Properties of the Social Discount Rate in a Benthamite Framework with Heterogeneous Degrees of Impatience

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The concept of a discount rate is central to economic analysis, as it allows effects occurring at different future times to be compared by converting each future dollar amount into equivalent present dollars. The problem of the determination of a discount rate has acquired renewed relevance lately in order to analyze environmental projects or activities[1] the effects of which will be spread out over hundreds of years, and the evaluation of which, through Costs and Benefits Analysis, is very sensitive to the discount rate being used. For instance, concerning global climate change, it has been argued that the strong conclusions of the Stern Review were essentially driven by the low assumed discount rate (see, e.g. Nordhaus, 2006 or Weitzman, 2007).

In the short run, the use of the observed risk free rate to discount (public) investment projects leads to a socially efficient level of investment. The analysis is less easy to perform when benefits and costs of the set of current potential actions are expected to last in the long run. The carbon dioxide that one emits today will not be recycled for a couple of centuries, yielding long term costs like global warming. Some nuclear wastes like plutonium have half-life in the tens of thousands years. Financial markets are not very helpful to provide a guideline for investing in technologies that prevent this kind of long-lasting risks to occur. Liquid financial instruments with such large durations do not exist. For the sake of comparison, US treasury bonds have time horizons that do not exceed 30 years. We must thus rely on the use of an economic model to value the distant future.

A critical feature that must be taken into account is divergence of opinion about the future of the economy. Estimating the growth rate for the coming year is already a difficult task. It is natural that the estimation of growth for the next century/millenium is subject to potentially enormous divergence. It is doubtful that agents or economists currently have a complete understanding of the determinants of long term consumption growth. The debate on the notion of sustainable growth is an illustration of the degree of possible divergence of opinion about future of society. Some will argue that the effects of improvement in information technology have yet to be realized and the world faces a period of more rapid growth. On the contrary, those who emphasize the effects of natural resource scarcity will see lower growth rates in the

[1] Prominent examples include: global climate change, radioactive waste disposal, loss of biodiversity, thinning of stratospheric ozone, groundwater pollution, minerals depletion, and many others.

future. Some even suggest a negative growth of the GNP per head in the future, due to the deterioration of the environment, population growth and decreasing return to scales. Moreover, as underlined by Weitzman (2001)[2], "these and many more are fundamentally matters of judgment or opinion, on which fully informed and fully rational individuals might be expected to differ". The objective of this paper is to determine the socially optimal discount rate, when explicitly taking into account possible disagreement among agents.

More precisely, we consider a model in which agents when the discount rates of the affected population are heterogeneous and when using a Benthamite social welfare function.

Among others, we wish to tackle the following questions. Can beliefs dispersion be analyzed as a sort of additional risk or uncertainty leading to possibly lower discount rates? How do discount rates vary with the degree of divergence? Is it socially efficient, when diversity of opinion is taken into account, to reduce the discount rate per year for more distant horizons? If so, what is the trajectory of the decline?

The last question about the shape of the yield curve is of particular interest. There is a wide agreement that discounting at a constant positive rate for long time horizons is problematic, irrespective of the particular discount rate employed. Indeed, with a constant rate, the costs and benefits accruing to generations in the distant future appear relatively unimportant in present value terms. Hence decisions made today on this basis, appear to tyrannize future generations and in extreme cases leave them exposed to catastrophic consequences. Weitzman (1998) summarizes this succinctly when he states: « To think about the distant future in terms of standard discounting is to have an uneasy intuitive feeling that something is wrong somewhere ». A recently proposed solution to this problem is to use a discount rate which declines over time, according to some predetermined trajectory, thus raising the weight attached to the welfare of future generations. It is clear that using a declining discount rate could make an important contribution towards the goal of sustainable development. But what formal justifications exist for using a declining discount rate and what is the optimal trajectory of the decline? For instance, Henderson and Langford (1998 p.1498-1499) state that “In practical terms the weight of evidence in favor of hyperbolic discounting must be particularly convincing if there is to be any likelihood of introducing its use in analyses by government agencies.”

In this paper we provide a general characterization of the properties of the social discount rate and we show that the social discounting function should be hyperbolic when individual discount rates are declining or even constant. Given the generality of our results, we believe that this paper provides the evidence required by Henderson and Langford (1998).

Our results are particularly relevant for very long-term cost-benefit evaluations (e.g. those dealing with global climate change) that are especially sensitive to the selected discount rate. We show that, for those cases, the appropriate discount rate should be equal to the discount rate of the most patient individuals which, in practice, is likely to be close to zero percent.

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[2] In this paper, the author undertakes a survey of over 2 000 academic economists, and a so-called blue ribbon selection of 50, as to their opinion on the constant rate of discount to use for Cost Benefit Analysis. The responses were distributed with a gamma distribution with mean 4% and standard deviation of 3%.