Mandatory Retirement and the Consumption Puzzle: Disentangling Price and Quantity Declines

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Abstract

This paper investigates changes in household consumption at retirement based on a comprehensive, diary-based household survey from China. We focus on disentangling price changes from quantity changes at retirement. The mandatory retirement policy in China provides a quasi-experimental setting for nonparametric identification of the true causal effects of fully anticipated retirement. Using a regression discontinuity design, we find that food expenditure declines at retirement, particularly among the less-educated group. We further show that this decline is driven by a reduction in prices rather than quantities. These findings, along with a documented increase in shopping time for food upon retirement among the less-educated households, are consistent with a time allocation model in which education enhances the value of leisure.

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1 Introduction

Many empirical studies show that consumption expenditure declines significantly at retirement. This phenomenon is referred to as the "retirement-consumption puzzle,"

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because a systematic decline in consumption is inconsistent with consumption smoothing suggested by the life cycle–permanent income hypothesis (PIH, Friedman, 1956, Hall, 1978). According to PIH, the marginal utility of consumption remains constant over the life cycle. Therefore, rational individuals are expected to smooth consumption through borrowing and saving, and their consumption should not decline when retirement is anticipated.

This "puzzle" has been documented in many developed countries using expenditure data.[1] Whether this finding can be interpreted as evidence that households are ill-prepared for retirement depends on how expenditures are mapped into consumption as well as researchers' ability to delineate between expected and unexpected retirement.

In their influential paper, Aguiar and Hurst (2005) suggest that retired households have considerably more leisure time, allowing them to shop for bargains and thereby pay lower prices for the same quantity and quality of goods. Expenditure declines at retirement, but actual consumption does not. They also argue that retired households can engage in more home production, which enables them to substitute home meals for restaurant meals. Aguiar and Hurst (2007) further show that the average prices paid for goods decrease while shopping time increases over the life cycle, and that purchase prices significantly decline around retirement age.

Following these two papers, we provide direct causal evidence on actual consumption changes at retirement. That is, we separate quantity changes from price changes at retirement, utilizing the mandatory retirement policy in China for identification and a large diary-based consumption data set, the Urban Household Survey (UHS) data, for estimation. We also document changes in household shopping time for food around retirement, which are consistent with the documented changes in prices and quantities.

The mandatory retirement policy in China provides a unique quasi-experimental setting for nonparametric identification of the true causal effects of fully anticipated

[1] See, for example, Banks et al. (1998) and Smith (2006) for evidence in the United Kingdom; Bernheim et al. (2001), Aguila et al. (2011), Ameriks et al. (2007), Haider and Stephens (2007) and Hurd and Rohwedder (2008) in the United States; Battistin et al. (2009) in Italy; Robb and Burbridge (1989) on Canada; Schwerdt (2005) in Germany; and Wakabayashi (2008) in Japan.

retirement. This policy requires workers to retire at a certain age. Workers who have just reached the retirement age and those who are just below this age are comparable except for their retirement status, so their mean outcome difference can be attributed to retirement at that age. The identified effects are for those compliers whose retirement is precipitated by their age exceeding a predetermined threshold rather than by endogenous factors, such as health shocks or being laid off. Furthermore, retirement at the required age is fully anticipated by Chinese workers because the policy has been in effect since the 1950s. This helps clarify consumption changes when retirement is foreseen versus when it is unforeseen.

Compared with most of the pension eligibility rules in the West, the mandatory retirement policy in China leads to a larger change in retirement probability. We show that about 30% of male workers retire at the mandatory retirement age. This policy can therefore help identify more precisely the retirement effects and provide implications for a broader group of workers. In addition, the mandatory retirement policy in China is based on age, which is well-defined and less susceptible to individual manipulation.

Existing studies based on developed countries typically show a decline in nondurable goods consumption, particularly food and work-related consumption (Hurst, 2008). There is also a large degree of heterogeneity. Consumption generally declines more among disadvantaged groups (see, e.g., Bernheim et al., 2001, Robb and Burbridge, 1989, and Schwerdt, 2005). China provides a different case because of its unique social, cultural, and economic environments. For example, Hurd and Rohwedder (2013) show that in the United States, the consumption decline at retirement is mainly induced by work-related expenditures, such as clothing and transportation. In contrast, workplaces in China typically do not impose a dress code, and many Chinese rely on inexpensive public transportation or bicycles to commute to work. Cessation of work therefore may not induce a significant decline in work-related expenditure. These institutions and social norms allow us to evaluate the role of job-related spending in the observed consumption patterns around retirement.

Following Battistin et al. (2009), we adopt a regression discontinuity (RD) design.

Battistin et al. (2009) exploit the pension eligibility rule in Italy to investigate expenditure changes at retirement. Unlike mandatory retirement, pension eligibility in Italy is determined by both age and contribution years. The constructed running variable for the RD design in Battistin et al. (2009) contains measurement error. They derive conditions under which the measurement error only leads to a fuzzier RD design. Interestingly, they show that retirement leads to a significant decline in the number of grown children living with their parents in Italy, which leads to changes in household composition and household size, and so partly cause a decline in household consumption. However, we show that household size in China does not experience a significant change when household heads retire.

More recently, Li et al. (2016) explore consumption changes at retirement in China using the UHS data. They analyze a shorter period (2002–2009) using data from nine provinces or municipalities,[2] while we study a longer period (1997–2007) using data from six provinces or municipalities. In addition, this paper directly examines the effects of retirement on consumption quantities vs. prices for narrowly defined food items and also at an aggregate level (using a consumption index). We consider more detailed expenditure categories, such as clothing and transportation. More importantly, we document heterogeneous retirement effects across education groups and provide new evidence for understanding interactions among consumption, education, and the value of leisure after retirement. We further conduct econometric analysis taking into account the potential bias caused by the rounding nature of the age data.

The rest of the paper proceeds as follows. Section 2 describes the institutional background and the data. Section 3 discusses identification and our empirical specification. Section 4 examines validity of the RD design. Section 5 investigates expenditure changes. Section 6 investigates price and quantity changes. Section 7 discusses changes in a constructed food consumption index and in food shopping time at retirement. Section 8 presents short concluding remarks.

[2]Their data cover Beijing, Liaoning, Zhejiang, Anhui, Hubei, Guangdong, Sichuan, Shaanxi, and Gansu.

2 Institutional Background and Data Description

In China, the official retirement age is 60 years for male workers, 55 years for white-collar female workers, and 50 years for blue-collar female workers, with some exceptions applying to certain occupations and to disabled workers.[3] These mandatory retirement ages have not changed since they were established in the 1950s. Mandatory retirement is strictly enforced in the state sector, including government organizations and state-owned enterprises (SOEs), whereas workers in the private sector have more flexibility. In our sample, the majority (78%) of the workers around retirement age work for the state sector. Working for the private sector is more common among younger workers, because the private sector in China was virtually non-existent until the 1980s.

Workers may retire earlier before they reach the mandatory retirement age. Retirees may also take a new job or may even be re-hired by the same employer after their official retirement. As a result, the change in the retirement rate is less than one at the mandatory retirement age, which entails a fuzzy RD design. Essentially those who retire before the mandatory retirement age are "always takers," while those who are re-employed after their official retirement are "never takers." Both groups do not contribute to the changes in retirement rate and in consumption at the mandatory retirement age. Identifying the causal effect of retirement in this fuzzy RD design relies on those "compliers" who comply with the mandatory retirement policy and retire at the policy-prescribed age.

In China, the replacement rate (pension as a fraction of a worker's pre-retirement income) depends on the duration of the pension program participation and on the pre-retirement occupation of an individual. To be eligible for a pension, one must participate in the program for a minimum of 10 years.[4] Typically, a worker with 10 years of par-

[3]Those who have jobs that are risky, harmful to their health, or extremely physically demanding can retire five years before the official retirement ages, namely 45 years for blue-collar female workers and 55 years for male workers. Male workers who become disabled and hence are unable to do their work can apply for retirement at 50 years, while disabled female workers can retire at 45.years. Civil servants also qualify for early retirement if they have worked for 30 years and are within 5 years of their retirement age.

[4]For those joining the workforce after 1993, the minimum number of years of contribution required

ticipation receives 60% of his/her pre-retirement wage, and the replacement rate can increase to 70% for workers with 15 or more years of participation. The maximum replacement rate for civil servants is 88%, and for government institution workers is 90%. However, a small number of workers, who started working for the Communist Party before 1945, receive a 100% replacement rate.

