Retirement Date effects on Savings Behaviour: The case of Non-Separable preferences

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Introduction

- Labour force participation rates in OECD countries have been increasing since the late 1990's
- For Example, in the US, men in the age group 65-69, had participation rates of 33% in 2008, after being at 24% in 1985 & 27% in 1995.
- Females in this age group: 27% in 2008 compared to 17% in 1995
- Trend expected to increase: Expected to be 40% for men, 31% for women by 2016

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    - Increase in the Normal Retirement age
    - Increase in the Delayed retirement credit
    - Removal of eanings test
    - Age discrimination became illegal

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  - **Other factors**
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  - changing social norms
  - greater percentage of labour force educated
  - growth in participation of older women, encourages growth in participation of older men

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    - In this paper we look at the case where utility is a function of both consumption and leisure
    - We show that the implications for savings behaviour of later retirement dates depends on the degree of separability of consumption and leisure

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    - Increase in retirement date not only implies an increase in future income, but also a decrease in future leisure
    - This nuance is not significant if preferences are separable in consumption and leisure, but is very significant if preferences are non-separable

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- We assume that the agent does not face any liquidity constraints in that he is able to borrow against future income.
- We now proceed to analyze the effect of variation in the anticipated retirement date on prior consumption/saving decisions .

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    - We define leisure, l_t, to be 1 before retirement , and equal to $\bar{l} > 1$ every period after retirement
    - For a given anticipated date of retirement, t_{ret} (and hence a given $v(l(t))$ in every period), the agent's aim at time t is to maximize utility as follows:

    $$\max_{(c_t \dots c_T)} \sum_{k=t}^{T} \beta^k (u(c_k))$$

    where β is the discount factor $= \frac{1}{1+\rho}$, where, ρ, is the rate of time preference.

Budget constraint

- The dynamic budget constraint at any time t given by:

$$x_{t+1} = (x_t - c_t)R + y_{t+1}$$

$$x_t = a_t + y_t$$

where x_t is "cash on hand", R is the fixed gross return on assets , and is equal to $(1 + r)$, where r is the interest rate common to borrowing and lending, and y_t is non-capital income.

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- and that

$$y_t = \begin{cases} l_t \text{ if } t < t_{\mathrm{Re}\,t} \\ i_t \text{ if } t \geqslant t_{\mathrm{Re}\,t} \end{cases}$$

Where l_t is labour income and i_t is social security/pension income. We assume $l_t > i_t$

Budget constraint

- Human capital wealth, h_t is given by

$$
\begin{aligned}
h_t &= \sum_{k=t+1}^{T} y_k R^{-(k-t)} = \frac{h_{t+1} + y_{t+1}}{R} \\
&= \sum_{k=t+1}^{t_{\mathrm{Re}\,t}-1} IR^{-(k-t)} + \sum_{k=t_{\mathrm{Re}\,t}}^{T} iR^{-(k-t)} \quad \text{for t} < \mathrm{t}_{\mathrm{Re}\,t}
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and is clearly the sum of total discounted non-capital income.

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- Finally

$$w_t = x_t + h_t$$

where w_t is total worth at time t, and evolves according to the following equation:

$$w_{t+1} = (w_t - c_t).R$$

Budget constraint

and

$$\sum_{k=t}^{T} \frac{c_t}{R^{k-t}} = w_t$$

with

$$w_{T+1} = 0$$

Terminal condition implies no bequest motive

Maximization Problem

Writing the utility maximization problem, from the perspective of any time period t, as a standard dynamic programming problem, we have

$$
\begin{aligned}
J(a_t, I, i,\ t_{ret}) &= \max_{(c_t \ldots c_T)} \sum_{k=t}^{T} \beta^{k-t}(u(c_k)) \\
&= \max_{(c_t \ldots c_T)} \left[u(c_t) + \beta J(a_{t+1}, I, i,\ t_{ret}) \right] \\
&= \max_{(c_t \ldots c_T)} \left[(u(c_t) + \beta u(c_{t+1}) + \beta^2 J(a_{t+2}, I, i,\ t_{ret}) \right] \\
&\quad etc
\end{aligned}
$$

First Order condition

$$u'(c_t) = \beta R u'(c_{t+1}) = ...\beta^{T-t} R^{T-t} u'(c_T)$$

$\Rightarrow$

$$\frac{u'(c_t)}{u'(c_{t+1})} = \beta R$$

First Order condition

Let us assume that the form of the utility function is of standard constant relative risk aversion (CRRA) form ,

$$u(c_k) = \frac{c_k^{1-\theta}}{1-\theta}$$

with $\theta \neq 1$

Now θ reflects the curvature/concavity of the utility function with a higher value of θ reflecting a more concave utility function. $\frac{1}{\theta}$ reflects the intertemporal elasticity of substitution.

