Retirement and the Marginal Propensity to Consume: Theory and Evidence

Daniel Jonas Schmidt*

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Abstract

This paper studies the effect of retirement on the marginal propensity to consume out of a windfall gain. First, I document that retirement status is an important determinant of MPCs in the US using data from the Survey of Consumer Expectations: The MPC of older workers is about 20% lower than the MPC of retirees of the same age, even when controlling for health and longevity expectations. Second, I examine two potential explanations for this empirical finding in a simple theoretical model: A) If leisure and consumption are sufficiently complementary, consumption levels and MPCs are lower among workers compared to retirees. B) If workers retire sooner in response to windfall gains, their MPC (but not their consumption level) is reduced relative to retirees. Third, I explore the effect of retirement on the MPC in a quantitative life-cycle model with a realistic social security system. According to my results, mechanism B can explain the relative MPC difference between workers and retirees almost completely, whereas mechanism A does not seem to be quantitatively important.

*University of Amsterdam, Roetersstraat 11, Amsterdam, 1018WB, d.j.schmidt2@uva.nl. I am grateful to my advisors Marcelo Pedroni and Roel Beetsma for their continuous guidance and support. I would also like to thank Jeppe Druedahl, Eva Janssens, Hanbaek Lee, Alexander Ludwig, Benjamin Moll, Christian Stoltenberg, Jasmine Xiao, Hakki Yazici, and the seminar participants at the University of Amsterdam for useful comments and suggestions.

1 Introduction

Why do the consumption expenditures of some households respond very strongly to an unexpected increase in financial resources, while others do not adjust their current spending behavior at all? A large literature[1] tries to identify observable characteristics that can explain the variation in the marginal propensity to consume (MPC) across households. Understanding MPC heterogeneity is important because it can help to distinguish between consumption-savings theories and because of its implications for the design of fiscal stimulus policies.[2] So far, only a few variables have been established as reliable predictors of high MPCs (e.g. liquid wealth), and much of the variation across households remains unexplained.

This paper focuses on the effect of retirement on the marginal propensity to consume out of a windfall gain. Using data from the Survey of Consumer Expectations (SCE), I show that the MPC of older workers in the US is significantly lower than the MPC of retirees of the same age and with similar characteristics. I explore potential explanations for this difference in MPCs both in a simple theoretical framework and in a life-cycle model with a realistic social security system. My main finding is that older workers use a part of the windfall to finance early retirement which decreases their consumption response compared to retirees.

My results are important for two reasons: First, they are crucial for the response of aggregate consumption to stock market fluctuations because older US workers hold a lot of stock market wealth in their defined-contribution plans. Here, it is not the simple average over MPCs which matters, but a weighted average which takes variation in stock market wealth across individuals into account. A similar argument applies to the response of aggregate consumption to house price shocks.

Second, not knowing about the effect of retirement on the MPC can cause misinterpretations. For example, MPCs are sometimes used in sufficient statistics formulas, with high MPCs indicating high welfare gains from financial transfers (Kolsrud et al., 2022). In my quantitative model however, older workers with little savings tend to have lower MPCs than their peers with more savings who are already retired.

Figure 1 illustrates the main empirical finding in its most simple form. It depicts the average self-reported MPC of older Americans grouped by age and retirement status. The average MPC among retirees is slightly above 25%, while the average MPC among workers is substantially lower at about 20%. Conditional on retirement status, the average MPC does not vary much with age.

A possible explanation for the difference in MPCs shown in Figure 1 is that workers decide to retire early based on a characteristic which is also associated with higher MPCs. For example, workers with poor health might retire sooner than their peers and possibly also have higher MPCs due to the shorter planning horizon. Therefore, section 2 provides a more careful econometric analysis: To identify the difference in MPCs between retirees and workers that cannot be attributed to variation in observable characteristics between the two groups, I regress the self-reported MPC from the Survey of Consumer Expectations on a dummy variable that indicates the retirement status, while controlling for a wide variety

[1] See Johnson et al. (2006), Parker et al. (2013), Agarwal and Qian (2014), Misra and Surico (2014), Jappelli and Pistaferri (2014), Kreiner et al. (2019), Fagereng et al. (2021), Gelman (2021).

[2] See Jappelli and Pistaferri (2014), Kaplan and Violante (2014, 2022).

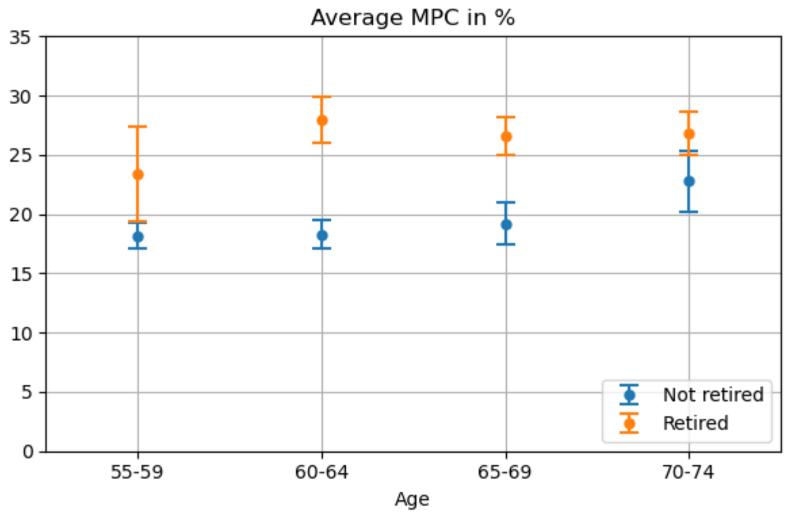

Figure 1: The marginal propensity to consume among older workers and retirees in the Survey of Consumer Expectations. The error bars indicate ± one standard error.

of household characteristics. In particular, I include various proxies for the health and the longevity expectations of the survey respondents as control variables. My main finding is that the MPC of a worker is on average about 5p.p. (or 20%) lower than the MPC of a retiree with similar age, financial wealth, longevity expectations etc. This implies that the gap in MPCs in Figure 1 cannot be explained by differences in observable characteristics between workers and retirees.

In section 3, I explore two potential ways how retirement can have a direct effect on the MPC in a simple continuous-time model: Agents choose consumption over time and possibly also their retirement age to maximize their lifetime utility subject to a standard budget constraint. Retirement is associated with an increase in leisure but comes at the cost of forgoing labor income. Since the main purpose of the model is to develop an intuition for the possible economic mechanisms, I abstract from details of the pension system and treat labor income, the time of death, and returns to wealth as deterministic.

First, I consider the case of a fixed retirement age. In this setting, a sufficiently high complementarity between consumption and leisure can decrease both the consumption level and the MPC of older workers relative to the consumption level and the MPC of retirees (mechanism A). However, according to the literature on the retirement consumption puzzle (e.g. Aguila et al., 2011), consumption expenditures do not increase at retirement - if anything, they decrease. Therefore, complementarity between consumption and leisure cannot explain why workers close to retirement have lower MPCs than retirees.

Second, I make retirement age a choice variable and use an additively separable utility function to switch off mechanism A. In this setting, workers use a fraction of the windfall gain to finance early retirement, which dampens the consumption response of workers to such a shock compared to retirees (mechanism B). In contrast to mechanism A, MPC differences associated with flexibility in the retirement age are not associated with differences in consumption levels. Moreover, the sensitivity of retirement age to wealth shocks which is necessary to match the 20% MPC difference in the data is roughly consistent with the estimates in the literature.[3] For this reason, endogenous retirement age appears to be a plausible explanation for the difference in MPCs across workers and retirees.

To evaluate the strength of mechanism B in a more realistic setting, I calibrate and solve a quantitative life-cycle model with endogenous retirement age in section 4. Compared to the simple framework in the section 3, there are three main differences: First, the quantitative model features social security benefits which are a function of average past income and retirement age. Second, labor income, the time of death, and returns to wealth are stochastic. Third, it is a discrete-time model with one time period corresponding to one year. Hence, the agents can no longer change their planned retirement age by arbitrarily small increments in response to a windfall gain.

I find that the quantitative model generates MPCs of workers which are almost 20% lower than MPCs of retirees with similar characteristics. Therefore, it can match the relative MPC difference in the SCE data even though it was not targeted in the calibration. However, the level of simulated MPCs is much lower than the average self-reported MPC in the SCE data, and standard ways to achieve higher MPC in the model do not seem promising. The simulated average response of retirement age to a windfall gain is 45% among older workers, i.e. they would use a windfall gain equivalent to one annual income to retire 5-6 months earlier than originally planned.

Literature review

This paper builds on Farhi and Panageas (2007) who study optimal consumption-savings behavior and portfolio choice in a theoretical model with endogenous retirement age. They show that in this framework workers close to retirement have a lower MPC than retirees because the increase in financial wealth from a windfall gain is partially offset by a decrease in future labor income due to early retirement (mechanism B according to my terminology).

Relative to Farhi and Panageas (2007), this paper makes the following contributions: 1) It provides empirical evidence which is consistent with the phenomenon described in Farhi and Panageas (2007). 2) Even if retirement age is fixed, sufficiently high complementarity between consumption and leisure can create a gap between the MPC of workers and retirees. This paper describes this alternative mechanism and shows how it can be distinguished from mechanism B. 3) It provides a simple formula that explicitly links the magnitude of the MPC difference to the effect of windfall gains on retirement age. 4) It explores the quantitative relevance of the effect of retirement on the MPC in a life-cycle model with a realistic social security system.

Moreover, this paper is related to two strands of literature. First, a large literature in macroeconomics is concerned with heterogeneity in the MPC. Various approaches to measuring MPCs have emerged: One possibility is to estimate the consumption response to income shocks using data on consumption and income (Parker et al., 2013, Fagereng et al., 2021, Commault, 2022). The main difficulty of this approach is to identify income changes which are unexpected and transitory. Alternatively, the MPC can be elicited using survey questions which ask respondents to state their consumption response to a hypothetical

[3]See Brown et al. (2010), Helppie McFall (2011), Zhao (2018), Golosov et al. (2021).

windfall gain (Jappelli and Pistaferri, 2014, Bunn et al., 2018, Christelis et al., 2019, Fuster et al., 2020). I follow the second approach in this paper and use self-reported MPCs from the Survey of Consumer Expectations in my analysis. Overall, empirical analyses using the two different methods obtain similar results both regarding the average MPC and MPC heterogeneity which validates my empirical approach.

Second, this paper is related to the literature on retirement and consumption. This literature mostly tries to understand if and why consumption expenditures change at the time of retirement (Banks et al., 1998, Aguiar and Hurst, 2005, Aguila et al., 2011). Instead of focusing on changes in consumption levels, this paper is concerned with differences in the MPC, i.e. the first derivative of consumption with respect to available financial resources.

2 Empirical evidence on the MPC of older Americans

Data and methodology

I use data from the Survey of Consumer Expectations (SCE) by the Federal Reserve Bank of New York to analyze the MPC among older workers and retirees in the US.[4] The SCE is a nationally representative online survey of a rotating panel of about 1300 household heads. While the core module of the survey is conducted monthly, other survey modules are conducted less frequently: The Household Spending module which contains self-reported MPCs is fielded in April, August, and December, and the Household Finance module with information on income and wealth is only fielded in August. Therefore, only the August waves of the survey contain all the necessary information to compare the MPCs of workers and retirees with similar socioeconomic characteristics. Since survey respondents rotate out of the panel after twelve months, the final dataset with observations from August only does not have a panel dimension.

The MPC is elicited as follows: The survey participants are supposed to imagine a windfall gain equivalent to 10% of their annual income and are then asked to indicate what share of the extra income they would use to "save or invest / spend or donate / pay down debts".[5] I define the fraction of additional income that the respondent would spend (or donate) in this hypothetical scenario as the self-reported MPC. Unfortunately, the survey question does not explicitly state the relevant time horizon for the MPC. Since the windfall gain is stated relative to annual income, it is natural for survey respondents to think of the fraction of the extra money which they would spend within one year. Therefore, I treat the self-reported MPCs as annual MPCs throughout the paper.