We use data from the UHS, an ongoing national annual survey of urban households conducted by the National Bureau of Statistics (NBS) of China. The first wave of the UHS was conducted in 1988. The UHS surveys a large representative sample of urban households (30,000–50,000 households every year during our sample period) and provides detailed information on household consumption and income as well as the education, employment, and demographic information of each household member. One unique feature of the UHS data is that the food consumption data are collected through a consumption diary. Both expenditure and quantity information is available for detailed consumption categories. Unlike data collected through recall questions, these data are less likely to have recall errors. The UHS data have been used to compile CPI and monitor consumption changes over time in China.

Limited by data availability, we use a subset of the UHS data that are representative of urban households in five provinces and one municipality.[5] Selection into the sample of urban residents at retirement is not an issue here. Given the restricted household registration or hukou system in China, workers rarely ever move to rural or other areas upon retirement. We choose the sample period 1997–2006, because the UHS questionnaires have changed a few times over the years, but the questionnaires used between 1997 and 2006 are largely consistent . In addition, the pension system in China changed in 1997, duing which the Chinese government adopted a system that combines individual accounts and social pooling to provide retirement funds. Before 1997, pensions were provided entirely by employers.[6]

is 15, but this requirement is irrelevant for the retiree cohorts being investigated in this study.

[5]The five provinces are Liaoning, Zhejiang, Guangdong, Shanxi, and Sichuan. The one municipality is Beijing.

[6]Given that we are looking at individuals near the retirement age, even if this change has any effects on the size of the compliers at mandatory retirement, it should not invalidate our identification.

We focus on male workers who are household heads for clean identification. Female labor supply is more complicated. Female workers' mandatory retirement age also varies across occupations. Focusing on household heads might cause a sample selection issue. That is, the reported household head might change with the head's retirement status, which would invalidate our research design. If this is true, the probability of being a household head should change at the mandatory retirement age of 60. We therefore inspect the fraction of household heads at each age among the full UHS sample of males. As shown in Figure 1(a), the probability of being a household head changes smoothly with age, and no abrupt changes are observed at the mandatory retirement age of 60.

Eligible male workers can start their retirement paperwork at the beginning of the month they turn 60. Typically the paperwork is processed within the same month, and eligible workers start to receive a pension the following month after they turn 60. Retirement status in our study is obtained from the survey question on individuals' employment status. A household head is retired if his employment status is "retiree." We do not include in our sample those who are not labor force participants.

3 Identification and Empirical Specification

3.1 The RD Model

As a quasi-experimental approach, a standard RD design identifies the effect of a binary treatment when the assignment of treatment is determined by an observed covariate, the so-called "running variable," exceeding a known threshold. RD identification associates a discrete change in the treatment probability at the threshold with a corresponding discrete change in the mean outcome. Here the treatment is whether a male household head is retired or not, while the running variable is household head's age.

We consider the standard static RD model, which identifies the short-run effect of retirement on household consumption at the mandatory retirement age of 60. The time-

Including or excluding data from 1997 does not significantly affect our results.

varying effects of retirement are discussed in the Online Appendix III.

Let Y denote household consumption, and let T be a binary indicator that equals 1 if a household head is retired and 0 otherwise. Let X denote a household head's exact age relative to the mandatory retirement age of 60. We define $D = I(X \geq 0)$, where $I(\cdot)$ is an indicator function that equals 1 if the argument is true and 0 otherwise. $D = 1$ for household heads who are at or above the mandatory retirement age, and $D = 0$ otherwise. Assume that household consumption depends on the head's retirement status and otherwise would change smoothly with his age. We can then write the consumption model as follows:

$$Y = f(X) + \tau_0 T + \varepsilon, \tag{1}$$

where $f(X)$ is some well-behaved continuous function of X, and ε captures all other smooth factors that determine a household's consumption. In Equation (1), τ_0 captures the average effect of retirement on consumption at the mandatory retirement age, even if the retirement effect is heterogeneous in the true consumption model.

Assume that the retirement rate changes smoothly with age in the absence of mandatory retirement, i.e.,

$$T = \sum\nolimits_{j=0}^{J} a_j X^j + \sum\nolimits_{j=0}^{J} b_j X^j D + v, \tag{2}$$

where J is the order of the polynomial and v is a smooth regression error.

Plugging Equation (2) into Equation (1) yields the following reduced-form consumption equation:

$$Y = \sum\nolimits_{j=0}^{J} c_j X^j + \sum\nolimits_{j=0}^{J} d_j X^j D + u. \tag{3}$$

For simplicity, we assume that the order of polynomial in Equation (3) is also J, although one may allow the order of polynomials to differ for the retirement and the consumption equations. In this case, J can be taken as the higher order of the two.

Both consumption Y and retirement T could depend on other covariates, which are suppressed for now, because a generic virtue of the RD approach is that the inclusion of other covariates (assumed to be smooth) only affects efficiency but not consistency of the estimated RD treatment effects. The above equations allow the slopes and higher-order derivatives of retirement and consumption profiles to differ at either side of the age threshold.

Given the smoothness of $f(X)$ and ε in Equation (1), any observed discontinuity in the mean consumption can be attributed to the change in the retirement rate. So the ratio of mean consumption change to retirement rate change at the mandatory retirement age identifies the average effect of retirement on consumption at that age (see, e.g., Hahn, Todd, and van der Klaauw, 2001). That is, $\tau_0 = d_0/b_0$.

3.2 Issues with Using Age in Years

Similar to many surveys, the UHS records age in years. Age in years can be considered as the exact age rounded down to the nearest integer. For example, a worker who is reported to be 60 in the survey can have his true age anywhere between 60 and 61 minus one day. However, identification in RD designs crucially relies on a continuous running variable. Using a rounded or hence discretized running variable may lead to biased estimates.

Given a discrete running variable, one does not observe data arbitrarily close to the cutoff even if one has an arbitrarily large sample. Extrapolation based on functional forms is inevitable, and well-established nonparametric methods, such as the recent bias-corrected robust inference approach proposed in Calonico et al. (2014), are infeasible.

Intuitively, rounding down means that each age is not centered at the mean or midpoint of the corresponding age cell. Even if one can re-center the integer age to the midpoint of the age cell (by adding 0.5 to each integer age), the curvature or nonlinearity of the age profiles can cause further problems. An illustration of the problem along with a description of a bias correction procedure utilizing the moments of the birth date distribution within a year is provided in the Online Appendix I. The bias correction procedure follows the general approach discussed in Dong (2014), but is modified to facilitate obtaining standard errors directly.

3.3 Retirement Rate at the Mandatory Retirement Age

Figures 1(b), 1(c), and 1(d) show the age profiles of the household heads' retirement rates, pensions, and wages, respectively. The dots in these figures represent the mean values at each age. A clear jump is observed in the retirement rate at age 60. Similarly, the average pensions and wages change discontinuously at the same age. The consistency among these figures suggests that the household heads' retirement status is not systematically mismeasured.

The UHS is an annual survey, and individuals' retirement status is recorded by the end of a survey year. In theory, a household head can retire at any time during the year, so the household consumption at 60 is generally a mixture of pre- and post-retirement consumption. When a household head retires at the end of the year, his household consumption at 60 captures entirely pre-retirement consumption. Therefore we exclude observations at age 60 to ensure that all observations below 60 are drawn from the pre-mandatory retirement profile, and that all observations above 60 are drawn from the post-mandatory retirement profile. The difference between these two profiles evaluated at 60 captures the exogenous change induced by mandatory retirement policy. We accordingly estimate the polynomial regressions using data from ages 59 and below and ages 61 and above, and then we evaluate changes at 60 by extrapolating these regression curves to the cutoff age of 60.[7]

We use widely varying ranges of age for the retirement equation, particularly 6, 10, and 15 years above and below the cutoff, corresponding to age ranges 54–66, 50–70, and 45–75, respectively. The sample sizes corresponding to these three windows are 12,050, 21,576, and 33,149, respectively. On average, there are more than 2,000 observations at each age. In practice, there is a tradeoff regarding what range of age around the

[7]We use a uniform kernel for convenience, since more complicated weighting or different kernels rarely make much difference in practice. The only difference between the regressions using a uniform kernel and those using more complicated kernels is that the latter put more weight on observations closer to the cutoff. An arguably more transparent way of putting more weight on observations closer to the cutoff is simply to re-estimate a model with a uniform kernel using a smaller bandwidth. If using different weights makes a difference, then the results can be highly sensitive to the choice of bandwidth, a point made by Lee and Lemieux (2010).

threshold to include in the model. A wider range provides more observations, thereby adding to the precision with which the model coefficients can be estimated. However, the further away the included ages are from the threshold, the more likely the correct model specification for these distant observations will differ from the correct specification near the threshold, risking specification errors.

The estimated increases in the retirement rate at the mandatory retirement age are reported in Table 1a. For comparison purposes, we also report in Table 1b the estimates using the observed age in years without any bias correction.

