The Retirement Consumption Puzzle in China

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Abstract

Using data from China's Urban Household Survey and exploiting China's mandatory retirement policy, we use the regression discontinuity approach to estimate the impact of retirement on household expenditures. Retirement reduces total non-durable expenditures by 21 percent. Among the categories of non-durable expenditures, retirement reduces work-related expenditures and expenditures on food consumed at home but has an insignificant effect on expenditures on entertainment. After excluding these three components, retirement does not have an effect on the remaining non-durable expenditures. It suggests that the retirement consumption puzzle might not be a puzzle if an extended life-cycle model with home production is considered.

Keywords: retirement; consumption puzzle; China
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1. Introduction

A considerable body of literature has documented a retirement consumption puzzle, that is, household consumption dropping substantially at retirement, which is inconsistent with the consumption-smoothing hypothesis by Modigliani and Brumberg (1954) and Friedman (1957).[1] Several explanations have been proposed to reconcile the empirical puzzle with the consumption-smoothing theory. Certain researchers argue that unexpected adverse information around retirement (Banks, Blundell, and Tanner, 1998) or involuntary retirement (Smith, 2006; Barrett and Brzozowski, 2012) has prevented households from smoothing consumption, whereas others use the change of household composition (Battistin et al., 2009) or the intra-household bargaining power (Lundberg, Startz, and Stilman, 2003) at the time of retirement to explain the drop in consumption.[2]

Empirical challenges to establish the causal link between retirement and consumption drop are present. First, consumption may not be well defined. Certain consumption expenditures are work-related or substitutable by home production, and thus should be expected to drop with retirement (Ameriks, Caplin, and Leahy, 2007). Once these parts are deducted, consumption is smoothed at retirement (Hurd and Rohwedder, 2003). However, the majority of studies do not observe different types of consumption in the data (e.g., Haider and Stephens, 2007). Second, retirement is an endogenous decision variable, and most studies do

[1] Hamermesh (1984) is one of the first to document the consumption drop at retirement. Other research using US data includes Banks, Blundell, and Tanner (1998), Bernheim, Skinner, and Weinberg (2001), Hurd and Rohwedder(2003, 2006), Lundberg, Startz, and Stilman (2003), Hurst (2003), Laitner and Silverman (2005), Anguiar and Hurst (2005), Scholz, Seshadri, and Khiatrakun (2006), Haider and Stephens (2007), Aguiar and Hurst (2007, 2013), Ameriks, Caplin and Leahy (2007), Fisher, Johnson, Marchand, Smeeding, and Torrey (2008), Hurst (2008), Aguila, Attanasio, and Meghir (2011). Other research uses data from other developed countries, for example, Italy (Miniaci, Monfardini, and Weber, 2002; Battistin, etal., 2007, 2009; Minicaci, Monfardini, and Webber, 2010), UK (Smith, 2004, 2006), Germany (Schwerdt, 2005), France (Moreau and Stancanelli, 2013), Australia (Barrett and Brzozowski, 2012), Russia (Nivorozhkin, 2010), Japan (Wakabayashi, 2008), and Korea (An and Choi, 2004; Cho, 2012). Hicks (forthcoming) uses data from Mexico.

[2] Battistin et al. (2009) show that the drop in the number of grown children living with their parents is an important factor accounting for the found decline of the non-durable consumption in Italy. Lundberg, Startz, and Stilman (2003) interpret retirement consumption puzzle using an intra-household bargaining model. They argue that the wives' bargaining power within households increases after their husbands retire, which leads to the increase of saving or the reduction of consumption since women usually live longer than men and thus would like to save more.

not have a good way of resolving endogeneity (see Hurst (2008) for a detailed summary of the literature). Thus, the retirement consumption link is not causal.

Our paper studies the retirement consumption puzzle in the Chinese context. Empirically, we are able to handle both challenges. First, we use data from China's Urban Household Survey (UHS), which includes detailed information on each item of household consumption. With this information, we could separate work-related consumption and household-substitutable consumption from other consumptions. Second, China has a mandatory retirement age (60 for men and 55 for women) for workers in the formal sectors (including governments, public sectors, state-owned enterprises (SOEs), and collectively-owned enterprises (COEs)), which allows us to use the regression discontinuity (RD) approach to estimate the causal impact of retirement on consumption. Essentially, we compare the consumption of those who just retired with the consumption of those who are about to retire.

Our RD estimation results are consistent with the consumption-smoothing hypothesis. Although retirement leads to a drop of household non-durable expenditures by 21 percent, this drop is primarily due to the decline of work-related expenditures and the expenditures on food consumed at home. One reason for the decline of food consumed at home is lower prices due to more time spent on searching for and preparing food.[3] As argued in Hurst (2008), the effect of retirement on work-related expenditures, expenditures on food consumed at home, and expenditures on entertainment can be explained by an extended life-cycle model combined with home production. Furthermore, after we exclude work-related expenditures, expenditures on food consumed at home and expenditures on entertainment, we find that retirement does not have a significant effect on the remaining non-durable expenditures. This suggests that the retirement consumption puzzle does not exist in our context.

[3] This finding is consistent with Aguiar and Hurst (2005) and Luengo-Prado and Sevilla (2013).

Our paper contributes to the literature in several aspects. First, this study contains both a credible identification method and a comprehensive dataset, including detailed information on consumption. Other studies addressing the problem of endogenous retirement do not have rich information on consumption. For example, Battistin et al. (2009) use the RD approach, and Haider and Stephens (2007) address the endogenous retirement decision by using the subjective retirement expectation as an instrumental variable (IV). However, both studies do not have detailed consumption data.[4]

Second, to the best of our knowledge, our paper is the first to study the retirement consumption puzzle in the context of China, and one of the first in the context of a developing country. Although developing countries are characterized by less efficient capital markets and households facing tighter credit constraint, our results show that households can still smooth consumption over predictable events such as retirement. This provides new evidence supporting an extended life cycle model.

There are caveats in the paper. Since the mandatory retirement policy only applies to employees in governments, public sectors, SOEs, and COEs, we should be cautious to extend the results to other sectors. In addition, the RD approach used in this paper essentially compares expenditures of households whose husbands' age is close to 60. Therefore, the results cannot be applied to households whose husbands' age is far from 60.

The remaining part of this paper is divided as follows: Section 2 introduces the mandatory retirement policy in China. Section 3 describes the data and variables used in the paper. Section 4 presents the identification strategy applied. Section 5 discusses the results. Section 6 extends the analysis, and Section 7 is the conclusion.

[4] There are some other studies using data with comprehensive household expenditure information. For example, Aguiar and Hurst (2013) and Fisher et al. (2008) use data from the US Consumer Expenditure Survey. However, Aguiar and Hurst (2013) simply compare expenditures of different cohorts. Although Fisher et al. (2008) address the endogenous retirement decision using a quadratic form of age as an IV, the validity of using age as an IV is a concern since age itself might affect expenditures directly.