Differences in the MPC between workers and retirees can either be driven by the direct effect of retirement on the MPC or by differences in the composition of the two groups. In order to isolate the effect of retirement on the MPC, I run a linear regression with the self-reported MPC as the dependent variable on year fixed effects, a retirement dummy, and

[4] See Armantier et al. (2017) for more information on the SCE.

[5] To be more precise, the survey question elicits the marginal propensity to *spend* and not the marginal propensity to *consume*. I will come back the difference between the two concepts in section 4 when I compare the empirical results with the model simulations. The exact wording of the survey question can be found in the appendix (Figure 8).

additional control variables x_i:

$$MPC_i = \sum_{j=2015}^{2019} \alpha_j 1_{j=\text{Year}_i} + \beta \,\text{Retired}_i + \gamma' x_i + \epsilon_i \tag{1}$$

The dummy variable which indicates retirement status is constructed as follows: The Household Finance module contains a survey question about the current employment situation. It is possible to pick more than one option, e.g. respondents can indicate that they are both "working part-time" and see themselves as "retiree[s] or early retiree[s]". In my baseline specification I treat such observations as if the respondent is not retired yet because this strict definition of retirement corresponds better to the models in sections 3 and 4. For a robustness check, also I construct a less restrictive version of the retirement dummy variable which is always set to 1 if the respondent selects the "retiree[s] or early retiree[s]" option. Moreover, the Household Finance module also contains information on the retirement status of the respondent's spouse which I use in another robustness check.

As control variables I select characteristics of the respondent which are commonly thought to affect either the retirement status or the MPC or both: I include basic demographic variables - age and age squared, a dummy variable that indicates a bachelor's degree or higher, one that indicates the presence of a partner in the household, and one that indicates the gender of the respondent. Moreover, I control for income and financial wealth in a flexible way by including dummy variables for the quartiles of both variables. Income is defined as the total pre-tax income of all household members during the last 12 months, including pensions, social security income, unemployment benefits etc. Financial wealth is defined as the sum of defined contribution plans, individual retirement accounts, and non-retirement savings (savings accounts, stocks, bonds, mutual funds). If the survey respondent has a partner, the financial wealth variable refers to the combined financial wealth of both. Both income and financial wealth are deflated with the CPI before constructing the quartile dummy variables.

The final group of control variables is informative about the health and the longevity expectations of the respondent: self-reported health status as a categorical variable, the quartiles of the proportion of household spending on medical care, and the percent chance to live to age 65, 75, and 85. The designers of the survey intended to ask all participants younger than age X about their probability to live until age X, but due to a coding error in the survey, all three variables about longevity expectations are only available for respondents younger than 65. Table 10 in the appendix shows that the self-reported health status is very informative about subjective longevity expectations.

The final sample spans the years 2015 to 2019 because the question about self-reported MPCs was introduced in 2015 and because data from the Household Finance module is only available until 2019. I only include respondents who are 55 to 74 years old because I want to focus on older workers who are close to retirement and their already retired peers. The survey data also includes weights to further improve the representativeness of the panel. I estimate the regression model in equation (1) using Weighted Least Squares so that I can take the survey weights into account.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Retired	6.17***	5.74***	4.53**	5.65***	6.27**	6.23**	6.70**
	(1.71)	(1.73)	(1.91)	(1.73)	(2.73)	(2.73)	(2.76)
Year fixed effects	✓	✓	✓	✓	✓	✓	✓
Age, age^2	✓	✓	✓	✓	✓	✓	✓
Demographic characteristics		✓	✓	✓	✓	✓	✓
Income and financial wealth		✓	✓	✓	✓	✓	✓
Subjective health			✓				
Health expenditures				✓			
Probability to live to age 65					✓		
Probability to live to age 75						✓	
Probability to live to age 85							✓
Observations	1,963	1,810	1,578	1,810	1,026	1,022	1,010
Adjusted R^2	0.02	0.04	0.04	0.04	0.03	0.03	0.03
Note:				*p<0.1; **p<0.05; ***p<0.01			

Table 1: Results from a linear regression of the self-reported MPC (in %) on retirement status.

Results

Table 1 shows the main regression results.[6] The first column is the regression counterpart to Figure 1 since only age and year fixed effects are included as control variables. The second regression specification adds demographic variables, income quartiles and financial wealth quartiles. Columns (3) - (7) consider five different proxy variables for health and longevity expectation in addition to the existing control variables. Overall, the effect of retirement on MPC is remarkably stable across different specifications: All point estimates range between 4.5 and 7p.p. and are statistically significant at the 5% level. The results in Table 1 imply that most of the difference in MPCs between workers and retirees cannot be explained away by differences in the composition of the two groups.

Two robustness checks are reported in the appendix. First, Table 7 shows the results with an alternative definition of retirement status: The retirement dummy is set to one for all respondents who see themselves as retirees even if they have not exited the labor force completely yet. The estimates for the effect of retirement on the MPC are somewhat smaller but still significant at the 5% level in specifications (1) - (4).

So far, all regression specifications have considered the retirement status of the survey respondents only. As my second robustness check, I run a regression which takes the retirement status of the respondents' partners into account:

$$MPC_i = \sum_{j=2015}^{2019} \alpha_j 1_{j=\text{Year}_i} + \beta_1 \,\text{One retired}_i + \beta_2 \,\text{All retired}_i + \gamma' x_i + \epsilon_i \tag{2}$$

[6]For better readability, Table 1 omits the estimated coefficients for the control variables. The complete regression table is made available in the appendix (Table 9).

where "One retired" indicates a couple with one retiree and one person in the labor force and "All retired" either indicates a couple of two retirees or a retiree living without a partner. Table 8 shows results from this alternative specification. The estimated regression coefficients show that the MPC of partially retired households is not significantly different from the MPC of workers, whereas the MPC of fully retired households is considerably larger than in the previously considered specifications which ignore the retirement status of the respondent's partner.

3 Potential mechanisms in a simple framework

Model

In this section, I introduce a simple theoretical framework to illustrate two mechanisms that can generate a lower MPC for workers than for retirees. In order to keep the model analytically tractable, I abstract from details of the pension system, and income, the time of death, and the return on wealth are deterministic. Throughout this paper, I will model retirement as binary decision problem. This is consistent with the empirical evidence reported in Rogerson and Wallenius (2013) who find that the majority of older US males transition from full-time work to not working within one calendar year.

Consider an agent who chooses consumption $c(\tau)$ and retirement age T to maximize

$$\max_{c(\tau),T} \int_t^T e^{-\rho(\tau-t)} u(c(\tau), l_w) d\tau + \int_T^D e^{-\rho(\tau-t)} u(c(\tau), l_r) d\tau \tag{3}$$

subject to the intertemporal budget constraint

$$\int_t^D e^{-r(\tau-t)} c(\tau) d\tau = a(t) + \underbrace{\int_t^T e^{-r(\tau-t)} y(\tau) d\tau}_{=h(t)} \tag{4}$$

where $a(t)$ is financial wealth at time t, $h(t)$ is human wealth, and $y(t)$ is labor income. Moreover, D denotes the time of death, r is the interest rate, ρ is the discount rate, l_w is leisure while working, and l_r is leisure while retired.

The instantaneous utility function is assumed to satisfy $u_c(c,l) > 0$, $u_{cc}(c,l) < 0$, and $u_l(c,l) > 0$. Moreover, I assume $\rho = r$ which implies that consumption is constant at some level c_w during the agent's working life and constant at some level c_r during retirement. For a given retirement age T, consumption levels c_w and c_r are then jointly determined by the first-order condition

$$u_c(c_w, l_w) = u_c(c_r, l_r) \tag{5}$$

and the rewritten intertemporal budget constraint

$$(1 - e^{-r(T-t)})c_w + (e^{-r(T-t)} - e^{-r(D-t)})c_r = r(a(t) + h(t)) \tag{6}$$

Mechanism A: Complementarity between consumption and leisure

Let us first consider the case of a fixed retirement age T. In this case, we can derive the following expression for the MPC of workers ($t < T$) and retirees ($t > T$):

$$MPC_w(t) = \frac{r}{(1 - e^{-r(D-t)}) + \left(\frac{u_{cc}(c_w,l_w)}{u_{cc}(c_r,l_r)} - 1\right)(e^{-r(T-t)} - e^{-r(D-t)})} \tag{7}$$

$$MPC_r(t) = \frac{r}{1 - e^{-r(D-t)}} \tag{8}$$

See appendix A for the derivation. In particular, the MPC just before retirement is

$$MPC_w(T) = \frac{r}{1 - e^{-r(D-T)}} \frac{u_{cc}(c_r, l_r)}{u_{cc}(c_w, l_r)} \tag{9}$$

Therefore, the MPC difference at the time of retirement is determined by the ratio of second derivatives of the utility function with respect to consumption: The MPC of workers is reduced compared to the MPC of retirees if the marginal utility is decreasing more slowly with consumption during retirement than during working life.

To get a more intuitive understanding of how the functional form of the utility function can generate differences in the MPC at the time of retirement, we consider two examples: First, an interesting special case is a separable utility function $u(c, l) = u_1(c) + u_2(l)$ which implies $u_c(c, l_w) = u_c(c, l_r)$ and $u_{cc}(c, l_w) = u_{cc}(c, l_r)$ for all consumption levels c. Therefore, there is no jump in consumption at the time of retirement $c_w = c_r$ regardless of total wealth $a(t) + h(t)$. Moreover, we can see from equations (8) and (9) that there is no difference in MPCs at the time of retirement.

Second, we consider a nested CRRA-CES utility function

$$u(c, l) = \frac{1}{1 - \gamma} (\alpha c^\rho + (1 - \alpha)l^\rho)^{\frac{1-\gamma}{\rho}} \tag{10}$$

The larger $\gamma > 0$, the less the agent is willing to substitute across time periods. The higher $\rho < 1$, the more the agent is willing to substitute within the same time period.[7]

Intuitively, the change in consumption at retirement is determined by two opposing forces: First, the agent dislikes fluctuations in the consumption-leisure ratio over time because consumption and leisure are complementary to a certain degree. This force tends to increase the consumption level of retirees compared to the consumption level of workers. Second, agents dislike fluctuations in the value of the CES aggregator over time, which tends to increase the consumption level of workers relative to the consumption level of retirees.

In appendix A, I show that for a nested CRRA-CES utility function

$$\begin{aligned}
\gamma + \rho < 1 &\Leftrightarrow c_w < c_r \Leftrightarrow MPC_w(T) < MPC_r(T) \\
\gamma + \rho = 1 &\Leftrightarrow c_w = c_r \Leftrightarrow MPC_w(T) = MPC_r(T) \\
\gamma + \rho > 1 &\Leftrightarrow c_w > c_r \Leftrightarrow MPC_w(T) > MPC_r(T)
\end{aligned} \tag{11}$$

[7] To be more precise, $\rho \to 1$ implies that consumption and leisure are perfect substitutes, and $\rho \to -\infty$ implies that consumption and leisure are perfect complements. The case $\rho \to 0$ corresponds to a Cobb-Douglas aggregator inside a CRRA utility function.

If $\gamma + \rho < 1$, the complementarity between consumption and leisure is more important than to the agent's intertemporal smoothing motive, and therefore a retiree consumes more than a worker. If $\gamma + \rho > 1$, the intertemporal smoothing motive is more important than the complementarity between consumption and leisure, and hence the sign of the consumption difference at retirement switches. Moreover, differences in consumption levels and differences in MPCs are closely connected: If workers consume less than retirees, the MPC of workers close to retirement is lower than the MPC of retirees, and vice versa.

