



The retirement consumption puzzle revisited: Evidence from the mandatory retirement policy in China



Hongbin Li, Xinzheng Shi^{1,*}, Binzhen Wu

School of Economics and Management, Tsinghua University, Beijing 100084, China

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ABSTRACT

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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 19%. 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. *Journal of Comparative Economics* 44 (3) (2016) 623–637. School of Economics and Management, Tsinghua University, Beijing 100084, 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).² 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 (Barrett and Brzozowski, 2012; Smith, 2006) has prevented households from smoothing

* Corresponding author. Fax: +86 106278 5562.

E-mail address: shixzh@sem.tsinghua.edu.cn (X. Shi).

¹ Hongbin Li is a C.V. Starr Professor of Economics, Xinzheng Shi and Binzhen Wu are associate professors of the School of Economics and Management, Tsinghua University. Xinzheng Shi is also a visiting scholar in the Chinese University of Hong Kong. All three authors are also affiliated with the China Data Center of Tsinghua University. The paper was titled as "The Retirement Consumption Puzzle in China." The authors thank Gérard Roland, two anonymous referees, seminar participants in Chinese University of Hong Kong, Peking University and Shanghai Jiao Tong University for comments. The remaining errors are all ours.

² Hamermesh (1984) is one of the first to document the consumption drop at retirement. Other research using US data includes Bernheim et al. (2001), Hurd and Rohwedder (2003, 2006), Lundberg et al. (2003), Hurst (2003), Laitner and Silverman (2005), Aguiar and Hurst (2005), Scholz et al. (2006), Haider and Stephens (2007), Aguiar and Hurst (2007, 2013), Ameriks et al. (2007), Fisher et al. (2008), Hurst (2008), Aguilu et al. (2011). Other research uses data from other developed countries, for example, Italy (Battistin et al., 2007, 2009; Miniaci et al., 2002; Minicaci et al., 2010), UK (Banks et al., 1998; 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 (2015) uses data from Mexico.

consumption, whereas others use the change of household composition (Battistin et al., 2009) or the intra-household bargaining power (Lundberg et al., 2003) at the time of retirement to explain the drop in consumption.³

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 et al., 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 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 19%, 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.⁴ 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.

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.⁵

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.⁶ 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. We also need to bear in mind that the estimated impact of retirement could be mixed with cohort effects since we compare the expenditures of households with husbands having different ages. One possible way is to use macroeconomic condition indicators at the beginning of the working life to account for heterogeneity across cohorts, but it is not feasible in our context because of data limitation.

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. Section 5 discusses the results. Section 6 extends the analysis, and Section 7 is the conclusion.

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

³ 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 et al. (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.

⁴ This finding is consistent with Aguiar and Hurst (2005) and Luengo-Prado and Sevilla (2013).

⁵ 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.

⁶ Rosenzweig and Zhang (2014) study a related issue but focus on the impacts of intergenerational co-residence on the saving behaviors of the young and the old.

of government documents for employees working in the formal sectors.⁷ According to these documents, the normal retirement age for male employees is 60,⁸ 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 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 55 to 65.⁹ 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, 14,974 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, 2013). 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,¹⁰ 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 min 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 55 and 65 (but excluding households whose husbands' age is 60), we have 1079 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 59 and their average years of schooling are 11. Approximately 3% of the husbands are minorities. A total of 60% of husbands retired at the time of survey. During the weekday, they spend 23 min per day on shopping and 59 min on food preparation, whereas during the weekend, they spend 36 min on shopping and 65 min on food preparation. Panel B shows the summary statistics of household-level variables. The family size is 2.9, and the housing area is approximately 81 m². A total of 69% of wives have retired. Panel B also lists the summary statistics of household annual expenditures. The average non-durable expenditures are 19,604 yuan, in which work-related expenditures are 6541 yuan (33% of total non-durable

⁷ 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.

⁸ For those who have high-risk or/and health-damaging jobs, the retirement age for males can be 55.

⁹ It is chosen using the method of cross-validation, which we will discuss in Section 4.

¹⁰ 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.

Table 1
Summary statistics.

	Mean	S. D.	Observations
<u>Panel A. Husband's characteristics</u>			
Age	59.376	3.317	14974
Years of schooling	11.086	3.080	14974
Minority	0.028	0.166	14974
Retired	0.595	0.491	14974
Time spent on searching on weekday (min)	23.355	43.149	1079
Time spent on searching on weekend day (min)	35.542	52.334	1079
Time spent on food preparation on weekday (min)	59.323	63.766	1079
Time spent on food preparation on weekend day (min)	64.643	66.743	1079
<u>Panel B. Household characteristics</u>			
Family size	2.861	1.018	14974
Housing area	80.818	40.568	14974
Wife retired	0.690	0.463	14974
Household income	40054.860	40193.280	14974
Expenditures on non-durables	19603.740	13165.200	14974
In which:			
Work related expenditures	6541.225	7447.32	14974
Expenditures on food at home	8986.51	4239.806	14974
Expenditures on entertainment	1166.665	3073.537	14974
Remaining non-durable expenditures	2909.339	2664.198	14974

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 2002–2009.

