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Export pricing and the cross-country correlation of stock prices☆

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ABSTRACT

This study analyses the cross-country correlation of stock prices (values of firms) using the basic New Open Economy Macroeconomics model. It is shown that cross-country correlations of stock prices greatly depend on the currency of export pricing in the case of monetary shocks but not notably for temporary technology shocks. In the case of a money supply shock, the producer (local) currency pricing version of the model generates negative (positive) cross-country correlation of stock prices.

1. Introduction

In open economy macroeconomics, economists have often analysed cross-country correlations of output and consumption.[1] Cross-country correlation of stock prices has received less attention despite the fact that many modern macro models with solid microfoundations in firms' optimising problems could be used to generate predictions of stock prices. If a macro model provides a good description of reality, it should be able to explain – partly – the movements in stock prices.

The main purpose of this paper is to analyse theoretically cross-country correlation of stock prices. To address this topic I present a standard New Open Economy Macroeconomics (NOEM) model that enables one to study the implications of the currency of export pricing (local versus producer currency pricing) for the cross-country correlations of stock prices. A stock price refers to the net present value of all future profits (dividends) of the firm.

The framework adapted here means that the paper falls in the intersection between finance and international macroeconomics. As emphasised by Dumas, Harvey, and Ruiz (2003) macro models typically attempt to explain the observed cross-country correlations of output and consumption without paying attention to equity prices. A finance paper in turn attempts to explain the cross-country correlation of equity prices with an asset pricing model and cash flows to equity that may not be related to output. As Cochrane (2005, 70) has emphasised "we have only begun to scratch the surface of explicit general equilibrium models – models that start with preferences, technology, shocks, market structure – that can address basic asset pricing and macroeconomic facts."

Kollmann (2001) analyses – both empirically and theoretically – cross-country correlations of (nominal and real) stock returns and their magnitudes relative to those of output and consumption. In the empirical part of the study, he finds that the cross-country correlation (between U.S. and the other G7 countries) of stock returns is positive and higher than that for output and consumption.

One of the main findings of Kollmann (2001) is that, in the event of a technology or monetary shock (or a combination of them), nominal rigidities imply that cross-country correlations of output, consumption and stock returns are higher than without such rigidities. He also studies the implications of the currency of export pricing — in the context of simultaneous money supply and technology shocks. He finds that the currency of export pricing has only minor quantitative effects on cross-country correlations of asset returns.

Kollmann (2001) extends the basic NOEM framework in several directions, whereas I retain the basic NOEM framework and focus on a question that is left virtually unexplored by him. Namely, I analyse the consequences of the currency of export pricing on the cross-country correlation of stock prices (hence stock returns) in the case of non-simultaneous shocks.

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[1] This literature includes Backus, Kehoe and Kydland (1992), Betts and Devereux (2000, 2001), Obstfeld and Rogoff (1995) and Schmidt (2006).

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My findings regarding the consequences of the currency of export pricing on the cross-country correlation of stock prices are dissimilar to those of Kollmann (2001). He shows that the currency of export pricing has only minor quantitative effects on cross-country correlations of asset returns. It is shown in this paper that the currency of export pricing apparently matters in connection with a monetary shock but not with a temporary technology shock. In the case of producer currency pricing (PCP), a monetary shock generates high negative cross-country correlation of stock prices; with local currency pricing (LCP), the correlation is positive. When the driving force of the business cycles is a temporary technology shock, the currency of export pricing is nearly irrelevant for the behaviour of stock prices.

The rest of the paper is organised as follows. Section 2 presents the model. Section 3 discusses the choice of numerical values for the parameters of the model. Section 4 discusses the empirical evidence on international business cycles. Section 5 studies the effects of monetary shocks on profits and stock prices. Section 6 analyses the consequences of technology shocks for stock prices. Section 7 concludes the paper.

2. Model

The model presented in this paper is a synthesis of those presented in Tervala (2007, 2010).[2] The focus of this paper is, however, different in that it addresses the effects of economic shocks on stock prices.

The model contains two countries: home and foreign. Firms and households are indexed by $z\in[0,1]$. A fraction n of households and firms is located in the domestic country and the fraction *1-n* is located in the foreign country. Each firm produces a differentiated good. In both countries, a fraction b of the firms can be "price-to-market". These firms set their prices in the customers' currency and are referred to as LCP firms. The rest of the firms, the fraction *1-b*, set their prices in the producers' currency (PCP firms). [3]

2.1. Households

The representative domestic household optimises the intertemporal welfare function

$$U_t(z) = E_t \sum_{s=t}^{\infty} \beta^{s-t}\left[\log C_s + \frac{\chi}{1-\varepsilon}\left(\frac{M_s}{P_s}\right)^{1-\varepsilon} - \frac{\ell_s(z)^2}{2}\right]. \qquad (1)$$

Here, E_t denotes the expectation formed at time t, β is the discount factor, C is a consumption index,[4] P is the associated price index,[5] M is nominal money balances, ℓ the household's labour supply, and χ and ε are positive parameters.