To summarize, we have shown that both the consumption level and the MPC of workers can be lower than the consumption level and the MPC of retirees if the complementarity between consumption and leisure is sufficiently high. But can this mechanism explain the MPC difference found in the SCE data? According to Aguila et al. (2011), there is little evidence that nondurable consumption expenditures change at the time of retirement in the US. If anything, the literature on the retirement consumption puzzle shows that consumption expenditures decrease rather than increase at retirement. This suggests that the complementarity between consumption and leisure cannot explain why workers close to retirement have lower MPCs than retirees.

Mechanism B: Response of retirement age to a windfall gain

Now we consider the case of endogenous retirement age. In order to turn off mechanism A, we assume an additively separable utility function $u(c, l) = u_1(c) + u_2(l)$ in the following. Without loss of generality, we can write

$$u(c, l) = \begin{cases} u_1(c) - \xi & \text{if } l = l_w \\ u_1(c) & \text{if } l = l_r \end{cases} \tag{12}$$

where $\xi = -u_2(l_w) > 0$ is the disutility of work and $u_2(l_r)$ is normalized to zero. The assumptions that we made about $u(c, l)$ earlier imply $u_1'(c) > 0$ and $u_1''(c) < 0$.

According to the first-order condition (5), optimal consumption is constant over the whole life-cycle for such a utility function. Using the intertemporal budget constraint (6), we can show that consumption $c(t)$, financial wealth $a(t)$ and human wealth $h(t)$ are related as follows:

$$c(t) = \begin{cases} \frac{r}{1-e^{-r(D-t)}} \left(a(t) + h(t)\right) & \text{if } t < T \\ \frac{r}{1-e^{-r(D-t)}} a(t) & \text{if } t > T \end{cases} \tag{13}$$

Differentiating with respect to financial wealth $a(t)$ yields the MPC out of a windfall gain:

$$MPC_w(t) = \frac{r}{1 - e^{-r(D-t)}} \left(1 + \frac{dh(t)}{dT} \frac{dT}{da(t)}\right) = \frac{r}{1 - e^{-r(D-t)}} \left(1 + e^{-r(T-t)} y(T) \frac{dT}{da(t)}\right) \tag{14}$$

$$MPC_r(t) = \frac{r}{1 - e^{-r(D-t)}} \tag{15}$$

Compared to the case of exogenous retirement age, an additional term appears in the expression for the MPC of a worker: The consumption response now depends on the response of human wealth to a windfall gain. If agents decide to retire earlier in response to a wealth shock, i.e. if $dT/da(t) < 0$, the MPC of a worker close to retirement is lower than the MPC of a retiree. In particular, if agents decide to use the complete windfall gain to finance early retirement, i.e. if $dT/da(t) = -e^{r(T-t)}/y(T)$, the MPC of workers becomes zero.

To better understand this mechanism, we now focus on the response of retirement age to a windfall gain. For simplicity, we assume an infinitely-lived agent $D \to \infty$ and mainly rely on a geometric argument in the main text. A mathematical derivation which also applies to agents with a finite lifetime and age-dependent disutility of work can be found in appendix B.

A useful concept is the wealth threshold $\bar{a}(T)$ which is defined as the lowest level financial wealth at which the agent prefers retiring over working. The wealth threshold depends on retirement age T through labor income at the time of retirement $y(T)$. For example, with CRRA utility $u(c) = c^{1-\gamma}/(1-\gamma)$, we have $\bar{a}(T) = (y(T)/\xi)^{1/\gamma}/r$. Intuitively, the incentive to endure the disutility of work ξ for at least one more period is stronger for an agent with high income compared to an agent with low income because the associated increase in future consumption is larger.

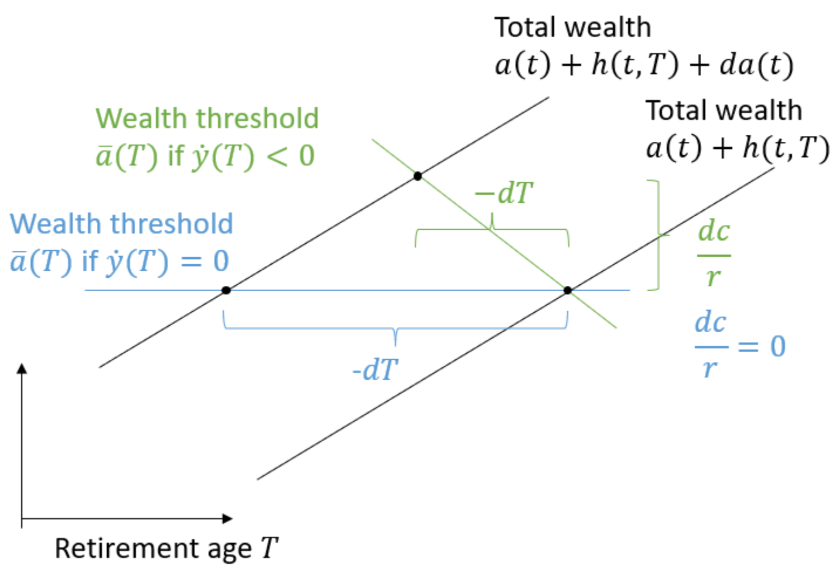

Figure 2: Illustration of mechanism B

In this simple theoretical framework, it is optimal for infinitely-lived households to keep total wealth $a(t) + h(t) = c(t)/r$ constant over time because optimal consumption $c(t)$ is constant. Consequently, optimal retirement age T has to satisfy $\bar{a}(T) = a(t) + h(t,T)$ where I make the dependence of human wealth on retirement age T explicit. Figure 2 shows optimal retirement age as the intersection of total wealth $a(t) + h(t,T)$ and the wealth threshold $\bar{a}(T)$. The blue line represents the special case of a flat wealth threshold due to constant labor income $\dot{y}(T) = 0$ at the time of retirement. The green line shows a declining wealth threshold as a result of decreasing labor income $\dot{y}(T) < 0$.

Figure 2 can be used to analyze the effect of a windfall gain on retirement and consumption. An unexpected increase in financial wealth shifts the total wealth curve upwards by $da(t)$. The responses of retirement age and consumption depend on the slope of the wealth threshold and hence on the slope of the income profile: In the case of a constant wealth threshold (blue line), total wealth says unchanged because the increase in financial wealth is completely offset by a decrease in human wealth by the same amount. In other words, the complete windfall gain is used to retire sooner and none of it is used for consumption. Therefore, the associated reduction in retirement age $-dT$ is large. In the case of decreasing labor income and hence a decreasing wealth threshold (green line), the reduction in retirement age is smaller and total wealth increases which indicates an increase in consumption and hence a positive MPC. As the slope of the wealth threshold goes to $-\infty$, we approach the case of exogenous retirement age: The change in retirement age converges to zero and the MPC converges to r, the MPC of a retiree.

In appendix B, I show that for infinitely-lived agents, the MPC of a worker and the response of retirement age to a windfall gain can be written as

$$\frac{dT}{da(t)} = -\left(\frac{dh(t)}{dT}\right)^{-1} \frac{1}{1+x(t)} = -\frac{e^{r(T-t)}}{y(T)} \frac{1}{1+x(t)} \tag{16}$$

$$MPC(t) = \frac{rx(t)}{1+x(t)} \tag{17}$$

$$x(t) = \left(\frac{dh(t)}{dT}\right)^{-1} \left(-\frac{d\bar{a}}{dT}\right) = \frac{e^{r(T-t)}}{y(T)} \left(-\frac{d\bar{a}}{dT}\right) \tag{18}$$

where mechanism B is stronger for low values of $x(t) > 0$. Equations (16)-(18) confirm the main result from the graphical analysis in Figure 2: The steeper the downward slope of the wealth threshold as a function of age, the larger $x(t)$, and the smaller the responsiveness of retirement age and the MPC difference between workers and retirees. In the special case of CRRA utility, we find

$$x(t) = \frac{1}{\gamma} e^{r(T-t)} \left(\frac{\dot{y}(T)}{y(T)}\right) \frac{\bar{a}}{y(T)} \tag{19}$$

Here, the importance of the slope of the labor income profile becomes explicit. Moreover, the term $e^{r(T-t)}$ indicates that the strength of the mechanism increases the closer the agent is to retirement. Appendix B derives analogous expressions for the finite-lifetime case, but the main conclusions remain unchanged.

To summarize, a model with endogenous retirement age can generate differences between the MPC of workers and retirees without simultaneously creating a gap in their consumption. This stands in contrast to mechanism A which can only decrease the MPC of workers relative to retirees if their consumption becomes lower than that of retirees. For this reason, flexibility in the retirement age appears like a more plausible explanation for the low MPC among workers in the SCE data than complementarity with leisure.

But does the magnitude of a typical response of retirement age to a windfall gain match the MPC difference found in section 2? We can use equation (14) for a back-of-the-envelope calculation: Older workers in the SCE have an MPC which is 20% lower than the MPC of similarly-aged retirees, hence the associated response of retirement age needs to satisfy $-e^{-r(T-t)}y(T) \cdot dT/da(t) \approx 0.2$. If we consider workers close to retirement, the term $-e^{-r(T-t)}y(T) \cdot dT/da(t)$ can be approximated by $y(t) \cdot (-\Delta T)/\Delta a(t)$ due to $e^{-r(T-t)} \approx 1$ and $y(T) \approx y(t)$. In other words, if an older worker in the US receives a windfall gain

Paper	Type of shock	Sign	Retirement response $-\Delta T/(\Delta a/y)$
Helppie McFall (2011)	2007 - 2008 change in housing + fin. wealth	-	$\approx 10\%$
Zhao (2018)	2007 - 2008 change in housing wealth	-	$\approx 20\%$
Brown et al. (2010)	Inheritance	+	$\approx 50\%^*$
Golosov et al. (2021)	Lottery win	+	$\approx 15\%^*$

Table 2: Estimates of the response of retirement age to windfall gains and losses.
*Own calculations based on estimated change in labor market exit rates.

equivalent to one annual income, we need her to retire 2-3 months sooner than originally planned to match the MPC difference. Table 2 lists estimates from the literature on the effect of wealth shocks on the retirement age. A response of retirement age of the magnitude $(-\Delta T)/(\Delta a/y) \approx 0.2$ is well within the range of estimates.

However, equation (14) was derived making a lot of simplifying assumptions, and therefore it is not clear if it is a good approximation for the relationship between the MPC and the sensitivity of retirement age to wealth shocks in the real world. For this reason, the following section studies the strength of mechanism B in a more realistic life-cycle model.

4 MPCs in a quantitative life-cycle model

Model

This section considers a quantitative life-cycle model with a realistic social security system and uncertainty about future income, the time of death, and returns to wealth. Households choose consumption, savings and retirement age to maximize expected lifetime utility.

Time is discrete and one period corresponds to one year. Households are born at time $t = 0$ and live at most to age $D - 1$. A household survives to the next period $t + 1$ with an age-dependent probability s_{t+1} and dies with probability $1 - s_{t+1}$ at the end of period t.

The retirement age of the household is a choice variable and is denoted by T. Households are allowed to retire starting at the early retirement age T_e. Retirement is irreversible, i.e. retirees are not allowed to start working again.

Preferences are time-separable where β is the discount factor. The instantaneous utility function is $u(c, l)$ where c is a non-durable consumption good and l is the amount of leisure. Workers enjoy l_w units of leisure whereas retirees have $l_r > l_w$ units of leisure.

Workers receive labor income $y_t = \exp(\chi_t + \eta_t)$ which has a deterministic life-cycle component χ_t and a stochastic component η_t. The stochastic component η_t follows a Markov chain with states $\{\eta^i\}_0^{n_\eta - 1}$ and a transition probability matrix $\text{Prob}(\eta'|\eta)$. An income tax $\tau(y)$ applies to labor income.

