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A characterization of inefficiency in stochastic overlapping generations economies

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Abstract

In this paper, we provide a characterization of *interim* inefficiency in stochastic economies of overlapping generations. With respect to the established body of results in the literature, we allow for sequentially incomplete markets and we remove the hypothesis of two-period horizons, by considering longer, though uniformly bounded, horizons for generations. The characterization exploits a suitably Modified Cass Criterion, based entirely on observable prices and independent of the length of the horizons of generations. For sequentially incomplete markets, we introduce a notion of *unambiguous* inefficiency, separating the inefficient intertemporal allocation of resources from incomplete risk-sharing. Unambiguous inefficiency reduces to inefficiency when markets are sequentially complete. Furthermore, our analysis shows that the hypothesis of two-period horizons is purely heuristic in establishing a criterion for inefficiency.

JEL classification: D52; D61

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1. Introduction

It is well established that competitive equilibrium might not achieve an optimal allocation of resources in economies of overlapping generations (Samuelson [22]). This inefficiency might occur even though competitive markets operate perfectly, as in the Arrow–Debreu abstraction. It

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is commonly understood as a lack of transversality condition, caused by the fact that generations act over short horizons compared with the infinite horizon of the economy, so that benefits from trade remain unexploited *at infinitum*. In order for this sort of market failure to justify active policy intervention (as social security), a suitable empirical criterion is needed for identifying unoptimality in the intertemporal allocation of resources, a criterion possibly grounded only on aggregate economic magnitudes. Does the mere observation of competitive prices fully reveal inefficiency?

This issue is of long tradition in general equilibrium. Intuitively, inefficiency requires that the real interest rate (net of growth) be sufficiently negative in the long-run, an admittedly vague and unprecise statement when interest rate fluctuates. Inspired by the original studies of Cass [13] and Benveniste [8,9] on capital theory, Balasko and Shell [5] and Okuno and Zilcha [21] initially proposed a precise necessary and sufficient Cass Criterion for inefficiency: the infinite sum of the reciprocals of (the norm of) present value prices of commodities over periods of trade converges. Their work was extended by Geanakoplos and Polemarchakis [18] to growing economies; by Aiyagari and Peled [1] (and, more recently, by Barbie and Kaul [7]) to recursive equilibria of economies with uncertainty; by Chattopadhyay and Gottardi [15] to economies with uncertainty; by Burke [12] and Molina-Abraldes and Pintos-Clapés [20] to economies with heterogeneous horizons for generations without uncertainty. Apart from these latter contributions, all of them adopt the simplifying hypothesis of two-period horizons for generations. In addition, with the only exception of part of the analysis in Chattopadhyay and Gottardi [15], all of them assume sequentially complete markets. Optimality under sequentially incomplete markets was also studied by Chattopadhyay [14] and Henriksen and Spear [19].

In this paper, we propose an extension of the analysis under uncertainty. In particular, differently from (most of) the literature, we allow for arbitrarily long, though uniformly bounded, horizons for generations and for possibly sequentially incomplete markets. Though these two extensions could be treated be means of a unified approach, it is worth separating the former from the latter, both for a more transparent presentation and because the former might be of interest independently of the latter. We first consider the case of sequentially complete markets.

For economies with two-period horizons for generations, Chattopadhyay and Gottardi [15] provide a necessary and sufficient condition for inefficiency, consisting in a sort of Weighted Cass Criterion: along any path, the weighted infinite sum of the reciprocals of prices converges. In addition, for recursive equilibria, elaborating on the criterion of Chattopadhyay and Gottardi [15], a recent work by Barbie and Kaul [7] presents an alternative characterization of inefficiency by means of a sort of First Order Condition, requiring the existence of bounded transfers whose value, in every state of nature, is less than their expected value in the following period.

In stochastic economies with two-period horizons for generations, when equilibrium allocation is inefficient, without loss of generality, a welfare improvement obtains by transferring resources from young individuals to old individuals. In economies with longer horizons for generations, instead, a welfare improvement might require a larger class of transfers. Thus, the extension to longer horizons of the characterization in the literature is not straightforward.

In order to carry out our extension and to provide a simpler Cass Criterion, we slightly modify the notion of inefficiency. An allocation is *robustly* inefficient if a welfare improvement exists even though a constant, however small, share of transferred resources is to be destroyed. This stronger notion of inefficiency permits us to avoid the common assumption of a lower bound on the curvature of indifference curves, which is ecumenically adopted in the literature (for instance, Chattopadhyay and Gottardi [15, Definition 4]). In addition, it allows for more direct and transparent arguments in the proofs. An interesting interpretation of robust inefficiency is that a