2. Mandatory Retirement Policy in China

In China, retirement age is mandatory in the formal sectors, including the governments, public sectors, SOEs, and COEs. However, mandatory retirement has not been established in the informal sectors. China's retirement policies originated from a series of government documents for employees working in the formal sectors.[5] According to these documents, the normal retirement age for male employees is 60,[6] while that for female government employees or managers is 55 and that for female workers is 50.

However, people can retire earlier than the mandatory retirement age. During the process of SOE reform in the 1990s, the Chinese government issued a new policy in 1994. Following the policy, employees of those SOEs becoming bankrupt can retire at the time of bankruptcy and therefore be covered by the pension system five years ahead of the normal retirement age.

3. Data and Variables

The main analysis relies on data from the UHS. The UHS was conducted by the National Bureau of Statistics (NBS) in China. The UHS covers all provinces in China and uses a probabilistic sampling and stratified multistage method to select households. It is a rotating panel in which one-third of the sample is replaced each year, and the full sample is changed every three years. Therefore, the data are essentially repeated cross sections. We have access to data gathered in the nine Chinese provinces of Beijing, Liaoning, Zhejiang, Anhui, Hubei, Guangdong, Sichuan, Shaanxi, and Gansu, which represent different regions and economic conditions. The mean values and the trends of the most important variables are comparable between our sample and the national sample. The survey collects demographic and income information for every member of the family. This survey also collects detailed information of

[5] They are *Principles of Labor Insurance* in 1953, *Methods for Dealing with the Retirement of Government Employees* in 1955, *Regulations for Employees' Retirement* in 1958, *Methods for the Retirement of Workers* in 1978, and *Principles for Government Employees* in 1993.

[6] For those who have high-risk or/and health-damaging jobs, the retirement age for males can be 55.

household expenditures (including the quantity of each item, from which we can calculate the price); unfortunately, it has no information on assets. Our paper focuses on data gathered from 2002 to 2009.

An indicator, *Retired*, is constructed to denote one's retirement status. *Retired* is equal to one if one's answer to the question about employment status is "retiree." Considering that the mandatory retirement policy is only applied to those who work in governments, public sectors, SOEs, and COEs, we only use entries from retirees and individuals working in these four types of institutes. In our paper, the retirement status of households is determined by the retirement status of the husband. The RD approach is applied to estimate the effect of retirement; we therefore keep households with husbands aged around 60 (the retirement age for men), that is, from 50 to 70. However, because the household expenditures are recorded annually, the expenditures of households with husbands aged 60 combine pre-retirement and post-retirement consumption. Therefore, we drop all households with the husband aged precisely 60, which is consistent with Battistin et al. (2009). Eventually, 36,974 households from the UHS are left.

We focus on household non-durable expenditures, which include work-related expenditures, expenditures on food consumed at home, expenditures on entertainment, and the remaining expenditures on non-durable goods. Following the literature, we do not include expenditures on education and medical care in non-durable expenditures (Aguiar and Hurst, 2008). Work-related expenditures include expenditures on eating-out, transportation, wear (including clothes, clothes processing service, shoes, and others), and communication (including phone service, postal service, and others). Expenditures on food consumed at home are the total expenditures on 24 types of foods consumed at home, such as rice, pork, beef, egg, fish, and vegetable. Expenditures on entertainment include expenditures on tour, physical fitness activities, and other entertainment activities. The remaining non-durable expenditures

include expenditures on property management, rent,[7] utilities, personal care, and other services.

Apart from the UHS, we also use data from a time use survey in 2008, also conducted by the NBS. The survey covered ten provinces in China: Beijing, Hebei, Heilongjiang, Zhejiang, Anhui, Henan, Guangdong, Sichuan, Yunnan, and Gansu. A sub-sample (approximately 50%) of the UHS sample was randomly selected for the time use survey. Unfortunately, we are not able to link these two surveys due to the lack of unique household and individual identification code. Every person aged from 15 to 74 in the households was asked to record their activities in every 10 minutes of two days in the same week: one during the weekday and one during the weekend. In addition, this survey collected individual information such as gender, age, and employment status. As for the UHS data, we only keep households whose husbands are retirees or work in governments, public sectors, SOEs, and COEs. Keeping households whose husbands' age is between 50 and 70 (but excluding households whose husbands' age is 60), we have 2,321 households from the time use survey. Only the sample of husbands is used in this paper.

Table 1 shows the summary statistics of variables used in our paper. Panel A in this table shows the characteristics of husbands. Their average age is 58 and their average years of schooling are 11. Approximately 3 percent of the husbands are minorities. A total of 48 percent of husbands retired at the time of survey. During the weekday, they spend 20 minutes per day on shopping and 53 minutes on food preparation, whereas during the weekend, they spend 35 minutes on shopping and 60 minutes on food preparation. Panel B shows the summary statistics of household-level variables. The family size is 2.8, and the housing area is approximately 79 square meters. A total of 58 percent of wives have retired. Panel B also lists

[7] For homeowners, the rent is a self-reported answer to the question of what the homeowner would charge (net of utilities) to someone who would like to rent their house. For renters, the rent is their annual out-of-pocket expenditures on rent.

the summary statistics of household annual expenditures. The average non-durable expenditures are 18,632 yuan, in which work-related expenditures are 6,357 yuan (34% of total non-durable expenditures), expenditures on food consumed at home are 8,546 yuan (46%), expenditures on entertainment are 949 yuan (5%), and the remaining non-durable expenditures are 2,780 yuan (15%).

4. Empirical Strategy

4.1. Regression discontinuity design

We employ an RD design to quantify the impact of retirement on consumption. The RD design was first developed by Thistlethwaite and Campbell (1960). Applying the RD design to a range of empirical questions has recently elicited considerable research interest (see Lee and Lemieux (2010) for a review), and methodological best practice has also evolved rapidly (Hahn, Todd, and van der Klaauw, 2001; Porter, 2003; Imbens and Lemieux, 2008; Lee and Lemieux, 2010). Following Battistin et al. (2009), we start with the following regression function,

$$Y_{spt} = \alpha_0 + \alpha_1 R_{spt} + u_{spt}, \text{ where } R_{spt} = 1 \; if \; s > \bar{S} \qquad (1)$$

Where Y_{spt} is the average household expenditures for husbands aged *s* in province *p* and year *t*, and R_{spt} is the ratio of retirees among husbands aged *s* in province *p* and year *t*. In the sharp RD design, that is, the mandatory retirement policy is strictly implemented, R_{spt} is equal to 1 if the husband's age *s* is above $\bar{S}$, that is 60, while it is equal to 0 if the husband's age is below $\bar{S}$.

