Present-biased preferences, retirement planning and demand for commitments

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Motivation

- Experimental evidence suggests that people have time-inconsistent preferences (e.g. Thaler (1981)) and in particular present-biased preferences.
- When considering trade-offs between two future moments, present-biased preferences give stronger relative weight to the earlier moment as it gets closer.
- Present-biased preferences provide a motive for commitment.
- Commitment puzzle: demand for commitment is often lower than we would expect (e.g. Giné et al. (2010), Kaur et al. (2015), Augenblick et al. (2015)) but also some evidence of large demand for commitment and willingness to pay (Schilbach, 2019).
- Most of the literature about life-cycle models and present-biased preferences abstracts from retirement planning (Laibson, 1997) or from demand for commitments (Diamond and Koszegi, 2003).

Research question

- How does the demand for commitment (illiquid assets - as in Laibson (1997)) change when agents decide both how much to consume and when to retire?
- Underlying idea: if agents use a single commitment device to address two actions that are inter-dependent the commitment can:
  - help committing both actions: the commitment is desirable.
  - push one action in an unintended direction while trying to address the other: is the commitment still desirable?
    - Yes! The agent *could* even demand more of the commitment in that case.

Related works

- Laibson (1997): present-biased agents who supply labour inelastically. Agents use illiquid assets to constraint their future (consumption) choice. Too much liquidity may reduce welfare.
- Diamond and Koszegi (2003): stylized three periods model with endogenous retirement decision. Present-biased preferences can result in retiring earlier than planned. Sophisticated agents can under/over-save to maximise their utility.

Definitions

- An agent is sophisticated (naïve) if he is (not) aware of the structure of his time-preferences.

Model set up (as in Diamond and Koszegi (2003))

3 periods model:

- In period 1 the agent has to work and earns a salary (w_1). He decides how much to consume (c_1) and save (s_1).
- In period 2 he can decide to work or to retire. If he works he earns a salary (w_2) and faces an additive disutility due to his effort (e). The savings (s_1) yields a constant interest rate. He consumes (c_2) and decides how much to leave for the next period.
- In period 3 he cannot work and consumes what is left from the previous periods.

The agent is present-biased and has logarithmic instantaneous utility.

Solution concept

- The consumer's choice can be modeled as an equilibrium in a sequential game played by the different selves (consider self 1, 2 and 3 as different agents).
- The game can then be solved using backward induction starting from the last period.
- The agent in the model understands perfectly the consequences of his actions, and acts optimally within the constraint imposed by his discount function.

Retirement decision: naïve agent

- Self 2 works if $U(working) \geq U(retiring)$
- this happens when self 2 dos not have enough savings: $s_1 \leq \bar{k}_2$ with

$$\bar{k}_2 = \frac{w_2}{R[\exp(\frac{e}{1+\beta\delta}) - 1]} \tag{1}$$

- Since self 1 is naïve, he thinks that self 2 will decide based on a slightly different comparison: $s_1 \leq \bar{k}_1$ with

$$\bar{k}_1 = \frac{w_2}{R[\exp(\frac{e}{1+\delta}) - 1]} \tag{2}$$

- $\beta \in (0,1)$ implies that $\bar{k}_1 > \bar{k}_2$. In particular, for $\bar{k}_2 < s_1 \leq \bar{k}_1$ self 2 will retire, but naïve self 1 thinks self 2 will work.

Retirement decision: sophisticated agent (without commitment)

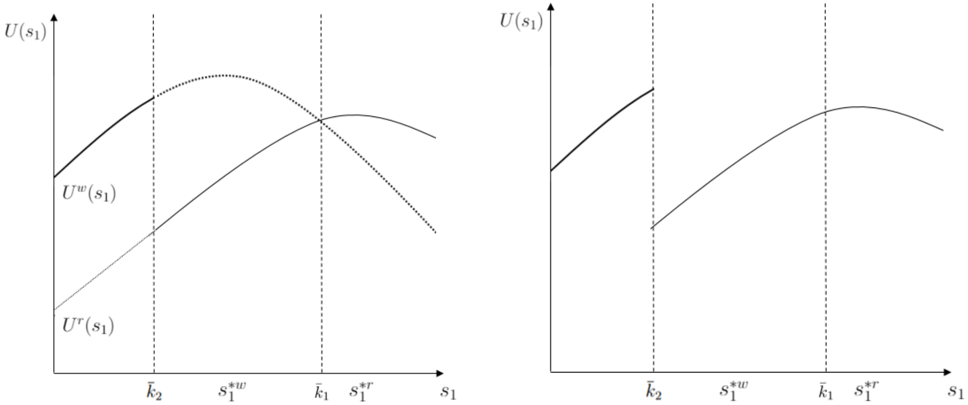

Figure 1: Life-time utility of self 1

Illiquid asset

- If you buy the illiquid asset in period t it yields a return in period $t+2$ (not in period $t+1$ as the liquid asset).
- If you decide to sell the illiquid asset in period t you get paid in period $t+1$ (not in period t as the liquid asset).
- If you apply for a loan in period t the associated cash flow is not available for consumption until period $t+1$.
- These assumptions are the same as in Laibson (1997): there is no way for self 2 to get in $t=2$ the money from the illiquid assets.

