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# Asset returns in an endogenous growth model with incomplete markets

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**Abstract**

This paper analyzes a class of stochastic endogenous growth models with uninsurable idiosyncratic income risk. The model economy is populated by infinitely-lived households who own and operate their own business, work for a stock company, and participate in stock and bond markets. Households have log-utility preferences and production functions exhibit constant returns to scale with respect to produced input factors (physical and human capital). If the idiosyncratic component of productivity and depreciation shocks is unpredictable, then there exists an equilibrium that can be found by solving a one-agent decision problem. The paper also analyzes the asset return implications of a calibrated model economy with an individual income process that displays realistic variations in idiosyncratic income risk. The calibrated model economy generates an equity premium of 1% if the volatility of implied stock returns matches the volatility of observed U.S. stock returns.


*JEL classification:* D52; D58; G12

*Keywords:* Incomplete markets; Heterogeneous agents; Asset returns; Endogenous growth

## 1. Introduction

Dynamic general equilibrium models provide a useful framework for the study of business-cycle fluctuations and asset returns. For the most part, the literature on business

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cycles has developed independently from the asset pricing literature.[1] This dichotomy is unfortunate since movements in both prices (asset returns) and quantities (output, consumption, employment) provide useful information for tests of general equilibrium models. In this paper, we assess the business cycle and asset return implications of a tractable incomplete-markets model of economic growth.

The model we analyze is an incomplete-markets version of the class of convex growth models analyzed, among others, by Alvarez and Stokey (1998), Jones and Manuelli (1990), Jones et al. (2000), and Rebelo (1991). In this class of models, production displays constant-returns-to-scale with respect to reproducible input factors, households are infinitely-lived and have homothetic preferences, and markets are competitive. In the particular model analyzed here, there are two input factors, physical and human capital, and households have log-utility preferences. Moreover, we assume that production of the homogeneous good takes place in two sectors. The first sector consists of many ex-ante identical businesses owned and operated by individual households (the "entrepreneurial sector"). Production in this sector is subject to productivity and depreciation shocks, and the idiosyncratic component of these shocks is assumed to be unpredictable.[2] The second sector consists of a large stock company (the "stock-market sector") and households have the opportunity to participate in the production process by purchasing equity shares and supplying labor in competitive markets. The market structure is incomplete in the sense that households can trade stocks, bonds, and human capital in frictionless markets, but cannot directly insure against idiosyncratic income shocks.[3]

In this paper, we show that there exists an equilibrium in which households optimally choose not to use bond trading (borrowing and lending) to smooth out idiosyncratic income shocks.[4] This no-trade result extends the work by Constantinides and Duffie (1996) to production economies with not necessarily normally distributed random variables.[5] As in Constantinides and Duffie (1996), the idiosyncratic component of log-income follows (approximately) a random walk, and borrowing and lending is therefore not a very effective way to insulate consumption from income shocks. In

[1] More precisely, the business cycle literature has usually ignored the asset pricing implications, and the asset pricing literature has followed Lucas (1978) and Mehra and Prescott (1985) by confining attention to exchange economies with exogenous aggregate consumption. See Cooley (1995) for a survey of the business cycle literature and Campbell (1999), Constantinides (2002), and Kocherlakota (1996) for recent surveys of the asset pricing literature. For notable exceptions, see Boldrin et al. (2001), Cochrane (1991), Danthine and Donaldson (1994), Jermann (1998), Lettau and Uhlig (2000), McGrattan and Prescott (2001), Storesletten et al. (2001), and Tallarini (2000).

[2] The introduction of a production sector in addition to the stock-market sector allows us to discuss two sources of idiosyncratic risk: labor income risk and proprietary income risk (entrepreneurial risk). Empirically, uninsured proprietary income risk appears to be an important component of idiosyncratic risk (Heaton and Lucas, 2000).

[3] The assumption that human capital can be sold is problematic, but essential to keep the model tractable. Economic intuition suggests that the introduction of non-negativity constraints on human capital investment is likely to lead to a larger effect of human capital risk on individual consumption and asset prices.

[4] This no-trade result still holds if households can trade an arbitrary number of assets whose payoffs only depend on the aggregate state of the economy.

[5] There is also an extensive computational literature on infinite-horizon, incomplete-market models. See, for example, Aiyagari (1994), den Haan (1997), Huggett (1993), and Krusell and Smith (1998).