In the RD design, under the assumption that the conditional mean function E[u|s] is continuous at $\bar{S}$, the treatment effect α_1 can be identified as follows:

$$\alpha_1 = \lim_{s \downarrow \bar{S}} E[Y|s] - \lim_{s \uparrow \bar{S}} E[Y|s] \qquad (2)$$

In the model, if s is correlated with the outcome via channels other than R_{spt}, then u_{spt}

would be correlated to R_{spt} as well. This could cause ordinary least squares (OLS) estimates of α_1 to be inconsistent. To address this, one approach is to specify a conditional mean function $\mathrm{E}[\mathrm{u}|\mathrm{R},\mathrm{s}]$ as a "control function" in the outcome equation (Heckman and Robb, 1985).

Therefore, in practice, the following equation is estimated:

$$Y_{spt} = \alpha_0 + \alpha_1 R_{spt} + k(\mathrm{s}) + \omega_{spt} \quad (3)$$

As long as $k(s)$ is continuous in s, identification is achieved because of the discontinuity in R_{spt}. Usually, $k(s)$ is approximated by the polynomial function of s (relative to $\bar{S}$). In this paper, we not only allow the slope of the polynomial functions on each side of $\bar{S}$ to be different, but also allow their orders to be different on the two sides of $\bar{S}$. The specifications of the polynomial function are chosen by Akaike information criterion (AIC) (Lee and Lemieux, 2010). Considering that each observation represents the average values of variables over province-age-year, the number of households in each cell is used as a weight in the regression. The standard errors are calculated by clustering over province-age.

We conduct several tests of the assumptions that underpin the RD specification. Lee (2003) proposes a direct test of the continuity assumption by checking whether discontinuities occur in the relationship between the treatment effect and other characteristics. That is, the following equation can be estimated as a test:

$$X_{spt} = \beta_0 + \beta_1 R_{spt} + k(s) + \varepsilon_{spt} \quad (4)$$

If β_1 is statistically insignificant, then the continuity assumption is valid. In this paper, the characteristics that are tested include both the husbands' features (schooling years and the minority status) and household characteristics (family size, the housing area, and the wife's retirement status).

Another concern of the RD design is the possibility of manipulation of the variable that determines treatment (or running variable). In our context, this concern is not an important

issue because the running variable age is unlikely to be manipulated.

4.2. Fuzzy regression discontinuity design and IV estimation

In the RD design, treatment depends on the running variable *s* in a deterministic manner. However, in reality, treatment assignment is likely to depend on *s* in a stochastic manner, which is referred to in the literature as the fuzzy RD design. In this case, OLS estimates of Equation (3) may be biased.

In our context, a man may retire before the age of 60 or continue to work after the age of 60. In this case, the OLS estimate of α_1 in Equation (3) using the variable R_{spt} could be subject to selection bias. To address this issue, we introduce the second treatment variable E_{spt}. E_{spt} is equal to 1 if the husband's age *s* is above 60 but equal to 0 if *s* is below 60. The variable E_{spt} itself does not suffer from fuzziness and can be used to cleanly estimate an intent-to-treat effect. However, the impact of eligibility is not of primary interest; our goal is to estimate the impact of actually retiring on consumption. To obtain an unbiased estimate of this effect, we can use E_{spt} as an instrument for R_{spt}, because E_{spt} strongly predicts R_{spt} but is not subject to selection bias. One caveat is that the IV estimate is local average treatment estimate (LATE), meaning that the results can only be applied to households whose husbands comply with the mandatory retirement policy.

5. Results

5.1. First stage results

Being over the age of 60 can strongly predict the probability of retirement. Figure 1 shows a sudden jump in the probability of retirement at the age of 60. The curves in the figure are the probability of retirement as a function of age, fitted by nonparametric method at each

side of age 60.[8] People start to retire even before 60. Approximately five percent of 50-year olds retire, and this proportion gradually increases to 55 percent for 59-year olds. Importantly, a discrete large jump occurs from age 59 to 61, by 25 percentage points (to 80 percent). The proportion of retirees is close to 100% when age reaches 70.

Regression results reported in Table 2 confirm the graphical findings. In this table, the outcome variable is the proportion of retirees over the cell of province-age in each year. We try different function forms of the running variable age, allowing the function form to be different on the two sides of age 60. In Column 1, we report a first-order specification without controlling for province and year dummies. The coefficient on the dummy variable for "older than 60" is 0.318, which is significant at the one percent level, suggesting that the probability of retirement jumps by 31.8 percentage points at age 60. Results on the jump do not change much (22 to 32%) when we try different function forms for the running variable (Columns 2 to 5) and when we include the province and year dummies (Columns 3 to 5). Results in Columns 3 to 5 in Table 2 are also the first stage results for the main results reported in Table 4. The F-values of the test for the null hypothesis that the coefficient on the dummy for being older than 60 is equal to zero are also very large (the last row of Table 2), supporting our strategy of using this dummy as an instrumental variable for retirement.

5.2. Effect of retirement on household income and pre-assumption tests

In this section, we first investigate whether household income decreases at the retirement of the husband. Otherwise, the smoothness of consumption could simply be due to the unchanged income.

Husband's retirement does reduce household income. Figure 2 shows an obvious downward jump of household income when husband's age increases from 59 to 61.The

[8] As mentioned above, all households with husbands aged 60 are dropped to avoid the mixture of pre-retirement and post-retirement expenditures.

magnitude is approximately 3,000 yuan. We also report regression with the household income as the dependent variable (Column 1 in Table 3).[9] The coefficient on the proportion of retirees (using the indicator for being older than 60 as an IV) is -0.256 and significant at the 1 percent level. It suggests that the household income drops by approximately 26 percent upon retirement of the husband.

We then test the validity of the RD design by checking whether other variables are correlated with the jump in the probability of retirement at age 60. The variables we test include the husband's years of schooling, minority status, family size, housing areas, and the wife's retirement status. We would hope that there is no jump at age 60 for these variables.

These pre-assumption tests support our using the RD approach. Figure 3 indicates that these variables do not jump when husband's age increases from 59 to 61. These are confirmed by regressions reported in Columns 2 to 6 in Table 3, as the coefficient on the "retired" is not significant for all five outcome variables.

In addition to supporting the validity of our RD design, these results also shed light on a possible channel by which retirement affects consumption. Battistin et al. (2009) show that in Italy, an important reason for consumption to drop is that children do not stay with their parents after their parents retire. However, our finding that family size does not change after retirement suggests that the change of family size is not a cause for the drop of consumption in China.

5.3. Main results

We then report the effects of retirement on expenditures. Figure 4 shows the reduced form impact of age on the total household non-durable expenditures. A downward jump of total non-durable expenditures is obvious when age increases from 59 to 61. The magnitude of

[9] In all regressions in Table 3, we control for the province dummies and year dummies. We use the method of AIC to choose the order of the polynomial function controlled in each regression.

the downward jump is approximately 1,000 yuan. Figure 5 shows the effect of retirement on different components of household expenditures. Work-related expenditures decrease the most with a magnitude of approximately 500 yuan. The drop of expenditures on food at home is approximately 200 yuan. The drop of expenditures on entertainment and the remaining non-durable expenditures are less pronounced.