Illiquid asset (continued)

- In period 1, self 1 invests a share α of his savings in the liquid asset and $(1-\alpha)$ in the illiquid one (which yields the same return).
- In period 2, self 2 has at his disposal only the part of savings that has been invested in the liquid asset.
- In period 3, self 3 can spend both the money from the liquid and the illiquid asset.
- Self 2 would like to consume c_2^{**} in period 2, but self 1 would like him to consume $c_2^* < c_2^{**}$. Self 1 can use the illiquid asset to induces his optimal allocation.
- Self 1 can use the illiquid asset to force self 2 to work (less liquidity provides an incentive to work).

Retirement decision with illiquid asset: case 1

Self 1 and self 2 agree that it is optimal to work in period 2 given self 1's first best saving s_1^{*w} and no commitment (no need to influence self 2's retirement decision).

- Self 1 would stick to s_1^{*w} and set α to influence self 2's consumption decision.
- Since $c_2^* < c_2^{**}$, self 1 leaves enough liquidity α^* to self 2 that is only sufficient to consume c_2^*.
- Self 2 has no means to relax the liquidity constraint: he is already working and cannot borrow.

$\Longrightarrow$ self 1 can achieve his first best solution by constraining his future selves.

Retirement decision with illiquid asset: case 2

Self 1 and self 2 agree that it is optimal to retire in period 2 given self 1's first best saving s_1^{*r} and no commitment (no need to influence self 2's retirement decision).

- Self 1 would stick to s_1^{*r} and set α to influence self 2's consumption decision.
- Self 1 can leave enough liquidity α^* to self 2 that is only sufficient to consume c_2^*.
- But less liquidity provides an incentive to work. If α^* induces working self 1 would either:
  - Stick to s_1^{*r} and buy less of the illiquid asset to not induce working. Self 1 induces his optimal decision about retirement but cannot induce his optimal consumption allocation.
  - Set s_1^{*w} to induce working and use the illiquid asset to influence consumption. Self 1 induces his optimal consumption allocation but cannot induce his optimal decision about retirement.

Retirement decision with illiquid asset: case 3

Self 1 and 2 disagree on the retirement decision given self 1's first best saving s_1^{*w} and no commitment: self 1 would like self 2 to work, but self 2 would like to retire.

- Self 1 could stick to the first best saving level s_1^{*w} and set α^* to induce the optimal consumption allocation. If this value is low enough to induce working then full commitment can be achieved.
- If α^* is not low enough to induce working self 1 would either:
  - Decide to not induce working ($s_1 = s_1^{*r}$) use the illiquid asset to influence consumption. Self 1 influences the consumption allocation but cannot induce his optimal decision about retirement.
  - Decide to induce working: set $s_1 = s_1^{*w}$, which would induce retirement without the commitment, but use a large quantity of the illiquid asset ($\alpha < \alpha^*$) to force self 2 to work. Self 1 induces his optimal decision about retirement but cannot induce his optimal consumption allocation.

Conclusions

- When addressing consumption and retirement together, illiquid assets are not always a perfect commitment device.
- The demand for illiquid assets when incorporating the retirement decision can be very different from the case with inelastic labour supply.
- Considering more choices at the same time can both result in lower or higher commitment demand, providing an explanation for the commitment puzzle.
- Mandatory savings schemes which aim at improving naïve agents' welfare should be designed considering possible spillover effects on labour supply.

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Consumption choice: naïve agent

Consider a naïve agent that in period $t = 1$ has to decide his optimal consumption path by solving:

$$(c_1^*, c_2^*, c_3^*) = \arg\max_{c_1, c_2, c_3} u(c_1) + \beta\delta u(c_2) + \beta\delta^2 u(c_3) \text{ s.t. budget costraint} \tag{3}$$

At $t = 2$, a present-biased agent will change his mind because he solves the following problem:

$$(c_2^{**}, c_3^{**}) = \arg\max_{c_1, c_2, c_3} u(c_2) + \beta\delta u(c_3) \text{ s.t. budget costraint} \tag{4}$$

with $c_2^* < c_2^{**}$ and $c_3^* > c_3^{**}$: if self 1 is naïve he would plan to consume a certain quantity in period 2 but would end up consuming more because of his present-time bias (the opposite is true for period 3). Realized consumption path is $c_1^*, c_2^{**}, c_3^{**}$.

