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Housing Wealth Effect and Labor Force Participation: Evidence from China Household Finance Survey

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Abstract

Whether an increase in housing wealth has a causal, positive effect on leisure consumption or negative effect on labor supply is inconclusive in the literature. This paper uses the 2011 China Household Finance Survey data to estimate the effect of a household's housing wealth change on the householders' labor force participation. Using the average housing capital gains of other households residing in the same community as the instrumental variable for the housing capital gains of a household, we find that a 100 thousand RMB increase in housing wealth leads to a 1.5 percentage points decrease in female householders' probability of participating labor force and a 3.1 percentage points increase in their probability of becoming housewives. We find little effect on male householders' labor force participation.

***Keywords*:** Housing wealth effect; housing price; labor supply; labor force participation

***JEL Classification*:** J21, J22, R20, R30

1. Introduction

A perceived increase in a household's housing wealth may have complex effects on different goods consumption. Many empirical studies have found that an increase in housing wealth has a positive impact on consumption expenditure.[1] For example, Carroll and Zhou (2010) use a state level panel data from the U.S. and find that a one dollar increase in housing wealth increases consumption by 6 cents after two years. Campbell and Cocco (2007) and Case, *et al*. (2005, 2013) also find that housing price appreciation increases household consumption. A less explored topic is whether an increase in housing wealth has any impact on leisure consumption, and if so, in what direction.

Leisure is generally considered a normal good. Economic theory predicts that the consumption of leisure increases with income or wealth, implying that an increase in income or wealth reduces work time or labor supply. A few studies provide supportive evidence using inheritance, lottery gains, housing voucher or rental subsidies as a positive income or wealth shock. Holtz-Eakin, *et al*. (1993) find that large inheritance depresses labor force participation in the US. Joulfaian and Wilhelm (1994) use data from the Panel Study of Income Dynamics and Federal Estate Tax returns in the U.S. and find that inheritance income reduces working hours but the effect is small.[2] Imbens, *et al*. (2001) use survey data of lottery players and find that large lottery winnings reduce winners' working hours and labor force participation. Jacob and Ludwig (2012) and Fischer (2000) find that receiving housing voucher or rental subsidies reduces labor force participation of recipients. All these findings suggest that an increase in housing wealth is likely to reduce labor supply. However, theoretically speaking, housing price appreciation can also signal high costs of living and lead to more labor supply (Johnson, 2014). Therefore, the net effect of housing wealth change on labor supply remains an empirical question.

A few studies find a negative association between housing price appreciation and labor supply. Henley (2004) finds that housing price appreciation significantly reduces females' working hours in Britain. Farnham and Sevak (2007) find that a 10% increase in housing wealth reduces the expected retirement age by between 3.5 and 5 months in the US. Disney and Gathergood (2013) show that in Britain housing price appreciation reduces young homeowners' labor force participation and working hours. Milosch (2014) finds that a

[1] Other studies estimate the effect of housing wealth change on college enrollment (Lovenheim, 2011; Cooper and Luengo-Prado, 2015), female fertility rate (Dettling and Kearey, 2014; Lovenheim and Mumford, 2013), and entrepreneurship (Adelino, *et al*., 2015; Harding and Rosenthal, 2013).

[2] Brown, *et al*. (2010) find that inheritance income increases older workers' probability of retiring and the effect is larger if the inheritance is unexpected.

positive housing price shock decreases married female homeowners' working hours and this effect is larger for highly educated, high income wives with children.

The effects of housing capital gain on labor supply may be heterogeneous depending on demographic characteristics. In cities with growing housing price, renters may need to work more and save more (Sheiner, 1995). In Britain, housing capital gains have little effect on middle-aged households' employment or working hours (Disney and Gathergood, 2013). In the US, housing capital gains do not reduce working hours of employed wives (Milosch, 2014).