Retirees receive social security benefits $y_{ss} = (1+\phi_{T-T_n})g(\bar{y})$ where $\bar{y}$ is the average labor income during the working life, $g(\cdot)$ is a potentially nonlinear function, and ϕ_{T-T_n} denotes the penalty (reward) for retiring sooner (later) than the normal retirement age T_n. There is no tax on social security income. Average past labor income $\bar{y}$ is computed iteratively as follows:

$$\bar{y}_{t+1} = \begin{cases} \frac{t}{t+1}\bar{y}_t + \frac{1}{t+1}y_t & \text{if } t < T_{\bar{y}} \\ \max\{\bar{y}, \frac{T_{\bar{y}}-1}{T_{\bar{y}}}\bar{y}_t + \frac{1}{T_{\bar{y}}}y_t\} & \text{if } t \geq T_{\bar{y}} \end{cases} \tag{20}$$

After $T_{\bar{y}}$ years, new income realizations are only taken into account if they increase the average income $\bar{y}$.

Households are allowed to save but not to borrow. I abstract from portfolio choice and implicitly assume that all households choose the same portfolio weights for risky assets (housing, stocks, bonds) and safe assets. Savings at the end of period t are denoted by a_t and wealth at the start of the next period is given by $w_{t+1} = (1+r)a_t$. The return on wealth r is stochastic and follows probability distribution with density $f(r)$. All households start their lives without any wealth at age 0. The timing in the model is such that workers decide whether to retire or not after they have learned about the realized return on wealth and their potential labor income in the current period.

Households get utility $u_{\text{beq}}((1+r)a_t)$ from wealth at the time of death. This is supposed to not only reflect a bequest motive but also other reasons to not dissave quickly during retirement such as high expected medical expenses toward the end of one's life (De Nardi et al., 2016).

The value function of a worker with age t, income state η, past average income $\bar{y}$, and wealth w is denoted by $V_t^w(\eta, \bar{y}, w)$ and the associated Bellman equation is given by:

$$\begin{aligned} V_t^w(\eta, \bar{y}, w) = & \max_{c\geq 0,\, a\geq 0} u(c, l_w) + \beta s_{t+1} \sum_{\eta'} \text{Prob}(\eta'|\eta) \int V_{t+1}(\eta', \bar{y}', (1+r)a) f(r) dr \\ & + \beta(1-s_{t+1}) \int u_{\text{beq}}((1+r)a) f(r) dr \qquad (21) \\ \text{s.t.} \quad & V_{t+1}(\eta', \bar{y}', w') = \begin{cases} V_{t+1}^w(\eta', \bar{y}', w') & \text{if } t+1 < T_e \\ \max\{V_{t+1}^r(\phi_{t+1} g(\bar{y}'), w'), V_{t+1}^w(\eta', \bar{y}', w')\} & \text{if } t+1 \geq T_e \end{cases} \qquad (22) \\ & w + y - \tau(y) = c + a \qquad (23) \\ & y = \exp(\chi_t + \eta) \qquad (24) \\ & \bar{y}' = \begin{cases} \frac{t}{t+1}\bar{y} + \frac{1}{t+1}y & \text{if } t < T_{\bar{y}} \\ \max\{\bar{y}, \frac{T_{\bar{y}}-1}{T_{\bar{y}}}\bar{y} + \frac{1}{T_{\bar{y}}}y\} & \text{if } t \geq T_{\bar{y}} \end{cases} \qquad (25) \end{aligned}$$

The value function of a retiree with age t, social security income y_{ss}, and wealth w is denoted by $V_t^r(y_{ss}, w)$ and the associated Bellman equation is given by:

$$\begin{aligned} V_t^r(y_{ss}, w) = & \max_{c\geq 0,\, a\geq 0} u(c, l_r) + \beta s_{t+1} \int V_{t+1}^r(y_{ss}, (1+r)a) f(r) dr \\ & + \beta(1-s_{t+1}) \int u_{\text{beq}}((1+r)a) f(r) dr \qquad (26) \\ \text{s.t.} \quad & w + y_{ss} = c + a \qquad (27) \end{aligned}$$

Calibration

I proceed in two steps to choose the model parameters: First, I set the majority of the parameters according to information from external sources. Second, I calibrate three preference parameters internally with the simulated method of moments. All parameter values are shown in Table 3. One unit of the non-durable good is normalized such that it corresponds to the average pre-tax labor income of workers below the early retirement age.

Parameter	Symbol	Value	Source
Maximum age	$D + 25$	100	
Survival rates	$\{s_t\}$		Actuarial life table from SSA
Elasticity of intertemporal substitution	$1/\gamma$	1/2	Standard value
Discount factor	β	0.9541	Simulated method of moments
Strength of bequest motive	ν	6.67	Simulated method of moments
Disutility of work	ξ	0.807	Simulated method of moments
Income profile	$\{\chi_t\}$		Kaplan and Violante (2010)
Variance of innovations	σ_ϵ^2	0.013	Kaplan and Violante (2010)
Lump-sum transfer	τ_0	0.088	Dyrda and Pedroni (2022)
Income tax rate	τ_1	0.225	Dyrda and Pedroni (2022)
Number of years for avg income	$T_{\bar{y}}$	35	Social security rules
Early retirement age	$T_e + 25$	62	Social security rules
Normal retirement age	$T_n + 25$	66	Social security rules
Penalty for early retirement	$\{\phi_{T-T_n}\}$		Social security rules
Social security benefits	$g(\bar{y})$		Social security rules
Mean real return on wealth	μ_r	0.06	Jordà et al. (2019)
Std real return on wealth	σ_r	0.10	Jordà et al. (2019)

Table 3: Model parameters.

I choose 25 as the age which corresponds to $t = 0$ in the model. Survival rates are taken from the Actuarial Life Table provided by the Social Security Administration.[8] I assume that households in the model live at most $D = 75$ years which corresponds to a maximum age of 100.

I assume that the utility function is additively separable $u(c, l) = u_1(c) + u_2(l)$ based on Aguila et al. (2011) who find no evidence of a change in nondurable expenditure at retirement. For the utility over consumption u_1, I use the commonly isoelastic utility function. Since the model only allows two possible levels of leisure, l_w and l_r, the utility function over consumption and leisure can be written as

$$u(c, l) = \begin{cases} \frac{c^{1-\gamma}}{1-\gamma} - \xi & \text{if } l = l_w \\ \frac{c^{1-\gamma}}{1-\gamma} & \text{if } l = l_r \end{cases} \tag{28}$$

where ξ is the disutility of work and $1/\gamma$ is the intertemporal elasticity of substitution. Moreover, I assume an isoelastic utility function for the bequest motive $u_{\text{beq}}(w) = \nu w^{1-\gamma}/(1-\gamma)$

[8] See `https://www.ssa.gov/oact/STATS/table4c6.html`. I compute the average of the survival rates for males and females.

where ν denotes the strength of the bequest motive. For the intertemporal elasticity of substitution, I choose the standard value $1/\gamma = 1/2$. The three remaining preference parameters are calibrated using the simulated method of moments, which is explained towards the end of this section.

The deterministic life-cycle component $\{\chi_t\}$ of labor income is taken from Kaplan and Violante (2010). This income profile implies a decrease of median labor income with an annual rate of roughly 6% at age 60, 8% at age 65, and 10% at age 70. For the stochastic component η_t of the income process, I assume a random walk $\eta_t = \eta_{t-1} + \epsilon_t$ where innovation ϵ_t is drawn from a Normal distribution with mean 0 and variance σ_ϵ^2. The random walk is discretized using the generalized Rouwenhorst method described in Fella et al. (2019). The variance of the innovations σ_ϵ^2 is chosen to match an increase in the variance of log net income of 0.3 between ages 25 and 55 (Kaplan and Violante, 2010). For the income tax, I assume a linear functional form $\tau(y) = -\tau_0 + \tau_1 y$ where τ_0 is the lump-sum transfer and τ_1 is the tax rate. Both tax parameters are taken from Dyrda and Pedroni (2022).

The parameters of the social security system in the model are chosen to match the existing social security system in the US: The early retirement age is $T_e + 25 = 62$, the minimum number of years for computing average income is $T_{\bar{y}} = 35$, and the formula for social security benefits as a function of past average income is taken from Storesletten et al. (2004):

$$g(\bar{y}) = \begin{cases} 0.9\bar{y} & \text{if } \bar{y} \leq 0.3 \\ 0.27 + 0.32(\bar{y} - 0.3) & \text{if } 0.3 < \bar{y} \leq 2 \\ 0.81 + 0.15(\bar{y} - 2) & \text{if } 2 < \bar{y} \leq 4.1 \\ 1.13 & \text{if } 4.1 < \bar{y} \end{cases} \tag{29}$$

In the US, both the normal retirement age and the penalty for retiring at the early retirement age are gradually increasing with the birth cohort because the US government is trying to incentivize older workers to stay in the labor force for a longer time. For the model, I choose the social security rules which apply for the birth cohorts 1943-1954[9]: $T_n + 25 = 66$ is the normal retirement age and the penalty (reward) for retiring early (late) is given in Table 4.[10]

Retirement age T	62	63	64	65	66	67	68	69	≥ 70
$T - T_n$	-4	-3	-2	-1	0	1	2	3	≥ 4
ϕ_{T-T_n}	-25%	-20%	-13.3%	-6.7%	0%	8%	16%	24%	32%

Table 4: Percentage change of social security benefits in the case of early and late retirement.

Net return r is assumed to follow a Normal distribution. The mean return $\mu_r = 0.06$ is the average annual real return on the average household portfolio in the US from Jordà et al. (2019) and the standard deviation $\sigma_r = 0.10$ is based on my own calculations with the data in Jordà et al. (2019).

In a final step, the discount factor β, the disutility of work ξ, and the strength of the bequest motive ν are jointly calibrated with the simulated method of moments. The first

[9] The MPC data analyzed in section 2 covers 55- to 74-year-olds during the years 2015-2019, i.e. birth cohorts 1941-1964.

[10] See `https://www.ssa.gov/benefits/retirement/planner/1943.html` and `https://www.ssa.gov/benefits/retirement/planner/1943-delay.html`.

targeted moment is the average wealth (including housing wealth) of 273 000 dollars in the SCE data which corresponds to 3.6 units of the nondurable good in the model. The second moment is the speed of wealth decumulation during retirement: Median wealth in the 70-74 age group is roughly 10% lower than median wealth in the 65-69 age group. These two moments summarize wealth dynamics over the life-cycle concisely and are informative about the discount factor β and the strength of the bequest motive ν. The third moment is the fraction of retirees at age 65 which is approximately 50% in the SCE data. This moment is particularly informative about the disutility of work. The resulting estimates for β, ξ and ν are shown in Table 3.

Results

I simulate income, consumption and savings using both the baseline version of the model with retirement age as a choice variable and an alternative version with fixed retirement at age $T_n = 66$. Figure 9 in the appendix shows the average of important variables over the life-cycle. For example, the consumption profile in Figure 9 is hump-shaped and almost all agents retire between ages 62 and 70. Replacing endogenous retirement with an exogenously given retirement age only has a small effect on the life-cycle profiles of income, consumption and wealth.

My main results concern the MPC which is computed as follows: For each age t and each agent i, I consider the counterfactual situation in which the agent has wealth $w'_{it} = w_{it} + \Delta w_{it}$ instead of the "regular" wealth level $w_{it} = (1 + r_{it}) a_{it-1}$ where Δw_{it} is the windfall gain, r_{it} is the stochastic return to wealth, and a_{it-1} are savings from the previous period. The MPCs of workers and retirees are then defined as

$$MPC^w_{it} = \frac{c^w_t(\eta_{it}, \bar{y}_{it}, w'_{it}) - c^w_t(\eta_{it}, \bar{y}_{it}, w_{it})}{\Delta w_{it}} \tag{30}$$

$$MPC^r_{it} = \frac{c^r_t(y_{ss,it}, w'_{it}) - c^r_t(y_{ss,it}, w_{it})}{\Delta w_{it}} \tag{31}$$

where $c^w_t(\eta, \bar{y}, w)$ and $c^r_t(y_{ss}, w)$ are the consumption policy functions for workers and retirees, respectively. Analogous to the survey question in the SCE, I consider a windfall gain which corresponds to 10% of the annual net income, i.e. $\Delta w_{it} = 0.1 y^{net}_{it}$.