Consumption choice: sophisticated agent

Consider a sophisticated agent that in period $t = 1$ has to decide his optimal consumption path. Since he is sophisticated, he knows that he has time-inconsistent preferences and that at $t = 2$ he will change his plan. Therefore, he takes (c_2^{**}, c_3^{**}) as given:

$$(c_1^*) = \arg\max_{c_1} u(c_1) + \beta\delta u(c_2^{**}) + \beta\delta^2 u(c_3^{**}) \text{ s.t. budget costraint} \tag{5}$$

- With logarithmic utilities, the consumption path of a naïve agent is observationally equivalent to that of a sophisticated agent.
- Being sophisticated does not necessarily increase one's own life-time utility if labour is supplied inelastically and no commitment devices are available.

Consumption choice

Consumer's decisions are unaffected by scale:

$$c_2^* = \frac{1}{1+\delta}(s_1 R + w_2 \mathbf{1}) = \lambda_1 (s_1 R + w_2 \mathbf{1}) \tag{6}$$

$$c_3^* = \frac{\delta}{1+\delta}(s_1 R + w_2 \mathbf{1}) R = (1-\lambda_1)(s_1 R + w_2 \mathbf{1}) R \tag{7}$$

$$c_2^{**} = \frac{1}{1+\beta\delta}(s_1 R + w_2 \mathbf{1}) = \lambda_2 (s_1 R + w_2 \mathbf{1}) \tag{8}$$

$$c_3^{**} = \frac{\beta\delta}{1+\beta\delta}(s_1 R + w_2 \mathbf{1}) R = (1-\lambda_2)(s_1 R + w_2 \mathbf{1}) R \tag{9}$$

$\mathbf{1}$ is an indicator for working in period 2.
$\lambda_1 < \lambda_2$ because $\beta \in (0, 1)$.

Retirement decision: naïve agent

If self 2 does not work his utility is given by the following (relative weight of t=2 to t=3 is $1/\beta\delta$):

$$u(\lambda_2 s_1 R) + \beta\delta u((1-\lambda_2)s_1 R^2) \tag{10}$$

If he does work he gets:

$$u(\lambda_2(s_1 R + w_2)) - e + \beta\delta u((1-\lambda_2)(s_1 R + w_2)R) \tag{11}$$

Self 2 then works if:

$$u(\lambda_2(s_1 R + w_2)) - u(\lambda_2 s_1 R) + \beta\delta[u((1-\lambda_2)(s_1 R + w_2)R) - u((1-\lambda_2)s_1 R^2)] \geq e \tag{12}$$

equivalently, self 2 works if $s_1 \leq \bar{k}_2$ with:

$$\bar{k}_2 = \frac{w_2}{R[\exp(\frac{e}{1+\beta\delta}) - 1]} \tag{13}$$

Retirement decision: naïve agent

Since self 1 is naïve, he thinks that self 2 will decide based on the following comparison (relative weight of t=2 to t=3 is $1/\delta$):

$$\beta\delta[u(\lambda_1(s_1R + w_2)) - u(\lambda_1 s_1 R)] + \beta\delta^2[u((1-\lambda_1)(s_1R + w_2)R) - u((1-\lambda_1)s_1R^2)] \geq \beta\delta e \tag{14}$$

Naïve self 1 thinks that the threshold that self 2 will use to decide is given by:

$$\bar{k}_1 = \frac{w_2}{R[\exp(\frac{e}{1+\delta}) - 1]} \tag{15}$$

$\beta \in (0,1)$ implies that $\bar{k}_1 > \bar{k}_2$. In particular, for $\bar{k}_2 < s_1 \leq \bar{k}_1$ self 2 will retire, but naïve self 1 thinks

Retirement decision with illiquid asset: partially naïve agents

- A partially naïve agent is aware of his present-biased preferences over consumption allocation, but not about the retirement decision (Diamond and Koszegi, 2003).
- Self 1 would always demand some amount of the illiquid asset to reallocate consumption from period 2 to period 3.
- This choice could have an unintended effect on the retirement decision in period 2: self 1 could force self 2 to work even if self 1 wanted him to retire.
- This would make the use of the commitment device undesirable. If self 2 is induced to work he would also be able to break the liquidity constraint.

Retirement decision with illiquid asset: partially naïve agents (continued)

- Therefore, the illiquid asset would induce working, which was not optimal, without improving the consumption allocation.
- In that case, being partially naïve is worse than being naïve.
- A mandatory saving plan that targets naïve individuals would have the same negative effect if retirement dynamics are not taken into account.