Habit Formation and Labor Supply

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Abstract

This paper shows that the combination of habit formation - present consumption creating additional consumption needs in the future - and myopia may explain why some retirees are forced to 'unretire', i.e., unexpectedly return to work. It also shows that when myopia about habit formation leads to unretirement there is a case for government's intervention. In a first-best setting the optimal solution can be decentralized by a simple 'Pigouvian' (paternalistic) consumption tax (along with suitable lump-sum taxes). In a second-best setting, when personalized lump-sum transfers are not available, consumption taxes may have conflicting paternalistic and redistributive effects. We study the design of consumption taxes in such a setting when myopic individuals differ in productivity.

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1 Introduction

Over the last decade, most of the discussion over the rate of labor participation of elderly workers and over the retirement decision has focused on the decline in activity resulting from generous and distorting social security schemes.[1] The fact that at the same time some workers, admittedly a minority, could have some regrets and could try to get out of retirement was neglected. And yet, there is an increasing number of workers who decide to work for pay after they retire. This number is clearly more important in countries where earnings tests are not enacted. In a recent survey conducted in the US, 77% of workers expect to work after retirement and among the retirees, 12% do work for pay.[2] In the same survey, two-third do work after retirement because they want to and one third because they have to. Not surprisingly, people's attitudes vary according to how much they earn and the kind of work they perform. Maestas (2007) studies this behavior known as "unretirement" and tries to explain it. She also explores two hypotheses: unretirement is unexpected resulting from failures in planning and financial shocks or unretirement is expected but reflects a complex retirement process. She shows that for the majority unretirement is anticipated. It remains that one out of five retirees unexpectedly returns to work.

In this paper, we provide a theoretical explanation for such a behavior and look for its consequences for optimal taxation design. It relies on two concepts, habit formation and myopia, that are introduced in a two period model. Individuals work during the entire first period and for part of the second period. In other words, labor supply is fixed and unitary in the first period; in the second one it is endogenous and can be viewed as the age of retirement. In the first period, individuals consume a certain fraction of their earnings, which brings some utility but creates some needs or habits in the second period. However we assume that out of myopia or ignorance, individuals underestimate the extent of this habit formation. Consequently, when they reach the second period, they face unexpected consumption needs along with insufficient saving, which forces them to work longer than expected; concretely they postpone retirement or they are

[1] Gruber and Wise (1999).

[2] Pew Research Center (2007). See also Herz (1995).

forced to unretire. The myopic habit formation model is capable of explaining the prolonged activity or the unretirement patterns discussed above. There is other recent evidence that support the use of this model: Fehr and Sych (2006) ask whether myopic of farsighted habit formation fits better observed behavior and argue that individuals tend to behave as the myopic habit formation model predicts.

To the best of our knowledge, the combination of habit formation and myopia has not been studied previously in the literature, with the exception of Diamond and Mirrlees (2000). Our approach differs from theirs in two ways: they focus on saving and not on labor supply and they do not look for the tax policy implications of habit formation.

As it is standard in behavioral economics, myopia calls for government's intervention aimed at avoiding that individuals are forced to unretire. With identical individuals, it suffices for the government to induce more saving or to tax first period consumption. With individuals differing in earnings, and in the absence of lump sum transfers, our linear tax instruments play two roles: correction for myopia and redistribution. The rest of the paper is organized as follows. In Section 2 the basic model along with the market and the first-best solutions are presented. Section 3 is devoted to the second-best.

2 The model

2.1 Market solution

We consider an individual with wage w. He works one unit of time in the first period of his life and thus earns w. This earning is divided into current consumption c and saving s. In the second period, he works an amount of time $\ell \leqslant 1$, and earns $w\ell$. Total second period income is then equal to $w\ell + s$ and devoted to second period consumption, d.

Individual utility is given by

$$U(c, d, \ell) = u(c) + v(d, c) - h(\ell),$$

where $v(d, c)$ is the utility for second period consumption that depends on first period consumption.

We assume that u is strictly concave and h strictly convex. As for $v(d, c)$ it is also strictly concave and increasing in d. Our habit formation assumption implies that

$v_c < 0$ and $v_{dc} > 0$; namely previous period consumption generates additional needs and reduces second period's utility.[3]

Myopia is represented by the fact that in the first period of their life, individuals do not see this delayed effect of consumption and thus in their choice of saving and in their expected retirement age they use $v(d, 0)$. A farsighted individual would have a correct perception of such an habit formation, that is $v(d, c)$.