Overall, we have 21 different specifications, depending on the order of polynomials, bandwidths, and whether to include covariates or not. The full set of covariates include year-fixed effects, province-fixed effects, year-province interactions, household size, household size squared, and household heads' education levels, which are divided into three categories: 1) college or above, 2) high school, and 3) less than high school (the default).[8]

The estimates do not vary much across the specifications. Close to 30% of male workers retire at age 60. In contrast, the estimates in Table 1b without correcting the rounding bias seem to systematically underestimate the true increase in the retirement rate. These estimates are also sensitive to different specifications, ranging from 13.0% to 26.4%.

4 RD Design Validity

Before our main RD analysis, we verify validity of our RD design. In order for the RD design to be valid, individuals should not systematically sort around the mandatory retirement age. For example, if the retirees systematically move in with their adult children or if their spouses retire jointly with them, then the estimated retirement effects

[8]Goodness of fit measures (adjusted R^2 and AIC) suggest that the second order polynomial is preferable when using the short six-year window, while the third order polynomial fits better when using the 10- or 15-year window. For the short 6-year window, the fourth-order polynomial obviously overfits the curve, while for the 15-year window, a quadratic seems to greatly underfit the curve. We omit results from those specifications.

would be confounded.

Following the standard practice (McCrary, 2008, and Lee and Lemieux, 2010), we examine smoothness of the density of the household head's age and smoothness of the conditional means of predetermined covariates, including the household head's education level, marital status, spouse's retirement status, and household size. Although our analysis is conditional on household head's education, marital status, and household size, any discontinuities in these variables at the mandatory retirement age would suggest that households just under and just above the mandatory retirement age are not comparable and hence our estimates may not be not valid.

Figure 2 presents the empirical density of the household head's age and the age profile of covariate means. No obvious discontinuities or bunching are observed around the mandatory retirement age of 60.

We then formally test both smoothness conditions. To test smoothness of the density of age, we run a regression of the empirical density, or the fraction of observations at each age, on a polynomial function of age and the full set of interactions between this polynomial function and the binary indicator for being 60 or older. The coefficient of this binary indicator measures the discontinuity in the density of age at the mandatory retirement age.

To test smoothness of the predetermined covariate means, we perform falsification tests using these covariates as dependent variables. Any false significant effects of retirement on these predetermined covariates would indicate discontinuities in these covariate means at the RD threshold. In all the estimation rounded age in years instead of the true age is used as the running variable, so we apply similar bias correction as that described previously. The test results are presented in Table 2. None of the estimates are statistically significant, supporting validity of our RD design. Note that unlike the evidence documented by Battistin et al. (2009) for Italy, the household size in China does not decrease when the household head retires.

5 Expenditure Changes

We investigate whether the actual expenditures decline at the mandatory retirement age in China.[9] To put things in context, Figure 3(a) presents the age profile of household income, including incomes from all sources such as wages, pensions, transfers and asset earnings. As expected, household income sharply declines at the mandatory retirement age. We then investigate how household spending and consumption change in response to the expected income drop at the mandatory retirement age. Following the literature, we divide the total expenditures into four categories, namely, food, clothing, transportation, and the remaining expenditures.

5.1 Food, Work-Related, and Other Expenditures

Figures 3(b), 3(c), 3(d), and 3(e) present the age profiles of the four expenditure categories. Food expenditures have an obvious drop at the mandatory retirement age. In contrast to food expenditures, clothing and transportation expenditures decline smoothly with age. These preliminary findings suggest that our results may differ from the typical findings from wealthy Western countries. A few studies find that work-related expenditures, particularly on clothing and transportation, decline significantly at retirement in developed Western countries (see, Battistin et al., 2009, for RD evidence from Italy).

While these figures present preliminary visual evidence on consumption changes around retirement, they may not represent the actual changes partly because of the discrete nature of age in years. We estimate the effects of retirement using the bias-corrected regressions discussed in the Online Appendix I. The outcome and the retirement equations are jointly estimated using generalized method of moments (GMM) to maximize efficiency. Given that household consumption depends on family size and other covariates, we control for household size, household size squared, household head's marital status, year fixed effects, province fixed effects, and year-province fixed effects

[9] All expenditures and prices are adjusted for regional specific inflation and are in 1996 constant Chinese Yuan.

in these regressions. Since these household characteristics are smooth at the mandatory retirement age, omitting these covariates does not affect consistency. However, these covariates may help reduce the sampling variation of the outcome variable, and hence improve efficiency. To facilitate comparison, we restrict the bandwidth to be the same (age range 45–75) for the large number of outcomes that we examine. For each outcome, we choose the optimal order of polynomial based on commonly used goodness of fit measures.

Table 3 reports the estimated changes in the four categories of expenditures when household heads retire.[10] We report the estimates separately for college-educated household heads and non-college-educated heads. These two groups respond to retirement very differently, which is consistent with the documented heterogeneity in the literature. A small (4%–5%) decline in food expenditures is estimated, particularly in the non-college education group. In contrast, in the college education group, food expenditures show a positive yet insignificant change.

For both the college- and non-college education groups, clothing and transportation expenditures, which are arguably "work-related", do not show significant declines. This finding is consistent with China's social norm. Workplaces in China typically do not impose dress codes, so their employees do not purchase business attire for work. In addition, many Chinese workers either use bikes or rely on affordable public transportation to go to work. Therefore, household transportation expenditures are usually low. In our sample, the median transportation expenditure among working households is about 266 Chinese Yuan (less than US $50) per year.

However, the cessation of non-wage benefits at retirement, such as work-related subsidies on clothing and transportation, may lead to potential complications for analyzing the consumption of these items using the RD framework. Under central planning, some

[10]For food, clothing and other expenditures, we use their logged values as dependent variables. In our sample, about 9% of the households report zero spending on transportation. To avoid excluding observations with zero spending or transforming them differently, we use the level instead of the logged value of transportation expenditures as the dependent variable to ensure comparability of means across age points. Afterwards, we convert the estimated level changes into percentage changes to facilitate interpretation.

work units provide subsidies for clothing and transportation to their employees. If the monetary value of these expenditures is not counted as consumption before retirement, the rise in compensatory spending after retirement may neutralize an actual decline in related expenditures.

To test whether the possible subsidies in clothing and transportation (which we do not directly observe in our data) affect our empirical results, we divide our sample into two periods, namely 1997–2001 and 2002–2007. Given that the state and collective ownership reforms in the late 1990s were associated with a decline in non-wage benefits, we conjecture that if subsidies are a significant factor, one should observe a decline in expenditures on clothing and transportation during 2002–2007. Our empirical results indicate that the declines in spending on clothing and transportation are smooth for both 1997–2001 and 2002–2007. Therefore, subsidies do not seem to have a significant effect on the smooth patterns of clothing and transportation consumption around retirement.[11]

5.2 Food at Home and Away from Home

Figures 4(a), 4(b), and 4(c) show the age profiles of expenditure for food consumed at home and at restaurants. Spending on restaurant meals shows a dramatic decline at the mandatory retirement age, in contrast to a small decline in expenditures on food consumed at home.

Spending on food at home increases steadily with age before reaching the mandatory retirement age (roughly by 14% over 15 years of age), and then rapidly declines afterwards. This trend may reflect the hump-shaped life cycle profile of the nondurable consumption of households (Fernandez–Villaverde and Krueger, 2007). The curvature may also reflect the time trend or cohort effects, given our repeated cross-sectional data. We explicitly take the hump-shaped age profile into account by including the polynomial functions of age. We also control for region-specific year fixed effects. Since the cohort is a perfect linear function of year and age, cohort effects are partly captured

[11] Unlike transportation, clothing is a semi-durable good. This may partly explain why one cannot observe a discrete change in clothing expenditures at retirement.

in our specifications by the flexible smooth function of age and year fixed effects. The standard RD model correctly estimates the local average treatment effect of retirement even when any smooth cohort or time effects are omitted.

Table 4 reports the estimated changes in spending on food at home and on food away from home. For the non-college education group, household spending on food at home shows small yet insignificant declines, while spending on food away from home shows significant declines. The total spending on eating out declines by about 20%, and that on eating at non-workplace restaurants declines by about 27%. In contrast, the college education group does not experience any significant declines in either type of food expenditure.

6 Price versus Quantity Changes

Spending on eating out declines dramatically upon retirement among the non-college education group. If they substitute home meals for restaurant meals, then one should see an increase in home production upon retirement, which may not be reflected in the expenditure data if the prices change. This section disentangles consumption quantity from price changes at retirement.

We investigate the quantities purchased and average prices paid for food for some major food categories. As one of the advantages, this aggregation takes into account the substitutability of different types of food within a category. As another advantage, this aggregation reduces the heterogeneity in consumption across households, because the food consumed by each household varies greatly. Therefore, the retirement effects on quantities and prices can be much more precisely estimated by looking at food categories. However, focusing on food categories can mask any compositional changes within a category. To overcome this problem, we additionally look at the prices and quantities of some commonly consumed foods.

