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Does non-traded input necessarily deepen the international non-diversification puzzle I?: The one-good case

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Abstract

This paper shows that, with non-traded inputs and only one good, the optimal portfolio should contain a larger share of foreign assets than domestic. It deepens the international non-diversification puzzle.

Keywords: International non-diversification puzzle; Non-traded input; Endogenous labor supply; Diminishing returns to scale technology; Long position

JEL classification: F41

1. Introduction

Countries do not receive the same technological shock at the same time. Because of this, people will diversify their portfolios. Empirical evidence, however, does not support this intuition (see Tesar, 1994, for instance).

Baxter and Jermann (1992) (hereafter BJ) may be the first paper with non-traded inputs in 'production'.[1] Since a large share of income comes from *labor*, which is *non-tradeable* (or *non-diversifiable*), it distorts the portfolio choice of the agents in their model The calibration results in BJ show that *agents will short-sell their domestic stocks in order to hedge*.

This paper re-examines their results in a simple, dynamic, general equilibrium model so that *closed form solutions* for asset holdings can be obtained. Despite the simplicity, the *exogenous labor supply assumption in BJ is relaxed*. It seems to be important because in a general equilibrium framework, the non-tradeable property of labor might not just affect the portfolio choice but might also affect the amount of labor supplied and hence will have *real effect*. As a side product, the model is able to *mimic the stylized fact* that the cross-country correlation of

[1] Compare the contributions by Cole and Obstfeld (1991), Stockman (1988), Stockman and Dellas (1989), Stockman and Tesar (1990), Tesar and Werner (1992), Uppal (1993), among others.

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output is greater than the cross-country correlation of consumption. The equilibrium in BJ is inefficient, while the economy considered here is (constrained) Pareto optimal. BJ considers the case of a *constant absolute risk aversion* utility function (which implies that the weight of risky assets in the portfolio is decreasing in the level of wealth) while here a *constant relative risk aversion* utility function is considered (which means that the relative weight of risky assets is constant across different wealth levels). BJ, as do many others, consider a constant returns to scale technology. Here, diminishing returns to scale (DRTS) technology is assumed. Consequently, profits (and hence dividends) are positive and it gives agents an incentive to hold equity.

It shows that, with non-traded inputs and only one consumption good, the holdings of both domestic and foreign assets are positive (long position), *in contrast to the short position in BJ*. The relative weight of foreign assets in the domestic agents' portfolio is higher than that of domestic assets. In other words, it shares the insight of BJ that the consideration of non-tradeable input deepens the non-diversification puzzle.

2. A simple model

Agents in both countries are infinitely lived. The population in both countries is constant and equal. Labor is the only input for goods production and is immobile. Therefore, it is a stationary economy. At the end of each period, people decide how much stock (claims to profits) to hold. At the beginning of the next period, the technological shock, which is the only uncertainty in the model, is resolved. Firms hire labor to maximize profits. Then wages and profits are distributed. Agents make consumption as well as portfolio decisions. The same sequence of events is then repeated.

Formally, domestic agents maximize the expected utility subject to a budget constraint (consumption good is the numeraire):

$$\max \mathrm{E} \sum_{t=0}^{\infty} \beta^t \ln\left(c_t - \frac{l_t^{1+\mu}}{1+\mu}\right), \quad \mu > 0,$$

s.t.

$$(\lambda_t) c_t + p_t s_{1,t+1} + p_t^* s_{2,t+1} \leq w_t l_t + p_t s_{1t} + p_t^* s_{2t} + q_t s_{1t} + q_t^* s_{2t},$$

where c_t (c_t^*) is the consumption of domestic (foreign) agents; l_t (l_t^*) is the labor time of domestic (foreign) agents; p_t (p_t^*) is the price for domestic (foreign) stock; q_t (q_t^*) is the dividend distributed per unit of domestic (foreign) stock; w_t (w_t^*) is the domestic (foreign) wage rate; s_{1t} (s_{1t}^*) is the amount of domestic stock held by domestic (foreign) agents; and s_{2t} (s_{2t}^*) is the amount of foreign stock held by domestic (foreign) agents. λ_t (λ_t^*) is simply the multiplier in the domestic (foreign) agents' budget constraint. Without retained earnings or investment, dividend equals profit. It is also assumed that $\alpha < (1+\mu)/(1+2\mu)$.

