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Intertemporal substitution, risk aversion, and economic performance in a stochastically growing open economy

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Abstract

The constant elasticity utility function implies that the intertemporal elasticity of substitution is the inverse of the coefficient of relative risk aversion. With empirical evidence suggesting that this relationship may or may not hold, studies of risk and growth should decouple these two parameters. This paper provides an analytical characterization and numerical simulations of the equilibrium of a stochastically growing small open economy under general recursive preferences. We show that errors committed by using the constant elasticity utility function, even for small violations of the compatibility condition, can be substantial. Our results suggest that the constant elasticity utility function should be employed with caution.

JEL classification: D81; D91; F43

Keywords: Intertemporal substitution; Risk aversion; Stochastic growth

1. Introduction

Recently, there has been a growing interest in analyzing the effects of policy shifts and other shocks on macroeconomic performance, growth, and welfare in the context of intertemporal stochastic growth models. These studies have been conducted for both closed and open economies, and a variety of shocks have been considered. Beginning with Eaton (1981), authors such as Gertler and Grinols (1982); Smith

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(1996); Corsetti (1997); Grinols and Turnovsky (1998) and Turnovsky (2000) have analyzed the effects of both monetary and fiscal shocks in stochastically growing closed economies. Parallel to this, Turnovsky (1993); Devereux and Smith (1994) Grinols and Turnovsky (1994); Obstfeld (1994a); Asea and Turnovsky (1998), and Turnovsky and Chattopadhyay (2003) have analyzed the effects of monetary shocks, terms of trade shocks, productivity shocks, and tax changes on economic growth and welfare in small open economies.

In order to obtain closed-from solutions, both the production characteristics and the preferences must necessarily be restricted, and with few exceptions the existing literature assumes that the preferences of the representative agent are represented by a constant elasticity utility function.[1] While this specification of preferences is convenient, it is also restrictive in that two key parameters critical to the determination of the equilibrium growth path—the intertemporal elasticity of substitution and the coefficient of relative risk aversion—become directly linked to one another and cannot vary independently. This is a significant limitation and one that can lead to seriously misleading impressions of the effects that each parameter plays in determining the impact of risk and return on the macroeconomic equilibrium and its welfare.

Conceptually, the coefficient of relative risk aversion, R say, introduced by Arrow (1965) and Pratt (1964) is a static concept, one that is well defined in the absence of any intertemporal dimension. Similarly, the intertemporal elasticity of substitution, emphasized by Hall (1978, 1988), Mankiw et al. (1985) and others, focuses on intertemporal preferences and is well defined in the absence of risk. A natural definition of the intertemporal elasticity of substitution is in terms of the percentage change in intertemporal consumption in response to a given percentage change in the intertemporal price. For any utility function separable both over time and states, this measure equals the elasticity of the marginal utility with respect to consumption, ϵ say; McLaughlin (1995). The standard constant elasticity utility function has the property that both parameters ϵ and R are constant, though it imposes the restriction $R = 1/\epsilon$, with the widely employed logarithmic utility function corresponding to $R = \epsilon = 1$. Thus it is important to realize that in imposing this constraint the constant elasticity utility function is also invoking these separability assumptions.

The empirical evidence for both these parameters is quite far-ranging. Estimates for ϵ based on macro data range from near zero (say 0.1) by Hall (1988), Campbell and Mankiw (1989), to near unity by Beaudry and van Wincoop (1995). Epstein and Zin (1991) provide estimates spanning the range 0.05–1, with clusters around 0.25 and 0.7. More recent estimates by Ogaki and Reinhart (1998) suggest values of around 0.4, somewhat higher than the early estimates of Hall (1988). Estimates of ϵ based on micro data introduce further sources of variation. Attanasio and Weber (1993, 1995) find that their estimate of ϵ increases from 0.3 using aggregate data, to 0.8 for cohort data, suggesting that the aggregation implicit in the macro data may cause a significant downward bias in the estimate of ϵ. Atkeson and Ogaki

[1] Two exceptions to this include Obstfeld (1994a) and Smith (1996).