Figure 3(i) and Table 5 present the MPCs in the quantitative model similarly to the empirical results in section 2: The MPCs of workers in Figure 3(i) are substantially lower compared to similarly-aged retirees, in particular in the 60-64 age group. In a regression with wealth quartiles and gross income quartiles as controls, I obtain an MPC difference of 1.44 p.p. This means that the MPC of workers is 18% lower than the MPC of retirees in the quantitative model which coincides almost perfectly with the relative MPC difference of 20% in the SCE data even though it was not targeted in the calibration. However, the model is unable to match the average level of MPCs. This issue will be discussed in the next subsection.

Panel (ii) of Figure 3 compares the baseline results with MPCs generated in a model with a fixed retirement age $T_n = 66$. I find that flexibility in the retirement age decreases the average MPC in the 55-65 age range substantially compared to the mandatory retirement benchmark.

	(1)	(2)	(3)
Retired	0.50***	1.44***	1.52***
	(0.05)	(0.04)	(0.04)
Age, age^2	✓	✓	✓
Income quartiles		✓	✓
Wealth quartiles		✓	✓
Individual-level fixed effects			✓
Observations	17,205	17,205	17,205
Adjusted R^2	0.43	0.76	0.84
Note:	*p<0.1; **p<0.05; ***p<0.01		

Table 5: Results from a linear regression of the simulated MPC (in %) on retirement status.

Moreover, Column (3) in Table 5 and panels (iii) and (iv) report further results which exploit the panel dimension of the simulated data: If individual-level fixed-effects are included into the MPC regression, the estimate of the MPC gap increases slightly to 1.52 p.p. Panel (iii) shows that the negative effect of retirement flexibility on the MPC of workers is at its maximum 2 years before retirement age but already substantial 10 years before retirement. Finally, panel (iv) documents substantial heterogeneity in the effect of endogenous retirement on MPCs: For example, the effect is relatively weak for agents who leave the labor force at the early retirement age $T_e = 62$ because the model does not allow retirement before that age and hence these individuals cannot use a windfall gain to retire even earlier.

The simple theoretical model in section 3 states that the response of retirement age to a windfall gain determines the MPC gap between workers and retirees. For this reason, Figure 4 shows the simulated sensitivity of retirement age to a windfall gain of the size $\Delta w_{it} = 0.1 y_{it}^{net}$. The average response of retirement age $E[(-\Delta T_{it})/(\Delta w_{it}/y_{it}^{net})]$ increases with age for young workers and stays constant at about 45% for workers aged 40-70. A retirement response of 45% is consistent with the estimate in Brown et al. (2010) but substantially higher than most other estimates in the empirical literature (see Table 2).

MPC level in the data and in the quantitative model

While the quantitative model matches the relative MPC difference between workers and retirees well, it does not match the average level of MPCs: For example, 65-year-old retirees have an average MPC of roughly 25% according to the SCE data but only 8% according to the quantitative model. Which factors can possibly explain this difference?

One possible reason is that the respondents actually report their marginal propensity to *spend* in the survey. The marginal propensity to spend differs from the marginal propensity to *consume* if durable goods are part of the households' consumption basket. To be more precise, the short-run response of spending to a windfall gain tends to be larger than the associated increase in consumption over the same time horizon. Laibson et al. (2022) derive a simple mapping between the marginal propensity to spend (MPX) and the MPC in a

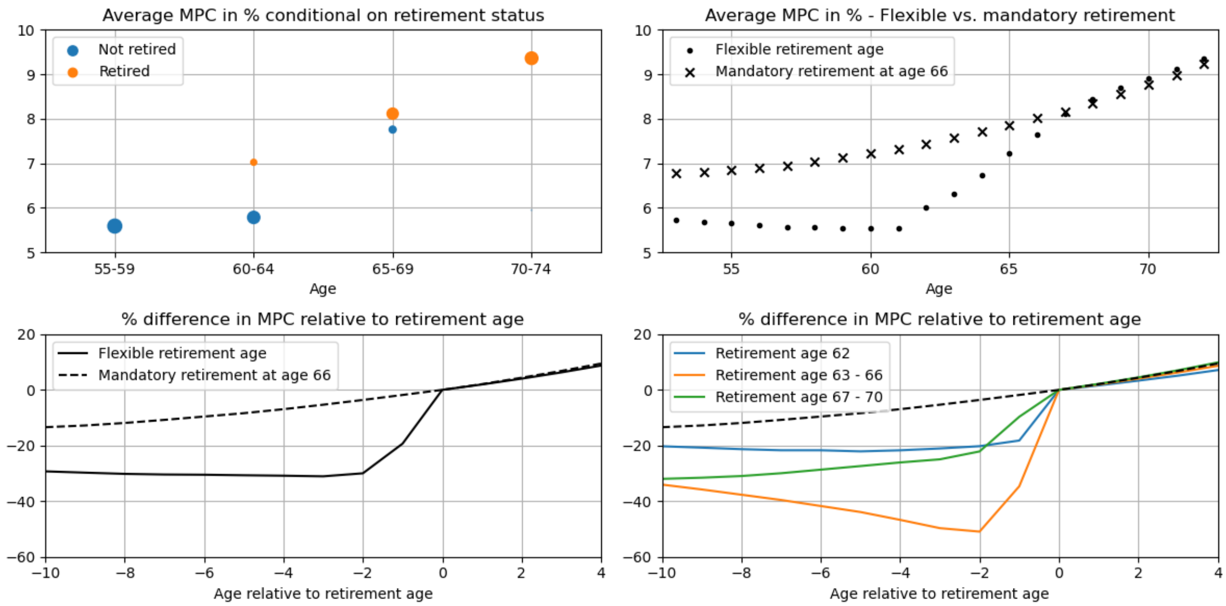

Figure 3: Simulated MPCs in a quantitative life-cycle model. (i) Mean MPC conditional on age and retirement status. The size of the dots is proportional to the number of simulated agents in a certain group. See Figure 1 for a comparison with the empirical MPCs. (ii) Mean MPC conditional on age but not retirement status, both for the baseline version of the model (endogenous retirement) and for a mandatory retirement age $T_n = 66$. (iii) Percentage difference relative to the MPC at retirement age. (iv) Percentage difference relative to the MPC at retirement age, grouped by retirement age.

consumption-savings model with durable goods

$$MPX = \left(1 - s + \frac{s}{r+d}\right) MPC \tag{32}$$

where s is the durable share s, r is the real interest rate and d denotes the durable depreciation rate. Laibson et al. (2022) suggest the values $s = 12.5\%$ and a quarterly depreciation rate of $d = 5.4\%$ which corresponds to an annual depreciation rate of 19.9%. With $r \approx 0$, I obtain $MPX \approx 1.5 \cdot MPC$ which means that an MPC of 8% in the model corresponds to a marginal propensity to spend of 12%. Therefore, taking into account that the survey data reports a marginal propensity to spend and not an MPC explains roughly one quarter of the difference between data and model.

Another possible reason for the discrepancy could be that wealth in the quantitative model is completely liquid even though many assets in the real world are illiquid (e.g. housing, pensions). Kaplan and Violante (2014, 2022) have demonstrated that two-asset models can generate higher MPCs than models with just one liquid asset. However, it is not clear if a two-asset model can fully explain the high MPCs among retirees in the SCE data because even respondents with plenty of liquid wealth report large propensities to spend. Moreover, 401k and IRA plans become completely liquid at the age of 59 1/2 which makes older wealthy hand-to-mouth households relatively rare. Nevertheless, I plan to add an illiquid asset to the quantitative model to see how much it improves the match with the data.

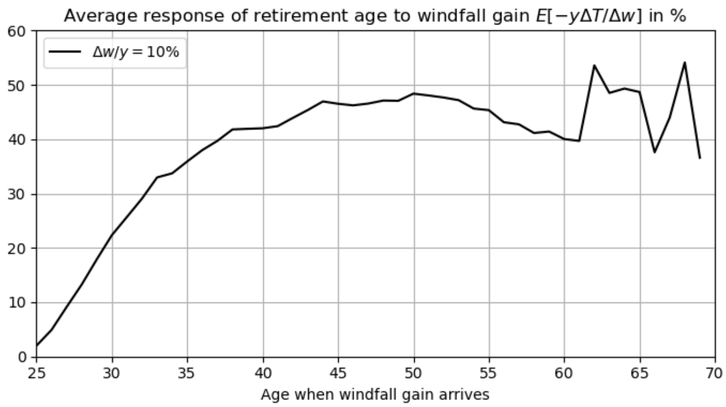

Figure 4: Average response of retirement age to a windfall gain over the life-cycle. Agents who are already retired when they receive the windfall gain are ignored in this calculation.

Implications

This subsection illustrates two implications of the main economic mechanism. First, I study the response of aggregate consumption to wealth shocks in partial equilibrium. The effect of retirement flexibility on the aggregate consumption response is measured as the relative difference between the baseline model with an endogenous retirement age and the counterfactual with a mandatory retirement age of 66. Table 6 shows the results for windfall gains of different types and sizes.[11]

Shock	$\Delta c/c$ (Flex. ret.)	$\Delta c/c$ (Mand. ret.)	Rel. diff.	Rel. diff. (Age < 70)
$\Delta w_i = 0.01$	0.128	0.131	-2.6%	-4.1%
$\Delta w_i = 0.1$	1.228	1.264	-2.8%	-4.5%
$\Delta w_i = 0.01 \cdot w_i$	0.324	0.347	-6.6%	-11.5%
$\Delta w_i = 0.1 \cdot w_i$	3.235	3.454	-6.3%	-11.1%

Table 6: Aggregate consumption response to wealth shocks both in the baseline model with flexible retirement age and in the model with a mandatory retirement age of 66.

The main finding is that retirement flexibility is not particularly relevant for windfall gains of constant size, but that it becomes much more important if we consider shocks that are proportional to household wealth. To be more precise, the simulated reduction of the aggregate consumption response to the uniform windfall gain due to endogenous retirement is approximately 3%. The small magnitude is not surprising because flexible retirement only has a sizable effect on MPCs in the 50-65 age group, and not on other age groups. The effect of endogenous retirement increases to about -6.5% for windfall gains which are proportional to household wealth because workers in the 50-65 age group to be wealthier than young

[11] The relative difference which measures the role of a flexible retirement age stays unchanged if we multiply all individual consumption responses by a constant factor. Therefore, the inability of the model to match the level of MPCs is not a big concern for this exercise even though we underestimate the magnitude of the aggregate consumption responses.

workers. The role of retirement behavior for the aggregate consumption responses does not vary much with the size of the wealth shocks.

One important caveat is that MPCs increase with age in the quantitative model - especially in the 65+ age group (see Figure 3) - whereas this is not the case in the data (see Figure 1). Hence, a disproportionaly large share of the simulated consumption response is due to old retirees. Excluding agents with age 70 and older from the computation of the aggregate consumption response increases the effect of flexible retirement to -11% for proportional wealth shocks.

These results imply that early retirement is potentially relevant for the reaction of aggregate consumption to stock market booms even though it only affects the MPCs of workers in a relatively narrow age range. What is more, stock market wealth is probably more concentrated in the 50-65 age group than total wealth which would further increase the importance of endogenous retirement for these types of wealth shocks relative to the results in Table 6.

Second, I explore the implications of my findings for the use of MPCs as sufficient statistics for the welfare gains from redistributive policies as in Kolsrud et al. (2022). Since retirees tend to have higher MPCs than workers according to the SCE data, a naive application of the sufficient statistics approach would imply that redistribution from workers to retirees increases social welfare.