Most of these studies use individual micro level data but use housing price (change) at the local (county, city, or metropolitan area) level as a proxy for individual households' housing wealth change. Lacking of housing wealth information at the household level, these estimates may be biased since many unobserved location attributes likely confound local housing price change. Endogeneity issues may also arise because workers tend to sort into different locations with specific housing price dynamics based on unobserved personal attributes and income expectations (Starkey and Port, 1993; Moretti, 2013). Using instrumental variables for local housing prices cannot solve the sorting bias issue since the instruments need to be at the local level and unobserved individual preferences may correlate with even exogenous location attributes due to worker sorting. For example, using natural amenities or geographic features as instruments for housing prices is still problematic if workers with unobserved high ability strongly prefer natural amenities and disproportionally sort into those locations.

Our study differs from the existing literature in two major aspects. First, we use a new micro dataset—the 2011 China Household Finance Survey (CHFS) data—to estimate the effect of an individual household's housing wealth change on the household heads' labor force participation in urban China. This dataset contains detailed information on housing and other assets for each household, such as the purchasing price and current value of each housing units (up to three housing units for each household), as well as detailed demographic information. This enables us to compute each household's housing capital gains and study the effect of housing capital gains on labor supply of individuals who have actually experienced housing wealth change. Second, to deal with possible measurement errors in self-reported housing value and possible omitted variables such as individual workers' income expectation and preferences for urban amenities, we employ an instrumental variable (IV) approach. Our IV is the average housing capital gain of households (excluding the household in question) living in the same community (similar to a census tract in the US). This IV is intuitively appealing: a homeowner's housing price change should be highly correlated with his or her neighbors' housing price change, but whether this homeowner decides to work or not should not be affected directly by the neighbors' housing price changes.

Our IV estimation results show that a 100 thousand RMB increase in a household's housing capital gains decrease the female household head's probability of joining labor force by 1.48 percentage points (put in another way, a one standard deviation increase in housing capital gains decrease this probability by 5.56 percentage points). Particularly, this effect is stronger for young females with children. However, an increase in housing wealth has little effect on males' labor force participation. We also find that a 100 thousand RMB increase in housing capital gains increase females' probability of becoming housewives by 3.13 percentage points, which is consistent with the previous findings that women tend to decrease labor supply in response to capital gains and switch to alternative activities such as home production or taking care of children (Henley, 2004; Disney and Gathergood, 2013). We also find that housing capital gains slightly reduce females' probability of being employed but have no effect on males' employment rate. Housing capital gains do not induce homeowners to retire earlier but reduce homeowners' probability of running family business.

Our findings provide some early empirical evidence on the effect of housing markets on labor markets in urban China. Housing prices have been growing rapidly during the past two decades (Fang, *et al*., 2015). With no property taxation on homeowners, a large proportion of housing capital gains have accrued to home owners. Understanding the social and economic consequences of this housing wealth effect in China is very important for policy makers but relevant empirical evidence is rare. This study aims to make such a contribution.

The rest of the paper is organized as follows. Section 2 introduces the data. Section 3 specifies the econometric model and discusses the identification issues. Section 4 presents the results and Section 5 concludes.

2. Data

We use the 2011 China Household Finance Survey (CHFS) data which is similar to the Survey of Consumer Finance data in the US.[3] It is the first micro dataset on household finance behavior in China. The survey employs a stratified three-stage, probability proportion to size (PPS) random sample design and the sample is representative of nationwide households.[4] The 2011 sample covers 25 provinces, 65 cities, 80 counties, and 320 communities, including 8,438 households and 29,234 individuals.

The CHFS data contains detailed information on household finance including financial assets, non-financial assets, debts, insurance, income, and consumption, as well as rich demographics variables. The survey asks how many housing units a household owns and

[3] The web site of CHFS data is http://www.chfsdata.org.
[4] For more details about the sampling scheme, see http://www.chfsdata.org/detail-14,15.html.

records housing attributes up to three housing units. Housing attributes include floor area, purchase price, purchase year, self-reported current value, location of the first housing unit, etc.

The sample we use consists of household heads and their spouses (if they have) who own at least one housing property in urban China. We restrict people's age to be between 16 and legal retirement age, which is 60 for males, 55 for female cadres, and 50 for female workers. As a robustness check, we also select a sample including people up to age 65; this age cutoff is commonly used in studies from developed countries.

