IV
log of housing wealth	0.2049 (0.1857)	0.1105 (0.2041)	-0.0716 (0.1561)	-0.0715 (0.1554)
Constant	6.2732*** (0.9373)	5.3360*** (0.9112)	5.4637*** (0.7844)	5.4825*** (0.8450)
Observations	929	928	928	928
R-squared	0.2160	0.2333	0.5378	0.5384
Province FE	Yes	Yes	Yes	Yes
Family background	Yes	Yes	Yes	Yes
Parents' background	No	Yes	Yes	Yes
Child's feature	No	No	Yes	Yes
Child's ability	No	No	No	Yes
1st F stat	11	10.50	9.955	9.992

Note: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors are in parentheses. All standard errors are cluster at county level

## 5. Robustness Checks

In this part, I do the robustness checks by exploiting four methods. All of the results are presented in Table 7. Columns (1) and (2) are the results at household level while columns (3) and (4) are at children level.

First of all, I address the concern that the houses bought or constructed before 1990 would bias the estimate. Because there was almost no housing market in China before 1990 and houses and apartments bought before 1990 are either of very low market value due to depreciation or of limited property rights due to the reform of housing welfare system (Fu, Liao, and Zhang 2016). Thereafter, I drop the households who purchased their houses before 1990, reducing the effective sample size at household level and individual level to 1262 and 999, respectively. The results of Columns (1) and (2) in panel A suggest that household housing wealth have a negative but insignificant effect on household education expenditure. And the first stage F statistics in column (2) is 9.90, slightly less than 10. When I do the OLS regression and 2SLS regression using IV at individual level, I find that the estimates of housing wealth on household spending on child's education within family stay insignificant but become positive (see columns (3)-(4) in Table 7). Moreover, the first stage F statistics at children level show that housing capital gains of other household within community is a weak instrument.

It is acknowledged that the household's decision on children's educational spending is not only determined by family environment, but also influenced by other family's decision on kids' education spending who living in the neighborhood. Supposed that one family decides to pay for outside school courses such as private tutoring for their children. Then when other families at the same community hear about it, they are more likely to increase their expenditure on children because no one wants their kids fall behind at school. This is what I call neighboring effect on education. In order to measure the neighboring effect, I construct the variables averaging the spending on education of other households living in the same community. Then I include it as a new control. Columns (1)-(4) show that the estimates of housing wealth are not significant neither at the household level nor at the individual level. It means that the appreciation of housing wealth does not induce the parents to improve the spending on children's education.

The third way of robustness checks is to consider the effect of school district. It is undoubted that some families especially the rich tend to buy a house at a school district in order to get access to school for the kids. Because of the rising demand for houses at school district, the price mounts up at a fast pace comparing with other housing price. Obviously, those who pay for the houses at school district place much emphasis on children's education. Hence, whether the houses are located at the school district would have an impact on the housing wealth and the household decision on human capital investment in children at the same time. To alleviate the concern of the effect of school district, Chen, Jiafeng, and Yupeng (2014) keep the subsample that purchase houses before 1998 and do the regression. In their mind, no such policies about houses and school district were issue before 1998, as a result, those who bought the houses at that time would not be affected by other factors. Nevertheless, their subsample size is so small that the estimates are not pretty convincing. More importantly, they do not consider the fact that houses at school districts goes up rapidly. Therefore, thanks to the question in the survey about "how does the kid go to school", I am able to construct the school district dummy. It is set one for those who answer that they go to school in the neighborhood, and zero otherwise. After controlling the school district effect, the estimates of housing wealth do not show statistically significant effect (see columns (1)-(4) of Panel C in Table 7).