In order to check whether this prediction is indeed true, I implement the following transfer from workers to retirees: I take Δ units of the consumption good from each worker of age t and give $n_t^w/n_t^r\Delta$ units of the consumption good to each retiree of age t. n_t^w and n_t^r denote the number of workers and retirees of age t, respectively. Then I compute the amount Δ_t^{eq} which needs to be given all agents of age t to achieve the same level of utilitarian welfare as without the wealth transfer. I define the welfare gain as the ratio Δ_t^{eq}/Δ. For the numerical exercise, I choose $\Delta = 0.01$ but since my measure of the welfare gain is normalized by the size of the transfer, it barely changes as I vary Δ.

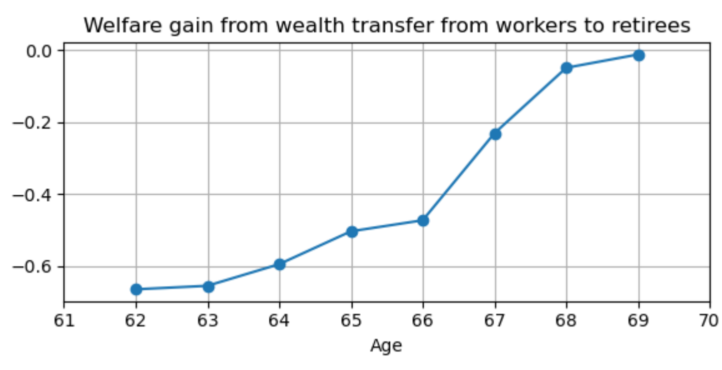

Figure 5: Welfare gain from a wealth transfer from workers to retirees. See the main text for detailed information about the wealth transfer and the computation of the welfare gain.

Figure 5 shows the welfare gains Δ_t^{eq}/Δ for ages $t = 62, \ldots 69$.[12] The main finding is that the redistributive transfer generates welfare losses, contrary to the prediction from the

[12]All agents in the quantitative model are retired at age 70, therefore it is not possible to conduct the wealth transfer with agents who are 70 years old or older.

sufficient statistics approach. The welfare losses are large relative to the size of the transfer: For ages 62-66, each unit of the consumption good which transferred to retirees is equivalent to decreasing the wealth of all agents of this age by 0.5-0.6 units. For ages 66-69, the welfare losses relative to the size of the transfer are somewhat smaller.

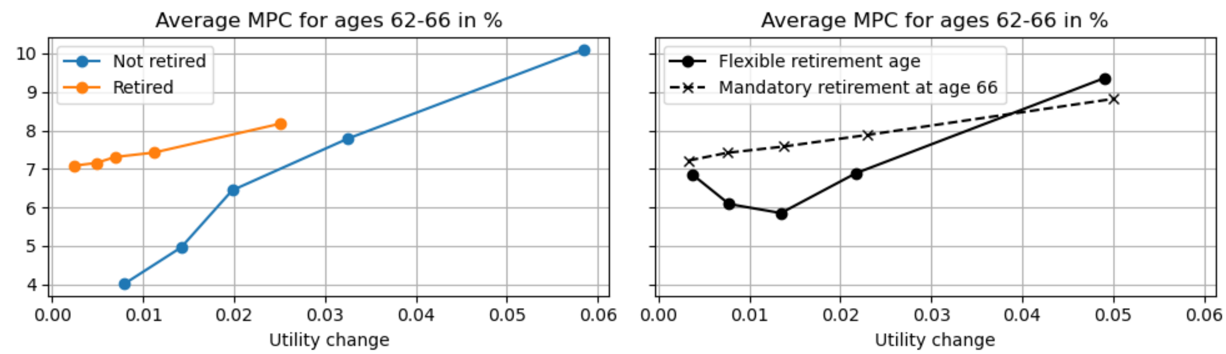

Figure 6: Binscatter plot of utility change from 0.01 additional wealth and MPCs for age group 62-66.

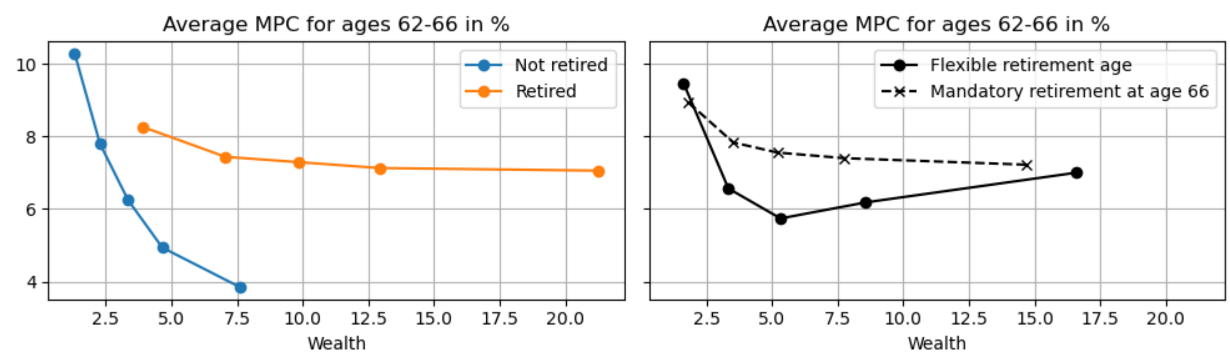

Figure 7: Binscatter plot of wealth and MPCs for age group 62-66.

Why does redistribution from low-MPC workers to high-MPC retirees not increase social welfare in the quantitative model? Intuitively, older workers do not have a lower MPC than retirees of the same age because they value one unit of additional wealth less but because they prefer to use a substantial fraction of the windfall gain to finance early retirement. Therefore, comparing the MPC across the two groups does not informative about the welfare gains of a redistributive policy.

To formalize this argument, Figure 6 shows a binscatter plot with the utility change from a 0.01 wealth transfer on the x-axis and the MPC on the y-axis. The left panel shows that MPCs and the utility gain have a strong positive correlation conditional on retirement status. However, retirees with a certain utility gain from additional wealth have a much higher MPC than workers with the same utility gain because endogenous retirement decreases the MPC of workers who are close to retirement. For this reason, the monotonous positive relationship between MPCs and the utility gain vanishes once we do no longer condition on retirement status in the right panel. A similar pattern can be observed in the relationship between MPCs and wealth which is depicted in Figure 7.

5 Conclusion

In this paper, I document that the self-reported MPC of older workers is substantially lower than the MPC of retirees and consider three possible explanations: 1) Individuals with poor health and low longevity expectations may retire earlier and also have higher MPCs than their peers. 2) Sufficiently high complementarity between consumption and leisure can generate a gap between the MPC of workers and retirees. 3) Older workers use part of a windfall gain to finance early retirement which reduces their MPC.

According to the empirical analysis in section 2, a possibly lower life expectancy among retirees cannot be the main explanation for the gap in MPCs. Moreover, the empirical evidence on the change of consumption expenditures at retirement is at odds with the predictions of an explanation based on complementarity of consumption and leisure. Using both a simple theoretical model and a quantitative life-cycle model, I show that the response of retirement age to windfall gains is the most plausible explanation: The results of the quantitative model (which only allows for explanation 3) are consistent with the relative MPC difference in the SCE data of 20%.

This project has ignored all margins of labor supply other than a binary retirement decision. In future research, I plan to study the effect of labor supply responses on the MPC in a more general setting.

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A Mechanism A: Derivations

Derivation of equation (7)

Apply implicit differentiation with respect to financial wealth $a(t)$ both to the first-order condition (5) and to the intertemporal budget constraint (6):

$$u_{cc}(c_w, l_w)\frac{dc_w}{da(t)} = u_{cc}(c_r, l_r)\frac{c_r}{da(t)} \tag{33}$$

$$(1 - e^{-r(T-t)})\frac{c_w}{da(t)} + (e^{-r(T-t)} - e^{-r(D-t)})\frac{c_r}{da(t)} = r \tag{34}$$

In the next step, rearrange (33) for $dc_r/da(t)$ and plug the resulting expression into (34):

$$(1 - e^{-r(T-t)})\frac{c_w}{da(t)} + (e^{-r(T-t)} - e^{-r(D-t)})\frac{u_{cc}(c_w, l_w)}{u_{cc}(c_r, l_r)}\frac{c_w}{da(t)} = r \tag{35}$$

Rearranging (35) for $dc_w/da(t)$ yields the MPC of workers in equation (7).

Derivation of equation (11)

Consider the CRRA-CES utility function and its derivatives:

$$u(c,l) = \frac{1}{1-\gamma}\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma}{\rho}} \tag{36}$$

$$u_c(c,l) = \alpha c^{\rho-1}\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma-\rho}{\rho}} \tag{37}$$

$$u_l(c,l) = (1-\alpha)l^{\rho-1}\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma-\rho}{\rho}} \tag{38}$$

$$\begin{aligned} u_{cc}(c,l) &= \alpha(\rho-1)c^{\rho-2}\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma-\rho}{\rho}} \\ &\quad + \alpha^2(1-\gamma-\rho)c^{2\rho-2}\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma-2\rho}{\rho}} && (39) \\ &= -\alpha c^{\rho-2}(\alpha\gamma c^\rho + (1-\alpha)(1-\rho)l^\rho)\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma-2\rho}{\rho}} && (40) \end{aligned}$$

$$u_{cl}(c,l) = \alpha(1-\alpha)(1-\gamma-\rho)c^{\rho-1}l^{\rho-1}\left(\alpha c^\rho + (1-\alpha)l^\rho\right)^{\frac{1-\gamma-2\rho}{\rho}} \tag{41}$$

where $\rho < 1$, $\gamma > 0$ and $0 < \alpha < 1$. It is easy to see that the marginal utilities $u_c(c,l)$ and $u_l(c,l)$ are positive for all possible combinations of consumption $c > 0$ and leisure $l > 0$ and that the second derivative $u_{cc}(c,l)$ is always negative. The sign of the cross-derivative $u_{cl}(c,l)$ depends on $\gamma + \rho \lesseqgtr 1$:

$$\begin{aligned} &\gamma + \rho < 1 \Leftrightarrow u_{cl}(c,l) > 0\ \forall c > 0,\ l > 0 \Leftrightarrow c \text{ and } l \text{ are q-complements} \\ &\gamma + \rho = 1 \Leftrightarrow u_{cl}(c,l) = 0\ \forall c > 0,\ l > 0 \Leftrightarrow \text{additively separable utility function} \\ &\gamma + \rho > 1 \Leftrightarrow u_{cl}(c,l) < 0\ \forall c > 0,\ l > 0 \Leftrightarrow c \text{ and } l \text{ are q-substitutes} \end{aligned} \tag{42}$$

The relationship $\gamma + \rho \lesseqgtr 1 \Leftrightarrow c_w \lesseqgtr c_r$ follows directly from equation (42) combined with $u_c(c,l) > 0$, $u_{cc}(c,l) < 0$.

