



# Quasi-hyperbolic discounting and social security systems

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Received 4 July 2005; accepted 25 September 2006

Available online 29 November 2006

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## Abstract

Hyperbolic discounting has become a common assumption for modeling bounded rationality with respect to individual savings decisions. We examine the effects of hyperbolic discounting on the comparison of alternative social security systems. We show that this form of bounded rationality breaks the equivalence between *funded* and *pay-as-you-go* (PAYG) systems established in Sheshinski and Weiss [Sheshinski, E., Weiss, Y., 1981. Uncertainty and optimal social security. *Quarterly Journal of Economics* 95, 189–206]. Intergenerational transfers within a PAYG economy are usually secured by the social security system and independent of longevity, whereas this is not the case for the funded economy. The savings level under hyperbolic discounting is lower than under exponential discounting [Laibson et al., 1998], but the ratio between the savings level under hyperbolic discounting within a funded economy and a PAYG economy depends on the effectiveness of the commitment devices. It is shown that if individuals are hyperbolic discounters, then in a PAYG economy any change in the mandated level of intergenerational transfers is neutralized by individuals' voluntary bequests. This does not apply to a funded system.

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*JEL Classification:* D64; G23; G28; H55

*Keywords:* Hyperbolic discounting; Funded; Pay As You Go; Social security; Pension

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## 1. Introduction

Time inconsistency of individual preferences and the notion of dynamic preferences or with evolving “selves” is a well-known and studied phenomenon (Pollak, 1968; Phelps and Pollak, 1968; Peleg and Yaari, 1973; Hammond, 1976; Thaler and Shefrin, 1981; Schelling, 1984). The prevalent tool for modeling time inconsistency of individual preferences in the last decades of the twentieth century was the hyperbolic discounting function (Ainslie, 1992; Lowenstein and Drazen, 1992; Laibson et al., 1998; Laibson, 2001), and such modeling can be traced back to the mid-20th century (Strotz, 1956; Chung and Herrnstein, 1961).

The hyperbolic discounting function was applied to the study of undersaving and the sharp reduction in consumption of old people (Laibson, 2001), to the early retirement pattern of workers (Laibson et al., 1998; Diamond and Kőszegi, 2003), and to job search behavior (Paserman and Della-Vigna, 2000).

The hyperbolic or quasi-hyperbolic discounting hypothesis (henceforth, HDH<sup>1</sup>), as an empirical finding, was based on experiments performed on humans and animals that the researchers interpreted as supporting this hypothesis (for a survey, see Laibson et al., 1998). However, as an empirical fact, HDH is controversial (Rubinstein, 2001, 2003; Read, 2001; Besharov and Coffey, 2003). From a theoretical point of view, hyperbolic discounting raises several problems. For instance, time inconsistency reflects irrationality, or at least bounded rationality, especially in its naïve version. However, in certain circumstances of uncertainty, hyperbolic discounting can be reconciled with rationality and does not necessarily generate time inconsistency and reversal of preferences (Weitzman, 1998; Azfar, 1999, 2002; Dasgupta and Maskin, 2003).

Our purpose in this paper is neither to decide on the empirical controversy nor to find any further theoretical justifications for assuming hyperbolic discounting by rational individuals. Rather, taking HDH for granted and leaving aside the empirical controversy, we explore its implications for optimal social security systems. The main result of this paper is that the equivalence between an optimal *pay-as-you-go* intergenerational transfers system (henceforth a PAYG system) and an optimal *funded* pension system, established in Sheshinski and Weiss (1981, henceforth SW), does not hold in general under hyperbolic discounting. The model we analyze in this paper is an extension of the SW model. In order to facilitate the analysis of the hyperbolic discounting effect, we have added a third period to the standard two periods' model.

We show that the equivalence between funded and PAYG pension systems, established in SW, holds only under exponential discounting (which is a special case of the hyperbolic discounting). A social security system provides perfect insurance under PAYG structure, whereas in a funded economy bequests are random and depend on realized longevity. The correlation between bequests and longevity in a funded economy depends on the elasticity of the parents' marginal utility from bequests. A similar result is obtained for savings. The savings level is identical in the two economies only if effective commitment devices exist in the PAYG economy. We also analyze the effect of government intervention in private decisions (i.e., introducing a compulsory pension scheme) and show that under hyperbolic discounting, such intervention has different consequences on the two types of economies.

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<sup>1</sup>We shall use the terms “hyperbolic discounting” and “quasi-hyperbolic discounting” interchangeably.

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