Next, we turn to regression results, shown in Table 4. All the outcome variables in Table 4 are average values over the province-age-year cell and we use their natural logarithms. We use the indicator for being older than 60 as an IV for the proportion of retirees. We control for the polynomial functions of age (relative to 60), the specifications of which are chosen by AIC, and province and year dummies. Regressions are weighted with the number of households in each cell of province-age-year as the weight. The standard errors are calculated by clustering over province-age.

Expenditures drop at retirement. In Column 1 of Table 4, we report a regression with the total non-durable expenditures as the dependent variable. The coefficient on the proportion of retirees is -0.209, which is significant at the 1 percent level, suggesting a drop of total non-durable expenditures by 21 percent at retirement. This is inconsistent with the prediction of the traditional life-cycle model.

We then investigate the channels by which retirement affects total expenditures by estimating the effect of retirement on each component of total expenditures. Table 4 indicates that retirement reduces work-related expenditures by 33% (Column2), reduces household expenditures on food consumed at home by 13% (Column3), and it has a negative but insignificant effect on the entertainment expenditures (Column 4).

Aguiar and Hurst (2005) point out that the decrease of time cost after retirement induces households to spend more time in searching for and preparing food, which leads to the decrease of expenditures on food consumed at home. It is confirmed by results shown in Table

5. During the weekday, retirement increases time spent on shopping by 30 minutes per day (Column 1) and on food preparation by 29 minutes (Column 2). Interestingly, on weekends, when the time cost is low for both retirees and non-retirees, retirement does not have a significant effect on time spent on shopping and food preparation (Columns 3 and 4).

Spending additional time on shopping and food preparation does reduce the food prices paid by households. Price for each type of food can be calculated by using the information of expenditures and quantity collected by the UHS. We construct a general price index by using ratios of expenditures on each type of food as weights. Column 1 in Table 6 shows that retirees pay about 9 percent lower in general, which is statistically significant at the 10 percent level. Columns 2, 4, and 5 show that retirement decreases grain price by 3 percent, vegetable price by 7 percent, and fruit price by approximately 5 percent. All of them are significant at least at the 5 percent level. Although retirement has no significant effect on the price of meat, it is negative, as shown in Column 3. These findings suggest that spending more time in searching for and preparing food does decrease the prices paid by households, leading to the decline in the expenditures on food consumed at home.

The decline of work-related expenditures and expenditures on foods consumed at home and entertainment can be easily embedded into an extended life-cycle model with home production and therefore might not be used as evidence for the existence of retirement consumption puzzle (Hurst, 2008; Li and Yang, 2009). In order to test the life-cycle model, we need to take these expenditures out of the non-durable expenditures and investigate the effect of retirement on the remaining expenditures.

Column 5 of Table 4 shows that the decline of the total non-durable expenditures after retirement can be fully explained by the decline of work-related expenditures and the expenditures on foods consumed at home. Retirement does not have a significant effect on the remaining non-durable expenditures and the coefficient is very small in magnitude. The results

suggest that if an extended life-cycle model with home production is considered, the retirement consumption puzzle is no longer a puzzle, consistent with Hurst (2008).

6. Robustness

6.1. Heterogeneous effects

The ability of consumption smoothing for a household likely depends on the wealth level at retirement. In this section, we investigate whether wealth affects the impacts of retirement on expenditures by using housing area as a wealth proxy.

Results reported in Table 7 show that the impacts of retirement on total non-durable expenditures are larger for poor households (Column 1, i.e., those having housing area in the bottom 50 percentile) than rich households (Column 2, i.e., those having housing area in the top 50th percentile). For poor households, retirement reduces the total non-durable expenditures by 20 percent, whereas for rich households, the reduction is 11 percent. This finding is consistent with the literature (Bernheim et al., 2001; Hurd and Rohwedder, 2003; Aguiar and Hurst, 2005; Ameriks et al., 2007; and Hurst, 2008).

Heterogeneous effects of retirement on total non-durable expenditures are driven by work-related expenditures and expenditures on entertainment. Retirement significantly reduces work-related expenditures by 47 percent for poor households (Row 2 in Column 1), whereas the reduction is 27 percent for rich households (Row 2 in Column 2). Compared with rich households, poor households could live far from their working places such that they spend more on transportation and eating out, leading to a larger reduction in work-related expenditures after retirement. Retirement significantly reduces expenditures on entertainment for poor households while the effect is insignificant for rich households (Row 4). Poor households could be more likely to substitute leisure time for entertainment after retirement due to their limited resources, which causes their expenditures on entertainment to decease

more.

However, after considering the extended life-cycle model with home production, retirement has similar effects on expenditures for poor and rich households. After excluding work-related expenditures, expenditures on food consumed at home, and expenditures on entertainment, retirement does not have significant effects on the remaining non-durable expenditures. It reveals that the extended life-cycle model holds for different groups of households.

6.2. Results using different samples around the retirement age

The RD identification relies on the sample around age 60. To check the robustness of our main results, we restrict our sample to a smaller range around age 60. As reported in Table 8, these regressions are specified the same as those having the same outcome variables in Table 4, except that we restrict the sample to smaller age ranges around age 60. For example, in Column 1, the sample includes households with the husband aged 51 to 69; while in Column 5, the sample includes households with the husband aged 55 to 65. Due to space limitation, we only present the coefficients on the proportion of retirees.

As shown in the first row in Table 8, except for the smallest sample in Column 5, retirement significantly reduces the total non-durable expenditures and the coefficients range from -0.143 to -0.193, comparable to that reported in Column 1 in Table 4. The effects of retirement on each component of consumption expenditures are also similar to those reported in Table 4 (Columns 2 to 5). Importantly, none of the coefficients in the last row are significant, suggesting that expenditures not related to work and home production do not change after retirement. These findings support the extended life-cycle model with home production.

6.3. Including households with husbands aged 60

In the main analysis above, we drop all households with husbands aged 60 to avoid the mixture of pre- and post-retirement expenditures. In this section, we check whether the results are robust to adding them back.

Results of regressions for the sample including 60-year olds are indeed weaker, though overall consistent with previous findings. Compared with the main results shown in Table 4, most of the estimated effects of retirement in Table 9 are smaller in magnitude. This is most likely because the expenditures of the 60-year olds include pre-retirement consumption expenditures.

7. Conclusion

In this paper, we test whether retirement consumption puzzle exists using China's UHS data. Taking advantage of China's mandatory retirement policy, we exploit the RD approach to identify the effect of retirement on household expenditures.