Based on the following two survey questions, we can infer whether a person is in the labor force or not. The first question is "Do you have a job currently?" If the answer is "no," then the next question is "why don't you have a job?" The survey lists nine options: (1) student in school; (2) housewife; (3) disabled; (4) have a seasonal job but not in the work season; (5) on vacation, sick, or on maternity leave; (6) unemployed or haven't found a job; (7) unwilling to work; (8) retired; (9) others. We classify a person as in the labor force if the person currently has a job, or has a seasonal job but not in the work season, or unemployed.

To estimate the effect of housing wealth change on homeowners' labor force participation, we specify the following econometric model:

$$LFP_i = \alpha + \beta HousingWealthChange_i + \lambda' X_i + \varepsilon_i, \qquad (1)$$

where the dependent variable LFP_i is a dummy variable set to one if individual i is in the labor force at the time being interviewed. α is a constant and ε_i the error term. The independent variables are defined as follows:

HousingWealthChange: the key independent variable of interest. It measures the total change in housing wealth owned by a household and is computed as the difference between self-reported current value of housing units and the purchase price of housing units deflated by consumer price indexes.[5] If a household owns only one housing unit, the total housing wealth change is simply the capital gains (in real term) of this house over the tenure period. If a household owns two or three housing units, the total housing wealth change is the sum of the real capital gains of all units.[6] In our sample, 99.45% of homeowners have three or fewer

[5] Consumer price indexes at the city level are not available in China. We use the national consumer price index to deflate housing prices to year 2011.

[6] We drop housing units purchased before 1990. There was almost no housing market before 1990. 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. In the data, 95.54% of housing units are bought or built after 1990. We also experiment including all housing units purchased before 1990 and the results are very similar.

housing units. The survey records price information only up to the third housing unit so for the households that own more than three housing units, we undercount their housing wealth. Note that a household may incur a housing capital loss, so the value of this *HousingWealthChange* variable may be negative.

X_i: other control variables including individual and household level attributes that may affect an individual's labor force participation decision. Specifically, individual attributes variables include a female dummy, age and age squared, a dummy indicating good health condition, a dummy for having a college degree or above. Household level variables include household size, number of children under age six, household income excluding the labor income of the person in question, number of housing units owned, total non-housing asset, total household debt, average years of owning all housing units, and the total purchase prices of housing units.[7]

Table 1 presents the summary statistics of these variables. The average labor force participation rate in our sample is 87%, 93% for males and 80% for females. The mean housing capital gain is 363,000 RMB and the mean housing purchase price is 329,000 RMB. Given the average years of owning a house is 9.4, the imputed annualized appreciation rate in real term is 8.23% per year, suggesting that urban homeowners have received substantial real capital gains. Housing capital gains are particularly large in super-large cities. For example, in Beijing, Shanghai, and Guangzhou, homeowners on average receive 1.17 million RMB capital gains over the tenure period. Our dataset enables us to compute housing wealth change for each homeowner; such cross-household variations in housing wealth changes are not available in studies using local level housing price to proxy for housing wealth.

3. Identification

Three possible identification issues may bias the estimate of the key coefficient β in equation (1). First, the self-reported housing purchase price and current value may not be precise, so the key variable *HousingWealthChang* may contain measurement errors, biasing the estimated value of β toward zero and making it less likely to find an effect of housing wealth change on labor force participation. Second, there may be omitted variables that correlate with housing wealth change and labor force participation, which could bias our estimates in either direction. For example, unobserved positive shocks to labor demand in local labor markets may increase labor force participation and also drive housing price up,

[7] Total non-housing assets include financial assets and non-financial assets excluding housing assets. Debt includes the total remaining housing debt of each household. Years of owning a housing unit is used to proxy for housing quality (for example, vintage quality and depreciation).

creating an upward bias in estimation. Another example is omitted individual ability or preference. If people with higher unobserved ability are more likely to work and to buy housing in fast-growing or amenity-rich locations, this will also bias the estimates upward. Finally, there is likely a reverse causality issue: household members are more likely to enter the labor market if they decide to buy high-quality housing.

