Incomplete-market dynamics in a neoclassical production economy

George-Marios Angeletos[a,d], Laurent-Emmanuel Calvet[b,c,d,*]

[a] *Department of Economics, MIT, 50 Memorial Drive, Cambridge, MA 02142, USA*
[b] *Department of Economics, Littauer Center, Harvard University, 1875 Cambridge Street,
Cambridge, MA 02138, USA*
[c] *HEC School of Management, Paris, France*
[d] *NBER, 1050 Massachusetts Avenue, Cambridge, MA 02138, USA*

Abstract

   We investigate a neoclassical economy with heterogeneous agents, convex technologies and idiosyncratic production risk. Combined with precautionary savings, investment risk generates rich effects that do not arise in the presence of pure endowment risk. Under a finite-horizon, multiple growth paths and endogenous fluctuations can exist even when agents are very patient. In infinite-horizon economies, multiple steady states may arise from the endogeneity of risk-taking and interest rates instead of the usual wealth effects. Depending on the economy's parameters, the local dynamics around a steady state are locally unique, totally unstable or locally undetermined, and the equilibrium path can be attracted to a limit cycle. The model generates closed-form expressions for the equilibrium dynamics and easily extends to a variety of environments, including heterogeneous capital types and multiple sectors.

* Corresponding author. Tel.: +1 617 495 4129; fax: +1 617 495 8570.
  E-mail addresses: angelet@mit.edu (G.-M. Angeletos); laurent_calvet@harvard.edu (L.-E. Calvet)

1. Introduction

How does incomplete risk-sharing affect the level and volatility of macroeconomic activity? We investigate this question in a neoclassical economy with missing markets and decentralized production. Idiosyncratic technological risks, unlike endowment shocks, introduce private risk premia on capital investment. The interaction of these premia with the precautionary motive can generate endogenous fluctuations and multiple equilibria even when agents are very patient, technology is strictly convex, and the wealth distribution has no effect on endogenous aggregates.

We conduct the analysis in the GEI growth framework introduced in Angeletos and Calvet (2003). Each agent is both a consumer and a producer, who can invest in a private neoclassical technology with diminishing returns to scale. Individuals are exposed to idiosyncratic shocks in productive investment and possibly in some exogenous endowment. Agents also trade in financial markets. They can borrow or lend a risk-free bond, and partially hedge their idiosyncratic risks by exchanging a finite number of risky assets. All securities are real and there are no constraints on short sales. When markets are complete, the economy reduces to a Ramsey growth model with identical agents, as in Cass (1965), Koopmans (1965) and Brock and Mirman (1972). With missing markets, on the other hand, the economy cannot be described by a representative agent; explicit aggregation is nonetheless possible under a CARA-normal specification for preferences and risks.

We previously established two main results on macroeconomic performance in the neighborhood of complete markets. First, idiosyncratic production shocks, unlike endowment risk, tend to discourage investment. Thus in contrast to Bewley models (e.g. Aiyagari, 1994; Huggett, 1997; Krusell and Smith, 1998), incomplete risk-sharing can lead to lower steady state levels of capital and output as compared to complete markets.[1] Second, financial incompleteness can increase the persistence of the business cycle. In the traditional Ramsey framework, a negative wealth shock has some persistence because agents seek to smooth consumption through time. When markets are incomplete, productive investment is risky and becomes even less attractive relative to current consumption. This can slow down convergence to the steady state, and thus increase the persistence of aggregate shocks.

The present paper extends our earlier work in a number of useful directions, including high levels of financial incompleteness and finite-horizon economies. We show that idiosyncratic production risk can generate rich dynamics that cannot be generated by endowment risks.

We begin by investigating finite-horizon economies. In contrast to the complete-market Ramsey model, agents accumulate large precautionary wealth in later periods, because shocks received around the terminal date cannot be smoothed through time by borrowing and lending. In economies with large uninsurable risks, the anticipation of these movements lead to endogenous fluctuations along the entire equilibrium path.

The interaction between investment risk and precautionary savings can also generate non-monotonicities in the equilibrium recursion. As a result, there exist multiple growth paths in some economies with investment risks.

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[1] See Ljungqvist and Sargent (2000) for an excellent discussion of Bewley models.