Ramsey meets Laibson and Itô: Effects of hyperbolic discounting on stochastic growth

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"Studies of animal and human behavior suggest that discount functions are approximately hyperbolic" Laibson (1996)

Abstract: In this short note we discuss the effects of random or deterministic hyperbolic discounting on growth, using the stochastic Ramsey model with logarithmic utility as an example. A comparison principle is given which allows to compare the optimal paths under different discount functions.

JEL classification: C61; D91; O40.
Keywords: Hyperbolic discounting, Ramsey model

1. Introduction

The study of the Ramsey model has had a long history. Since its introduction in 1928 in a deterministic set up and its subsequent generalization to include the effects of uncertainty (see e.g. Merton (1975)) it has been used as a paradigm for the study of endogenous growth and the effects of production, labour and uncertainty might have on growth. For detailed accounts of the model and its generalizations see the excellent textbook of Barro and Sala-i-Martin (2004). However, the majority of the work on the field has been done under the assumption of exponentially discounted

intertemporal preferences. An interesting exception is the recent work of Barro (1999) where the deterministic Ramsey model is studied under the effect of hyperbolic discounting. Hyperbolic discounting refers to the application of time declining (rather that constant) discount rates to trade offs between present and future. Hyperbolic discounting seems to be an interesting concept the study of which has become a major field of research in the economics community analysed by Laibson (1996, 1997a, 1997b) in the theory of consumption functions and Phelps and Pollak (1968) in the intergenerational altruist problem. Under hyperbolic discounting short horizons are discounted at a higher rate than long horizons, an effect that seems to gain ground on experimental work (see e.g. Loewenstein and Thaler (1989) or Ainslie (1991)). That is the individuals are more impatient when they make short-run trade offs. Angeletos et al (2001) provided a remarkable example on this point: ``Our preferences for the long run tend to conflict with our short-run behaviour. When planning for the long run, we intend to meet our deadlines, exercise regularly, and eat healthfully. But in the short-run, we have little interest in revising manuscripts, jogging on the StairMaster, and skipping the chocolate soufflé a la mode. Delay of gratification is a nice long-term goal, but instant gratification is disconcertingly tempting."

Literature in economic growth using continuous time stochastic optimization, such as Merton (1971, 1974), Eaton (1981), Grinols and Turnovsky (1998), have developed the stochastic growth framework. In these studies, the theoretical framework is based on the assumption that the agents have an exponential discounting function.

However, Laibson (1997, 1998) argues that individuals are highly impatient about consuming today and tomorrow, but are much more patient about choices advanced further in the future. This implies that the rate of time preference would be very high in the short run but much lower in the long run. Given these results, the assumption that the agents have an exponential discounting function must be modified.

Barro (1999) has extensively studied the implication of hyperbolic discounting on the neoclassical growth exonomy in a deterministic continuous time model.

The aim of this short note is to discuss the effect of alternative forms of discounting, e.g. hyperbolic discounting on growth. We choose a classic model, the Ramsey model, where both the effects of uncertainty (in the form of Brownian motion perturbations) as well as the hyperbolic discounting, in the intertemporal utility function of consumption have been taken into account. As such it complements the results of Barro (1999) on the effects of hyperbolic discounting on growth in the presence of uncertainty. Thus, this study contributes to the literature by examining how the assumption of hyperbolic discounting and the effects of uncertainty affect the implications of the standard Ramsey model.

2. The stochastic Ramsey model; Stochastic discount factors

Our model is based on the classical Ramsey optimal growth model, with the inclusion of uncertainty in the per capita capital, which in turn is introduced through