(3) Households with husbands aged from 55 to 65 (excluding 60) are used.

expenditures), expenditures on food consumed at home are 8987 yuan (46%), expenditures on entertainment are 1167 yuan (6%), and the remaining non-durable expenditures are 2909 yuan (15%).¹¹

4. Empirical strategy

4.1. Regression discontinuity design

Usually, the impact of retirement on household expenditures cannot be consistently estimated since the decision of retirement can be affected by some unobservable variables. In our context, male employees in governments, public sectors, SOEs, and COEs are required to retire when their age exceeds 60. In other words, the probability of retirement is discontinuous at 60. This discontinuity helps to solve the endogeneity problem due to the unobservable variables. It fits what is known as an RD design in the literature.¹²

We start with the following regression function

$$Y_{ispt} = \alpha_0 + \alpha_1 R_{ispt} + u_{ispt}, \text{ where } R_{ispt} = 1 \text{ if } s \geq \bar{s}, \quad (1)$$

where Y_{ispt} is the expenditures for household i having husband aged s in province p and year t , and R_{ispt} is a dummy variable which equals 1 if the husband retired and 0 otherwise. In the sharp RD design, that is, the mandatory retirement policy is strictly implemented, R_{ispt} 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} .

As shown in Hahn et al. (2001), the treatment effect α_1 can be identified as follows:

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

In practice, α_1 can be estimated nonparametrically (Li and Racine, 2007; Pagan and Ullah, 1999). However, since we are interested in the regression function at a single boundary point in the RD case, the bias for the standard nonparametric kernel regression is high (Imbens and Lemieux, 2008). As suggested by Imbens and Lemieux (2008), local linear regression is a solution to the bias in practice. The essential idea of the local linear regression is to fit linear regression functions over the observations within a distance h on either side of the discontinuity point. The treatment effect α_1 is estimated by the difference of the fitted

¹¹ Employees in other sectors account for 16% in our data set. Compared with employees in governments, public sectors, SOEs and COEs, employees in other sectors are younger and less educated, and their household incomes and total non-durable expenditures are lower as well. They are similar in terms of family size and minority status. However, housing areas of employees in other sectors are larger. The detailed summary statistics of employees in other sectors are not shown in the paper due to space limit but are available upon request.

¹² 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 et al., 2001; Porter, 2003; Imbens and Lemieux, 2008; Lee and Lemieux, 2010).

values at the discontinuity point. In other words, we estimate α_1 by solving

$$\min_{\{\alpha_0, \alpha_1, \alpha_2, \alpha_3\}} \sum_{i=1}^N k(s) * (Y_{ispt} - \alpha_0 - \alpha_1 * R_{ispt} - \alpha_2 * (s - \bar{s}) - \alpha_3 * R_{ispt} * (s - \bar{s}))^2 \quad (3)$$

Here, $k(s)$ is a kernel. If a rectangular kernel is used, then solving Eq. (3) is equivalent to use observations within a distance h on either side of the discontinuity point to estimate the following equation using OLS¹³:

$$Y_{ispt} = \alpha_0 + \alpha_1 * R_{ispt} + \alpha_2 * (s - \bar{s}) + \alpha_3 * R_{ispt} * (s - \bar{s}) + u_{ispt} \quad (4)$$

α_1 is the treatment effect of interest. In this paper, we follow this approach. Considering the fact that age is a discrete variable, the standard errors are calculated by clustering over province-age (Lee and Card, 2008).

One important issue in local linear regressions is to determine the distance h on either side of the discontinuity point, i.e. the bandwidth of the neighborhood around the discontinuity point in which the observations are used to estimate Eq. (4). We use the method of cross-validation proposed by Imbens and Lemieux (2008) to choose the optimal bandwidths for all five main outcome variables, i.e. total nondurable expenditures, work-related expenditures, expenditures on food at home, expenditures on entertainment, and the remained nondurable expenditures, respectively, and we use the smallest one in the paper. The bandwidth used in this paper is 5, i.e. households having husbands aged between 55 and 65 years (but excluding households whose husbands' age is 60 to avoid the mixture of pre- and post-retirement expenditures at age 60)¹⁴.