We include a set of demographic variables to control for individual and household characteristics and city fixed effects to control for unobserved location attributes. Furthermore, we employ an instrumental variable approach to deal with the identification issues. A valid instrumental variable should be highly correlated with housing wealth change of individual households but not correlated with households' labor force participation decisions. Our instrumental variable for *HousingWealthChang* is the average housing capital gains of other households living in the same community where the household in question lives; a community is a self-governed commune in cities with a size of between 1000 and 2000 households.[8] This instrumental variable is intuitively appealing if each household owns only one housing unit. In this case, the price change of one's housing unit should be highly correlated with the price change of his or her neighbor's housing simply because these two housing units are located in the same community; however, this person's decision to work should not be directly affected by the price change of his or her neighbor's house. The validity of this instrumental variable becomes weakened when households have two or more housing units that are located in different cities for two reasons: first, correlation of housing prices between cities is not as strong as within a city or within a community since housing markets are very localized; second, the CHFS data records the location of only the first housing units; for other housing units we know only whether those units are located within or outside of the city where the household currently lives. Therefore, when using the instrumental variable approach, we restrict our sample to the homeowners whose housing units are all located in the same city where they are currently residing. This reduces the sample size from 4,880 to 4,152.

Table 1 shows that the mean and standard deviation of the instrumental variable are very similar to those of the instrumented variable *HousingWealthChang*, suggesting a high correlation between them. We present the first-stage results and a formal weak instrument test in the next section.

(Insert Table 1 here)

4. Results

[8] This is similar to a census tract (on average 1600 housing units and 4000 people) defined by the US Census Bureau.

4.1 Effect of housing wealth change on labor force participation: Probit models

We first select a sample with urban homeowners no matter where their housing units are located. We estimate Model (1) using both OLS and Probit regressions and all standard errors are clustered at the city level. The results are presented in Table 2. Columns (1)-(3) are the OLS regression results and the coefficients of *HousingWealthChange* are all negative and significant in the full sample and the female sample. Since the linear probability model does not produce correct standard errors, we also report the Probit estimation results in Columns (4)-(6). Because in a few cities all people are in the labor force, these city dummies perfectly predict the dependent variable; therefore, these observations (34 observations in Column (4)) are dropped in the maximum likelihood estimation due to "quasi-complete separation." Column (4) shows that for the full sample, a 100 thousand RMB increase in housing wealth reduces householder's probability to work by 0.16 percentage points (statistically significant at the 1% level). This effect is twice as large for females (Column (5)) and statistically significant at the 5% level; but the effect is very small and not significant for males, consistent with the OLS regression results. Since these results may suffer from bias due to measurement errors, omitted variables, and reverse causality, they must be interpreted with caution.

(Insert Table 2 here)

The other control variables have reasonable signs and magnitudes. For example, Column (4) shows that females are less likely to work compared with males, consistent with the fact that females are more attached to families. People with a college degree or above, with good health condition are more likely to work. People with more children under six are less likely to work. Most of the coefficients of household level variables are not statistically significant. Since all these are controls and are not of our particular interest, we will not report them in the ensuing analysis.

4.2 Effect of housing wealth change on labor force participation: IV Probit models

We focus on the instrumental variable estimation. Our IV for the total housing wealth change of a household is the average total housing wealth change of other households in the same community. We restrict the sample to the households whose housing units are all located in the same city where the households reside because price change of housing units located in different cities may not be highly correlated since housing markets are very localized. This reduces the effective sample size to 4,152.

Columns (1)-(3) of Table 3 report the Probit estimation results using this restricted sample. The coefficients of the key variable *HousingWealthChange* for the full sample and for the male subsample are statistically insignificant but significant in the female subsample. When using the IV Probit models, the pattern of the coefficients is similar but the magnitudes are much larger. Particularly, the coefficient of *HousingWealthChange* for the female subsample is -0.0148 and significant at the 5% level. This suggests that a 100 thousand RMB increase in a household's total housing wealth decreases the female householder's probability of joining labor force by 1.48 percentage points. Put in a different way, a one standard deviation increase in housing wealth change (376,000 RMB) decreases females' probability of working by 5.56 percentage points. This impact is particularly large in super-large cities: the mean housing wealth gains in Beijing, Shanghai, and Guangzhou are 1.17 million RMB implying a 17.32 percentage points decrease in the probability of working for females compared with those without housing capital gains. This finding is consistent with the literature. For example, Henley (2004) points out that compared with men, women have a lower degree of labor market attachment and tend to put more value on home production or child caring. In response to a housing wealth increase, women tend to decrease labor supply. Column (6) shows that the effect of housing wealth increase actually increases males' labor force participation although it is not statistically significant.