**Table 7. Robust checks: exclude, include neighboring effect, include school district dummy**

VARIABLES	(1) OLS	(2) IV	(3) OLS	(4) IV
Panel A: exclude household that built or purchase houses before 1990				
log of housing wealth	-0.1025 (0.1073)	-0.2820 (0.3173)	0.0213 (0.0593)	0.0160 (0.1974)
Constant	1.5032 (1.0900)	2.2777 (1.4427)	6.6069*** (0.7512)	6.5269*** (0.9639)
Observations	1,066	989	811	805
R-squared	0.1094	0.1108	0.5725	0.5713
Province FE	Yes	Yes	Yes	Yes
Family background	Yes	Yes	Yes	Yes
Neighbor effect	Yes	Yes	Yes	Yes
School district	Yes	Yes	Yes	Yes
Child's feature	No	No	Yes	Yes
Child's ability	No	No	Yes	Yes
1st F stat		9.897		7.299
Panel B: include neighboring effect				
log of housing wealth	0.0319 (0.0783)	-0.1124 (0.2552)	-0.0080 (0.0659)	-0.0893 (0.1551)
Constant	2.4266** (1.0521)	3.0559** (1.3570)	5.3075*** (0.7329)	5.4529*** (0.8451)
Observations	1,221	1,134	935	928
R-squared	0.0958	0.0959	0.5420	0.5398
Province FE	Yes	Yes	Yes	Yes
Neighbor effect	Yes	Yes	Yes	Yes
Family background	Yes	Yes	Yes	Yes
Child's feature	No	No	Yes	Yes
Child's ability	No	No	Yes	Yes
1st F stat		11.89		9.976
Panel C: include school district dummy				
log of housing wealth	0.0257 (0.0774)	-0.1085 (0.2521)	-0.0169 (0.0659)	-0.1178 (0.1572)
Constant	2.8116*** (1.0322)	3.4510*** (1.3371)	5.9574*** (0.7782)	6.2045*** (0.9105)
Observations	1,221	1,134	935	928
R-squared	0.1043	0.1051	0.5466	0.5437
Province FE	Yes	Yes	Yes	Yes
Neighbor effect	Yes	Yes	Yes	Yes
Family background	Yes	Yes	Yes	Yes
School district	Yes	Yes	Yes	Yes
Child's feature	No	No	Yes	Yes
Child's ability	No	No	Yes	Yes
1st F stat		11.83		9.704

Note: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors are in parentheses. All standard errors are cluster at county level

The above 2SLS results show that the housing capital gains of other households at the same community is a weak instrumental variable. That is because a small fraction respondents live at the same community in my sample, which results in the measurement error of the instrument. Based on this, I reconstruct the instrumental variable by calculating the average change of housing wealth of other families at the same county, and do the regression at the household level and individual level. All the results are showed at Table 8, and I also exclude the housing units that are purchased or constructed before 1990 and control the neighboring effect, school district effect. The results of first stage F statistics suggest that instrumental variable at the county level is much better than that at the community level. And the estimates of housing wealth in column (2) and (4) is much larger than that in column (1) and (3) though they are not significant yet.

To sum up, the aforementioned robustness checks show that the appreciation of the houses do not guarantee the increase of household's spending on children's education, which is consistent with the OLS results and 2SLS results in section 4.

**Table 8.** Robust checks: IV at county level

VARIABLES	(1)	(2)	(3)	(4)
	IV: community level	IV: county level	IV:community level	IV:county level
log of housing wealth	-0.2820 (0.3173)	0.2151 (0.3549)	0.0160 (0.1974)	0.1583 (0.1869)
Constant	2.2777 (1.4427)	0.1785 (1.7395)	6.5269*** (0.9639)	6.1709*** (0.9655)
Observations	989	886	805	809
R-squared	0.1108	0.1250	0.5713	0.5666
Province FE	Yes	Yes	Yes	Yes
Family background	Yes	Yes	Yes	Yes
Neighbor effect	Yes	Yes	Yes	Yes
School district	Yes	Yes	Yes	Yes
Child's feature	No	No	Yes	Yes
Child's ability	No	No	Yes	Yes
1st F stat	9.897	23.84	7.299	41.29

Note: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors are in parentheses. All standard errors are cluster at county level

## 6. Conclusion

With the rapid growth of housing price in urban China in recent years, the family's housing wealth increase quickly, account for a majority of total appreciation of household wealth. In this paper, I estimate the effect of total housing value on household spending on children's education. In contrast to similar work by Chen, Jiafeng, and Yupeng (2014), I control the children's attributes and employ a new instrumental variable to deal with potential identification issue. Specifically, I use the average housing wealth change of other households residing in the same community as an instrument for housing wealth in a given household,

which is used by Fu, Liao, and Zhang (2016). My finding suggest that housing wealth appreciation do not have significant and positive impact on household decision on children's educational expenditure. By excluding the housing units purchased before 1990, including neighboring effect, schoold district effect as controls and constructing a new instrument, I do the robustness checks and the results are consistent with the findings. Hence, it implies that when a given household face an appreciation of housing wealth, they do not translate their housing capital gains into expenditure on children's education immediately. This phenomenon could probably be attributed to two factors. Firstly, the average of household education expenditure is much high, accounting for almost 10% of family income in one year, consequently, there is no need for family to increase their educational spending when housing wealth appreciates. The second reason is that the instrumental variable in this paper is the present housing capital gains of other families, and the household could not respond at once. In other words, the housing capital gains have a lagged effect on housing wealth. The effective way to address the concern is to employ panel data and take account for the lagged effect of housing wealth. In a word, the effect of housing wealth on family investment in human capital need more attentions in the future.

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