

Existence and Uniqueness of Equilibrium in Distorted Dynamic Economies with Capital and Labor¹

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In this paper, we provide a set of sufficient conditions under which recursive competitive equilibrium exists and is unique for a large class of distorted dynamic equilibrium models with capital and elastic labor supply. We develop a lattice based approach to the problem. The class of economies for which we are able to obtain our existence and uniqueness result is considerably larger than those considered in previous work. We conclude by applying the new results to some important examples of monetary economies often used in applied work. *Journal of Economic Literature* Classification Numbers: C62, D51, D90, E10. © 2001 Elsevier Science (USA)

Key Words: recursive competitive equilibrium; distortion; monotone operators; Tarski's fixed point theorem.

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1. INTRODUCTION

This paper studied the existence of competitive equilibrium in a large class of dynamic recursive economies with capital accumulation and elastic labor supply. The type of equilibrium distortions considered encompasses a broad class of non-optimal environments including distortionary taxation policies, situations where firms face equilibrium production externalities, and various monetary economies where there exists a functional equivalence between monetary and real economies. This class of infinite horizon dynamic equilibrium models continues to be the standard setting used to model many issues in applied macroeconomics.² Relative to the existing literature concerning the existence of equilibrium for these models, we are able to make progress in a number of important directions. First, we are able to provide conditions under which there exists a competitive equilibrium for situations where both the equilibrium distortions and the period preferences are allowed to be quite general. To accomplish this, we develop a class of concave, monotone operator methods for these economies with elastic labor supply. In particular in our setting, period preferences and equilibrium distortions are allowed to take a more general form than in previous work.³ In particular, the period preferences must

² Examples of environments in applied work with capital and elastic labor abound. See for example the monetary models built around Greenwood and Huffman [22] and Cooley and Hansen [13, 14] and Ohanian and Cole [8]; the multiple means of payment models such as Ireland [27] and Lacker and Schreft [32]; non-convex endogenous growth models such as Romer [37]; equilibrium models with market frictions such as the monopolistic competition models such as Hornstein [25] and Devereux, Head, and Lapham [15]; and the optimal taxation models Judd [28], Chari and Kehoe [7], and Judd [29].

³ Greenwood and Huffman [23] study an environment with elastic labor supply similar to the one we study, but require $u(c, l) = h(c - g(l))$, where h is monotone increasing and $g(l)$ is concave. In this case, the marginal rate of substitution between leisure and consumption to be independent of consumption, which means the results for the case without elastic labor supply can be applied to this economy (after constructing an appropriate technology for the problem).

Coleman [11] also studies an environment related to ours, and he requires the preferences to have the restricted homothetic form $u(c, l) = h(g(c, l))$, where h is monotonically increasing, g homogeneous of degree one, and h strictly concave and satisfied Inada conditions (where obviously the latter restriction on h rules out many homothetic forms such as Cobb-Douglas preferences). Also, Coleman considers the distorted equilibrium prices to have the following homogeneous form: $r(K, \theta) = r(\frac{K}{N}, \theta)$ and $w(K, \theta) = w(\frac{K}{N}, \theta)$. See assumption 4 and its use in proving Lemma 2. For applied work, homogeneous distortion can be very problematic because of its implied restrictions on fiscal and monetary policy (e.g., the when studying issues associated with the welfare of optimal dynamic taxation like in Coleman [12]).

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