We conduct several tests of the assumptions that underpin the RD specification. Lee (2008) 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:

$$X_{ispt} = \beta_0 + \beta_1 * R_{ispt} + \beta_2 * (s - \bar{s}) + \beta_3 * R_{ispt} * (s - \bar{s}) + \varepsilon_{ispt} \quad (5)$$

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 sharp 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.¹⁵ In this case, OLS estimates of Eq. (4) 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 Eq. (4) using the variable R_{ispt} could be subject to selection bias. To address this issue, we introduce the second treatment variable E_{ispt} . E_{ispt} 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_{ispt} 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_{ispt} as an instrument for R_{ispt} , because E_{ispt} strongly predicts R_{ispt} but is not subject to selection bias (Imbens and Lemieux, 2008). 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. Fig. 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

¹³ As pointed out by Imbens and Lemieux (2008), the only case where more sophisticated kernel makes a difference is when the estimates are sensitive to the choice of bandwidth, i.e. the distance h on either side of the discontinuity point. Therefore, we use the rectangular kernel in the whole paper but show a robustness check in Section 6.2 to investigate whether our estimates are sensitive to the bandwidth chosen.

¹⁴ The detailed statistics from the method of cross-validation are not reported in the paper due to the space limit but are available from authors upon request.

¹⁵ We investigate what determines the probability of retirement by estimating a Probit model for husbands. In the Probit model, we include a dummy for being older than 60, education, family size, housing area, an indicator for whether wives retired, year dummies, and province dummies. Being older than 60 has the largest effect on the probability to retire (with the marginal effect equal to 0.654 and significant at the 1% level). Wife's retirement and family size also have significantly positive effects on the probability to retire; however, education and housing areas have significantly negative effects on the probability to retire. We do not report the results in the paper but they are available upon request.

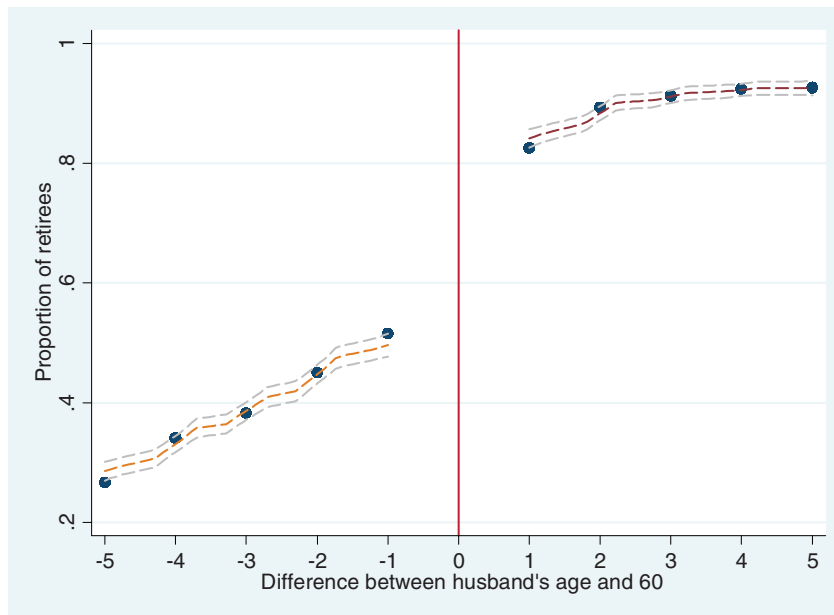


Fig. 1. Impact of being older than 60 on retirement note: (1) The data are from the UHS (2002–2009). The sample of husbands aged from 55 to 65 (excluding those aged 60) is used. (2) The points are the proportion of retirees in each age. The curves are fitted by the local linear functions on each side of 60.

Table 2

First stage results, impacts of retirement on household income and pre-assumption tests.

	(1) Retired	(2) Ln(household income)	(3) Schooling years	(4) Minority	(5) Family size	(6) Housing area	(7) Wife was retired=1
Older than 60	0.250 (0.020)***						
Retired (older than 60 as an IV)		−0.237 (0.083)***	−0.597 (0.421)	0.012 (0.021)	−0.166 (0.156)	−1.165 (6.243)	0.127 (0.078)
Constant	0.566 (0.020)***	10.127 (0.057)***	11.273 (0.319)***	0.017 (0.015)	3.049 (0.113)***	68.107 (4.479)***	0.436 (0.052)***
Observations	14974	14974	14974	14974	14974	14974	14974
R-squared	0.30	0.34	0.05	0.02	0.04	0.10	0.05
F-value	99.83						

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 (excluding 60) are used.

(2) “Retired” is an indicator for households having retired husbands, and “older than 60” is an indicator representing whether the husband’s age is older than 60.

(3) Province dummies, year dummies, and (age-60) are controlled in all columns. The interaction of (age-60) and “older than 60” is controlled in Column 1. The interaction of (age-60) and “retired” is controlled in Columns 2–7 and the interaction of (age-60) and “older than 60” is used as an IV for it.