To keep the analysis simple, we adopt a simple form for the function v:

$$v(d, c) = u\left(d - \alpha c\right),$$

where $\alpha = 0$ for myopic individuals in the first period of their life, and $\alpha = \bar{\alpha}$ as the true value of the parameter (used by myopic individuals in the second period, and by farsighted in both periods).

We first study the impact of myopic behavior on consumption and retirement decisions. With this formulation and using the budget constraint, the individual problem in the first period can be written as

$$\max_{s,\ell^p} u(w - s) + u(w\ell^p - \alpha w + (1 + \alpha)s) - h(\ell^p)$$

where ℓ^p is the amount of labor that the individual *plans* to supply in the second period, and where the myopic individual mistakenly uses $\alpha = 0$ while the farsighted uses the correct value of $\alpha = \bar{\alpha}$. The FOCs are given by

$$[s] \quad : \quad -u'(w - s) + (1 + \alpha)u'(w\ell^p - \alpha w + (1 + \alpha)s) = 0 \tag{1}$$

$$[l^p] \quad : \quad wu'(w\ell^p - \alpha w + (1 + \alpha)s) - h'(\ell^p) = 0. \tag{2}$$

The appendix shows that the equilibrium amount of saving increases with α, so that a myopic individual saves less and consumes more in the first period than a farsighted individual. This is intuitive, since the myopic individual under-estimates the needs that first period consumption creates later on. On the other hand, the sign of the derivative of ℓ^p with respect to α is ambiguous. On the one hand, the myopic individual under-estimating his needs calls for a smaller planned labor than for the farsighted individual.

[3] An alternative specification is to assume $v_c > 0$, which implies that previous consumption brings status and hence additional utility.

On the other hand, the myopic individual over-estimates the benefits from working longer, since part of any additional labor income is consumed in the first period, and since he does not anticipate the negative impact of such consumption later on. Formally, solving simultaneously the FOCs (1) and (2), we obtain that

$$\frac{u'(c)}{1+\alpha}w = h'(\ell^p). \tag{3}$$

For a given ℓ^p, the numerator of the left-hand side of (3) increases with α (as c decreases) while the denominator is also increasing in α, so that it is not possible to sign the derivative of ℓ^p with respect to α.

In the second period, individuals choose their (realized) labor supply by solving

$$\max_{\ell} u\left[w\ell - \overline{\alpha}w + (1+\overline{\alpha})s\right] - h(\ell),$$

which yields the following first-order condition

$$wu'\left[w\ell - \overline{\alpha}w + (1+\overline{\alpha})s\right] = h'(\ell). \tag{4}$$

Observe that condition (4) is identical to (2) for farsighted individuals: their realized labor supply is identical to their planned one. As for myopic agents, they differ since they realize in second period that the true value of α is $\overline{\alpha}$ and also realize they have saved too little in the first period.

From (4), it is easy to see that the optimal value of ℓ decreases with s. As we know that a myopic individual saves less than a farsighted one, we obtain that the realized labor supply of a myopic individual is larger than the one of a farsighted individual. The intuition for this result is that a myopic individual under-estimates his second period needs and does not save enough in the first period, so he is obliged to work more than planned, and also more than a far sighted individual. In other words, myopia leads to prolonged activity or even to unretiring.

From now on we shall assume that all individuals are myopic and have $\alpha = 0$. The farsighted who are mentioned are merely used as a benchmark.

2.2 First-best

We now turn to the first-best solution assuming that the social planner observes the productivity of each individual and their degree of myopia, but imposes its own view by inducing individuals to behave as if they were farsighted. We assume that the social planner adopts an objective function with $\alpha = \bar{\alpha}$.