6.1 Prices and Quantities for Major Food Categories

We look at five major food categories, including staples, vegetables, oils, meat and poultry, and fruit.[12] Figures 5 and 6 show how the average price paid and quantity purchased for each category of food change with the household head's age using the full sample.

In Figure 5, the average prices for all food categories greatly decline at the mandatory retirement age. In striking contrast, the quantities do not decline as shown in Figure 6, and some small increases, if any, in quantities are observed at the mandatory retirement age. In the Online Appendix II, we present similar figures separately for the non-college education sample and college education sample. The figures for the non-college education sample largely mimic the price and quantity patterns in Figures 5 and 6 based on the full sample, while the figures for the college education sample show no discrete changes in either prices or quantities at the mandatory retirement age, although the data patterns are noisy because of the small sample size.

Table 5 reports the estimated changes in the average price for each food category at retirement. Consistent with the visual evidence, the prices paid by the non-college education group are estimated to decline significantly for all food categories except for staples. In contrast, the prices paid by the college education group are estimated to be mostly positive yet insignificant.

The estimated price declines for the non-college education group greatly vary across all food categories. For example, meat and oil prices slightly decline by 2.8% and 4.1%, respectively, while vegetable and fruit prices decline by 7.1% and 10.6%, respectively, in the non-college education group. These varying price declines are consistent with the possible price variations in China. For example, staple, oil, and meat are often sold in formal stores and their prices are usually regulated by the government. Therefore, search efforts may not lead to large price reductions. In contrast, vegetables and fruits

[12] "Staples" include rice, flour, and other grain or grain products; "meat" includes pork, beef, lamb, and other meat or meat products; "poultry" includes chicken, duck, and other poultry or poultry products. All quantities are quantities per household member.

can be purchased through a variety of channels, including local farmers' markets. The purchase prices of these products can vary significantly, depending on when and where they are purchased. These market arrangements are consistent with the larger decline in vegetable and fruit prices than in the prices of other food categories.

Table 6 reports the estimated changes in food quantities. The quantities for most categories, except for fruit, are estimated to increase significantly in the non-college education group, but no significant changes are found among the college education group.

Overall, these results suggest that the average price of food in each category declines, but not the quantity. The quantities may even increase upon retirement, which to a certain extent offsets the significant decline the expenditures on dining out. These results are consistent with the substitution of home meals for restaurant meals.

6.2 Prices and Quantities of Specific Foods

The average price for a food category is constructed by dividing the total expenditure by the total quantity, and therefore represents a unit value (see Deaton, 1988 for a discussion on unit values). In reality, the prices of different components vary within a category. For instance, the prices of beef are usually higher than those of pork. Therefore, a decline in unit value can be driven either by price declines of all components within a category or by compositional changes. For example, retirees may substitute relatively cheaper foods for more expensive foods within a category. In other words, retirees may choose to consume goods of lower quality after retirement.

To investigate whether the price decline for all components within a food category results from a greater search effort or form compositional changes, we examine narrowly defined food items, including rice and potato as components of staple food, as well as pork, beef, and lamb as components of meat. The price declines are expected to be weaker under disaggregation because some households may not search for bargains for a specific item, thereby lowering the estimated average effect. As Figure 7 shows, the prices of these individual components obviously decline at the mandatory retirement age, despite the variation in the quality of these food items.

Table 7 reports the estimated changes in the prices of the five goods, which are all negative in the non-college education group. While the price of potato shows a significant decline, the other price reductions are not precisely estimated, consistent with a weaker price effect with disaggregation than without disaggregation. Table 8 reports the estimated changes in the quantities of these specific food categories. No significant declines are found in the non-college education group. Overall, the declines in the prices of individual food items can be attributed to shopping for cheaper prices, although we cannot completely rule out the possibility of individuals substituting high-quality goods for lower-quality goods after retirement.

7 Discussion

7.1 Food Consumption Index and Predicted Expenditure with Price Fixed

Our analysis so far has focused on major food categories and several specific food items. To shed more light on the magnitude of the overall decline in food expenditures, an aggregation is required. Following the approach of Aguiar and Hurst (2005), we construct a food consumption index. We also construct a predicted expenditure holding fixed the prices of individual food items, i.e., assuming that the retirees pay the same prices as those individuals who still participate in the labor market. This analysis can further confirm whether price decline is the driving force behind the overall reduction in food expenditures after retirement.

The food consumption index is constructed as a weighted average of various quantities of food purchased and prices paid by a household. As shown in Aguiar and Hurst (2005), household consumption (quantities and prices) has a significant forecasting power for permanent income; therefore, one can compute the implied permanent income of retirement-age households based on their consumption baskets.

We obtain the required weights by projecting the logarithm of permanent income on the quantities and expenditure of various foods consumed by working-age household heads. Including food expenditure in the projection is a way of incorporating price heterogeneity across households. Therefore, the unit of the consumption index is the log permanent income. The projection also includes a vector of taste controls and a smooth polynomial function of the household head's age. Given a permanent income I^{perm}, we estimate the following equation to obtain the weights to be used later in constructing the consumption index for the retirement-age household heads:

$$\ln(I^{perm}) = \eta_0 + \eta_{\mathbf{Q}}\mathbf{Q} + \eta_{\mathbf{E}}\mathbf{E} + \eta_{\boldsymbol{\pi}}\boldsymbol{\pi} + m(X) + \epsilon, \tag{4}$$

where $\mathbf{Q}$ and $\mathbf{E}$ are vectors of food quantities and expenditure, respectively, $\boldsymbol{\pi}$ is a vector of taste parameters, and $m(X)$ is a low-order polynomial of household head's age.

Permanent income is not directly observed for working-age individuals. To estimate Equation (4), we must obtain $\ln(I^{perm})$ first. We estimate a regression of log household income on the household head's education, birth cohort, industry, and occupation controls, and the full set of occupation-industry interactions, using data on male household heads aged 25–45 who are working full time (16,772 individuals). We then take the fitted value $\ln\left(\hat{I}^{perm}\right)$ and replace the unknown $\ln(I^{perm})$ in the above Equation (4) with this estimate. $\mathbf{Q}$ and $\mathbf{E}$ denote the quantities and expenditures for 45 types of food, using the same sample. The vector of taste controls includes household size, household size squared, marital status, and province of residence. Afterward, we apply the estimated coefficients $\widehat{\eta}_{\mathbf{Q}}$ and $\widehat{\eta}_{\mathbf{E}}$ to quantities purchased and prices paid by the retirement-age household heads in our RD sample (19,887 non-college-educated heads and 6,178 college-educated heads).

We predict the food expenditure of retirement-age household heads using the estimated coefficients $\eta_{\mathbf{Q}}$ on food quantities in Equation (4). Since Equation (4) is estimated based on the sample of prime-age working household heads, these weights can be taken as the average prices paid by these households. Therefore, the predicted food expenditure assumes that the retirement-age household heads pay the same price as the prime-age working household heads.

After constructing the food consumption index and predicted expenditure holding price fixed, we use these measures as our outcome variables in our RD analysis and test whether they decline significantly at retirement. We estimate both changes separately for the college and the non-college education groups. These estimates are presented in Table 9.

The estimated changes in the predicted food expenditure are small and insignificant for both the college and the non-college education group. Therefore, if the retirement-age individuals pay the same prices for food as the prime-age workers, we will not see a decline in their food expenditure at retirement. In contrast, the consumption index is estimated to decline significantly by 2.2% in the non-college education group, but is estimated to decline insignificantly by 0.4% among the college education group.[13] Given that the only difference between the food consumption index and the predicted expenditure is that the latter holds prices fixed, the differential responses provide strong evidence that the observed decline in food expenditure is driven by price declines, instead of quantity declines. Therefore, consistent with findings in Aguiar and Hurst (2005), households, in response to forecastable income changes, smooth their consumption instead of their expenditures, as predicted by the standard PIH augmented with home production.

7.2 Food Shopping Time

Another caveat of the previous analysis is that price differences may reflect quality differences. Without detailed quality measures, we cannot tell whether retirees pay lower prices because they buy a lower quality of the same goods or because they shop for bargains and thereby pay lower prices for the same quantity and quality of goods. For example, if retired households buy ordinary cuts of meat instead of premium ones, it would not be captured in our estimation.

[13] Although we do not report them in our paper, the estimated changes based on the full sample are insignificant, similar to the findings of Aguiar and Hurst (2005), which were based on U.S. data. In particular, the estimated change in the consumption index is -0.005 with a standard error of 0.007, while that in Aguiar and Hurst (2005) is -0.006 with a standard error of 0.02.