(Insert Table 3 here)

Table 3 also reports the first-stage results. The coefficient of the IV is around 0.75 and very significant and stable across all models. The value of the F statistic for weak instruments test in the first stage is much larger than 10 in Columns (4)-(6), suggesting a high correlation between the IV and the instrumented variable *HousingWealthChange*. [9]

The effect of housing wealth increase on labor force participation may vary across life-cycle stages. We also estimate the IV Probit models based on two demographic characteristics: age of householders and whether a household has children under age six. In the full sample the median age of householder is 41. Table 4 presents the results. Panel 1 models use the full sample and show that the negative effect of housing wealth increase on labor force participation is stronger for younger people (age between 16 and 41, Column (1)), people with young children (Column (3)), and particularly younger people with young children (Column (5)) although most of the coefficients are insignificant. Panel 2 models use the female sample and show the same pattern: the negative effect is much stronger for

[9] The IV Probit estimation does not produce F test in the first stage. Following the convention, we report the Cragg-Donald Wald F test statistic using the two-stage least squares (2SLS) estimates.

younger females, females with young children, and particularly younger females with young children, and all the coefficients are significant at the 5% level or better. Note that all the F statistics in the first stage pass the weak instruments test except for the subsample of younger females with children possibly due to the very small sample size.

(Insert Table 4 here)

4.3 Robustness checks

Many existing studies select a sample of workers aged between 16 and 65. Although legal retirement age in China is lower, we also re-run the models using a larger sample including workers aged between 16 and 65. Columns (1)-(3) of Table 5 show that the general pattern is very similar to that in Table 3: a 100 thousand RMB increase in housing wealth reduces females' probability of working by 1.30 percentage points but has little effect on males.

(Insert Table 5 here)

If a household owns only one housing unit, perceived housing capital gains probably are not as influential as to multi-home owners since the house serves as the primary residential place. We test this hypothesis in Columns (3)-(6) and find that the overall pattern for this subsample is very similar to the full sample and the effect on labor force participation is negative, statistically significant, and with slightly smaller magnitudes as expected.

Renters may respond to housing wealth change differently. If substantial average housing capital gains in a city signal high housing prices, renters may need to work more and harder to be able to afford a home in the future. However, assigning average housing prices or average housing capital gains in a location to each renter involves endogeneity issues and it is very hard to find valid instrumental variables in our data for renters. Therefore, we are unable to test renters' response. Ideally, we also would like to test how the effect of stock wealth increase differs from that of housing wealth increase; however, our dataset records only current value, not the accumulative gains or losses of households' stock accounts.

4.4 Effect of housing wealth change on other labor supply decisions

The related literature has studied other dimensions of labor supply, including employment, early retirement, self-employment, and working hours. Our dataset enables us to

examine the first three and Table 6 reports the results.[10] Columns (1)-(3) show that a 100 thousand RMB increase in housing capital gains decreases females' probability of being employed by 1.09 percentage points but has little effect on males' employment. Following the literature (Farnham and Sevak, 2007), we also check if housing capital gains give people incentive to retire earlier. Based on the legal retirement age and the actual retirement status, we create a dummy variable indicating whether a person retired ahead of the legal retirement time and use it as the dependent variable. Columns (4)-(6) shows that housing capital gains do not give people incentive to retire early.

(Insert Table 6 here)

Some studies find that housing capital gains may serve as collateral helping homeowners creating businesses (Disney and Gathergood, 2009; Harding and Rosenthal, 2013; Hurst and Lusardi, 2004). Using the 2005 China Inter-Census Population Survey and Chinese Family Panel Studies datasets, Li and Wu (2014) find that in urban China high housing prices discourage entrepreneurial activities, possibly because the booming real estate industry has attracted more investment crowding out other types of business investment. We also test whether housing capital gains strengthen homeowners' incentive to own family businesses. The result in Column (7) of Table 6 shows a negative effect：a 100 thousand RMB increase in housing capital gains reduces households' probability to run businesses by 1.41 percentage point. This implies that housing capital gains in Chinese cities may have depressed entrepreneurship.

