

# Nonseparable preferences and optimal social security systems<sup>☆</sup>

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## Abstract

In this paper, we consider economies in which agents are privately informed about their skills, which evolve stochastically over time. We require agents' preferences to be weakly separable between the lifetime paths of consumption and labor. However, we allow for intertemporal nonseparabilities in preferences like habit formation. In this environment, we derive a generalized version of the Inverse Euler Equation and use it to show that intertemporal wedges characterizing optimal allocations of consumption can be strictly negative. We also show that preference nonseparabilities imply that optimal differentiable asset income taxes are necessarily retrospective in nature. We show that under weak conditions, it is possible to implement a socially optimal allocation using a *social security system* in which taxes on wealth are linear, and taxes/transfers are history-dependent only at retirement. The average asset income tax in this system is zero. © 2010 Elsevier Inc. All rights reserved.

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## 1. Introduction

In this paper, we consider a class of economies in which agents are privately informed about their skills and those skills might evolve stochastically over time. As in Golosov, Kocherlakota, and Tsyvinski (GKT) [3], we impose no restriction on the evolution of skills over time. GKT assume that preferences are additively separable between consumption and labor, and between consumption at different dates. We relax this assumption, and instead require only that preferences over consumption sequences be *weakly* separable (not additively separable) from agents' labor supplies. This assumption means that the marginal rate of substitution between consumption at any two dates is independent of the agent's sequence of labor supplies. However, we allow for intertemporal nonseparabilities: the marginal rate of substitution between consumption at any two dates may depend on other consumptions. We restrict attention to economies in which agents must retire at some date  $S$  (but may live thereafter).

Our goal is to study optimal allocations and tax systems in this setting with preference nonseparabilities. We first derive a necessary optimality condition on the consumption allocation that generalizes the so-called Inverse Euler Equation of Rogerson [10] and GKT [3]. To do so, we use a variational argument that involves perturbations of consumption after the retirement date  $S$ , as the standard variational argument perturbing consumption in any two consecutive periods cannot be used when preferences are nonseparable.

In the separable case, GKT [3] use the Inverse Euler Equation to show that optimal allocations of consumption in dynamic private-skill economies are characterized by a positive intertemporal wedge: at every date and state, the marginal return on savings exceeds the shadow interest rate of every agent in the economy. We use the generalized version of this Euler equation to show that the same result does not hold when preferences are nonseparable: optimal intertemporal wedges can be negative.

We show next that the complications arising from the nonseparability of preferences have important implications for the structure of the optimal tax systems that Albanesi and Sleet [1], Kocherlakota [8], and others studied in dynamic private-skill economies with additively separable preferences. We use an illustrative example to show that with intertemporal nonseparabilities an optimal tax that is differentiable with respect to period  $t$  asset income must depend on labor income in *future* periods. This result means that an agent must pay his period  $t$  asset income taxes at some future date, after the tax authorities learn his labor income at that future date. Hence, optimal asset income taxes are necessarily *retrospective*.

This finding leads us to consider a class of tax systems that we term *social security systems*. Agents pay a linear tax on labor income during their working lives. Then, during retirement, they receive a constant payment that is conditioned on their entire labor income history. As well, at the retirement date, agents pay taxes on their current and past asset income. These taxes are a linear function of past asset incomes; the tax *rates* are a possibly complicated function of the agents' labor income histories.

The social security systems that we study in this model are similar to the actual Social Security system in the United States. In the United States, as in the model, labor income is subject to a linear Social Security payroll tax.<sup>1</sup> In the United States, as in the model, the size of the benefit paid by the Social Security program in retirement is a complicated function of agents'

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<sup>1</sup> In fact, the Social Security payroll tax is linear on income not exceeding a certain limit known as the Social Security Wage Base. Income above this limit is taxed at the rate of zero. At a cost of additional notation, this feature could be introduced into our model with minor changes to our analysis.

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