We take w to be continuously distributed on $[w^-, w^+]$ according to $F(w)$. The social planner's problem is[4]

$$\max_{c,d,\ell} \; E\left\{u(c) + u(d - \overline{\alpha}c) - h(\ell) + \lambda\left(w + w\ell - c - d\right)\right\}.$$

This leads to the FOCs:

$$[c] \quad : \quad u'(c) - \overline{\alpha}u'(d - \overline{\alpha}c) = \lambda, \tag{5}$$

$$[d] \quad : \quad u'(d - \overline{\alpha}c) = \lambda, \tag{6}$$

$$[\ell] \quad : \quad h'(\ell) = \lambda w. \tag{7}$$

The planner equalizes marginal utility of consumption across periods and across individuals; separability guarantees that the consumption (in the same period) of individuals of different productivities will be the same. Habit formation implies that consumption in the second period will be higher than in the first period. Labor supply increases with productivity; this means that more productive individuals will retire later than less productive ones.

To discuss the possibility of decentralizing such an optimum, we introduce the tax instruments that we will use below: a tax on first period consumption, τ_c, a tax on second period consumption, τ_d and a lumps sum transfer $T(w)$ that, for the time being, may depend on wage.

The first period problem of our myopic individual is to maximize:

$$u(c) + u(d^p) - h(\ell^p) - \mu_1\left[c(1 + \tau_c) + d^p(1 + \tau_d) \; - w(1 + \ell^p) - T(w)\right].$$

[4]Throughout the paper E denotes the expectation operator. For any expression x we have

$$E(x) = \int_{w^-}^{w^+} x(w)dF(w).$$

where d^p is the planned second period consumption and μ_1 is the Lagrange multiplier associated with the budget constraint. We thus have:

$$[c] \quad : \quad u'(c) = \mu_1 (1 + \tau_c), \tag{8}$$

$$[d^p] \quad : \quad u'(d^p) = \mu_1 (1 + \tau_d), \tag{9}$$

$$[\ell^p] \quad : \quad h'(\ell^p) = \mu_1 w. \tag{10}$$

In the second period, the problem is to maximize

$$u(d - \bar{\alpha}c) - h(\ell) - \mu_2 [d(1 + \tau_d) - s - T(w) - w\ell],$$

where μ_2 is the Lagrange multiplier (which is different from μ_1) associated with the second period budget constraint. The corresponding FOCs are given by

$$[d] \quad : \quad u'(d - \bar{\alpha}c) = \mu_2 (1 + \tau_d), \tag{11}$$

$$[\ell] \quad : \quad h'(\ell) = \mu_2 w. \tag{12}$$

To achieve the first-best one needs to induce the myopic individuals to save the appropriate amount. From there on, the choice of retirement age will be optimal. To obtain the "right" (first-best) level of saving we combine (5), (6),(8) and (9):

$$\frac{1 + \tau_c}{1 + \tau_d} = \frac{(1 + \bar{\alpha}) u'(d^* - \bar{\alpha}c^*)}{u'(d^*)},$$

where the * denotes the first-best solution. Interestingly, one only needs one of the two tax instruments supplemented by the lump sum transfer $T(w)$. More specifically one needs

$$\tau_c = \frac{(1 + \bar{\alpha}) u'(d^* - \bar{\alpha}c^*) - u'(d^*)}{u'(d^*)} > 0 \qquad \text{with } \tau_d = 0, \tag{13}$$

or

$$\tau_d = \frac{u'(d^*) - (1 + \alpha) u'(d^* - \bar{\alpha}c^*)}{(1 + \bar{\alpha}) u'(d^* - \bar{\alpha}c^*)} < 0 \qquad \text{with } \tau_c = 0. \tag{14}$$

In words, to decentralize the first-best solution, one needs a Pigouvian tax on first period consumption or a Pigouvian subsidy on second period consumption (that is equivalent to a subsidy on saving). With heterogenous individuals, decentralization also calls for individualized transfers $T(w)$.

3 Second-best

As we have just seen with taxes τ_c, τ_d and individualized transfers $T(w)$, one can achieve the first-best optimum. Let us assume that such transfers are not available and that the transfer is constrained to be the same for all. It is denoted by T which now represents the demogrant and is determined by the (government) budget constraint

$$T = \tau_c E c + \tau_d E d.$$

In such a setting, we expect that the two taxes will play two roles: a corrective Pigouvian role (positive for τ_c, negative for τ_d) and a redistribution role (the taxes are used to finance the demogrant).