(4) F-value is for the hypothesis test that the coefficients of “older than 60” and the interaction of (age-60) and “older than 60” are zero.

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

*** significant at 1%.

method at each side of age 60.¹⁶ People start to retire even before 60. Approximately 25% of 55-year olds retire, and this proportion gradually increases to 55% for 59-year olds. Importantly, a discrete large jump occurs from age 59 to 61, by 25 percentage points (to 80%).

Regression results reported in Column 1 in Table 2 confirm the graphical findings. We regress the dummy variable for retirement on the dummy variable for being older than 60 while controlling for province dummies, year dummies, and the piecewise linear function of age relative to 60 (i.e. age relative to 60 and its interaction with the dummy variable for being older than 60). The coefficient on the dummy variable for “older than 60” is 0.250, which is significant at the 1% level, suggesting that the probability of retirement jumps by 25 percentage points at age 60. The F-value of the test for the validity of IV is also very large (the last row of Table 2), supporting our strategy of using the dummy variable for being older than 60 as an instrumental variable for retirement.

¹⁶ As mentioned above, all households with husbands aged 60 are dropped to avoid the mixture of pre-retirement and post-retirement expenditures.

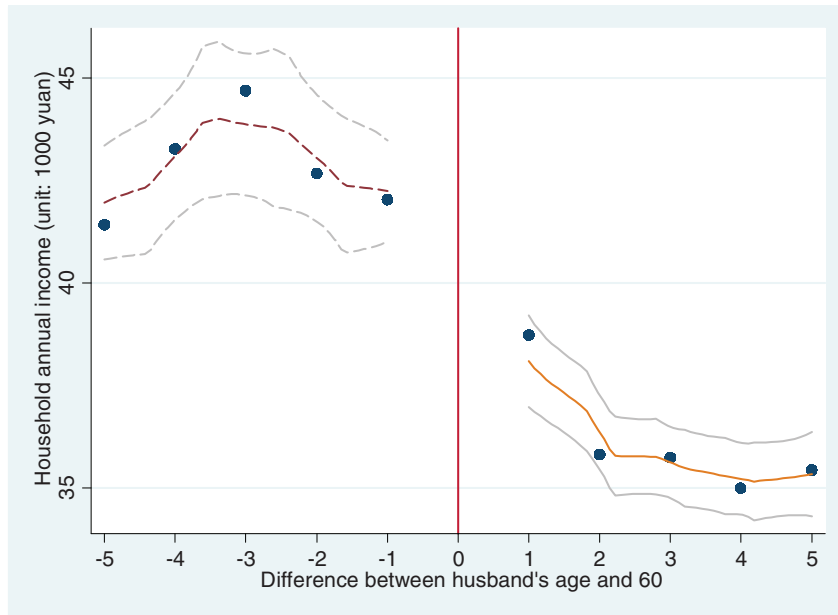


Fig. 2. Impact of retirement on household annual income.

Note: (1) The data are from the UHS (2002–2009). Households with the husband aged from 55 to 65 (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.

5.2. Effects 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. Fig. 2 shows an obvious downward jump of household income when husband's age increases from 59 to 61. The magnitude is approximately 3000 yuan.¹⁷ We also report regression with the household income as the dependent variable (Column 2 in Table 2).¹⁸ The coefficient on the dummy for retirement (using the indicator for being older than 60 as an IV) is -0.237 and significant at the 1% level. It suggests that the household income drops by approximately 24% 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. Fig. 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 3–7 in Table 2, 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. Fig. 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 the downward jump is approximately 1000 yuan. Fig. 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 drops of expenditures on entertainment and the remaining non-durable expenditures are less pronounced.

¹⁷ We investigate the changes of income components around the retirement. We find that labor income decreases and the transfer income, 88% of which is pension income, increases after retirement. However, the increase of transfer income can only make up half of the decrease of labor income, which leads to the decrease of the household total income. The detailed results are not shown in the paper but are available upon request.

¹⁸ In all regressions in Table 2, we control for the province dummies, year dummies and the piecewise linear function of age relative to 60.

