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# Optimal taxation in a habit formation economy

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ABSTRACT

This paper studies habit formation in consumption preferences in a dynamic Mirrlees economy. We derive optimal labor and savings wedges based on a recursive approach. We show that habit formation creates a motive for subsidizing labor supply and savings. In particular, habit formation invalidates the well-known "no distortion at the top" result. We demonstrate that the theoretical findings are quantitatively important: in a parametrized life-cycle model, average labor and savings wedges fall by more than one-third compared with the case of time-separable preferences.



## 1. Introduction

What determines the optimal taxes on labor income and capital? Fundamental to this classic public finance question is a description of intertemporal decision making. Existing studies, following Diamond and Mirrlees (1978), have explored optimal taxation when decision makers aggregate across time in a separable way. The present paper proposes a model of decision making motivated by evidence from macroeconomics, psychology, and micro data—the *habit formation* model.[1] This model contains time-separable preferences as a special case but allows for intertemporal complementarities in consumption.

We introduce habit formation preferences into an otherwise standard dynamic Mirrlees economy. Agents face shocks to their abilities to generate labor income. Labor income is publicly observed, but abilities and labor supply are private information. In this environment, we characterize the solution of the social planning problem in terms of labor and savings wedges. As is common in this literature, positive wedges represent *implicit* taxes and indicate that decentralizations of the social planning allocation must correct individual labor or savings returns downward in one way or another.[2] To make the multiperiod social planning problem tractable for theoretical and numerical analysis, we transform it into a dynamic programming problem by generalizing insights from the recursive contract theory literature. This approach is common in dynamic private information problems with time-separable preferences (Spear and Srivastava, 1987; Phelan and Townsend, 1991). Our recursive formulation extends beyond optimal taxation and applies to a large class of private information problems.

We first study optimal labor taxation. For habit formation preferences, labor wedges are shaped by two countervailing forces. First, as in any self-selection problem with time-separable preferences, there is a motive for downward distortions to labor supply of all but the most productive type. This motive calls for positive labor wedges. Second, habit formation connects present and future self-selection problems. Because of complementarity between habits and consumption, self-selection becomes easier in the future if the worker consumes a lot in the present. This *habit effect* calls for subsidies to labor supply for all types and counteracts the conventional self-selection distortion. As a consequence, the "no distortion at the top" result breaks down, and the most productive type obtains a negative labor wedge. For less

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[1] See Messinis (1999) for a summary of habit formation in macroeconomics and Frederick and Loewenstein (1999) for a review of habit formation in the empirical and behavioral economics literature.

[2] The decentralization of optimal allocations is not unique; compare Golosov et al. (2003), Kocherlakota (2005), Albanesi and Sleet (2006), Golosov and Tsyvinski (2006), Werning (2011), Gottardi and Pavoni (2011) and Abraham et al. (2014).

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productive types, labor wedges can be positive or negative, depending on the importance of the habit effect compared with the conventional self-selection distortion.

We next turn to optimal savings taxation. Our decomposition of savings wedges reveals three motives. First, savings should be taxed because the agent has a better incentive to supply labor in the next period if he starts the next period with lower wealth (*wealth effect*). This force is well known from models with time-separable preferences. Second, savings should be taxed, because stimulating present consumption increases the habit level in the next period. This effect makes high consumption in the next period more attractive and thereby reinforces the incentive to supply labor (*immediate habit effect*). Third, savings should be subsidized, because stimulating next period's consumption increases the habit level in the remaining periods and thereby improves labor supply incentives in those periods (*subsequent habit effect*). Habit formation thus affects savings taxation in opposing ways, and its impact will depend on the relative magnitude of immediate versus subsequent habit effects.

Our theoretical results identify forces that counteract the conventional Mirrleesian distortions to labor supply and savings. To demonstrate the quantitative importance of these results, we evaluate habit formation in a stylized life-cycle model. We parametrize the model according to empirical findings for the U.S. economy. We find the impact of habit formation on optimal savings and labor wedges to be negative and sizable. Averaged over the life cycle, optimal savings wedges of a typical worker fall by 40%, and optimal labor wedges by 35%, compared with the case of time-separable preferences. The negative impact on labor wedges was already suggested by our theoretical results. The negative impact on savings wedges is due to subsequent habit effects that prevail over immediate habit effects. Intuitively, incentive provision becomes more costly when rewards can be smoothed over fewer periods. Therefore, relaxing incentive problems later in life through subsequent habit effects is more important than relaxing incentive problems in the direct future through immediate habit effects.