We find that retirement reduces the total non-durable expenditures by 21 percent. We further investigate how retirement affects different components of non-durable expenditures. We find that retirement reduces work-related expenditures by 33 percent. Retirement significantly reduces the expenditures on food consumed at home by 13 percent. Retirement does not have a significant effect on the expenditures on entertainment. After we take work-related expenditures, expenditures on food consumed at home, and expenditures on entertainment out of the total non-durable expenditures, retirement does not have a significant effect on the remaining non-durable expenditures. These results show that if the extended life-cycle model with home production is considered, retirement does not have a significant effect on the expenditures. In this sense, retirement consumption puzzle is actually not a puzzle.

China is now experiencing the process of population aging. The ratio of old people aged

above 60 in the population has increased from about 10 percent in 2000 to about 13 percent in 2010. There is a concern that their welfare could decrease after their retirement. Our results suggest that people themselves could prepare well for retirement, leading to the smoothness of the expenditures over retirement. However, our sample only includes people working in governments, public sectors, SOEs, and COEs. This group of people might benefit more from the pension system than other people not covered by this study. Therefore, we should be very cautious in drawing a conclusion from this finding that the government can just let people plan for their retirement by themselves but need not do things to increase the benefits and coverage of the pension system.

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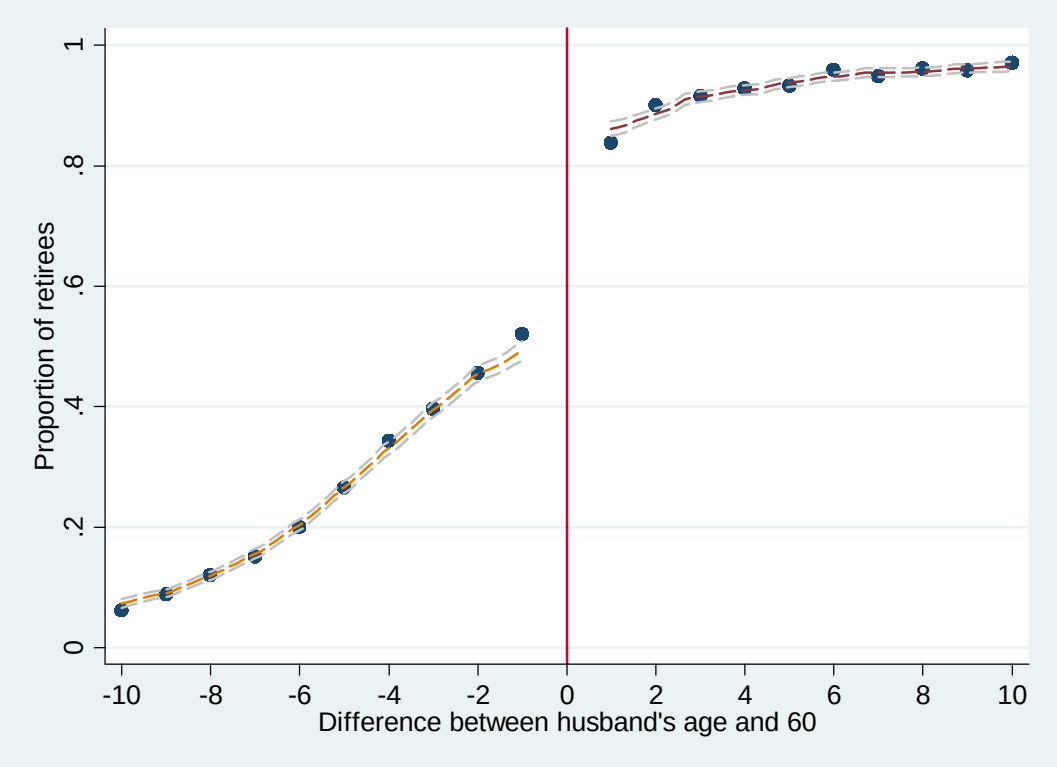
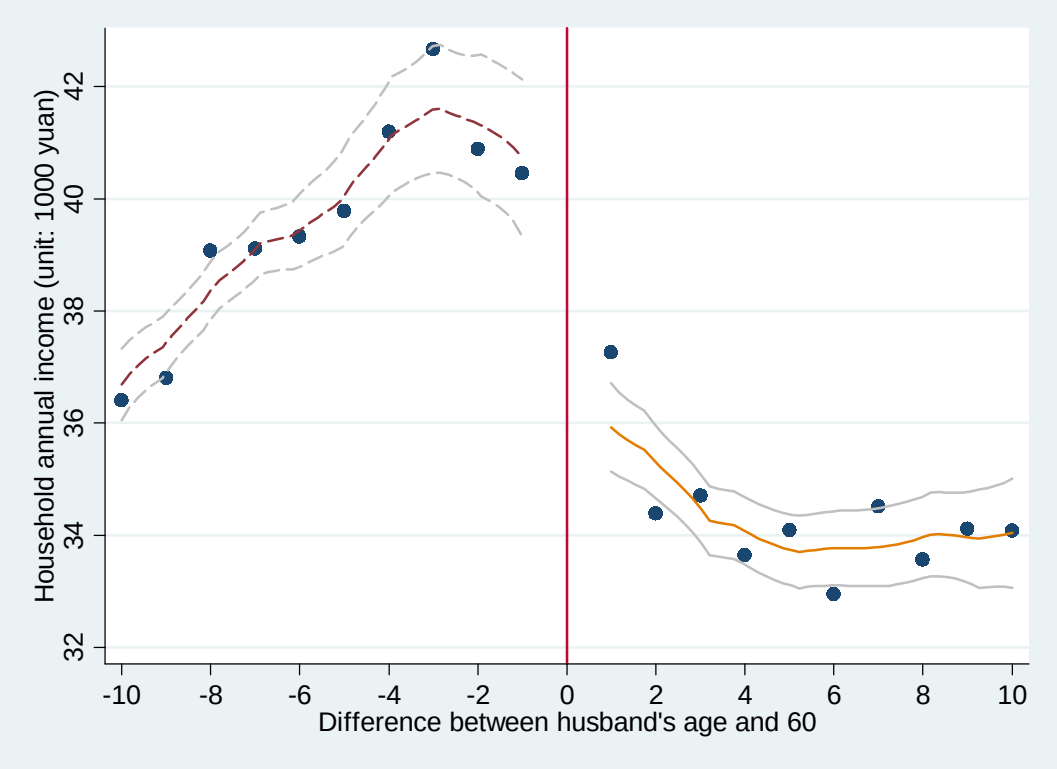
Figure 1 Impact of being older than 60 on retirement