To investigate whether retirees shop for bargains, we examine food shopping time changes upon retirement. We use the data from the China Health and Nutrition Survey (CHNS), which contains information on food shopping time.[14] In particular, the CHNS asks, "During the past week, how much time (in minutes) did you spend per day, on average, to buy food for your household?"

The CHNS is an ongoing project that surveys households in nine provinces.[15] These provinces cover similarly geographically diverse areas as the UHS. So far, eight waves of data have been released for years 1989, 1991, 1993, 1997, 2000, 2004, 2006, and 2009, which overlap with our UHS sample period from 1997 to 2006. Ideally, we want to use the data from the same years as our UHS data. However, because of the relatively small sample of the CHNS, we use all years of data. Our main goal is to provide suggestive evidence on food shopping time changes at retirement among urban males rather than estimate how shopping time causally affects food prices. The CHNS involves households in both urban and rural areas. We only focus on the urban male household heads to make the sample comparable to our UHS sample. The sample includes 4,742 household heads, among which 4,240 are non-college education and 502 are college education.

Figure 8(a) presents the age profile of the retirement rate in the CHNS sample. Similar to what we find in our UHS data, the retirement rate increases by about 30% at the mandatory retirement age, although the retirement rate at each age is slightly lower, which might be attributed to the different provinces and periods covered.

Figures 8(b) and 8(c) show the age profiles of food shopping time for the non-college and college education household heads, respectively. The average time spent on shopping for food clearly increases at the mandatory retirement age in the non-college education group, but not in the college education group.

Table 9 reports the estimated changes in the probability of shopping for food at all over the previous week and in the average time spent on shopping for food at retirement.

[14] CHNS is an open cohort, international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention.

[15] These provinces include Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou.

Both are positive and significant among the non-college education group. In particular, the average shopping time for food is estimated to increase by 22 minutes per day, and the probability of shopping for food last week is estimated to increase by 22.9% (the sample mean is 22.98 minutes per day for everyone and is 49.96 minutes per day among those with positive food shopping time). No significant changes are found for the college- educated group. The probability and average time spent on shopping for food increase only among the non-college education group at retirement, which is consistent with the significant price decline in this group. Aguiar and Hurst (2007) show an inverse relationship between life cycle prices and shopping time. Therefore, the price decline observed for the non-college education group may be partly attributed to the increased shopping for bargains among retirees.

The significant increase in shopping time among the non-college education group can be justified using a framework of human capital and time allocation. After retirement, the elderly primarily allocate their time between leisure and household chores, including cooking and shopping for food. More (or less) time will be spent on chores if the value of leisure is lower (or higher). According to the literature on education and time allocation (e.g., Becker, 1965), education can enhance the value of leisure for retirees. For instance, people with higher education often have larger social networks. Education also helps people process information that is complementary to leisure, thereby facilitating certain activities such as reading and travel. Therefore, we expect the non-college education group to devote more time to shopping for food after retirement because their marginal value of leisure is lower than that of the college education group.

Alternatively, the differences in the provision of non-wage benefits, such as health insurance, may affect the incentive of households to search for bargains. Previous studies show that medical expenses and insurance may influence the consumption and saving decisions of people near retirement (see, e.g., De Nardi et al., 2010). In China, non-pecuniary benefits may vary across jobs and their availability and amounts are often positively correlated with workers' education. If the college education group continue to enjoy similar medical arrangements after retirement, then their food consumption will not be affected. However, if the non-college education group receive reduced provision of health care after retirement, then they could be pressured to search for cheaper prices of other consumption items, including food. A systematic examination on the role of non-wage benefits requires benefit information before and after retirement, which we do not have. However, the preliminary evidence shows that non-pecuniary benefits may not have a significant role in understanding the incentive to search for cheaper food. In particular, we find that consumption expenditures on items unrelated to time-intensive home production, such as transportation and other categories, do not decline upon retirement in the non-college education group. These results contradict the hypothesis that loss of non-wage benefits leads to a discontinuous decline in consumption. The enhancing effect of education on the value of leisure remains a more coherent explanation.

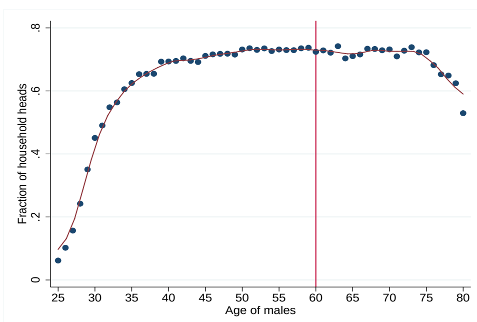
8 Conclusion

This study provides direct evidence on the causal effects of retirement on household consumption. We focus on disentangling price from quantity changes. The mandatory retirement policy in China serves as a unique quasi-experimental setting allowing for identification of the true causal effects of fully anticipated retirement.

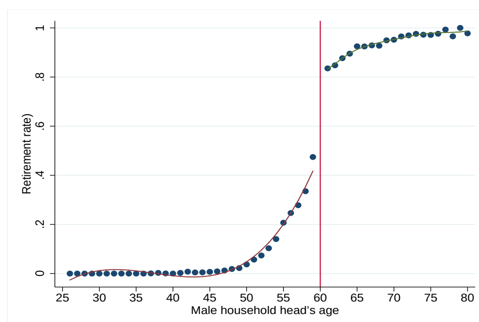
Based on the detailed diary-based consumption data from the UHS, we show that the mandatory retirement policy leads to a sharp increase in the rate of retirement at the mandated age threshold. Upon retirement, household food expenditure declines significantly among male workers without a college education, a group who constitutes roughly three-fourths of our sample. More importantly, we show that such a decline is primarily driven by lower food prices rather than lower quantities of consumption. Then using a supplemental data set, we document that male workers without a college education spent significantly time shopping for food upon retirement, suggesting that they search for lower prices.

This paper's empirical results are consistent with a model of time allocation in which education enhances the value of leisure for retirees. Households without college education are expected to devote more time to shopping after retirement because of their lower marginal value of leisure relative to that of the better educated households. Consistent with Aguiar and Hurst (2005), our findings highlight the fact that with home production, expenditures on food are poor proxies for actual household consumption. In particular, they mask the extent to which individuals smooth their consumption in practice.

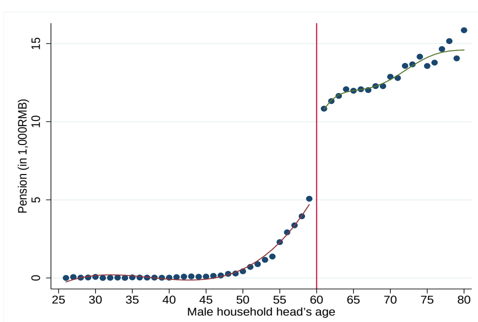
Food consumption accounts for about 45% of the total consumption in our urban household sample. Over three-fourths of the household heads in our sample have not received a college education. Our findings of the retirement effects on food consumption, particularly among the non-college education group, offer broad policy implications for the welfare of the Chinese population.



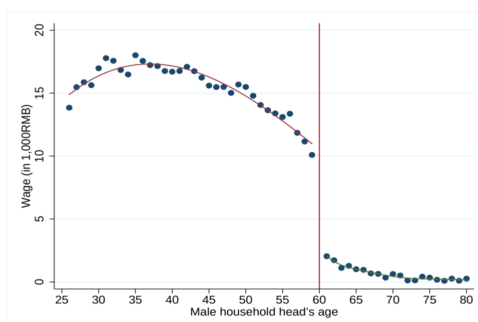
(a) Age distribution of household heads



(b) Retirement rate

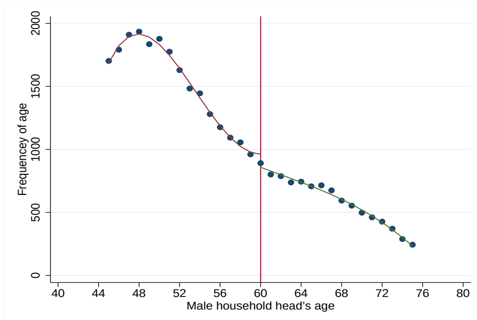


(c) Pension income

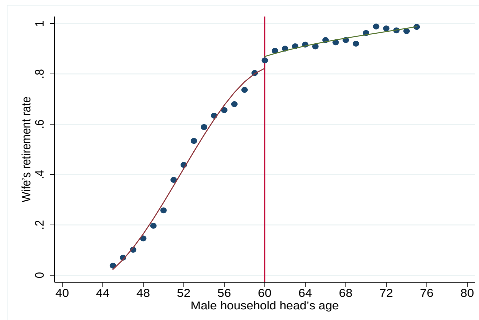


(d) Wage income

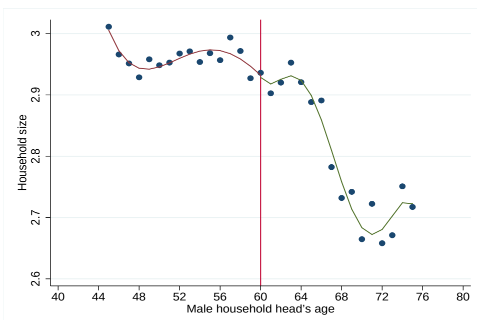
Figure 1: Age Profiles of Male Household Heads, Retirement Rate, and their Wage, and Pension Incomes, UHS 1997–2006