- First order condition implies

$$\left(\frac{c_t}{c_{t+1}}\right) = [\beta R]^{-\frac{1}{\theta}}$$

First order condition

- Implies

$$c_t = c_{t+1} = \ldots = c_T$$

if $\beta R \rightarrow 1$ or $\frac{1}{\theta} \rightarrow 0$

Proposition 1

Our solution for consumption in any period t can be given as:

$$c_t = \left(\frac{R^{T-t}}{\sum_{j=0}^{T-t} (\beta R)^{\frac{j}{\theta}} \cdot R^{T-t-j}} \right) w_t$$

with the marginal propensity to consume out of total worth equal to $\left(\frac{R^{T-t}}{\sum_{j=0}^{T-t} (\beta R)^{\frac{j}{\theta}} \cdot R^{T-t-j}} \right)$

Corollary 1

Saving at any point in time, t, is given by:

$$\begin{aligned} S_t &= Y_t - c_t \\ &= Y_t - \left[\left(\frac{R^{T-t}}{\sum_{j=0}^{T-t} (\beta R)^{\frac{j}{\theta}} \cdot R^{T-t-j}} \right) w_t \right] \end{aligned}$$

Corollary 2

- *An agent whose preferences are separable in consumption and leisure, and who foresees that he will have more income in the future due to a later anticipated retirement date, will, for a given level of* a_t*,* I*,* i*,* R *,*T *and* β*, experience a higher net worth, and will thus necessarily institute a higher level of consumption and a lower level of saving now.*

Non-Separable preferences

- Assume that instantaneous utility at time, t, is given by the following cobb douglas isoelastic utility function:

$$
\begin{aligned}
u(c,l) &= \frac{\left(c_t^{\eta}\ (l_t)^{1-\eta}\right)^{1-\theta}}{1-\theta} \\
&= \begin{cases} \frac{\left(c_t^{\eta}\ \right)^{1-\theta}}{1-\theta} \ for \text{ t} < t_{ret} \\ \frac{\left(c_t^{\eta}\ (\bar{l})^{1-\eta}\right)^{1-\theta}}{1-\theta} \ for \text{ t} \geqslant t_{ret} \end{cases}
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with $\frac{1}{\theta}$being the intratemporal elasticity of substitution between consumption and leisure.

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- If $\theta = 1$, then the function reduces to a log utility function which is additively separable in consumption and leisure.

Non-separable preferences

- Now,

$$\frac{\partial u}{\partial c_t} = \eta \left(c_t^{\eta} (l_t)^{1-\eta} \right)^{-\theta} c_t^{\eta-1} (l_t)^{1-\eta}$$
$$= \eta c_t^{\eta(1-\theta)-1} (l_t)^{(1-\eta)(1-\theta)}$$

and

$$u_{cl} = (1-\theta)(1-\eta) c_t^{\eta(1-\theta)-1} l_t^{(1-\theta)(1-\eta)-1}$$

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- Conversely, consumption and leisure are complements if $u_{cl} > 0$.
- Note that $u_{cl} < 0 \Rightarrow \theta > 1$ i.e. $\frac{1}{\theta} < 1$

Empirical evidence on intratemporal elasticity in the US

- Most empirical estimates of $\frac{1}{\theta}$ suggest that consumption and leisure are indeed substitues.
  - Ghez and Becker (1975) report a value of 0.83. Auerbach and Kotlikoff (1987) report values between 0.3 and 1.5, but select a value of 0.8 as their base value in simulations. Altig et al (2001) also select a parameter of 0.8 for their simulations, while Diamond and Zodrow (2007, 2008) use a value of 0.6 in their benchmark simulation. Attanasio & Weber report an estimate of 0.67, while French's (2003) estimates imply an intratemporal elasticity of substitution between 0.18 and 0.45 .Zilak and Kneisner report values ranging from 0.09 to 0.23.

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- We thus proceed with our model, concentrating on the case where consumption and leisure are substitutes.

