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Planning for the long run: Programming with patient, Pareto responsive preferences ☆

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Abstract

Respect for first order distributional overtaking guarantees that social welfare functions for intergenerational problems treat present and future people equally and respect the Pareto criterion, modulo null sets. For weakly ergodic optimization problems, this class of social welfare functions yields solutions that respect welfare concerns, sharply contrasting with extant patient criteria. For problems in which the evolution of future paths hinges on early events and decisions, the curvature of our social welfare functions determines the risks that society is willing to undertake and leads to a variant of the precautionary principle.

JEL classification: C6; D6; D8

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> ... intergenerational solidarity is not optional, but rather a basic question of justice, since the world we have received also belongs to those who will follow us. (Pope Francis, 2015)
>
> As we peer into society's future, we — you and I, and our government — must avoid the impulse to live only for today, plundering for our own ease and convenience the precious resources of tomorrow. We cannot mortgage the material assets of our grandchildren without risking the loss also of their political and spiritual heritage. We want democracy to survive for all generations to come .... (Dwight David Eisenhower, Farewell Address, January 17, 1961)

1. Introduction

We study long-term intertemporal optimization for a society made up of an infinite number of generations. In this setting, current decisions can have lasting, even irreversible, future consequences. We develop a theoretical framework for analyzing decisions a society makes when current decisions generate externalities, positive or negative, for later generations. We aim to characterize optima that a patient society, as a whole, might choose.

To address such intertemporal problems with generational externalities, we need to first answer two questions.

(1) How patient does the society want to be while evaluating the effects of current actions? In other words, what is the society's view on intergenerational ethics?
(2) What kind of efficiency criteria could we use?

While each of the two questions separately has a ready-made answer, taken together they pose significant operational difficulties, or it would appear so. As regards to the first question, the idea of treating generations equally, conditional on the resource endowments, is central to the economic study of intergenerational social welfare. But modern formulations of intergenerational equity have come up against what seems to be an incompatibility with the ethical imperative of the Pareto criterion — the commonly espoused answer to the second question. We put forward a resolution to the apparent incompatibility of the two ethical criteria, and then connect the resulting patient, ethical intergenerational social welfare functions to the dynamic programming tools for long-run optimization, thereby offering a route to applications.

Our motivation stems from a set of observations about the state of the art, both substantive and technical, in the literature on long-run planning at the societal level. A significant part of the literature shares the premise that long-run planning must, of necessity, discount the well-being of future generations. The argument runs as follows: consumption foregone and well-invested grows at some rate r, and this leads to an inequitable $1 : \frac{1}{1+r}$ trade-off between the consumption of present and future people.

To the contrary, it appears to us that in a wide class of societal investment problems with intergenerational implications, arguments based on opportunity cost (as measured by the present marginal rates of return on investment) suffer from an important limitation: a neglect of both durability and non-exclusivity. Knowledge, once created and disseminated, is a durable and mostly non-exclusive good. A reliable understanding of causal structures, once found, is avail-