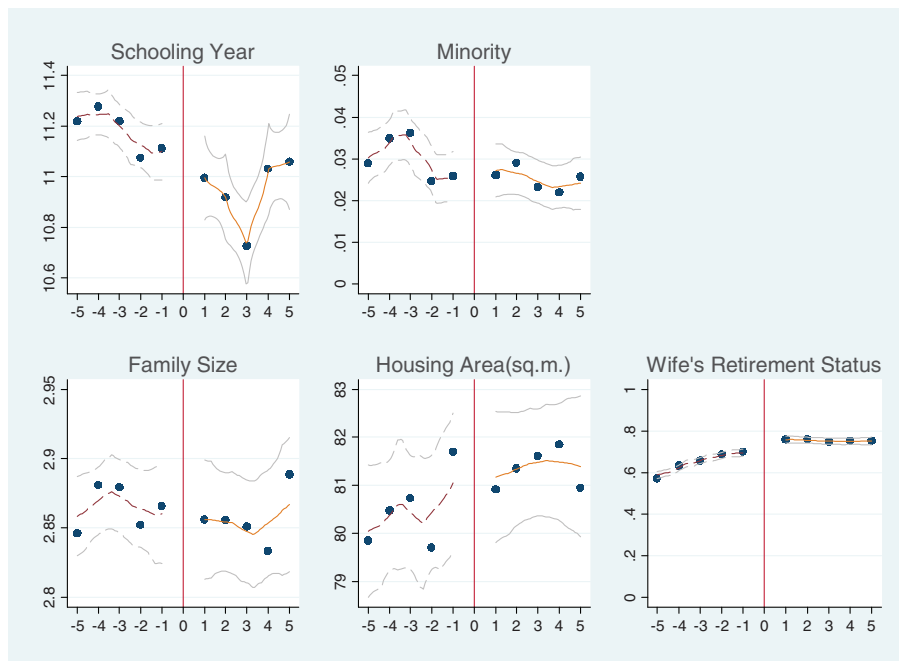


Fig. 3. Pre-assumption tests.

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 (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.

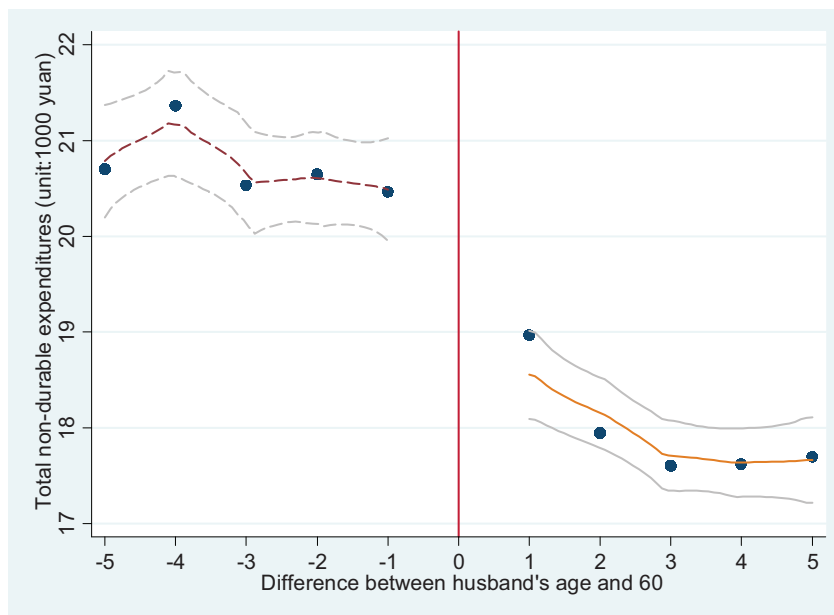


Fig. 4. Impact of retirement on total non-durable expenditures.

Note: (1) The data are from the UHS (2002–2009). Households with the husband aged from 55 to 65 (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.

Next, we turn to regression results, shown in [Table 3](#). We use the indicator for being older than 60 as an IV for the indicator for retirement. We control for province dummies, year dummies, and the piecewise linear function of age (relative to 60). The standard errors are calculated by clustering over province-age.

Expenditures drop at retirement. In Column 1 of [Table 3](#), we report a regression with the total non-durable expenditures as the dependent variable. The coefficient on the dummy variable for retirement is -0.190, which is significant at the 1% level, suggesting



Fig. 5. Effects of retirement on components of non-durable expenditures.

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 (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 3

Impact of retirement on categories of expenditures.

	(1) Ln (non-durable exp.)	(2) Ln (work related exp.)	(3) Ln (exp. on food at home)	(4) Ln (exp. on entertainment)	(5) Ln (remained exp. on non-durables)
Retired (older than 60 as IV)	−0.190 (0.064)***	−0.308 (0.118)**	−0.107 (0.059)*	−0.171 (0.207)	−0.078 (0.110)
Constant	9.806 (0.045)***	8.661 (0.082)***	8.984 (0.042)***	5.735 (0.157)***	7.738 (0.076)***
Observations	14974	14974	14974	14974	14974
R-squared	0.27	0.20	0.24	0.12	0.14
F-value					

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 (excluding 60) are used.

(2) “Retired” is an indicator for households having retired husbands, and “older than 60” is an indicator representing whether the husband's age is large than 60.