Since an increase in housing wealth reduces females' incentive to work, it is natural to ask what activities females will take in response to housing wealth increase. We estimate an IV Probit model using "whether a female is a housewife or not" as the dependent variable. The result is reported in Column (8) of Table 6. The coefficient of *HousingWealthChange* is 0.0313 and significant at the 1% level, indicating that a 100 thousand RMB increase in housing wealth increases the probability of being a housewife by 3.13 percentage points. In Beijing, Shanghai, and Guangzhou, where housing prices has risen much more rapidly, this effect amounts to a 36.62 percentage points increase in the probability of becoming a housewife. This suggests that women are very likely to substitute on-site work by housework in response to housing capital gains, especially in large cities.

5. Conclusion

[10] Our dataset does contain working hour information. However, estimating a working hour model involves a sample selection issue combined with IV Probit model which is technically challenging. Since this dimension is not our primary focus in this study, we leave this for the future research.

During the past two decades, Chinese housing markets have experienced rapid price appreciation. We use the 2011 China Household Finance Survey data to estimate how a household's housing wealth change affects householders' labor force participation. To deal with the endogeneity issue, we employ an instrumental variable approach using the average housing capital gains of other households residing in the same community as the instrument. We find that housing wealth increase has a significant impact on females' labor force participation but has little impact on males. A 100 thousand RMB increase in housing wealth reduces females' probability of working by 1.48 percentage points and increases females' probability of becoming housewives by 3.13 percentage points. These results are consistent with the previous findings that women are more attached to family and substitute on-site work by home production when facing a wealth increase.

We also find that housing capital gains reduce females' probability of being employed and reduce homeowners' incentive to run family businesses, but have little effect on the timing of householders' retirement. These findings together provide some early empirical evidence on the effect of housing price dynamics on urban labor markets in China.

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Table 1: Summary Statistics

Variable description	Obs.	Mean	Std. Dev.	Min.	Max.
LFP dummy (=1 if a person is in the labor force)	4880	0.87	0.33	0.00	1.00
LFP dummy for female sample	2142	0.80	0.40	0.00	1.00
LFP dummy for male sample	2738	0.93	0.25	0.00	1.00
HousingWealthChange	4880	3.63	6.62	-37.90	63.01
HousingWealthChang for the IV sample	4152	3.76	6.69	-12.55	63.01
Instrument variable for *HousingWealthChange* (average housing capital gains of other households living in the same community)	4152	3.78	5.25	-0.39	24.98
Total purchase price of housing units	4880	3.29	5.19	0.00	77.90
Average purchase years	4880	9.44	4.96	1.00	21.00
Number of housing units owned	4880	1.27	0.55	1.00	11.00
Female dummy	4880	0.44	0.50	0.00	1.00
Age	4880	41.24	8.82	16.00	60.00
College dummy (=1 with a college degree or above)	4880	0.14	0.35	0.00	1.00
Good health dummy (=1 if health condition is good or better)	4880	0.43	0.50	0.00	1.00
Number of Children under age 6	4880	0.25	0.47	0.00	4.00
Household income (excluding individual labor income)	4880	0.57	1.74	-4.91	30.00
Household size	4880	3.47	1.14	1.00	9.00
Household assets (excluding housing)	4880	2.65	8.07	0.00	116.40
Household debts	4880	0.80	3.52	0.00	107.80
Employed dummy	4880	0.79	0.40	0.00	1.00
Own family business dummy	4880	0.19	0.40	0.00	1.00
Retired early dummy	4880	0.04	0.20	0.00	1.00
Housewife dummy	4880	0.07	0.26	0.00	1.00

Note: The sample with the size of 4,880 includes householders who own at least one housing unit and meet other criteria described in Section 3 of the paper. The sample with the size of 4152 keeps the householders whose housing units are located in the same city. All monetary values are in 100,000 RMB in 2011 value adjusted by annual consumer price index when applicable.