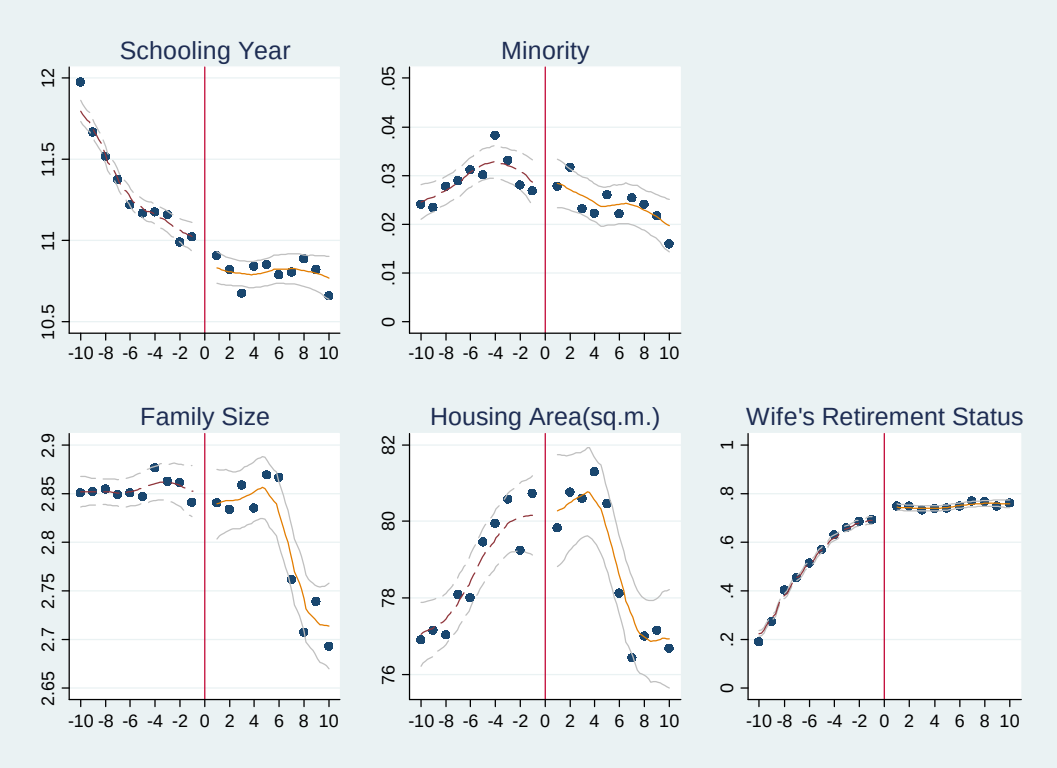
Note:
(1) The data are from the UHS (2002-2009). The sample of husbands aged from 50 to 70 (excluding those aged 60) is used.
(2) The points are the proportion of retirees in each age. The curves are fitted by the local linear functions on each side of 60.

Figure 2 Impact of retirement on household annual income



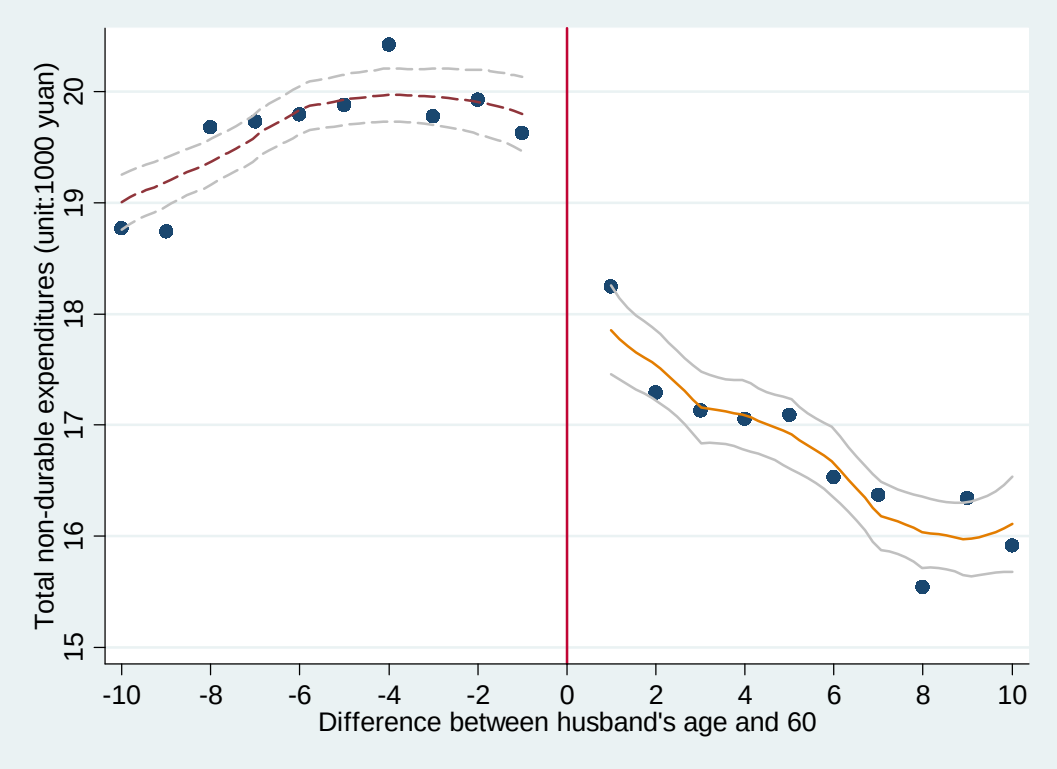
Note:
(1) The data are from the UHS (2002-2009). Households with the husband aged from 50 to 70 (excluding 60) are used.
(2) The points are average value of household income in each age. The curves are fitted by the local linear functions on each side of 60.

Figure 3 Pre-assumption tests



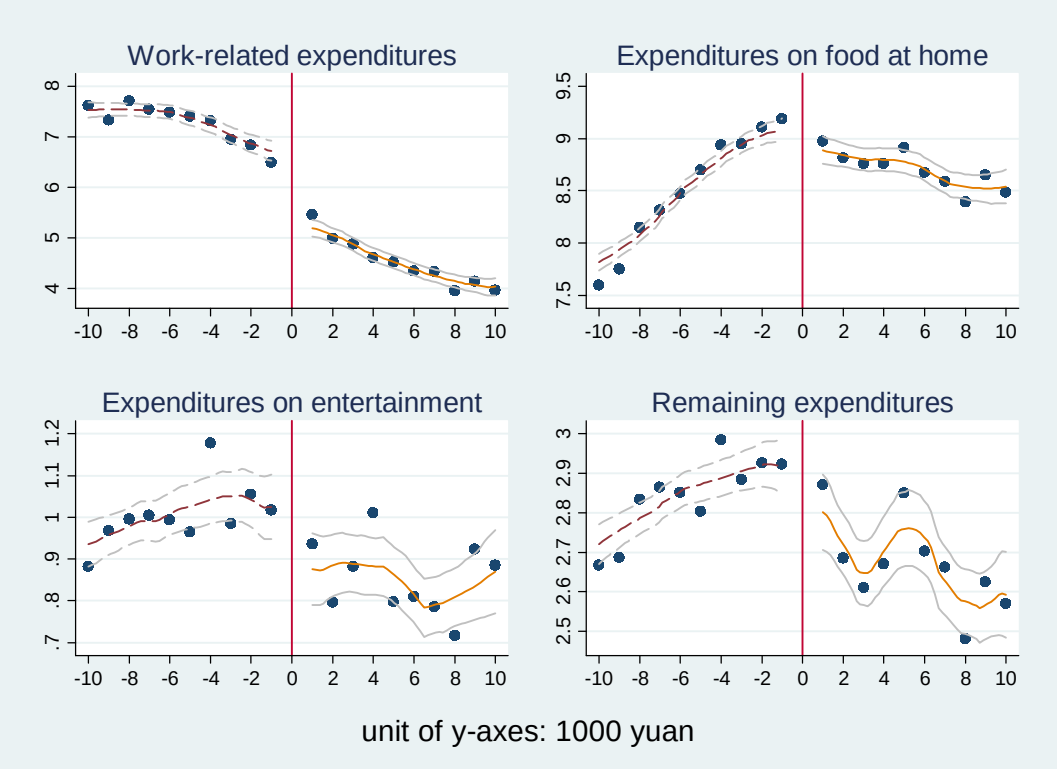
Note:
(1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.
(2) The X-axis in each graph is the difference between the husbands' age and 60. The Y-axis is the average value of schooling years, dummy for minority, family size, housing area, and dummy for wife's retirement status, respectively.
(3) The points are average values of variables in each age. The curves are fitted by the local linear functions on each side of 60.