Consumption path over time

- First order conditions give rise to the following

$$c_t = \beta R^{\frac{1}{\eta(1-\theta)-1}} \cdot \left(\frac{l_{t+1}}{l_t}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}} \cdot c_{t+1}$$

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- which for $t < t_{ret} - 1$, and $t \geqslant t_{ret} \Rightarrow$

$$c_t = \beta R^{\frac{1}{\eta(1-\theta)-1}} \cdot c_{t+1}$$

, and between $t_{ret} - 1$ and t_{ret}

$$c_{t_{ret}-1} = \beta R^{\frac{1}{\eta(1-\theta)-1}} \cdot \left(\bar{l}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}} . c_{t_{ret}}$$

Thus, even if βR was equal to unity, for $\theta > 1$ (leisure and consumption substitutes), consumption before retirement is greater than consumption after retirement.

Proposition 2

At any point in time t,

$$c_t = \left(\frac{R^{T-t}}{\sum_{j=0}^{T-t} \left[R^{T-t-j} \cdot (\beta R)^{-\frac{j}{\eta(1-\theta)-1}} \cdot \left(\frac{l_t}{l_{t+j}}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}} \right]} \right) w_t$$

- We see that the marginal propensity to consume out of net worth,

$$\left(\frac{R^{T-t}}{\sum_{j=0}^{T-t} \left[R^{T-t-j} \cdot (\beta R)^{-\frac{j}{\eta(1-\theta)-1}} \cdot \left(\frac{l_t}{l_{t+j}}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}} \right]} \right)$$

, is determined to a large degree by the path of future leisure relative to current leisure

Observation

An agent who is working in time period t,who considers consumption and leisure substitutes, and who anticipates a postponement in his retirement date, will experience a decrease in the marginal propensity to consume out of net worth at time t.

Observation proof

Proof:

Suppose the agent is not retired in period t. $\frac{l_t}{l_{t+j}} = \frac{1}{\bar{l}} < 1$ if the agent is retired in period $t+j$, and is equal to 1 if the agent is not retired in period $t+j$. Thus, for $\theta > 1$, i.e. consumption and leisure substitutes, the term $\sum_{j=0}^{T-t}\left[R^{T-t-j}\left(\beta R\right)^{-\frac{j}{\eta(1-\theta)-1}}\left(\frac{l_t}{l_{t+j}}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}}\right]$ will be greater if the agent is not retired in period $t+j$ than if the agent is retired in period $t+j$.

Thus, the more time the agent anticipates working, the greater will be $\sum_{j=0}^{T-t}\left[R^{T-t-j}\left(\beta R\right)^{-\frac{j}{\eta(1-\theta)-1}}\left(\frac{l_t}{l_{t+j}}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}}\right]$, and the smaller will be

$$\left(\frac{R^{T-t}}{\sum_{j=0}^{T-t}\left[R^{T-t-j}(\beta R)^{-\frac{j}{\eta(1-\theta)-1}}\left(\frac{l_t}{l_{t+j}}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}}\right]}\right)$$

Proposition 3

At any time t prior to retirement, if preferences are non-separable in consumption and leisure and the two are viewed as substitutes, a postponement in the anticipated retirement date increases w_t, but also decreases the mpc,

$$\left(\frac{R^{T-t}}{\sum_{j=0}^{T-t} \left[R^{T-t-j} (\beta R)^{-\frac{j}{\eta(1-\theta)-1}} \left(\frac{l_t}{l_{t+j}}\right)^{\frac{(1-\eta)(1-\theta)}{\eta(1-\theta)-1}} \right]} \right).$$

Proposition 3

The net effect on consumption of a change in the anticipated retirement date will be given by the total differential

$$\frac{\partial c_t}{\partial w_t} \cdot \frac{\partial w_t}{\partial t_{ret}} \cdot + \frac{\partial c_t}{\partial (mpc)_t} \cdot \frac{\partial (mpc)_t}{\partial t_{ret}}$$

where the first term is positive, and the second term is negative.

- Thus, when preferences are non -separable in consumption and

  leisure, the effect of later retirement dates on consumption is twofold. The positive effect on consumption caused by an increase in total worth, is dampened by a second negative effect on consumption caused by a decrease in the path of future leisure.

- **Corollary 3**: The effect of later retirement dates on consumption approaches the separable case as $\theta \longrightarrow 1$, or as $\bar{l} \longrightarrow 1$.This is since the magnitude of the second effect diminishes under such conditions.