In the first period an individual with productivity w maximizes:

$$u(c) + u\left[\frac{1}{1+\tau_d}(w + w\ell + T) - \left(\frac{1+\tau_c}{1+\tau_d} + \alpha\right)c\right] - h(\ell), \tag{15}$$

where $\alpha = 0$. This yields the effective level of c and a planned value of second period labor supply ℓ^p. Both are functions of tax instruments and yield a planned value for d, d^p. *Ex post*, given c, they maximize (15) with $\alpha = \bar{\alpha}$ to determine the effective levels of d and ℓ which are different from the planned one d^p and ℓ^p.

The social planner will choose the tax instruments τ_c, τ_d and T on the basis of the *preferences* of (hypothetical) farsighted individuals (but based on the *behavior* of the myopics). As a consequence, in solving the social optimization problem we cannot use the envelope theorem for the choice of saving. The Lagrangian expression associated with the problem of the social planner is given by

$$\mathcal{L} = E\left\{u(c) + u\left[\frac{1}{1+\tau_d}(w + w\ell + T)\right] - \left(\frac{1+\tau_c}{1+\tau_d} + \bar{\alpha}\right)c - \lambda(T - \tau_c c - \tau_d d)\right\},$$

where λ is the multiplier associated with the revenue constraint and c, d and ℓ now represent the optimal choices of the individuals for the policy instruments.

We first focus on the choice of T. The FOC is given by

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial T} &= E\left\{\left[u'(c) - u'(d - \bar{\alpha}c)\left(\frac{1+\tau_c}{1+\tau_d} + \bar{\alpha}\right)\right]\frac{\partial c}{\partial T} + u'(d - \bar{\alpha}c)\frac{1}{1+\tau_d}\right. \\ &\quad \left. -\lambda\left(1 - \tau_c\frac{\partial c}{\partial T} - \tau_d\frac{\partial d}{\partial T}\right)\right\} = 0.\end{aligned}$$

Using (8) and (9) we obtain:

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial T} &= E\left[\frac{1}{1+\tau_d}u'\left(d-\bar{\alpha}c\right)-\Delta\frac{\partial c}{\partial T}-\lambda\left(1-\tau_c\frac{\partial c}{\partial T}-\tau_d\frac{\partial d}{\partial T}\right)\right], \\ &= \lambda E\left(b-1\right)=0.\end{aligned}$$

where

$$\Delta \equiv \left(\frac{1+\tau_c}{1+\tau_d}+\bar{\alpha}\right)u'\left(d-\bar{\alpha}c\right)-\frac{1+\tau_c}{1+\tau_d}u'\left(d^p\right)>0,$$

and

$$b=\frac{1}{\lambda}\left(\frac{1}{1+\tau_d}u'\left(d-\bar{\alpha}c\right)-\Delta\frac{\partial c}{\partial T}\right)+\tau_c\frac{\partial c}{\partial T}+\tau_d\frac{\partial d}{\partial T}.$$

The term Δ reflects the cost of myopia in terms of ex post utility. It tends to 0 when $\bar{\alpha}$ tends to zero. The term b is quite standard in the linear taxation literature; it is what Atkinson and Stiglitz (1980) call the net social marginal valuation of income. It is measured in terms of government revenue. It is net in the sense that the effect of a lump sum transfer includes the direct effect on individual utility but also the indirect effect on tax revenue.

Using this notation, we can get the two other FOCs:

$$\frac{\partial \mathcal{L}}{\partial \tau_c}=E\left[\frac{-c}{1+\tau_d}u'\left(d-\bar{\alpha}c\right)-\Delta\frac{\partial c}{\partial \tau_d}+\lambda\left(c+\tau_c\frac{\partial c}{\partial \tau_c}+\tau_d\frac{\partial d}{\partial \tau_c}\right)\right]=0,$$

and

$$\frac{\partial \mathcal{L}}{\partial \tau_d}=E\left[\frac{-d}{1+\tau_d}u'\left(d-\bar{\alpha}c\right)-\Delta\frac{\partial c}{\partial \tau_d}+\lambda\left(d+\tau_c\frac{\partial c}{\partial \tau_d}+\tau_d\frac{\partial d}{\partial \tau_d}\right)\right]=0.$$