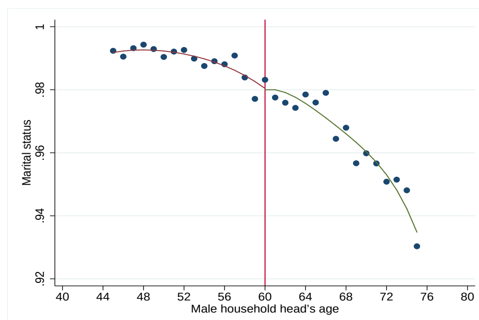
(a) Frequency of age



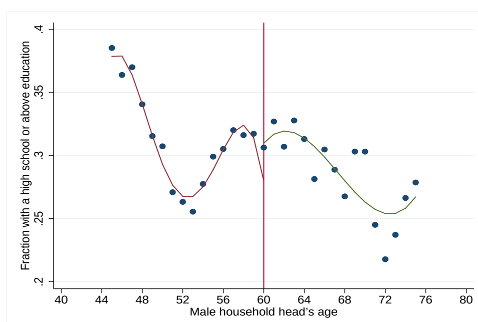
(b) Wife's retirement rate



(c) Household size

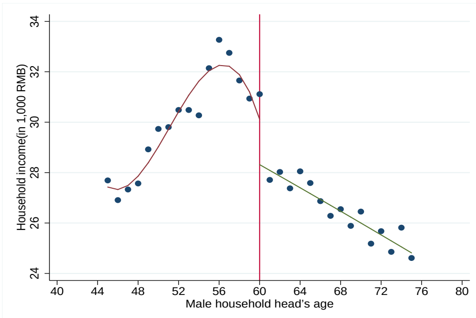


(d) Marital status

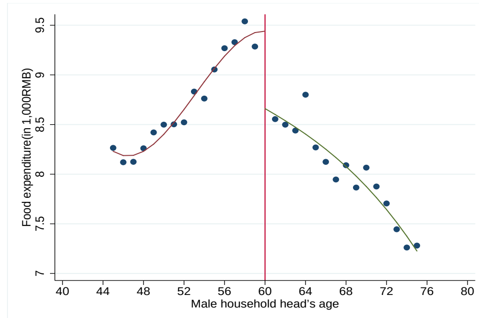


(e) Household head's education

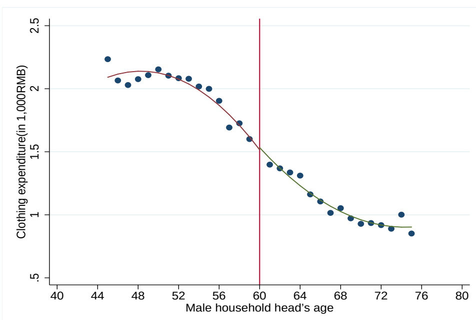
Figure 2: Age Profiles of Male Household Heads: Age Distribution, Wife's Retirement Age, Household Size, Marital Status, and their Education,UHS 1997–2006



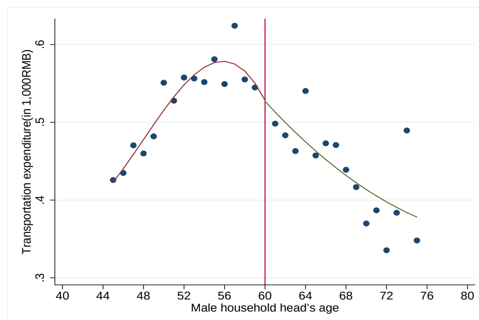
(a) Income



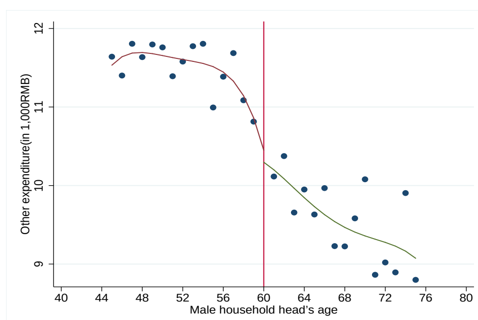
(b) Food



(c) Clothing

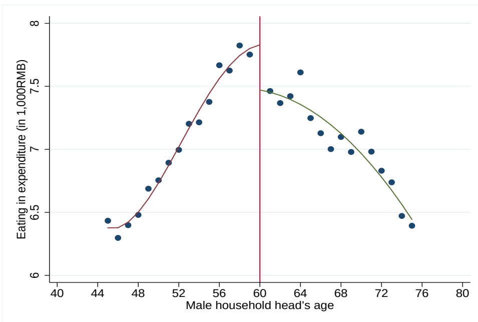


(d) Transportation

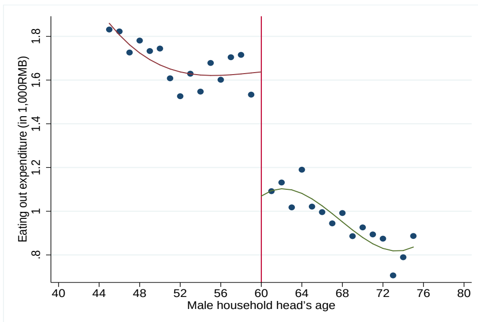


(e) Other

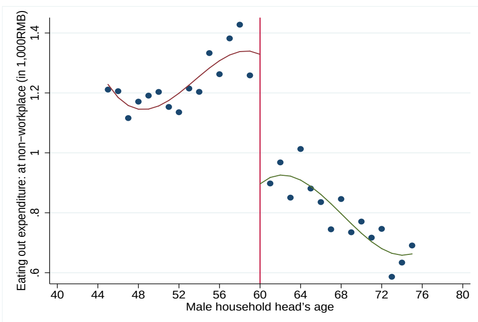
Figure 3: Age Profiles of Household Income and Expenditure: Male Household Heads, UHS 1996–2007



(a) Food at home

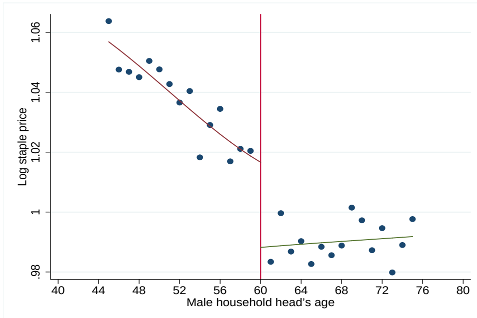


(b) Eating out

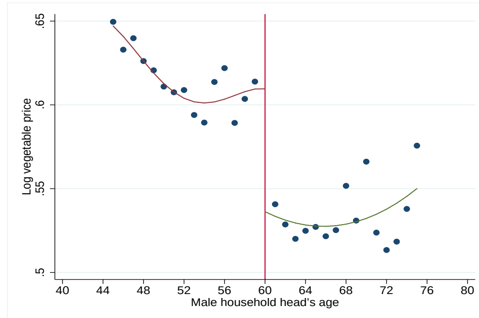


(c) Eating out: nonworkplace restaurants

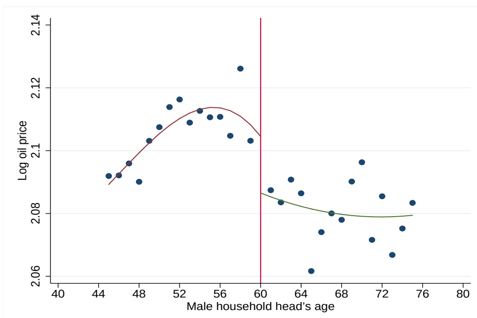
Figure 4: Age Profiles of Food Expenditure: Male Household Heads, UHS 1997–2006