### 1.1. Related literature

With few exceptions, most existing studies of dynamic taxation problems work with time-separable preferences. The contribution closest to ours is by Grochulski and Kocherlakota (2010) and explores a Mirrlees framework with time-nonseparable preferences similar to the present paper. Their focus is decentralization, and they show that social security systems (with history-dependent taxes and transfers upon retirement) can be used to implement optimal allocations when preferences are time-nonseparable. Apart from a three-period example with a negative savings wedge, they do not investigate savings or labor wedges any further.[3]

Several papers study Mirrleesian models with alternative forms of preference nonseparabilities. While habit formation differs from other nonseparabilities and requires an independent treatment, a general finding is that preference nonseparabilities affect Mirrleesian wedges in magnitude and sign. This finding applies to recursive preferences (Farhi and Werning, 2008), human capital effects (Bohacek and Kapicka, 2008; Grochulski and Piskorski, 2010; Stantcheva, 2014), and nonseparabilities between consumption and labor supply (Farhi and Werning, 2013), for example.

Another related paper is by Cremer et al. (2010) and explores optimal commodity taxation in a framework with myopic habit formation. This framework gives rise to paternalistic taxation motives, because individuals do not foresee the habit formation relation when making consumption and savings decisions. Similar effects arise when myopic habit formation is introduced into a model of retirement; see Cremer and Pestieau (2011). The present paper is different in several key aspects, because we focus on labor and savings taxation and study time-consistent decision makers that anticipate their future preferences.

Finally, the paper builds on the extensive literature on habit formation preferences. Habit formation goes back to the theory of adaptation formalized in the psychological literature by Helson (1964). Habit formation postulates that individuals compare their current consumption with a historical reference level and derive utility both from consumption per se and from consumption growth.[4] Heien and Durham (1991) find support for habit formation based on micro-level consumption data. Frederick and Loewenstein (1999) review the substantial body of empirical research supporting the habit formation hypothesis. Moreover, habit formation has reconciled theory and evidence for several important questions in the macroeconomic literature, such as the equity premium puzzle (Abel, 1990; Constantinides, 1990; Campbell and Cochrane, 1999), the relationship between savings and growth (Ryder and Heal, 1973; Carroll et al., 2000), and reactions to monetary policy shocks (Fuhrer, 2000).

## 2. Model

This section sets up a dynamic Mirrlees model of optimal taxation with habit formation preferences. The economy consists of a risk-neutral principal/planner and a unit measure of risk-averse agents facing a binary stochastic skill process. Time is discrete and indexed by $t = 1, 2, \ldots, T$, with $T < \infty$.

### 2.1. Preferences

Agents have identical von Neumann–Morgenstern preferences and maximize the expected value of

$$\sum_{t=1}^{T} \beta^{t-1}(u(c_t, h_t) - v(l_t)),$$

where $c_t$, $h_t$, $l_t$ represent the agent's consumption, habit, and labor supply in period $t$, and $\beta \in (0, 1)$ is the agent's discount factor.[5] Labor disutility $v : \mathbb{R}_+ \to \mathbb{R}$ is continuous, strictly increasing, and weakly convex. Consumption utility $u : \mathbb{R}_+^2 \to \mathbb{R}$ is twice continuously differentiable, strictly concave, strictly increasing in its first argument, and strictly decreasing in its second argument. Consumption and habit are complements: $u''_{ch} > 0$. As usual, we use subscripts to denote partial derivatives.

The complementarity assumption $u''_{ch} > 0$ is standard in the habit formation literature. It holds for the widely used case of linear habit formation: $u(c_t, h_t) = \tilde{u}(c_t - \gamma h_t)$, with $\gamma \in (0, 1]$ and $\tilde{u} : \mathbb{R}_+ \to \mathbb{R}$ strictly increasing and strictly concave; compare Constantinides (1990) and Campbell and Cochrane (1999) among others. Another common specification of habit formation is the Cobb–Douglas case: $u(c_t, h_t) = \tilde{u}(c_t h_t^{-\gamma})$; compare Abel (1990), Carroll et al. (2000), Fuhrer (2000) and Diaz et al. (2003). Here, $u''_{ch} > 0$ holds if the coefficient of relative risk aversion of $\tilde{u}$ is bounded below by one.[6]

### 2.2. Habits

We assume from now on that habits are short-lived: $h_t = c_{t-1}$, with $c_0$ being exogenous. This assumption simplifies the exposition and is empirically supported by results in Fuhrer (2000). Our results

[3] Our decomposition of savings wedges shows that the subsequent habit effect is responsible for their finding. However, we also reveal that incentive problems in the immediate future create countervailing forces because of wealth and immediate habit effects. Our quantitative analysis therefore finds that, even though it is possible to construct theoretical cases in which savings wedges are negative, those cases are not representative of typical taxation environments.

[4] In addition, there is the concept of *external* habit formation, where the reference point depends on the consumption levels of a peer group; see the discussion of "Catching up with the Joneses" in Abel (1990).

[5] The preferences we use are time-consistent; see Johnsen and Donaldson (1985), for example.

[6] Write $\tilde{c} = ch^{-\gamma}$. Then $u''_{ch}(c, h) = \gamma h^{-\gamma-1}\tilde{u}'(\tilde{c})\left[-\tilde{c}\tilde{u}''(\tilde{c})/\tilde{u}'(\tilde{c}) - 1\right]$.