Using the traditional procedure of replacing all Marshallian price effects by its equivalent decomposition in Hicksian price effects and income effects (the Slutsky equation) in the previous FOCs and rearranging we obtain:

$$\begin{aligned}-\operatorname{cov}\left(b,c\right)-E\left[\frac{\Delta}{\lambda}\frac{\partial \tilde{c}}{\partial \tau_c}-\tau_c\frac{\partial \tilde{c}}{\partial \tau_c}-\tau_d\frac{\partial \tilde{d}}{\partial \tau_c}\right] &= 0 \\ -\operatorname{cov}\left(b,d\right)-E\left[\frac{\Delta}{\lambda}\frac{\partial \tilde{c}}{\partial \tau_d}-\tau_c\frac{\partial \tilde{c}}{\partial \tau_d}-\tau_d\frac{\partial \tilde{d}}{\partial \tau_d}\right] &= 0\end{aligned}$$

where $\widetilde{c}$ and $\widetilde{d}$ are the compensated demand functions. To get more intuition let us first consider the case when only one of the consumption taxes (either τ_c or τ_b) is available.

Then we obtain either

$$\tau_c = \frac{\text{cov}\,(b,c)}{E\frac{\partial \tilde{c}}{\partial \tau_c}} + \frac{E\frac{\Delta}{\lambda}\frac{\partial \tilde{c}}{\partial \tau_c}}{E\frac{\partial \tilde{c}}{\partial \tau_c}} \qquad \text{with } \tau_d = 0, \tag{16}$$

or

$$\tau_d = \frac{\text{cov}\,(b,d)}{E\frac{\partial \tilde{d}}{\partial \tau_d}} + \frac{E\frac{\Delta}{\lambda}\frac{\partial \tilde{c}}{\partial \tau_d}}{E\frac{\partial \tilde{d}}{\partial \tau_d}} \qquad \text{with } \tau_c = 0. \tag{17}$$

First of all, if $\Delta = 0$, namely if there is no myopia, we only have the first part of these formulas, that is standard in optimal consumption tax with heterogenous individuals. The numerator reflects the redistributive objective; it is negative as the covariance between the marginal utility of income and consumption is negative. This term would be zero with identical individuals or without concern for redistribution (linear utility). The denominator is also negative and reflects the efficiency effect (deadweight loss). The tax and thus redistribution will be larger if the (compensated) demand for c or d is inelastic.

Note that if the first part of (16) and (17) were equal to zero, we would end up with expressions very similar to (13) and (14). That is:

$$\tau_c = \frac{\Delta}{\lambda} > 0 \quad \text{and} \quad \tau_d = \frac{\Delta}{\lambda}\,\frac{\partial \tilde{c}}{\partial \tau_d}\Big/\,\frac{\partial \tilde{d}}{\partial \tau_d} < 0.$$

If we assume that c and d have the same redistributive pattern (same covariance between marginal utility of income and consumption) and the same price elasticity, two reasonable assumptions, one can state that $\tau_d < \tau_c$ if the two taxes are used alone.

Let us now turn to the case when the two taxes are used together. Then we have:

$$\tau_c = \frac{\text{cov}\,(b,c)\,E\frac{\partial \tilde{d}}{\partial \tau_d} - \text{cov}\,(b,d)\,E\frac{\partial \tilde{d}}{\partial \tau_c}}{E\frac{\partial \tilde{c}}{\partial \tau_c}\;E\frac{\partial \tilde{d}}{\partial \tau_d} - E\frac{\partial \tilde{c}}{\partial \tau_d}\;E\frac{\partial \tilde{d}}{\partial \tau_c}} + \frac{E\frac{\Delta}{\lambda}\left[\frac{\partial \tilde{c}}{\partial \tau_c}E\frac{\partial \tilde{d}}{\partial \tau_d} - \frac{\partial \tilde{c}}{\partial \tau_d}E\frac{\partial \tilde{d}}{\partial \tau_c}\right]}{E\frac{\partial \tilde{c}}{\partial \tau_c}\;E\frac{\partial \tilde{d}}{\partial \tau_d} - E\frac{\partial \tilde{c}}{\partial \tau_d}\;E\frac{\partial \tilde{d}}{\partial \tau_c}}, \tag{18}$$

