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A quartet of asset pricing models in nominal and real economies

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ABSTRACT

This paper studies the equity premium implications of a canonical New Keynesian model with investment. We find that the presence of a time-varying marginal cost dampens the expansionary impact of a positive technology shock. With a given fraction of firms standing ready to satisfy demand at predetermined prices, the variations in the marginal utility of consumption attributed to technology shocks can easily be smoothed. Thus, technology shocks contribute little to the equity premium. Under a standard monetary policy rule, the real effect of monetary policy shocks is too weak and short-lived to generate a reasonable equity premium.

1. Introduction

Despite the success of New Keynesian models in matching key real business cycle features, the asset pricing implications of New Keynesian models have not been fully studied. This is especially true with regards to the equity premium. Compared with real business cycle models, New Keynesian models possess distinctly different features which may lead to different asset pricing implications. The most notable of these features is the inability of firms to set prices optimally every period. The paper addresses the following intriguing issues regarding asset pricing in New Keynesian models. First, we examine if it is possible to explain the equity premium in a standard New Keynesian framework. Second, we examine if the three features required to match the observed equity premium in real business cycle models also help to deliver a larger equity premium in New Keynesian models. These three features include (1) high curvature of the utility function, (2) high capital adjustment costs, and (3) inelastic labor supply. Lastly, we examine the role of monetary policy in achieving a sizable equity premium.

In this paper, we study a quartet of asset pricing models in both nominal and real economies. By turning on and off a few parameters of a canonical New Keynesian model, we are able to identify the impact of nominal rigidities and investment on the equity premium. The table below categorizes these four models:

	Flexible prices	Sticky prices
Without investment	Model I (incl. exchange economy)	Model II
With investment	Model III	Model IV

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Most research on the financial aspects of New Keynesian models has focused on term structure, but not on equity premium issues.[1] Sangiorgi and Santoro (2006) study how the equity premium depends upon whether it is prices or wages that are sticky in New Keynesian models without internal persistence. Their study differs from ours in one key aspect: there is no investment or capital stock in their model. Including investment is important for three reasons. First, in reality, the value of a firm's securities measures the value of the firm's productive assets in general, and the capital stock in particular. Second, both consumption and investment are endogenously determined in our models. Investment demand, being an important component of the demand side of the economy, affects the marginal value of contemporary goods. The marginal value of contemporary goods is, in turn, an important determinant of the stochastic discount factor used to price all financial assets. Third, capital accumulation is an important process through which technology and monetary shocks are propagated over time. Since asset prices are forward-looking variables, it is important to capture the propagation of these shocks by incorporating investment in the model.

We also incorporate internal persistence mechanisms such as habit formation, inflation inertia and interest rate smoothing in Models III and IV. In addition, we study a model with both sticky prices and sticky wages to examine the robustness of our results.

These are the three main findings of the paper:

First, technology shocks contribute little to the equity premium. The equity premium generated by technology shocks diminishes as nominal rigidities in price-setting increase. There are two explanations for this behavior: first, the time-varying marginal cost in a model with nominal rigidities dampens the expansionary impact of a positive technology shock. Second, the sticky-price feature in the model implies that a fraction of firms must have the flexibility to adjust labor input in order to satisfy demand at pre-set prices. That flexibility in varying labor input, however, can moderate most variations in the marginal utility of consumption caused by technology shocks.

Second, when the economy moves toward more nominal rigidities in price-setting, monetary policy shocks become the major contributor to the equity premium. However, under a standard monetary policy rule, the real effect of monetary policy shocks seems too weak and short-lived to generate a reasonable equity premium. Only when the exogenous monetary policy shock is assumed to be highly persistent (which is unusual in the literature) are there enough variations in the marginal utility of consumption and the real stock return to explain a substantial equity premium. Without this added exogenous persistence, even a sticky-wage sticky-price model cannot explain a large equity premium.

Third, variations in investment spending allow agents to alter their production plans to reduce fluctuations in consumption. In both nominal and real economies with production, costly capital adjustment leaves consumption susceptible to fluctuations caused by both monetary and technology shocks. The result is more variation in the marginal utility of consumption. However, the presence of capital adjustment costs is a necessary, but not sufficient, condition for a large equity premium in both economies.

The paper is organized as follows: Section 2 presents a canonical New Keynesian model which can be specialized into the four sub-models of interest. Sections 3 describes the asset pricing implications of each sub-model. Section 4 concludes.

2. A canonical New Keynesian model

2.1. Model environment

In this section, we describe a generalized New Keynesian model, which can be further specialized into four sub-models when we turn on or off particular features.

2.1.1. The representative household

The representative household obtains utility from consumption, leisure, and real money balances. The household's maximization problem is standard and specified as in Appendix A. Solving the household's problem yields first-order conditions for the nominal bond, real equity, and labor supply[2]:

$$\mathrm{E}_t\left[\beta\frac{\Psi_{t+1}}{\Psi_t}\frac{R_t}{P_{t+1}/P_t}\right]=1, \tag{1}$$

$$\mathrm{E}_t\left[\beta\frac{\Psi_{t+1}}{\Psi_t}(V_{t+1}+D_{t+1})\right]=V_t, \tag{2}$$

$$\frac{W_t}{P_t}=\tau\frac{L_t^{\theta-1}}{\Psi_t}, \tag{3}$$

where $\Psi_t=(C_t-bC_{t-1})^{-\sigma}-b\beta\mathrm{E}_t[(C_{t+1}-bC_t)^{-\sigma}]$.

[1] For example, Rudebusch and Wu (2008). The paper also relates to an earlier literature, including Giovannini and Labadie (1991), as well as Bansal and Coleman (1996), which study asset prices in a general equilibrium monetary endowment economy. Alternative models have also been developed to explore equity premium using the prospect theory, including Barberis et al. (2001) and Gruene and Semmler (2008).

[2] The money demand equation serves only to determine how much money the central bank needs to supply to clear markets given its interest rate target. This equation can be dropped when a monetary policy rule is present.