(3) Province dummies, year dummies, and (age-60) are controlled in all columns. The interaction of (age-60) and “retired” is controlled in regressions and the interaction of (age-60) and “older than 60” is used as an IV for it.

Robust standard errors are calculated by clustering over province-age;

* significant at 10%.

** significant at 5%.

*** significant at 1%.

a drop of total non-durable expenditures by 19% at retirement. This drop is larger than those estimated using the UK data (3%, Banks et al., 1998) and Italian data (9.8%, Battistin, et al., 2009). However, it is comparable to that estimated using the US data (20%, Ameriks et al., 2007; Bernheim et al., 2001). Compared with the drop in household income (24% or 3000 yuan), the drop in non-durable expenditures is smaller as well. It suggests that people may prepare for the retirement to some extent. However, in general, the drop of total non-durable expenditures at retirement 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 3 indicates that retirement reduces work-related expenditures by 31% (Column 2), reduces household expenditures on food consumed at home by 11% (Column 3), 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 4. During the weekday, retirement increases time spent on shopping by 43 min per day (Column 1) and on

Table 4

Impact of retirement on time spent on shopping and food preparation.

	(1) Weekday	(2)	(3) Weekend	(4)
	Time spent on shopping	Time spent on food preparation	Time spent on shopping	Time spent on food preparation
Retired (older than 60 as IV)	42.988 (21.790)**	25.536 (5.840)***	6.267 (22.807)	6.914 (6.327)
Constant	–6.838 (16.793)	55.764 (9.007)***	36.923 (18.549)**	79.720 (9.758)***
Observations	1064	1064	1064	1064
R-squared		0.08	0.01	0.02

Note: (1) The data are from the time use survey in 2008. Households with husbands aged from 55 to 65 (excluding 60) are used.

(2) “Retired” is an indicator for households having retired husbands, and “older than 60” is an indicator representing whether the husband’s age is large than 60.

(3) Province dummies, year dummies, and (age-60) are controlled in all columns. The interaction of (age-60) and “retired” is controlled in regressions and the interaction of (age-60) and “older than 60” is used as an IV for it.

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

** significant at 5%.

*** significant at 1%.

Table 5

Impact of retirement 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)	–0.017 (0.009)*	–0.035 (0.016)**	–0.022 (0.018)	–0.070 (0.035)**	–0.028 (0.034)
Constant	3.272 (0.011)***	1.242 (0.012)***	2.863 (0.013)***	1.176 (0.026)***	1.419 (0.024)***
Observations	14821	14821	14821	14821	14821
R-squared	0.87	0.97	0.98	0.93	0.95

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 (excluding 60) are used.

(2) 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.

(3) “Retired” is an indicator for households having retired husbands, and “older than 60” is an indicator representing whether the husband’s age is large than 60.

(4) Province dummies, year dummies, and (age-60) are controlled in all columns. The interaction of (age-60) and “retired” is controlled in regressions and the interaction of (age-60) and “older than 60” is used as an IV for it.

Robust standard errors are calculated by clustering over province-age;

* significant at 10%.

** significant at 5%.

*** significant at 1%.

food preparation by 26 min (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 or 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 5 shows that retirees pay about 2% lower in general, which is statistically significant at the 10% level. Columns 2 and 4 show that retirement decreases grain price by 4% and vegetable price by 7%. Both of them are significant at the 5% level. Although retirement has no significant effect on the prices of meat and fruit, it is negative, as shown in Columns 3 and 5. 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 food 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 3 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 food consumed at home. Retirement does not have a significant effect on the remaining non-durable expenditures and the coefficient is 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).

Table 6
Heterogeneous tests.

	Housing area in the bottom 50 percentile	Housing area in the top 50 percentile
Ln(non-durable exp.)	−0.268 (0.106)**	−0.139 (0.071)*
Ln(work related exp.)	−0.342 (0.234)	−0.278 (0.107)**
Ln(exp. on food at home)	−0.154 (0.100)	−0.076 (0.063)
Ln(exp. on entertainment)	0.111 (0.439)	−0.304 (0.219)
Ln(remained exp. on non-durables)	−0.037 (0.285)	−0.119 (0.089)

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 (excluding 60) are used.

(2) The specifications are the same as those shown in Table 3. The coefficients shown are those of the dummy for retirement using the dummy for older than 60 as an IV.

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

* significant at 10%.

** significant at 5%.

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 6 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 27%, whereas for rich households, the reduction is 14%. This finding is consistent with the literature (Aguiar and Hurst, 2005; Ameriks et al., 2007; Bernheim et al., 2001; Hurd and Rohwedder, 2003; Hurst, 2008).

Retirement has different effects on work-related expenditures for different households. Retirement significantly reduces work-related expenditures by 28% for rich households (Row 2 in Column 2) while this effect is not significant for poor households. Compared with poor households, rich 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.