and

$$\tau_d = \frac{\text{cov}\,(b,d)\,E\frac{\partial \tilde{c}}{\partial \tau_c} - \text{cov}\,(b,c)\,E\frac{\partial \tilde{c}}{\partial \tau_d}}{E\frac{\partial \tilde{c}}{\partial \tau_c}\;E\frac{\partial \tilde{d}}{\partial \tau_d} - E\frac{\partial \tilde{c}}{\partial \tau_d}\;E\frac{\partial \tilde{d}}{\partial \tau_c}} - \frac{E\frac{\Delta}{\lambda}\left[\frac{\partial \tilde{c}}{\partial \tau_c}E\frac{\partial \tilde{c}}{\partial \tau_d} - \frac{\partial \tilde{c}}{\partial \tau_d}E\frac{\partial \tilde{c}}{\partial \tau_c}\right]}{E\frac{\partial \tilde{c}}{\partial \tau_c}\;E\frac{\partial \tilde{d}}{\partial \tau_d} - E\frac{\partial \tilde{c}}{\partial \tau_d}\;E\frac{\partial \tilde{d}}{\partial \tau_c}}. \tag{19}$$

These are very complex formulas. Note that in the case where cross derivatives $\partial \tilde{d}/\partial \tau_c$ and $\partial \tilde{c}/\partial \tau_d$ are negligible, we end up with the above formulas (16) and (17). In other

words, what makes these formulas (18) and (19) different is the set of cross effects. We know little about the size of these cross effects.

Note that the expressions for τ_c and τ_d have the same denominator which measures the inefficiencies introduced by the tax system. Also note that the denominator is equal to the determinant of the Slutsky matrix and consequently we can expect it to be positive. Focusing on the numerators, they include a positive equity effect (the numerator of the first fraction) and a corrective effect (the numerator of the second fraction). Both effects are intuitive and very similar to what happens when only one of the taxes is present. The first effect (positive for both τ_c and τ_d) is related to equity since the covariances measure inequality in consumption. With cross-price effects, we have to take into account covariances between marginal utility of income and consumption in both periods for both taxes. The second effect is related to myopia since it is proportional to Δ. The presence of cross-price effects makes it difficult to sign this term.

An interesting case emerges when the form of the utility function implies demand functions which exhibit multiplicative separability. Suppose (compensated) demand functions can be written as

$$\widetilde{c} = \gamma_c(w) \times \beta_c(\tau_c, \tau_d) \qquad \text{and} \qquad \widetilde{d} = \gamma_d(w) \times \beta_d(\tau_c, \tau_d). \tag{20}$$

In this case

$$\tau_c = \frac{\operatorname{cov}(b,c)\, E\frac{\partial \tilde{d}}{\partial \tau_d} - \operatorname{cov}(b,d)\, E\frac{\partial \tilde{d}}{\partial \tau_c}}{E\frac{\partial \tilde{c}}{\partial \tau_c}\; E\frac{\partial \tilde{d}}{\partial \tau_d} - E\frac{\partial \tilde{c}}{\partial \tau_d}\; E\frac{\partial \tilde{d}}{\partial \tau_c}} + \frac{E\frac{\Delta}{\lambda}\frac{\partial \tilde{c}}{\partial \tau_c}}{E\frac{\partial \tilde{c}}{\partial \tau_c}},$$

and

$$\tau_d = -\frac{\operatorname{cov}(b,c)\, E\frac{\partial \tilde{c}}{\partial \tau_d} - \operatorname{cov}(b,d)\, E\frac{\partial \tilde{c}}{\partial \tau_c}}{E\frac{\partial \tilde{c}}{\partial \tau_c}\; E\frac{\partial \tilde{d}}{\partial \tau_d} - E\frac{\partial \tilde{c}}{\partial \tau_d}\; E\frac{\partial \tilde{d}}{\partial \tau_c}}.$$

Consequently, in this special case only the tax on first period consumption is corrected by a Pigouvian term and the taxation of second period's consumption is only used for redistribution. The Pigouvian term is positive meaning that the tax on the first period's consumption is higher in the presence of myopic habit formation than when this type of behavior is absent.

This can be stated in terms of the so called targeting principle (Sandmo, 1975) which says that to correct for the consequences of externalities Pigouvian terms must

be included only in the taxes of the goods that generate the externality and not in other goods. One can see myopic behavior as generating an externality from one incarnation to another incarnation of the same individual. The reason that the principle of targeting found by Sandmo does not hold in the general model in this paper is that it applies only to atmosphere externalities. When externalities are not of the atmosphere type, the principle of targeting does not apply as happens in the general formulation in this paper (unless we have multiplicative compensated demand functions as specified by (20)).