The household can hold three assets: national money, the only internationally traded asset (a one-period nominal bond that denominated in domestic currency terms), and a stock that represents a claim on the aggregate dividends of all domestic firms. Thus each domestic household owns an equal share of all domestic firms. The stock is not traded within a county or between countries.[6]

The budget constraint is given by[7]

$$M_t + \delta_t D_t = D_{t-1} + M_{t-1} + w_t \ell_t(z) - P_t C_t + \pi_t + P_t \tau_t, \qquad (2)$$

where D is the household's holding of bonds, δ_t is the price of a bond $(1/(1+i_t)$, where i is the domestic nominal interest rate), w is the nominal wage, π denotes the dividends (profits) of domestic firms and τ denotes government transfers.[8] It is noteworthy that the labour market is perfectly competitive and wages are fully flexible. The assumption of a Walrasian labour market is likely to have important implications for the results of this paper, as discussed below.

Households maximise the utility function subject to the budget constraint. The first order conditions are given by

$$\delta_t P_{t+1} C_{t+1} = \beta P_t C_t, \qquad (3)$$

$$\delta_t P^*_{t+1} C^*_{t+1} S_{t+1} = \beta P^*_t C^*_t S_t, \qquad (4)$$

$$\ell_t = \frac{w_t}{C_t P_t}, \qquad (5)$$

$$\ell^*_t = \frac{w^*_t}{C^*_t P^*_t}, \qquad (6)$$

$$\frac{M_t}{P_t} = \left(\frac{\chi C_t}{1-\delta_t}\right)^{\frac{1}{\varepsilon}}, \qquad (7)$$

$$\frac{M^*_t}{P^*_t} = \left(\frac{\chi C^*_t}{1-\frac{\delta_t S_{t+1}}{S_t}}\right)^{\frac{1}{\varepsilon}}. \qquad (8)$$

Eqs. (3) and (4) are the Euler equations for optimal consumption. In Eq. (4), S is the nominal exchange rate, defined as the price of the foreign currency in terms of the domestic currency. Eqs. (5) and (6) are the optimal labour supply equations. Finally, Eqs. (7) and (8) show that households' optimal money demand depends positively on consumption and negatively on the interest rate.

2.2. Firms

2.2.1. Technology

The production function of the representative domestic firm is

$$y_t(z) = a_t \ell_t(z), \qquad (9)$$

where $y_t(z)$ denotes the output of firm z, a_t denotes the level of technology and $\ell_t(z)$ is the labour input used by the firm. There is no explicit physical capital in the model. Technology in both countries follows the AR(1) process

$$\hat{a}_t = \rho_a \hat{a}_{t-1} + \epsilon^a_t,$$

where ρ_a $(0\leq\rho_a\leq1)$ governs the persistence of a technology shock, ϵ^a_t is an unpredictable shift in the level of technology ($\epsilon^a \sim N(0,\delta^2_\epsilon)$), and the hat notation denotes the percentage deviation from the initial steady state ($\hat{a}_t = \frac{da_t}{a_0}$, where a_0 is the initial steady state value).

[2] These models are straightforward extensions of Obstfeld and Rogoff (1995) and especially Betts and Devereux (2000).

[3] The model is a standard NOEM model, and so only the key equations, vital for understanding the main results, are presented in the main text. Moreover, in the description of the model that follows, the equations for the foreign country are explicitly discussed only if they are not symmetric to those for the home country.

[4] The consumption index is $C_t = \left[\int_0^1 c_t(z)^{\frac{\theta-1}{\theta}} dz\right]^{\frac{\theta}{\theta-1}}$, where *c(z)* is consumption of good z and the elasticity of substitution between goods is given by θ.

[5] The domestic price index is given by $P_t = \left[\int_0^n p_t(z)^{1-\theta} dz + \int_n^{n+(1-n)b} p^*_t(z)^{1-\theta} dz + \int_{n+(1-n)b}^1 (S_t q^*_t(z))^{1-\theta} dz\right]$, where $p^*(z)$ is the domestic currency price of a foreign good and $q(z)$ is the foreign currency price of that foreign good.

[6] Stocks are not traded between countries in order to be able to derive the consolidated budget constraint of the country. In the representative agent framework, there is no room for stock trading within countries.

[7] The foreign budget constraint is $M^*_t + \delta_t \frac{D^*_t}{E_t} = \frac{D^*_{t-1}}{E_t} + M^*_{t-1} + w^*_t \ell^*_t(z) - P^*_t C^*_t + \pi^*_t + P^*_t \tau^*_t$.

[8] The government budget constraint in per-capita terms is $\tau_t = \frac{M_t - M_{t-1}}{P_t}$.