Figure 4 Impact of retirement on total non-durable expenditures



Note:
(1) The data are from the UHS (2002-2009). Households with the husband aged from 50 to 70 (excluding 60) are used.
(2) The points are average value of total non-durable expenditures in each age. The curves are fitted by the local linear functions on each side of 60.

Figure 5 Effect of retirement on components of non-durable expenditures



Note:
(1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.
(2)The X-axis in each graph is the difference between the husbands' age and 60. The Y-axis is the average value of work-related expenditures, expenditures on food at home, expenditures on entertainment, and remaining expenditures, respectively.
(3) The points are average value of categories of non-durable expenditures in each age. The curves are fitted by the local linear functions on each side of 60.

Table 1 Summary statistics

	Mean	S. D.	Observations
Panel A. Husbands' characteristics			
Age	57.977	5.930	36974
Years of schooling	11.164	3.047	36974
Minority	0.027	0.163	36974
Retired	0.481	0.500	36974
Time spent on food searching on weekday (minutes/day)	20.233	39.400	2321
Time spent on food searching on weekend day (minutes/day)	34.696	52.670	2321
Time spent on food preparation on weekday (minutes/day)	53.490	62.733	2321
Time spent on food preparation on weekend day (minute/day)	60.259	66.400	2321
Panel B. Household characteristics			
Family size	2.838	0.935	36974
Housing area	78.724	40.454	36974
Wife retired	0.578	0.494	36974
Expenditures on non-durables (yuan/year)	18632.400	11877.980	36974
In which:			
Work related expenditures(yuan/year)	6356.659	6695.809	36974
Expenditures on food at home(yuan/year)	8546.267	4071.468	36974
Expenditures on entertainment(yuan/year)	949.127	2648.220	36974
Remaining non-durable expenditures(yuan/year)	2780.352	2531.808	36974

Note: (1) Time spent on searching and food preparation comes from the time use survey conducted in 2008.
(2) Information of other variables comes from the UHS conducted in 2002 to 2009.
(3) Households with husbands aged from 50 to 70 (excluding 60) are used.

Table 2 Effect of being older than 60 on retirement

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Proportion of the retirees over province-year-age				
Older than 60=1	0.318	0.209	0.316	0.277	0.216
	(0.019)***	(0.033)***	(0.015)***	(0.018)***	(0.018)***
Province dummies	No	No	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes	Yes
Polynomial function of age relative to 60	First order on either side of 60	Second order on either side of 60	First order on either side of 60	First order on the left of 60 and second order on the right	Third order on the left of 60 and second order on the right
Constant	0.546	0.614	0.534	0.533	0.557
	(0.015)***	(0.026)***	(0.015)***	(0.015)***	(0.014)***
Observations	1440	1440	1440	1440	1440
R-squared	0.95	0.95	0.96	0.96	0.96
F-value of H0 that the coefficient on the variable (older than 60=1) is equal to 0	315.08	168.67	434.97	418.23	395.97

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used. The number of households in each cell of province-year-age is used as a weight in all regressions.
(2) The specifications of the polynomial functions are chosen by AIC.

Table 3 Effect of retirement on household income and pre-assumption tests

	(1) Ln(Household income)	(2) Schooling years	(3) Minority	(4) Family size	(5) Housing area	(6) Wife was retired=1
Retired (Older than 60 as an IV)	-0.256	-0.860	0.006	-0.007	-7.021	-0.037
	(0.052)***	(0.662)	(0.011)	(0.178)	(8.751)	(0.075)
Polynomial function of age relative to 60	First order on either side of 60	Second order on either side of 60	Second order on the left of 60 and first order on the right	Third order on the left of 60 and second order on the right	First order on the left of 60 and second order on the right	Third order on the left of 60 and second order on the right
Constant	10.637	11.743	-0.001	3.372	105.137	0.652
	(0.037)***	(0.400)***	(0.006)	(0.118)***	(5.568)***	(0.046)***
Observations	1440	1440	1440	1440	1440	1440
R-squared	0.88	0.41	0.38	0.38	0.69	0.79

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.

(2) Outcome variables are average values over province-year-age. "Retired" is the proportion of retired people in each province-year-age cell, and "older than 60" is an indicator representing whether the husband's age is larger than 60.

(3) Province dummies and year dummies are controlled in all columns. The number of households in each cell of province-year-age is used as a weight in all regressions.

(4) The specifications of the polynomial functions are chosen by AIC.

Table 4 Effect of being retired on income and categories of expenditures

	(1)	(2)	(3)	(4)	(5)
	Ln(Non-durable exp.)	Ln(Work related exp.)	Ln(Exp.on food at home)	Ln(Exp.on entertainment)	Ln(Remaining exp. on non-durables)
Retired (Older than 60 as IV）	-0.209	-0.334	-0.130	-0.526	-0.094
	(0.064)***	(0.068)***	(0.060)**	(0.374)	(0.095)
Polynomial function of age relative to 60	Third order on the left of 60 and second order on the right	First order on either side of 60	Third order on the left of 60 and second order on the right	First order on the left of 60 and second order on the right	Third order on the left of 60 and second order on the right
Constant	9.880	8.863	9.052	6.859	7.923
	(0.044)***	(0.047)***	(0.041)***	(0.245)***	(0.063)***
Observations	1440	1440	1440	1440	1440
R-squared	0.87	0.83	0.87	0.66	0.72

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.

(2) Outcome variables are log of average values over province-year-age. "Retired" is the proportion of retired people in each province-year-age cell, and "older than 60" is an indicator representing whether the husband's age is larger than 60. The number of households in each cell of province-year-age is used as a weight in all regressions.