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 investigate the sensitivity of our results to different bandwidths used. As reported in Table 7, these regressions are specified the same as in Table 3, except that we use different samples. For example, in Column 1, the sample includes households with the husband aged 53–67; while in Column 4, the sample includes households with the husband aged 57–63. Due to space limitation, we only present the coefficients on the dummy for retirement.

As shown in the first row in Table 7, retirement significantly reduces the total non-durable expenditures and the coefficients range from −0.136 to −0.197, comparable to that reported in Column 1 in Table 3. Most of the effects of retirement on each component of consumption expenditures are similar to those reported in Table 3 (Columns 2–5). 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 3, most of the estimated effects of retirement in Table 8 are smaller in magnitude. This is most likely because the expenditures of the 60-year olds include pre-retirement consumption expenditures.

Table 7
Robustness check using different samples.

	(1) [53, 67]	(2) [54, 66]	(3) [56, 64]	(4) [57, 63]
Ln(non-durable exp.)	−0.197 (0.084)**	−0.196 (0.057)***	−0.168 (0.076)**	−0.136 (0.079)*
Ln(work related exp.)	−0.327 (0.178)*	−0.339 (0.109)***	−0.307 (0.154)**	−0.253 (0.143)*
Ln(exp. on food at home)	−0.142 (0.073)*	−0.103 (0.050)**	−0.117 (0.066)*	−0.058 (0.069)
Ln(exp. on entertainment)	−0.559 (0.363)	−0.251 (0.185)	−0.582 (0.394)	−0.217 (0.282)
Ln(remained exp. on non-durables)	−0.144 (0.125)	−0.194 (0.122)	−0.099 (0.108)	−0.058 (0.109)

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged 60 are excluded.

(2) From Columns 1 to 4, we use sample within different neighborhoods around 60. For example, [53, 67] means that households with husband aged between 53 and 67 are included in the sample.

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

Robust standard errors are calculated by clustering over province-age;

* significant at 10%.

** significant at 5%.

*** significant at 1%.

Table 8
Impact of retirement on categories of expenditures including households with husbands aged 60.

	(1) Ln (non-durable exp.)	(2) Ln (work related exp.)	(3) Ln (exp. on food at home)	(4) Ln (exp. on entertainment)	(5) Ln (remained exp. on non-durables)
Retired (older than 60 as IV)	−0.187 (0.067)***	−0.267 (0.119)**	−0.116 (0.058)**	−0.164 (0.203)	−0.158 (0.111)
Constant	9.798 (0.046)***	8.618 (0.081)***	8.991 (0.040)***	5.711 (0.149)***	7.775 (0.077)***
Observations	16469	16469	16469	16469	16469
R-squared	0.27	0.20	0.24	0.12	0.14

Note: (1) The data are from the UHS (2002–2009). Households with husbands aged from 55 to 65 are used.

(2) “Retired” is an indicator for households having retired husbands, and “older than 60” is an indicator representing whether the husband’s age is large than 60.

(3) Province dummies, year dummies, and (age-60) are controlled in all columns. The interaction of (age-60) and “retired” is controlled in regressions and the interaction of (age-60) and “older than 60” is used as an IV for it.

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

** significant at 5%.

*** significant at 1%.

6.4. Results from parametric estimation

In the main analysis, we rely on nonparametric estimation. We investigate whether the general conclusion holds if we estimate the impact of retirement on household expenditures using the parametric method.

Parametric estimates of the retirement’s impacts on expenditures are in general robust. We use household level data and restrict the sample to those with husbands aged from 50 to 70 (excluding 60). Instead of controlling for the piecewise linear function, we control for the polynomial function of age relative to 60, the order of which is selected by the AIC (Lee and Lemieux, 2010). The results are shown in Table 9. We can see that the impacts of retirement on the total non-durable expenditures, work-related expenditures, and expenditures on food consumed at home are still negative and significant. More importantly, after we exclude work-related expenditures, expenditures on food and entertainment from total non-durable expenditures, the impact of retirement on the remaining expenditures is not significant. From this perspective, results from parametric estimation support our conclusion that the extended life-cycle model with home production holds in Chinese context.

6.5. Impact of wife’s retirement

In the main analysis, we define the retirement status of households by husbands’ retirement status. We redefine the retirement status of households by wives’ retirement status in this section and investigate the impacts of retirement on household expenditures. The results are shown in Table 10, from which we can see that wives’ retirement does not have any significant effects on household expenditures.

Table 9

Impact of retirement on expenditures, parametric method.