The remainder of the derivation concerns the MPCs of workers and retirees. From equation (9) we know that MPCs are closely related to the second derivative of the utility function with respect to consumption:

$$MPC_w(T) \gtreqless MPC_r(T) \Leftrightarrow \frac{u_{cc}(c_r, l_r)}{u_{cc}(c_w, l_w)} \gtreqless 1 \tag{43}$$

The second derivative can be expressed in terms of the first derivative

$$\begin{aligned} u_{cc}(c,l) &= -u_c(c,l)\left((1-\rho)c^{-1} + \alpha(\gamma+\rho-1)c^{-(1-\rho)}(\alpha c^\rho + (1-\alpha)l^\rho)^{-1}\right) && (44)\\ &= -u_c(c,l)c^{-1}\left((1-\rho) - \alpha(1-\gamma-\rho)c^\rho(\alpha c^\rho + (1-\alpha)l^\rho)^{-1}\right) && (45)\end{aligned}$$

In the following, I distinguish between the three regions of the parameter space:

- Case $\gamma + \rho > 1$ and $\gamma > 1$: Using equation (44), we know that $MPC_w(T) > MPC_r(T)$ holds if

$$\frac{(1-\rho)c_r^{-1} + \alpha(\gamma+\rho-1)c_r^{-(1-\rho)}(\alpha c_r^\rho + (1-\alpha)l_r^\rho)^{-1}}{(1-\rho)c_w^{-1} + \alpha(\gamma+\rho-1)c_w^{-(1-\rho)}(\alpha c_w^\rho + (1-\alpha)l_w^\rho)^{-1}} > 1 \tag{46}$$

  Note that the terms related to the first derivative cancel due to the first-order condition. Both the numerator and the denominator are a sum of two positive terms with the same structure. The first term is greater in the numerator than in the denominator because $c_w > c_r$ holds in this part of the parameter space. In order to see why the second term is also greater in the numerator than in the denominator, we need to rearrange the first-order condition:

$$\begin{aligned} \left(\frac{c_r}{c_w}\right)^{1-\rho} &= \left(\frac{\alpha c_r^\rho + (1-\alpha)l_r^\rho}{\alpha c_w^\rho + (1-\alpha)l_w^\rho}\right)^{\frac{1-\gamma-\rho}{\rho}} && (47)\\ \Leftrightarrow \left(\frac{c_r}{c_w}\right)^{-\frac{(1-\rho)\rho}{1-\rho-\gamma}} &= \left(\frac{\alpha c_r^\rho + (1-\alpha)l_r^\rho}{\alpha c_w^\rho + (1-\alpha)l_w^\rho}\right)^{-1} && (48)\\ \Leftrightarrow \left(\frac{c_r}{c_w}\right)^{\frac{(1-\rho)(\gamma-1)}{1-\rho-\gamma}} &= \frac{c_r^{-(1-\rho)}}{c_w^{-(1-\rho)}}\left(\frac{\alpha c_r^\rho + (1-\alpha)l_r^\rho}{\alpha c_w^\rho + (1-\alpha)l_w^\rho}\right)^{-1} > 1 && (49)\end{aligned}$$

  The inequality sign in the last equation follows from $c_w > c_r$ and $\frac{(1-\rho)(\gamma-1)}{1-\rho-\gamma} < 0$ in this region of the parameter space. Consequently, we have indeed shown that $MPC_w(T) > MPC_r(T)$ holds in this region of the parameter space.

- Case $\gamma + \rho < 1$ and $\rho < 0$: Using equation (45), we know that $MPC_w(T) < MPC_r(T)$ holds if

$$\frac{c_r^{-1}}{c_w^{-1}} \cdot \frac{(1-\rho) - \alpha(1-\gamma-\rho)c_r^\rho(\alpha c_r^\rho + (1-\alpha)l_r^\rho)^{-1}}{(1-\rho) - \alpha(1-\gamma-\rho)c_w^\rho(\alpha c_w^\rho + (1-\alpha)l_w^\rho)^{-1}} < 1 \tag{50}$$

  Again, the terms related to the first derivative cancel due to the first-order condition. Both terms of the product on the left-hand side of the equation above are positive.

The first term of the product is smaller than one because $c_w < c_r$ holds in this part of the parameter space. In order to see why the second term is also smaller than one, we need to rearrange the first-order condition:

$$\left(\frac{c_r}{c_w}\right)^{-\frac{\gamma\rho}{1-\rho-\gamma}} = \frac{c_r^\rho}{c_w^\rho}\left(\frac{\alpha c_r^\rho + (1-\alpha)l_r^\rho}{\alpha c_w^\rho + (1-\alpha)l_w^\rho}\right)^{-1} > 1 \tag{51}$$

The inequality sign follows from $c_w < c_r$ and $-\frac{\gamma\rho}{1-\rho-\gamma} > 0$ in this region of the parameter space. Consequently, we have indeed shown that $MPC_w(T) < MPC_r(T)$ holds in this region of the parameter space.

- Case $\gamma < 1$ and $\rho > 0$: In this part of the parameter space, I have not been able to formally prove yet that $\gamma + \rho \gtreqless 1 \Leftrightarrow MPC_w(T) \gtreqless MPC_r(T)$ holds. However, numerical computations for a huge range of values for initial wealth strongly support this relationship.

B Mechanism B: Derivations

The theoretical model considered here is more general than the example in the main text: In contrast to the example in section 3, the subsequent results allow for agents with a finite lifetime D and the disutility of work ξ can vary with age t. Whenever it is necessary to make assumptions about the functional form of $u_1(\cdot)$ in (12), I assume CRRA utility $u_1(c) = c^{1-\gamma}/(1-\gamma)$.

Optimal retirement age for given consumption

Objective function (3) with utility function (12), optimal consumption (13), and $\rho = r$ plugged in:

$$\max_T \frac{1-e^{-r(D-t)}}{r} u_1(c(t)) - \int_t^T e^{-r(\tau-t)}\xi(\tau)d\tau \tag{52}$$

First-order condition with respect to retirement age T:

$$\frac{1-e^{-r(D-t)}}{r} u_1'(c(t))\frac{dc(t)}{dT} = e^{-r(T-t)}\xi(T) \tag{53}$$

- Left-hand side: marginal benefit of postponing retirement by dT (as seen from time t)
- Right-hand side: marginal cost of postponing retirement by dT (as seen from time t)

Effect of retirement age on consumption:

$$\frac{dc(t)}{dT} = \frac{r}{1-e^{-r(D-t)}}\frac{dh(t)}{dT} = \frac{r}{1-e^{-r(D-t)}}e^{-r(T-t)}y(T) \tag{54}$$

Plug (54) into (53) to obtain simplified optimality condition for T:

$$u'(c(t))y(T) = \xi(T) \tag{55}$$

Derive the wealth threshold $\bar{a} = a(T)$ using $c = c(t) = c(T)$:

$$c(T) = \frac{r}{1 - e^{-r(D-T)}} a(T) = \left(\frac{y(T)}{\xi(T)} \right)^{1/\gamma} \tag{56}$$

$$\implies \bar{a} = \frac{1 - e^{-r(D-T)}}{r} \left(\frac{y(T)}{\xi(T)} \right)^{1/\gamma} = (1 - e^{-r(D-T)}) \bar{a}_\infty \tag{57}$$

There are three possible reasons why the wealth threshold declines with T:

- time to death $D - T$ decreases
- labor income $y(T)$ decreases
- disutility from work $\xi(T)$ increases

Relationship between total wealth and wealth threshold:

$$a(t) + h(t) = \frac{1 - e^{-r(D-t)}}{1 - e^{-r(D-T)}} \bar{a} = \left(1 - e^{-r(D-t)}\right) \bar{a}_\infty \tag{58}$$

Wealth threshold if $D \to \infty$:

$$a(t) + h(t) = \bar{a}_\infty = \frac{1}{r} \left(\frac{y(T)}{\xi(T)} \right)^{1/\gamma} \tag{59}$$

A solution for T only exists if wealth threshold is lower than total wealth $a(t) + h(t)$ as $T \to \infty$.

Explicit retirement age formula if $\dot{y} = 0$, $\dot{\xi} = 0$, and $D \to \infty$:

$$a(t) + \frac{1 - e^{-r(T-t)}}{r} w = (1 - e^{-r(D-t)}) \bar{a}_\infty \tag{60}$$

$$\implies T - t = -\frac{1}{r} \log \left(\frac{r}{w} \left(a(t) + \frac{w}{r} - (1 - e^{-r(D-t)}) \bar{a}_\infty \right) \right) \tag{61}$$

Effect of wealth shock on retirement age $dT/da(t)$ and final MPC formula

Differentiate (58) with respect to $a(t)$:

$$1 + \frac{dh}{dT} \frac{dT}{da(t)} = (1 - e^{-(D-t)}) \frac{d\bar{a}_\infty}{dT} \frac{dT}{da(t)} \tag{62}$$

Special case $D \to \infty$:

$$1 + \frac{dh}{dT} \frac{dT}{da(t)} = \frac{d\bar{a}}{dT} \frac{dT}{da(t)} \tag{63}$$

The equation above is illustrated in Figure 2.

Effect of wealth shock on retirement age $dT/da(t)$:

$$\frac{dT}{da(t)} = \left(-\frac{dh}{dT} + (1 - e^{-(D-t)})\frac{d\bar{a}_\infty}{dT}\right)^{-1} \tag{64}$$

$$= -\left(\frac{dh}{dT}\right)^{-1} \frac{1}{1 + x(t)} \tag{65}$$

$$x(t) = \left(1 - e^{-r(D-t)}\right)\left(\frac{dh}{dT}\right)^{-1}\left(-\frac{d\bar{a}_\infty}{dT}\right) \tag{66}$$

Effect of retirement age on wealth threshold (both finite D and $D \to \infty$):

$$-\frac{d\bar{a}/dT}{\bar{a}} = \frac{1}{\gamma}\left(-\frac{\dot{y}(T)}{y(T)} + \frac{\dot{\xi}(T)}{\xi(T)}\right) + r\left(\frac{1}{1 - e^{-r(D-T)}} - 1\right) \tag{67}$$

$$-\frac{d\bar{a}_\infty/dT}{\bar{a}_\infty} = \frac{1}{\gamma}\left(-\frac{\dot{y}(T)}{y(T)} + \frac{\dot{\xi}(T)}{\xi(T)}\right) \tag{68}$$

Effect of wealth shock on retirement age $dT/da(t)$

$$\frac{dT}{da(t)} = -\left(\frac{dh}{dT}\right)^{-1} \frac{1}{1 + x(t)} \tag{69}$$

$$x(t) = \frac{1}{\gamma} e^{r(T-t)} \frac{1 - e^{-r(D-t)}}{1 - e^{-r(D-T)}}\left(-\frac{\dot{y}(T)}{y(T)} + \frac{\dot{\xi}(T)}{\xi(T)}\right)\frac{\bar{a}}{y(T)} \tag{70}$$

Plug (69) into (14) and (15):

$$MPC_w(t) = \frac{r}{1 - e^{-r(D-t)}}\frac{x(t)}{1 + x(t)} \tag{71}$$

$$MPC_r(t) = \frac{r}{1 - e^{-r(D-t)}} \tag{72}$$

The results in equations (16)-(18) correspond to the special case $D \to \infty$ and $\dot{\xi} = 0$.

C Additional figures and tables

QSP12n [added August 2015]

Suppose next year you were to find your household with **10% more income** than you currently expect. What would you do with the extra income?