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- **Corollary 3**: The effect of later retirement dates on consumption approaches the separable case as $\theta \longrightarrow 1$, or as $\bar{l} \longrightarrow 1$.This is since the magnitude of the second effect diminishes under such conditions.
- **Corollary 4**: The second effect gets stronger as $\bar{l}$ gets very large.
- In fact, if $\bar{l}$ is very large, and if innitial assets at time t are non-zero , then an increase in the anticipated retirement date at time t, might result in the second effect dominating the first effect, so that overall consumption decreases in response to the later anticipated retirement date.

Corollary 5

At any point in time t, the net effect on savings of an increase in the anticipated retirement date is given by

$$\frac{\partial S_t}{\partial w_t} \cdot \frac{\partial w_t}{\partial t_{ret}} \cdot + \frac{\partial S_t}{\partial (mpc)_t} \cdot \frac{\partial (mpc)_t}{\partial t_{ret}}$$

where the first term is negative, and the second term is positive.

- Thus, absolute saving levels of the young will decrease minimally in response to a delay in the anticipated date of retirement and, under the conditions considered in corollary 4, may actually increase..

Concluding remarks

- When preferences are separable in consumption and leisure, an exogenous increase in the expected age of retirement will lead agents to consume more and hence accumulate less wealth prior to the initial anticipated retirement date.

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- Agents whose preferences are not separable in consumption and leisure, and who view the two as substitutes, will experience, if at all, a minimal decrease in saving levels in anticipation of a later retirement date. In fact saving levels might actually increase under certain conditions.

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- When preferences are separable in consumption and leisure, an exogenous increase in the expected age of retirement will lead agents to consume more and hence accumulate less wealth prior to the initial anticipated retirement date.
- Agents whose preferences are not separable in consumption and leisure, and who view the two as substitutes, will experience, if at all, a minimal decrease in saving levels in anticipation of a later retirement date. In fact saving levels might actually increase under certain conditions.
- In light of this theoretical outcome, what would have been and continue to be the impact of the upward trend in retirement dates that the US economy has experienced since the mid 90's and that is expected to persist at least until 2016, on aggregate savings behaviour ?

Concluding remarks

- Well, what people save when they are young and working, they dissave when they are retired. Aggregate savings are determined by the aggregation of the saving of the young and the dissaving of the old.

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- Now, if preferences are separable, younger people anticipating to retire later than their older counterparts, save considerably less than their older counterparts did. Thus, the saving of the young has decreased relative to the dissaving of the old, resulting in a decrease in aggregate savings.

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- Now, if preferences are separable, younger people anticipating to retire later than their older counterparts, save considerably less than their older counterparts did. Thus, the saving of the young has decreased relative to the dissaving of the old, resulting in a decrease in aggregate savings.
- Thus, in the case of separable preferences, the effect of an increase in retirement dates might have an unintended adverse effect on aggregate savings.

Concluding remarks

- However, if one is to believe the anecdotal evidence suggesting that consumption and leisure are indeed substitutes, the adverse negative effect on savings will be minimal, since the young will not decrease their savings substantially in anticipation of a later retirement date, and aggregate saving rates will be only minimally affected. In fact, there may even be a slight positive effect on savings.

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- As a last point, it is important to realise that in analysing the effect of an exogenous change in the retirement date, we are analysing the direct effect on savings behaviour of a change in the retirement date.

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- As a last point, it is important to realise that in analysing the effect of an exogenous change in the retirement date, we are analysing the direct effect on savings behaviour of a change in the retirement date.
- In reality, it is likely that some of the factors influencing later retirement dates are endogenous to the saving decision, and that there are multiple effects at play.

Concluding remarks

- However, if one is to believe the anecdotal evidence suggesting that consumption and leisure are indeed substitutes, the adverse negative effect on savings will be minimal, since the young will not decrease their savings substantially in anticipation of a later retirement date, and aggregate saving rates will be only minimally affected. In fact, there may even be a slight positive effect on savings.
- As a last point, it is important to realise that in analysing the effect of an exogenous change in the retirement date, we are analysing the direct effect on savings behaviour of a change in the retirement date.
- In reality, it is likely that some of the factors influencing later retirement dates are endogenous to the saving decision, and that there are multiple effects at play.
- We do not, in this paper, attempt to analyse the general equilibrium relationship between retirement dates and savings in the economy. The point of this paper is merely to analyse one effect- the direct effect on savings behaviour of later retirement dates- under varying preference structures

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- At very low consumption levels experienced by alot of South Africans, preferences are likely to be more separable in consumption and leisure