	(1) Ln (non-durable exp.)	(2) Ln (work related exp.)	(3) Ln (exp. on food at home)	(4) Ln (exp. on entertainment)	(5) Ln (remained exp. on non-durables)
Retired (older than 60 as IV)	−0.195 (0.060)***	−0.331 (0.064)***	−0.116 (0.059)*	−0.223 (0.249)	−0.168 (0.111)
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	9.773 (0.041)***	8.598 (0.046)***	8.981 (0.040)***	5.850 (0.162)***	7.768 (0.072)***
Observations	36974	36974	36974	36974	36974
R-squared	0.26	0.22	0.23	0.11	0.12

Note: (1) Households with husband aged 50–70 years olds are used, and households with husbands aged 60 years are dropped in order to avoid the mixture of pre- and post-retirement expenditures at the age of 60.

(2) “Retired” is an indicator for households having retired husband, and “older than 60” is an indicator representing whether the husband’s age is large than 60.

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

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

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

* significant at 10%.

*** significant at 1%.

Table 10

Impact of wife’s retirement on household expenditures.

	(1) Ln (non-durable exp.)	(2) Ln (work related exp.)	(3) Ln (exp. on food at home)	(4) Ln (exp. on entertainment)	(5) Ln (remained exp. on non-durables)
Retired (older than 55 as IV)	0.371 (1.045)	0.734 (2.012)	0.006 (0.738)	3.245 (3.969)	−0.248 (1.130)
Constant	9.475 (0.701)***	8.157 (1.353)***	8.853 (0.496)***	3.757 (2.628)	7.864 (0.765)***
Observations	24866	24860	24865	20547	24862
R-squared	0.09		0.23		0.12

Note: (1) Households with wives aged from 50 to 60 are used. Households with wives aged 55 are dropped in order to avoid the mixture of pre- and post-retirement expenditures at the age of 55.

(2) Retired is an indicator for households having retired husbands, and “older than 55” is an indicator representing whether the wife’s age is older than 55.

(3) Province dummies, year dummies, and (age-55) are controlled in all columns. The interaction of (age-55) and “retired” is controlled in regressions and the interaction of (age-55) and “older than 55” is used as an IV for it.

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

*** significant at 1%.

Table 11

Heterogeneous impacts of husbands’ retirement on expenditures in terms of wife’s retirement.

	(1) Ln (non-durable exp.)	(2) Ln (work related exp.)	(3) Ln (exp. on food at home)	(4) Ln (exp. on entertainment)	(5) Ln (remained exp. on non-durables)
Retired husband	−0.050 (0.119)	−0.157 (0.207)	0.051 (0.102)	−1.070 (0.586)*	0.258 (0.268)
Retired husband * Retired wife	−0.125 (0.140)	−0.193 (0.245)	−0.206 (0.120)*	0.149 (0.774)	0.227 (0.352)
Retired wife	0.221 (0.112)*	0.284 (0.173)	0.241 (0.091)***	0.432 (0.655)	−0.115 (0.308)
Constant	9.716 (0.084)***	6.697 (0.138)***	8.871 (0.073)***	6.965 (0.356)***	7.734 (0.171)***
Observations	14974	14974	14974	14974	14974
R-squared	0.28	0.20	0.25	0.05	0.02

Note: (1) Households with husbands aged from 55 to 65 are used. Households with husbands aged 60 are dropped in order to avoid the mixture of pre- and post-retirement expenditures at the age of 60.

(2) “Retired husband” is a dummy for husbands who retired, and “retired wife” is a dummy for wives who retired. An indicator for whether husbands’ age is older than 60 is used as an IV for “retired husband”.

(3) Province dummies, year dummies, and (husband age-60) are controlled in all columns. The interaction of (husband age-60) and “retired husband” are controlled in regressions and the interaction of (husband age-60) and the indicator for whether husbands’ age is older than 60 is used as an IV for it.

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

* significant at 10%.

*** significant at 1%.

We then investigate how the impacts of husbands' retirement on household expenditures depend on wives' retirement. We estimate the same regression functions as those in Table 3 but add wife's retirement and its interaction with husband's retirement. Results are shown in Table 11. We can see that the coefficient on the interaction term is only significant for expenditures on food consumed at home, and the coefficient is negative. It means that compared with households where only husbands retired, the reduction of expenditures on food consumed at home for households where both husband and wife retired is larger. It could be because husbands with retired wives can spend more time in searching and preparing food such that expenditures on food consumed at home decrease more at retirement compared with those whose wives do not retire.

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 19%. We further investigate how retirement affects different components of non-durable expenditures. We find that retirement reduces work-related expenditures by 31%. Retirement significantly reduces the expenditures on food consumed at home by 11%. 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% in 2000 to about 13% 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. In addition, employees in governments, public sectors, SOEs and COEs are different from those in other sectors in terms of some observable characteristics such as age, education and income. 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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