(3) Province dummies and year dummies are controlled in all columns.

(4) The specifications of polynomial functions are chosen by AIC.

Table 5 Effect of being retired on time spent on shopping and food preparation

	(1)	(2)	(3)	(4)
	Weekday		Weekend	
	Time spent on shopping	Time spent on food preparation	Time spent on shopping	Time spent on food preparation
Retired (Older than 60 as IV)	30.182	29.297	10.145	2.678
	(11.164)***	(17.357)*	(27.138)	(18.413)
Polynomial function of age relative to 60	Third order on the left of 60 and first order on the right	First order on either side of 60	First order on the left of 60 and second order on the right	First order on either side of 60
Constant	2.756	50.461	37.117	74.726
	(7.581)	(13.437)***	(20.767)*	(13.198)***
Observations	198	198	198	198
R-squared	0.40	0.47	0.13	0.26

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the time use survey in 2008. Households with husbands aged from 50 to 70 (excluding 60) are used.

(2) Outcome variables are log of average values over province-year-age. "Retired" is the proportion of retired people in each province-year-age cell, and "older than 60" is an indicator representing whether the husband's age is larger than 60. The number of households in each cell of province-year-age is used as a weight in all regressions.

(3) Province dummies and year dummies are controlled in all columns.

(4) The specifications of polynomial functions are chosen by AIC.

Table 6 Effect of being retired on food prices

	(1) Ln(Price index)	(2) Ln(Grain price)	(3) Ln(Meat price)	(4) Ln(Vegetable price)	(5) Ln(Fruit price)
Retired (Older than 60 as IV)	-0.093	-0.028	-0.020	-0.070	-0.045
	(0.054)*	(0.011)**	(0.026)	(0.022)***	(0.021)**
Polynomial function of age relative to 60	First order on either side of 60	First order on either side of 60	First order on the left of 60 and second order on the right	First order on either side of 60	First order on either side of 60
Constant	3.326	1.235	2.867	1.177	1.432
	(0.059)***	(0.008)***	(0.017)***	(0.017)***	(0.015)***
Observations	1440	1440	1440	1440	1440
R-squared	0.86	0.97	0.98	0.93	0.96

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.

(2) Outcome variables are log of average values over province-year-age. "Retired" is the proportion of retired people in each province-year-age cell, and "older than 60" is an indicator representing whether the husband's age is larger than 60. The number of households in each cell of province-year-age is used as a weight in all regressions.

(3) Grain price is the weighted average of rice price and flour price using the expenditures on rice and flour as weights; meat price is the weighted average of pork, beef, chicken, fish, and egg prices using the expenditures on each item as weights.

(4) Province dummies and year dummies are controlled in all columns.

(5) The specifications of the polynomial functions are chosen by AIC.

Table 7 Heterogeneous tests

	Housing area in the bottom 50 percentile	Housing area in the top 50 percentile
Ln(Non-durable exp.)	-0.198	-0.108
	(0.047)***	(0.043)**
Ln(Work related exp.)	-0.469	-0.270
	(0.091)***	(0.073)***
Ln(Exp.on food at home)	-0.115	-0.058
	(0.095)	(0.039)
Ln(Exp.on leisure)	-0.728	-0.230
	(0.223)***	(0.391)
Ln(Remaining exp. on non-durables)	-0.063	-0.072
	(0.083)	(0.113)

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.
(2) The coefficients shown are those of the proportion of retirees in the regressions using the dummy for older than 60 as an IV. The sample used in Column 1 includes households having housing area in the bottom 50 percentile; and Column 2 uses households having housing area in the top 50 percentile.
(3) In all regressions, province dummies and year dummies are controlled. The polynomial function controlled in each regression is chosen by AIC. The detailed information of the order of polynomial function is not reported due to space limit but is available upon request. The number of households in each cell of province-year-age is used as a weight in all regressions.

Table 8 Robustness check using different samples

	(1)	(2)	(3)	(4)	(5)
	[51,69]	[52,68]	[53,67]	[54,66]	[55,65]
Ln(Non-durable exp.)	-0.159	-0.180	-0.193	-0.143	-0.109
	(0.069)**	(0.071)**	(0.075)**	(0.080)*	(0.091)
Ln(Work related exp.)	-0.338	-0.292	-0.297	-0.297	-0.303
	(0.075)***	(0.085)***	(0.093)***	(0.115)**	(0.124)**
Ln(Exp.on food at home)	-0.103	-0.116	-0.119	-0.086	-0.081
	(0.060)*	(0.064)*	(0.065)*	(0.071)	(0.081)
Ln(Exp.on entertainment)	-1.072	-0.780	-0.878	-1.206	-1.131
	(0.764)	(0.513)	(0.631)	(0.693)*	(0.868)
Ln(Remaining exp. on non-durables)	-0.064	-0.133	-0.167	-0.094	0.043
	(0.103)	(0.110)	(0.114)	(0.121)	(0.143)

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 (excluding 60) are used.

(2) From Columns 1 to 5, we use sample within the smaller neighborhood around 60. For example, [51, 69] means households with husband aged between 51 and 69 are included in the sample.

(3) The same specifications as those in Table 4 are used. The coefficients shown are of "Retired" (using the dummy for being older than 60 as an IV).

Table 9 Impact of being retired on categories of expenditures including households with the husband's age equal to 60

	(1)	(2)	(3)	(4)	(5)
	Ln(Non-durable exp.)	Ln(Work related exp.)	Ln(Exp.on food at home)	Ln(Exp.on entertainment)	Ln(Remaining exp. on non-durables)
Retired (Older than or equal to 60 as IV)	-0.160	-0.339	-0.070	0.191	-0.016
	(0.091)*	(0.077)***	(0.087)	(0.865)	(0.131)
Polynomial function of age relative to 60	Third order on the left of 60 and second order on the right	First order on either side of 60	Third order on the left of 60 and second order on the right	First order on the left of 60 and second order on the right	Third order on the left of 60 and second order on the right
Constant	9.843	8.860	9.014	6.408	7.863
	(0.062)***	(0.052)***	(0.058)***	(0.535)***	(0.086)***
Observations	1512	1512	1512	1512	1512
R-squared	0.87	0.83	0.87	0.65	0.72

Robust standard errors are calculated by clustering over province-age; * significant at 10%; ** significant at 5%; *** significant at 1%.
Note: (1) The data are from the UHS (2002-2009). Households with husbands aged from 50 to 70 are used.
(2) Outcome variables are log of average values over province-year-age. "Retired" is the proportion of retired people in each province-year-age cell, and "older than or equal to 60" is an indicator representing whether the husband's age is larger than or equal to 60. The number of households in each cell of province-year-age is used as a weight in all regressions.
(3) Province dummies and year dummies are controlled in all columns.
(4) The specifications of the polynomial functions are chosen by AIC.