- ❍ Save or invest all of it (1)
- ❍ Spend or donate all of it (2)
- ❍ Use all of it to pay down debts (3)
- ❍ Spend some and save some (4)
- ❍ Spend some and use part of it to pay down debts (5)
- ❍ Save some and use part of it to pay down debts (6)
- ❍ Spend some, save some and use some to pay down debts (7)

Show QSP12a if codes 4,5,6, or 7 selected at QSP12n

QSP12a [added August 2015]

Please indicate what share of the extra income you would use to... (Please note that the three proportions need to add up to 100%)

Save or invest (1) ________________________________ % (1)
Spend or donate (2) ________________________________ % (2)
Pay down debts (3) ________________________________ % (3)

Figure 8: Survey questions in the SCE that elicit the marginal propensity to consume out of a windfall gain.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Retired	5.84***	5.44***	4.13**	5.37***	4.34*	4.28*	4.67*
	(1.68)	(1.69)	(1.91)	(1.70)	(2.43)	(2.44)	(2.46)
Year fixed effects	✓	✓	✓	✓	✓	✓	✓
Age, age^2	✓	✓	✓	✓	✓	✓	✓
Demographic characteristics		✓	✓	✓	✓	✓	✓
Income and financial wealth		✓	✓	✓	✓	✓	✓
Subjective health			✓				
Health expenditures				✓			
Probability to live to age 65					✓		
Probability to live to age 75						✓	
Probability to live to age 85							✓
Observations	1,963	1,810	1,578	1,810	1,026	1,022	1,010
Adjusted R^2	0.02	0.04	0.04	0.04	0.03	0.02	0.03
Note:							*p<0.1; **p<0.05; ***p<0.01

Table 7: Results from a linear regression of the self-reported MPC (in %) on retirement status. This regression uses an alternative definition of the retirement dummy.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
One retired	1.39	1.14	0.62	1.05	3.15	3.06	3.14
	(2.13)	(2.15)	(2.34)	(2.16)	(3.07)	(3.09)	(3.10)
All retired	8.29***	7.91***	6.70***	7.78***	9.31***	9.26***	9.96***
	(1.98)	(2.01)	(2.21)	(2.02)	(3.41)	(3.42)	(3.47)
Year fixed effects	✓	✓	✓	✓	✓	✓	✓
Age, age^2	✓	✓	✓	✓	✓	✓	✓
Demographic characteristics		✓	✓	✓	✓	✓	✓
Income and financial wealth		✓	✓	✓	✓	✓	✓
Subjective health			✓				
Health expenditures				✓			
Probability to live to age 65					✓		
Probability to live to age 75						✓	
Probability to live to age 85							✓
Observations	1,963	1,810	1,578	1,810	1,026	1,022	1,010
Adjusted R^2	0.03	0.05	0.04	0.05	0.03	0.03	0.04
Note:							*p<0.1; **p<0.05; ***p<0.01

Table 8: Results from a linear regression of the self-reported MPC (in %) on retirement status. See regression equation (2).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
age_minus_65	0.09	0.00	0.07	0.03	-0.57	-0.52	-0.50
	(0.16)	(0.16)	(0.17)	(0.16)	(1.64)	(1.64)	(1.67)
age_minus_65_sq	-0.01	-0.02	-0.02	-0.02	-0.05	-0.05	-0.05
	(0.02)	(0.03)	(0.03)	(0.03)	(0.14)	(0.14)	(0.14)
health_2			4.45**				
			(2.16)				
health_3			3.37				
			(2.36)				
health_4			4.23				
			(2.89)				
health_exp_2				-1.30			
				(2.34)			
health_exp_3				-3.90*			
				(2.16)			
health_exp_4				-1.54			
				(2.37)			
high_educ		3.18**	3.38**	3.07**	4.60***	4.49***	4.66***
		(1.39)	(1.48)	(1.40)	(1.73)	(1.71)	(1.72)
income_Q2		-0.59	0.08	-0.42	-0.40	-0.56	-0.93
		(2.19)	(2.35)	(2.17)	(3.12)	(3.14)	(3.15)
income_Q3		-1.95	-3.69	-1.61	-4.81	-4.92	-5.00
		(2.46)	(2.55)	(2.47)	(3.10)	(3.13)	(3.13)
income_Q4		-4.49*	-4.64*	-4.15	-5.19	-5.38	-5.45
		(2.52)	(2.68)	(2.53)	(3.34)	(3.37)	(3.36)
male		2.23	0.87	2.06	2.71	2.65	2.22
		(1.55)	(1.69)	(1.56)	(2.05)	(2.12)	(2.16)
mort_65					-0.01		
					(0.05)		
mort_75						0.01	
						(0.04)	
mort_85							0.01
							(0.04)
partner		-4.93***	-3.78**	-4.75***	-5.00**	-4.86**	-4.60*
		(1.80)	(1.88)	(1.81)	(2.34)	(2.37)	(2.40)
retired_strict	6.17***	5.74***	4.53**	5.65***	6.27**	6.23**	6.70**
	(1.71)	(1.73)	(1.91)	(1.73)	(2.73)	(2.73)	(2.76)
wealth_Q2		2.43	1.12	2.34	2.71	2.58	2.31
		(2.08)	(2.22)	(2.08)	(2.93)	(2.92)	(2.94)
wealth_Q3		6.28***	7.25***	6.34***	4.76	4.55	4.39
		(2.35)	(2.60)	(2.36)	(3.07)	(3.10)	(3.09)
wealth_Q4		7.86***	7.74***	7.66***	4.02	3.88	3.63
		(2.49)	(2.73)	(2.48)	(3.17)	(3.19)	(3.19)
year_2015	21.55***	20.63***	18.17***	22.35***	19.36**	18.81***	19.27***
	(2.23)	(2.70)	(4.65)	(3.09)	(7.74)	(7.14)	(6.69)
year_2016	16.11***	14.38***	11.97***	16.29***	14.84**	14.10**	14.63**
	(1.89)	(2.51)	(3.11)	(2.95)	(7.08)	(6.43)	(5.99)
year_2017	16.63***	16.39***	13.59***	18.13***	15.56**	14.83**	15.12***
	(1.76)	(2.44)	(3.29)	(3.02)	(6.58)	(5.98)	(5.59)
year_2018	20.09***	19.25***	16.81***	21.14***	18.18***	17.62***	18.31***
	(1.91)	(2.51)	(3.30)	(2.95)	(6.80)	(6.28)	(5.91)
year_2019	17.68***	15.81***	13.55***	17.54***	15.93**	15.22**	15.02***
	(1.81)	(2.34)	(3.17)	(2.85)	(6.93)	(6.22)	(5.76)
Observations	1,963	1,810	1,578	1,810	1,026	1,022	1,010
R^2	0.02	0.05	0.05	0.05	0.05	0.04	0.05
Adjusted R^2	0.02	0.04	0.04	0.04	0.03	0.03	0.03
Note:							*p<0.1; **p<0.05; ***p<0.01

Table 9: Results from a linear regression of the self-reported MPC (in %) on retirement status. Unabbreviated version of Table 1.

	(1)	(2)	(3)	(4)
age_minus_65	0.49	1.81	1.77	1.69
	(1.92)	(1.94)	(1.98)	(1.91)
age_minus_65_sq	0.08	0.19	0.17	0.17
	(0.17)	(0.17)	(0.18)	(0.17)
health_2			-7.93*	
			(4.11)	
health_3			-17.41***	
			(4.51)	
health_4			-30.93***	
			(4.89)	
health_exp_2				-7.87**
				(3.82)
health_exp_3				-6.36*
				(3.64)
health_exp_4				-8.21**
				(3.70)
high_educ		6.52***	4.75**	6.26***
		(2.27)	(2.38)	(2.30)
income_Q2		0.11	-0.63	1.13
		(4.06)	(4.44)	(4.12)
income_Q3		5.24	3.21	6.64
		(4.18)	(4.46)	(4.27)
income_Q4		5.55	1.93	6.28
		(4.29)	(4.48)	(4.37)
male		-11.39***	-9.20***	-11.38***
		(2.65)	(2.71)	(2.66)
partner		-3.33	-2.88	-2.92
		(3.03)	(3.27)	(3.02)
retired_strict	1.25	-0.18	-3.05	-0.15
	(3.29)	(3.43)	(3.51)	(3.48)
wealth_Q2		1.53	-0.29	0.99
		(3.82)	(4.01)	(3.83)
wealth_Q3		3.93	-2.34	3.86
		(3.96)	(4.20)	(3.99)
wealth_Q4		5.01	-1.20	4.90
		(4.36)	(4.82)	(4.42)
year_2015	43.64***	48.25***	60.95***	53.49***
	(5.58)	(6.22)	(9.37)	(6.52)
year_2016	49.32***	54.10***	71.53***	59.61***
	(5.60)	(5.98)	(7.39)	(6.14)
year_2017	45.07***	50.15***	70.01***	55.22***
	(5.20)	(5.87)	(7.31)	(6.06)
year_2018	49.40***	53.66***	74.46***	59.39***
	(5.36)	(6.31)	(7.85)	(6.50)
year_2019	47.59***	52.18***	71.02***	57.46***
	(5.31)	(5.89)	(7.20)	(6.03)
Observations	1,079	1,010	878	1,010
R^2	0.01	0.07	0.17	0.08
Adjusted R^2	0.00	0.06	0.15	0.06
Note:		*p<0.1; **p<0.05; ***p<0.01		

Table 10: Results from linear regression with probability to live to 85 as dependent variable.

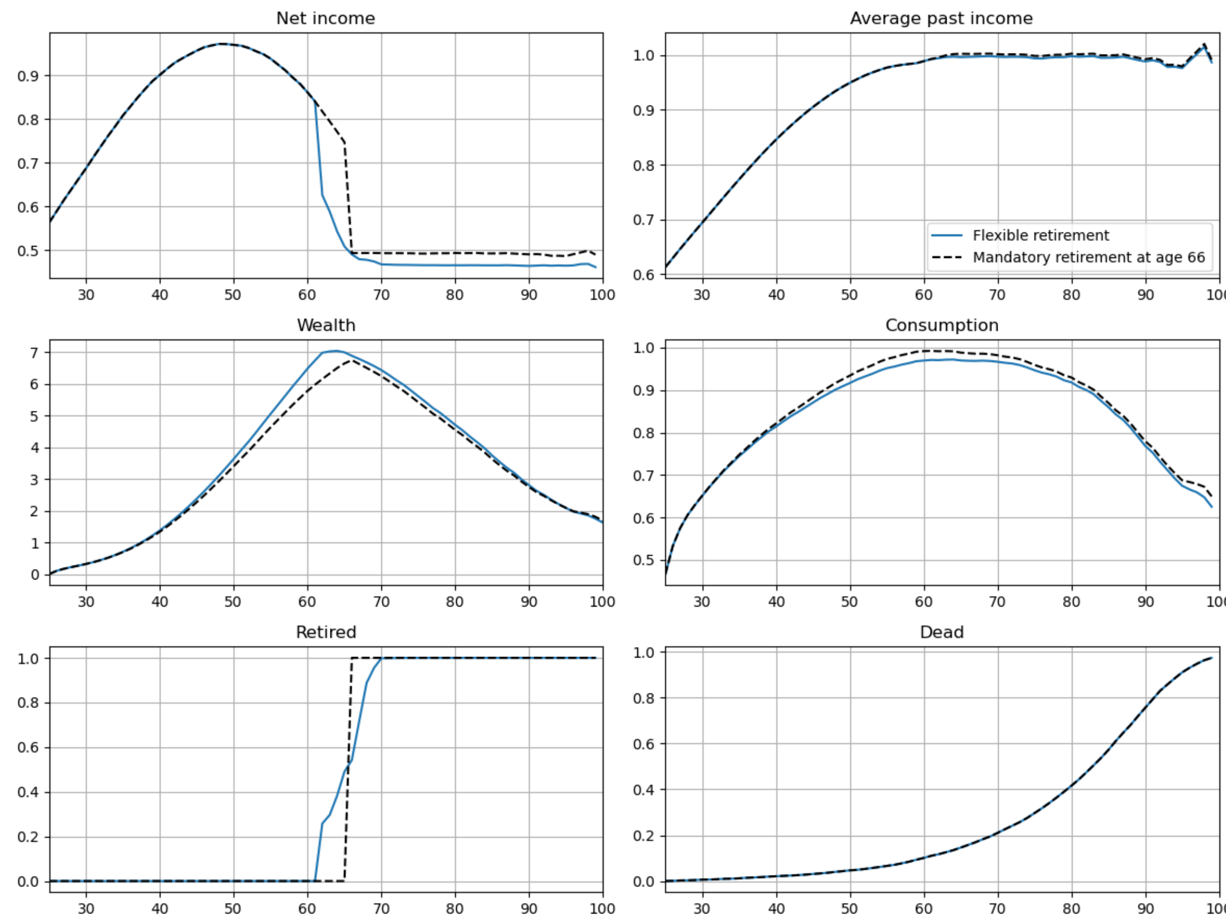

Figure 9: Average value of selected variables over the life-cycle.