Table 2: Effect of housing wealth change on labor force participation: OLS and Probit estimation

	(1)	(2)	(3)	(4)	(5)	(6)
		OLS			Probit	
Variables	Full Sample	Female Sample	Male Sample	Full Sample	Female Sample	Male Sample
HousingWealthChange	-0.0016***	-0.0029*	-0.0003	-0.0016***	-0.0032**	-0.0004
	(0.0006)	(0.0015)	(0.0010)	(0.0006)	(0.0014)	(0.0006)
Female dummy	-0.1652***			-0.2001***		
	(0.0087)			(0.0090)		
Age	0.0575***	0.0701***	0.0587***	0.0564***	0.0678***	0.0372***
	(0.0062)	(0.0134)	(0.0062)	(0.0038)	(0.0111)	(0.0025)
Age squared	-0.0008***	-0.0009***	-0.0008***	-0.0007***	-0.0009***	-0.0005***
	(0.0001)	(0.0002)	(0.0001)	(0.0000)	(0.0002)	(0.0000)
College dummy	0.0532***	0.1136***	0.0075	0.0663***	0.1569***	0.0038
	(0.0103)	(0.0211)	(0.0103)	(0.0170)	(0.0292)	(0.0144)
Good health dummy	0.1414***	0.2865***	0.0241***	0.1692***	0.3750***	0.0387***
	(0.0091)	(0.0150)	(0.0094)	(0.0120)	(0.0249)	(0.0107)
Number of Children under 6	-0.0415***	-0.1218***	0.0243**	-0.0349***	-0.1118***	0.0450***
	(0.0123)	(0.0225)	(0.0097)	(0.0113)	(0.0189)	(0.0158)
Household size	0.0051	-0.0025	0.0055	0.0069	0.0019	0.0022
	(0.0054)	(0.0074)	(0.0047)	(0.0048)	(0.0068)	(0.0046)
Household income	-0.0031	-0.0001	-0.0042	-0.0018	0.0006	-0.0028
	(0.0028)	(0.0041)	(0.0028)	(0.0018)	(0.0026)	(0.0022)
Total purchase price of housing units	-0.0016	-0.0040**	-0.0001	-0.0015	-0.0037**	-0.0005
	(0.0021)	(0.0018)	(0.0023)	(0.0018)	(0.0018)	(0.0015)
Number of housing units owned	0.0155	0.0373**	0.0007	0.0113	0.0367**	-0.0046
	(0.0113)	(0.0152)	(0.0137)	(0.0103)	(0.0168)	(0.0085)
Average purchase years	-0.0003	-0.0023	0.0013	-0.0006	-0.0019	0.0009
	(0.0012)	(0.0020)	(0.0010)	(0.0011)	(0.0019)	(0.0010)
Household assets	-0.0010*	-0.0017*	0.0002	-0.0008	-0.0014	0.0004
	(0.0006)	(0.0009)	(0.0005)	(0.0005)	(0.0009)	(0.0010)
Household debts	0.0022	0.0058**	-0.0011	0.0025	0.0083	-0.0007
	(0.0015)	(0.0024)	(0.0017)	(0.0021)	(0.0055)	(0.0016)
Sample size	4,880	2,142	2,738	4,846	2,118	2,499
Adjusted R^2 (Pseudo R^2)	0.1707	0.1763	0.1845	0.2729	0.2456	0.3477

Note: Constant term and city fixed effects are included in all the models but their coefficients are not reported here. Standard errors are clustered at the city level and are reported in the parentheses. Coefficients in Columns (4)-(6) are marginal effects. "***", "**" and "*" indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Effect of housing wealth change on labor force participation: IV Probit estimation

	(1)	(2)	(3)	(4)	(5)	(6)
		Probit			IV Probit	
Variables	Full sample	Female sample	Male sample	Full sample	Female sample	Male sample
HousingWealthChange	-0.0010	-0.0026*	0.0004	-0.0025	-0.0148***	0.0034
	(0.0008)	(0.0016)	(0.0010)	(0.0037)	(0.0059)	(0.0040)
			First-stage regression			
Instrumental variable for *HousingWealthChange*				0.7539***	0.7506***	0.7619***
				(0.0370)	(0.1390)	(0.0907)
First stage F test				415.8	162.2	231.8
Sample size	4,152	1,805	2,147	4,152	1,805	2,147
Pseudo R^2	0.2648	0.2450	0.3463			