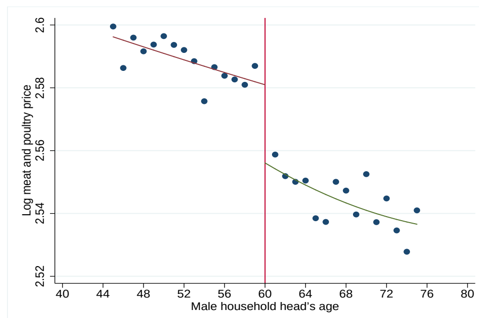
(a) Staple price



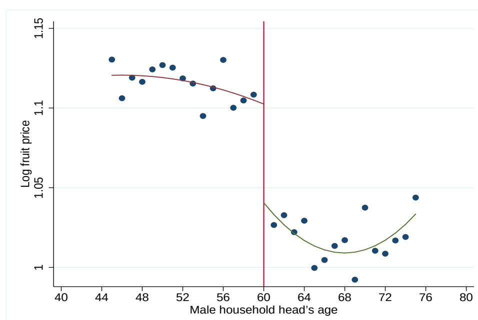
(b) Vegetable price



(c) Oil and fat price

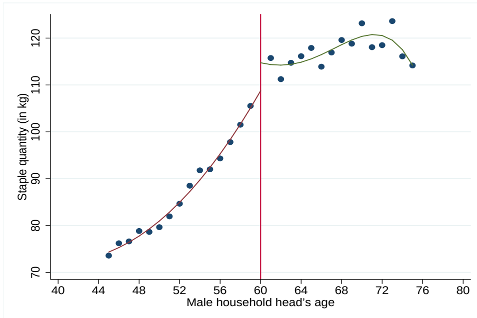


(d) Meat and poultry price

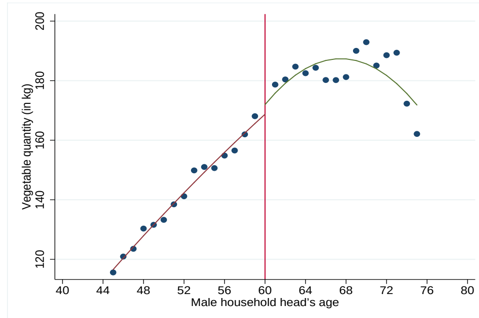


(e) Fruit price

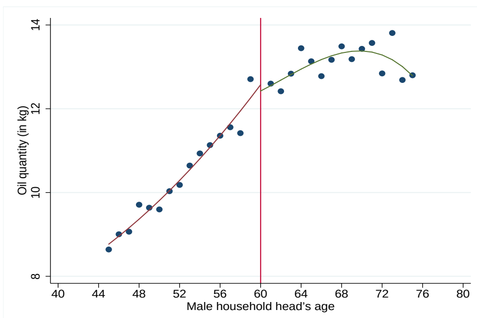
Figure 5: Age Profiles of Food Prices by Category: Male Household Heads, UHS 1997–2006



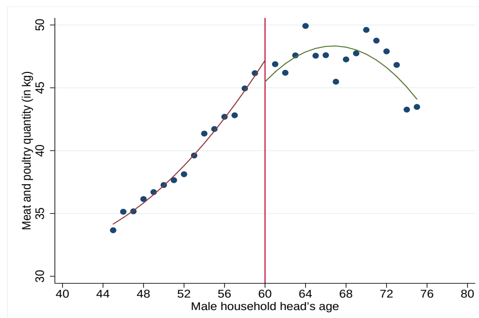
(a) Staple quantity



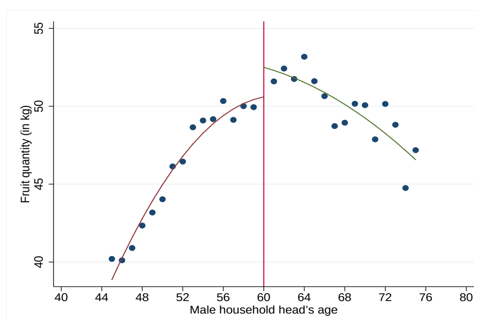
(b) Vegetable quantity



(c) Oil and fat quantity

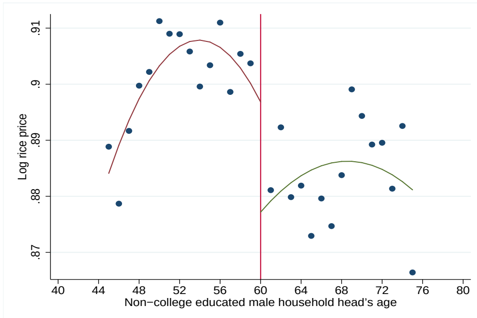


(d) Meat and poultry quantity

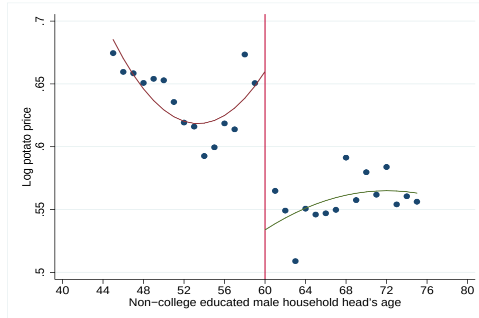


(e) Fruit quantity

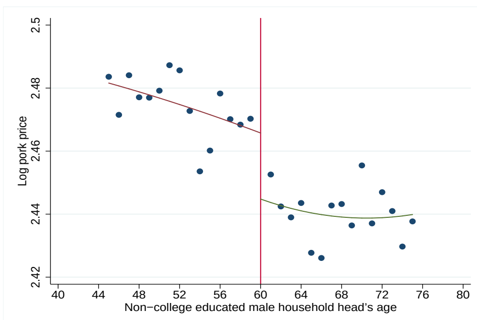
Figure 6: Age Profiles of Food Quantities by Category: Male Household Heads, UHS 1997–2006



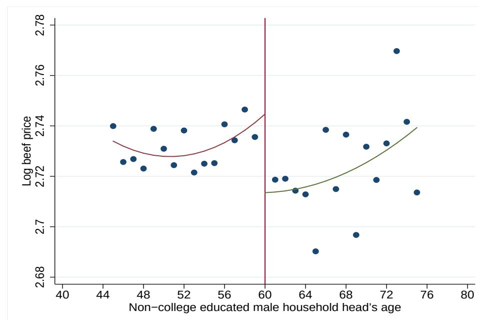
(a) Rice price



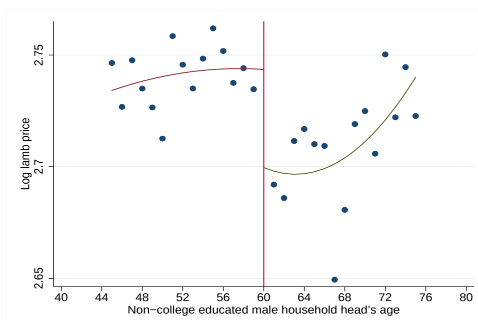
(b) Potato price



(c) Pork price

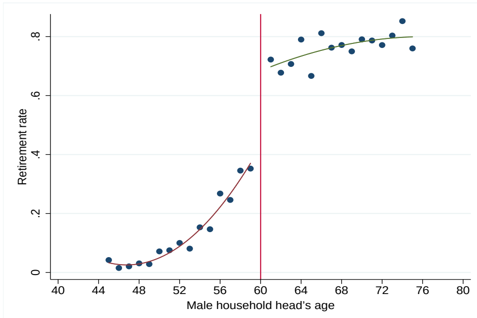


(d) Beef price

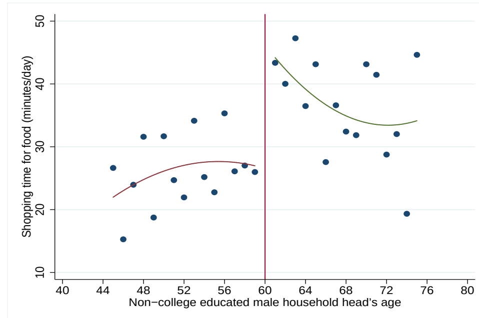


(e) Lamb price

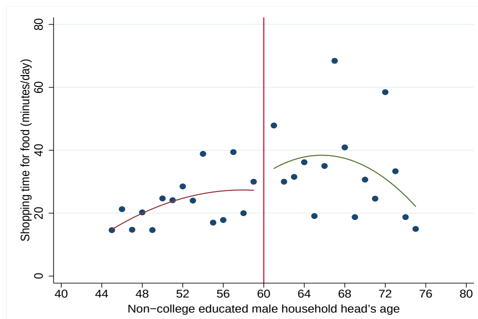
Figure 7: Age Profiles of Specific Food Prices: Non-college-educated Male Household Heads, UHS 1997-2006



(a) Retirement rate in the CHNS sample



(b) Average daily shopping time for food: Non-college-educated household heads



(c) Average daily shopping time for food: College-educated household heads

Figure 8: Age Profiles of Retirement Rate, Shopping Time for Food: Male Household Heads, CHNS 1989–2009

Table 1a The Retirement Rate Increase at the Mandatory Retirement Age for Male Household Heads