4 Conclusion

This paper analyzes the pattern of consumption taxes in a two period model with individuals who have in the second period needs that are related to their first period consumption but who don't see this habit formation relation when they make their saving decision. In a identical individuals setting, the first-best can be achieved by taxing first period consumption or subsidizing second period consumption. When individuals have different wages, both consumption taxes are needed not only to correct for individual myopia, but also to finance redistribution. Under plausible assumption, we expect first period tax to be higher than second period tax.

The idea that taxation should vary with age is not new. Banks et al. (2007) following what is called the new dynamic public finance argue in favor of an age-dependent taxation. Lozachmeur (2006) reaches the same conclusion but showing that elderly workers should be subject to a lower tax than the others because they are exposed to both intensive (how many hours a week?) and extensive (when to retire?) labor supply choice. In this paper, we also reach the conclusion that second period consumption should be taxed at a lower rate than first period work. The reason is that one has to correct for a myopic behavior which leads individuals to save too little and forces them to work longer than initially expected.

Appendix

A Impact of α on savings and labor supply

Differentiating the FOCs (1) and (2) with respect to α, and denoting the derivatives of s and ℓ^p with respect to α by s_a and ℓ^p_α, we obtain

$$u''(c)s_\alpha + (1+\alpha)u''(d-\alpha c)[w\ell^p_\alpha + (1+\alpha)s_\alpha] + u'(d-\alpha c) - (1+\alpha)u''(d-\alpha c)[w-s] = 0,$$

$$wu''(d-\alpha c)[w\ell^p_\alpha + (1+\alpha)s_\alpha] - wu''(d-\alpha c)[w-s] - h''(\ell^p)\ell^p_\alpha = 0,$$

which we express in matrix form as follows:

$$\begin{bmatrix} s_\alpha \\ \ell^p_\alpha \end{bmatrix} \begin{bmatrix} u''(c) + (1+\alpha)^2 u''(d-\alpha c) & (1+\alpha)wu''(d-\alpha c) \\ (1+\alpha)wu''(d-\alpha c) & w^2u''(d-\alpha c) - h''(\ell^p) \end{bmatrix} = \begin{bmatrix} -u'(d-\alpha c) + (1+\alpha)u''(d-\alpha c)[w-s] \\ wu''(d-\alpha c)[w-s] \end{bmatrix}$$

Using Cramer´s rule we get the expressions

$$s_\alpha = \frac{\underset{-}{R}[\underset{-}{w^2u''(d-\alpha c)} - h''(\ell^p)] - (1+\alpha)\underset{+}{w^2(u''(d-\alpha c))^2}[w-s]}{D},$$

$$\ell_\alpha = \frac{[u''(c) + (1+\alpha)^2\underset{-}{u''(d-\alpha c)}]\underset{-}{wu''(d-\alpha c)}[w-s]}{D} - \frac{\underset{+}{(1+\alpha)wu''(d-\alpha c)R}}{D}.$$

where

$$D = [u''(c) + (1+\alpha)^2u''(d-\alpha c)][w^2u''(d-\alpha c) - h''(\ell^p)] - [(1+\alpha)wu''(d-\alpha c)][(1+\alpha)wu''(d-\alpha c)] > 0$$

and

$$R = -u'(d-\alpha c) + (1+\alpha)u''(d-\alpha c)[w-s] < 0.$$

From there, it is easy to show that $s_\alpha > 0$, since its numerator is equal to

$$
\begin{aligned}
&[-u'(d-\alpha c)+(1+\alpha)u''(d-\alpha c)[w-s]][w^2u''(d-\alpha c)-h''(\ell^p)] \\
&\qquad -(1+\alpha)w^2(u''(d-\alpha c))^2[w-s]= \\
&\quad -u'(d-\alpha c)w^2u''(d-\alpha c)+(1+\alpha)w^2(u''(d-\alpha c))^2[w-s] \\
&\qquad -Rh''(\ell^p)-(1+\alpha)w^2(u''(d-\alpha c))^2[w-s]= \\
&-u'(d-\alpha c)w^2u''(d-\alpha c)-[-u'(d-\alpha c)+(1+\alpha)u''(d-\alpha c)[w-s]]h''(\ell^p)= \\
&\qquad -u'(d-\alpha c)w^2u''(d-\alpha c)-Rh''(\ell^p)>0.
\end{aligned}
$$

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