Note: All models include the same set of control variables as in Table 2 but their coefficients are not reported here. Standard errors are clustered at the city level and are reported in the parentheses. First-stage F test reports the Cragg-Donald Wald F statistic produced in the first stage of the two-stage least squares estimates. All coefficients are marginal effects. "***", "**" and "*" indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Effect of housing wealth change on labor force participation by demographic subsamples: IV Probit estimates

	(1)	(2)	(3)	(4)	(5)
	Panel 1: Full sample				
	16≤age≤41	41<age≤60	With children	Without children	16≤age≤41 and with children
HousingWealthChange	-0.0067	-0.0003	-0.0139*	-0.0028	-0.0370
	(0.0063)	(0.0054)	(0.0084)	(0.0048)	(0.0341)
	First-stage regression				
Instrumental variable for *HousingWealthChange*	0.6230***	0.8414***	0.6428***	0.7734***	0.5702
	(0.1115)	(0.1624)	(0.1459)	(0.1360)	(0.4388)
First-stage F test	153.7	245.5	64.0	341.4	13.5
Sample size	1,992	2,077	913	3,204	318
	Panel 2: Female sample				
	16≤age≤41	41<age≤60	With children	Without children	16≤age≤41 and with children
HousingWealthChange	-0.0241**	-0.0082	-0.0393**	-0.0127**	-0.0876***
	(0.0103)	(0.0067)	(0.0179)	(0.0065)	(0.0292)
	First-stage regression				
Instrumental variable for *HousingWealthChange*	0.8480***	0.7839***	0.6002***	0.7845***	0.4353**
	(0.1450)	(0.2579)	(0.1734)	(0.1358)	(0.2005)
First Stage F test	114.4	48.5	22.4	133.3	4.72
Sample size	617	729	401	1,374	183

Note: All models include the same set of control variables as in Table 2 but their coefficients are not reported here. Standard errors are clustered at the city level and are reported in the parentheses. First-stage F test reports the Cragg-Donald Wald F statistic produced in the first stage of the two-stage least squares estimates. All coefficients are marginal effects. "***", "**" and "*" indicate significance at the 1%, 5%, and 10% levels, respectively. The sample sizes are slightly different from those in Table 3 because of the "quasi-complete separation" issue in Probit model.

Table 5: Effect of housing wealth change on labor force participation: Robustness Check

	(1)	(2)	(3)	(4)	(5)	(6)
		16≤age≤65		Have only one housing unit		
	Full sample	Female sample	Male sample	Full sample	Female sample	Male sample
HousingWealthChange	-0.0038	-0.0130*	0.0033	-0.0027	-0.0097*	0.0034
	(0.0038)	(0.0074)	(0.0045)	(0.0037)	(0.0053)	(0.0030)
Sample size	5,191	2,368	2,471	3,268	1,429	1,636

Note: All columns are IV Probit models including the same set of control variables as in Table 2 but their coefficients are not reported here. Standard errors are clustered at the city level and are reported in the parentheses. First-stage results are pretty similar to those in Tables (3) and (4) and are suppressed here. All coefficients are marginal effects. "***", "**" and "*" indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Effect of housing wealth change on other labor supply decisions: IV Probit estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Employment			Early retirement		Own business	Housewife
	Full sample	Female sample	Male sample	Full sample	Female sample	Male Sample	Full sample	Female sample
HousingWealthChange	0.0010	-0.0109*	-0.0059	0.0008	0.0068	-0.0015	-0.0141***	0.0313***
	(0.0058)	(0.0062)	(0.0080)	(0.0027)	(0.0058)	(0.0030)	(0.0052)	(0.0123)
Sample size	4,183	1,820	2,249	3,662	954	2,044	4,165	1,139

Note: All columns are IV Probit models including the same set of control variables as in Table 2 but their coefficients are not reported here. Standard errors are clustered at the city level and are reported in the parentheses. First-stage results are pretty similar to those in Tables (3) and (4) and are suppressed here. All coefficients are marginal effects. "***", "**" and "*" indicate significance at the 1%, 5%, and 10% levels, respectively.