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# A marginal cost of funds approach to multi-period public project evaluation: implications for the social discount rate

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## Abstract

Although the use of marginal cost of funds (MCF) has been widely appreciated in public finance literature, discussions of MCF have been confined to a static setting. This paper develops a multi-period project evaluation rule that is based on MCF. Unlike previous approaches, the parameters required for implementing the MCF rule are independent of projects under consideration. A lesson from this paper is that the government discount rate policies that are largely based on the concepts of social discount rate and shadow price of capital should be rewritten with the use of parameters representing MCF.

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## 1. Introduction

The ways in which the standard Samuelson Rule should be modified to incorporate the ‘distortionary effects’ of second-best taxation has been studied extensively in the considerable literature of the marginal cost of public funds

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(MCF).<sup>1</sup> All existing studies on MCF, however, define and discuss the MCF in a static setting, typically with a static labor supply model. Consequently, the existing MCF concept deals only with public projects in which benefits and costs occur simultaneously. However, a typical public project in the real world often has an intertemporal structure. That is, it tends to be a multi-period project with costs and benefits distributed over its lifetime.

Although to date there exist no results which explain how the concept of MCF should be defined and used for multi-period projects, the literature on the social discount rate (SDR) does address the evaluation of public projects with costs and benefits in different periods in the context of a tax-induced wedge between gross (before tax) and net (after tax) rates of return.<sup>2</sup> This literature mainly consists of two schools of thought. One school (the weighted-average approach) believes that the SDR is a weighted-average of gross and net rates of return with weights determined by the fractions of resources drawn from consumption and private savings, respectively.<sup>3</sup> The other school (the shadow price of capital approach) believes that future benefits should be discounted at the net rate, but that costs should be multiplied by a scale factor first and then the resulting consumption equivalent costs should also be discounted at the net rate.<sup>4</sup>

Both SDR approaches suffer severe implementation problems. On one hand, there is no general formula for determining the weights needed to calculate the SDR as a weighted-average of the two market rates of return (Dreze, 1974) and indeed, the appropriate SDR to use is project-specific (Stiglitz, 1982). Such project dependence renders this view of SDR almost impossible to apply in practice. On the other hand, the view equalizing SDR to the net return must quantify the scale factor that is used to convert direct costs into contemporary consumption-equivalent units. This in turn requires estimating whether costs come from private

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<sup>1</sup>For example, the seminal work of Stiglitz and Dasgupta (1971) and Atkinson and Stern (1974) have been extended in several directions. Ahmed and Croushore (1996); Ballard and Fullerton (1992); Browning (1987); Mayshar (1991); Snow and Warren (1996), and Wildasin (1984) studied the role of the feedback effects of the public good in determining the MCF of a distortionary tax; Batina (1990); Dahlby (1998); Kaplow (1996); King (1986) and Sandmo (1998) investigated the cost-benefit rule in economies with heterogeneous agents.

<sup>2</sup>Intergenerational equity and uncertainty associated with the future costs and benefits have also been used to justify the use of a social discount rate (SDR). For the SDR issue motivated by the consideration of equity across generations, see Intergovernmental Panel on Climate Change (1996) and Lind (1997). Liu et al. (2000) use an MCF approach similar to the one in the present paper to study the rule for multi-generation project evaluation and draw implications for the SDR. For discussions of the risk/uncertainty-related SDR, see Arrow and Lind (1970); Sandmo (1972).

<sup>3</sup>This school of thought (the weighted-average approach to SDR) consists of, among others, Usher (1969); Ramsey (1969); Sandmo and Dreze (1971); Harberger (1973); Pestieau (1975) and Burgess (1988).

<sup>4</sup>This school of thought (the shadow price of capital approach – since it involves calculating the value of a shadow price of capital) consists of, among others, Marglin (1963a,b); Feldstein (1964), and Lind (1982).

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