2nd order polynomial	0.290	0.288	0.280	0.307	0.301	0.294			
	(0.037)***	(0.036)***	(0.036)***	(0.020)***	(0.020)***	(0.020)***			
3rd order polynomial	0.285	0.294	0.295	0.277	0.275	0.269	0.295	0.292	0.285
	(0.085)**	(0.084)**	(0.084)**	(0.036)***	(0.035)***	(0.035)***	(0.020)***	(0.020)***	(0.020)***
4th order polynomial				0.301	0.306	0.307	0.270	0.269	0.254
				(0.068)***	(0.068)***	(0.067)***	(0.033)***	(0.033)***	(0.033)***
Year fixed effects	N	Y	Y	N	Y	Y	N	Y	Y
Province fixed effects	N	Y	Y	N	Y	Y	N	Y	Y
Year-province fixed effects	N	N	Y	N	N	Y	N	N	Y
Demographic controls	N	N	Y	N	N	Y	N	N	Y
Bandwidth	6	6	6	10	10	10	15	15	15

NOTE: Male household heads, UHS 1997–2006; demographic controls include household head's education and marital status, family size, and family size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 1b The Retirement Rate Increase at the Mandatory Retirement Age for Male Household Heads, without Correcting for Discrete Age Bias

2nd order polynomial	0.251	0.249	0.241	0.278	0.271	0.264			
	(0.033)***	(0.033)***	(0.033)***	(0.019)***	(0.019)***	(0.018)***			
3rd order polynomial	0.133	0.137	0.130	0.241	0.238	0.232	0.262	0.258	0.252
	(0.067)**	(0.066)**	(0.066)**	(0.031)***	(0.031)***	(0.030)***	(0.018)***	(0.018)***	(0.018)***
4th order polynomial				0.188	0.195	0.191	0.236	0.233	0.228
				(0.052)***	(0.052)***	(0.052)***	(0.028)***	(0.027)***	(0.027)***
Year fixed effects	N	Y	Y	N	Y	Y	N	Y	Y
Province fixed effects	N	Y	Y	N	Y	Y	N	Y	Y
Year-province fixed effects	N	N	Y	N	N	Y	N	N	Y
Demographic controls	N	N	Y	N	N	Y	N	N	Y
Bandwidth	6	6	6	10	10	10	15	15	15

NOTE: Male household heads, UHS 1997–2006; demographic controls include household head's education and marital status, family size, and family size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 2 Estimated Discontinuities in the Density of Age and Retirement Effects on Covariate Means

Density of age	-0.005	(0.003)	Married	0.003	(0.008)
College education	-0.055	(0.057)	Wife retired	-0.106	(0.221)
High school education	-0.012	(0.063)	Household size	0.026	(0.056)

NOTE: Male household heads, UHS 1997–2006; the regression for the density of age controls for a smooth polynomial age function, while all other GMM IV estimates additionally control for year fixed effects, province fixed effects, and province-year fixed effects. robust standard errors are in parentheses.

Table 3 Retirement Effects on Different Categories of Expenditure

	Non-college education			College education		
Food	-0.041	-0.053	-0.047	0.031	0.045	0.052
	(0.027)	(0.025)**	(0.025)**	(0.039)	(0.038)	(0.038)
Clothes	0.222	0.191	0.198	0.028	0.072	0.079
	(0.182)	(0.176)	(0.178)	(0.189)	(0.192)	(0.192)
Transport	0.021	0.023	0.060	0.158	0.159	0.192
	(0.210)	(0.212)	(0.217)	(0.258)	(0.258)	(0.258)
Other	0.115	0.214	0.276	0.053	0.103	0.129
	(0.233)	(0.228)	(0.228)	(0.258)	(0.255)	(0.247)
Year fixed effects	Y	Y	Y	Y	Y	Y
Province fixed effects	Y	Y	Y	Y	Y	Y
Demographic controls	N	Y	Y	N	Y	Y
Year-province fixed effects	N	N	Y	N	N	Y

NOTE: Male household heads, UHS 1997–2006; demographic controls include household head's education and marital status, household size, and household size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 4 Retirement Effects on Different Categories of Food Expenditure

	Non-college education			College education		
Food at home	-0.026	-0.033	-0.031	0.025	0.029	0.039
	(0.025)	(0.024)	(0.024)	(0.036)	(0.035)	(0.035)
Food out (total)	-0.229	-0.250	-0.232	-0.003	0.020	0.047
	(0.070)***	(0.068)***	(0.069)***	(0.116)	(0.118)	(0.117)
Food out (non-workplace)	-0.276	-0.300	-0.289	0.092	0.101	0.125
restaurants)	(0.069)***	(0.067)***	(0.068)***	(0.128)	(0.129)	(0.130)
Year fixed effects	Y	Y	Y	Y	Y	Y
Province fixed effects	Y	Y	Y	Y	Y	Y
Demographic controls	N	Y	Y	N	Y	Y
Year-province fixed effects	N	N	Y	N	N	Y

NOTE: Male household heads, UHS 1997–2006; demographic controls include household head's education and marital status, household size, and household size squared; food-out expenditure has a non-negligible fraction of zeros and so is not logged in estimation; percentage changes are reported here by converting the estimated average level changes; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 5 Retirement Effects on Average Food Prices by Category

	Non-college education		College education	
Staple	-0.013	(0.011)	-0.013	(0.020)
Vegetable	-0.075	(0.016)***	0.006	(0.024)
Oil	-0.041	(0.012)***	0.007	(0.023)
Meat	-0.028	(0.009)***	0.007	(0.014)
Meat and poultry	-0.025	(0.009)***	0.004	(0.014)
Fruit	-0.106	(0.018)***	-0.022	(0.026)

NOTE: Male household heads, UHS 1997–2006; all estimates control for year fixed effect, province fixed effect, year-province fixed effects, a low-order polynomial of household head's age, head's education and marital status, household size, and household size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 6 Retirement Effects on Food Quantities by Category

	Non-college education		College education	
Staple	0.151	(0.078)**	0.055	(0.044)
Vegetable	0.101	(0.026)***	-0.045	(0.138)
Oil	0.109	(0.039)***	0.062	(0.067)
Meat	0.089	(0.029)***	0.053	(0.043)
Meat and poultry	0.081	(0.028)***	0.033	(0.041)
Fruit	-0.008	(0.035)	-0.008	(0.049)

NOTE: Male household heads, UHS 1997–2006; all estimates control for year fixed effect, province fixed effect, year-province fixed effects, a low-order polynomial of household head age, household head's education and marital status, household size, and household size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 7 Retirement Effects on Food Prices

	Non-college education		College education	
Rice	-0.015	(0.022)	-0.016	(0.015)
Potato	-0.125	(0.061)**	-0.044	(0.034)
Pork	-0.007	0.022	0.017	(0.012)
Beef	-0.038	0.046	0.000	(0.048)
Lamb	-0.096	(0.083)	0.028	(0.032)

NOTE: Male household heads, UHS 1997–2006; all estimates control for year fixed effect, province fixed effect, year-province fixed effects, a low-order polynomial of household head's age, household head's education and marital status, household size, and household size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 8 Retirement Effects on Quantities of Food

	Non-college education		College education	
Rice	0.102	(0.129)	0.096	(0.086)
Potato	0.181	(0.057)***	0.085	(0.084)
Pork	0.090	(0.038)**	0.014	(0.059)
Beef	-0.032	(0.080)	0.051	(0.404)
Lamb	-0.060	(0.080)	-0.186	(0.440)

NOTE: Male household heads, UHS 1997–2006; all estimates control for year fixed effect, province fixed effect, year-province fixed effects, a low-order polynomial of household head's age, household head's education and marital status, household size, and household size squared; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 9 Retirement Effects on Food Consumption Index
and Predicted Food Expenditure

	Non-college education		College education	
log of food consumption index	-0.022	(0.008)***	-0.004	(0.011)
log of predicted food expenditure	0.005	(0.011)	0.008	(0.014)

NOTE: Male household heads, UHS 1997–2006; food consumption index is in the unit of permanent income, taking into account both quantities and prices of various foods a household consumed, while predicated food expenditure holds food prices fixed; detailed construction of both are in the main text; robust standard errors are in parentheses; * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 10 Retirement Effects on Shopping Time for Food

	Non-college education		College education	
Time spent on shopping for food	22.04	(6.944)***	8.267	(15.96)
Whether shopping for food last week (0/1)	0.229	(0.077)***	0.031	(0.169)

NOTE: Male household heads, CHNS 1989–2009; all estimates control for province, year and province-year fixed effects; robust standard errors are in parentheses; the average shopping time for the non-college educated is 22.98 minutes per day and is 49.96 minutes per day among those with positive time, while the average shopping time for the college educated is 26.66 minutes per day and is 45.53 minutes per day among those with positive time. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

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