This special functional form gives closed-form solutions in a frictionless market.[2] Foreign consumers face a similar problem:

[2] It is adopted from Greenwood et al. (1988).

$$\max \mathrm{E} \sum_{t=0}^{\infty} \beta^t \ln\left(c_t^* - \frac{(l_t^*)^{1+\mu}}{1+\mu}\right),$$

s.t.

$$(\lambda_t^*)c_t^* + p_t s_{1,t+1}^* + p_t^* s_{2,t+1}^* \leq w_t^* l_t^* + p_t s_{1t}^* + p_t^* s_{2t}^* + q_t s_{1t}^* + q_t^* s_{2t}^* .$$

Firms maximize temporal profits q_t^i, given technology A_t^i and wage rate $w_t^i, i = ,*$, respectively:

$$\max q_t^i \equiv A_t^i (l_t^i)^{\alpha^i} - w_t^i l_t^i , \quad \forall t, \alpha^i \in (0,1) , \quad i = ,* .$$

Market clearing conditions obviously are:

$$s_{i,t} + s_{i,t}^* = 1 , \quad i = 1,2 , \quad \forall t ,$$

$$c_t + c_t^* = A_t l_t^{\alpha} + A_t^* (l_t^*)^{\alpha^*} , \quad \forall t .$$

Note that labor shares α^* need not be equalized across countries. With a no-migration assumption, risk-sharing can still be achieved between countries with different (labor) productivities.

Standard stochastic dynamic programming techniques will lead to the following conditions (time subscripts are suppressed):

$$l^i = (A^i \alpha^i)^{(1+\mu-\alpha^i)^{-1}} , \quad i = ,* ,$$

$$w^i = (l^i)^{\mu} , \quad i = ,* ,$$

$$q^i = (1-\alpha^i) y^i , \quad i = ,* ,$$

where $y_i = A^i (l^i)^{\alpha^i}$. Observing that without any market frictions, the equilibrium solution coincides with the planner's solution with equal welfare weights assigned to the two countries:

$$\max \mathrm{E} \sum \beta^t \left[\ln\left(c_t - \frac{l_t^{1+\mu}}{1+\mu}\right) + \ln\left(c_t^* - \frac{(l_t^*)^{1+\mu}}{1+\mu}\right)\right],$$

s.t.

$$c_t + c_t^* = y_t + y_t^* , \quad \forall t .$$

Exploiting the relation that $y^i = A^i (l^i)^{\alpha^i}$ and $\ln l^i = (1+\mu-\alpha^i)^{-1} \ln(A^i \alpha^i)$, $i = ,*$, it is easy to check that the following are the optimal allocations:

$$c = \frac{1}{2}\left[\left(1 + \frac{\alpha}{1+\mu}\right) y + \left(1 - \frac{\alpha^*}{1+\mu}\right) y^*\right],$$

$$c^* = \frac{1}{2}\left[\left(1 + \frac{\alpha^*}{1+\mu}\right) y^* + \left(1 - \frac{\alpha}{1+\mu}\right) y\right].$$

It is easy to see that *the model is compatible with the stylized fact that the cross-country correlation of output is greater than the cross-country correlation of consumption. The ratio of* *domestic consumption over domestic output is not constant over time. It is positively correlated to the ratio of foreign output over domestic output.*

If the share holdings are constant over time, i.e. $s_{i,t} = s_{i,t+1}$, $\forall i, t$, it is easy to verify that the equilibrium stock holdings of domestic agents are (the foreign investors' counterpart is analogous):

$$0 < s_1 = \frac{(1 + \mu - \alpha - 2\alpha\mu)}{2(1 + \mu - \alpha - \alpha\mu)} < 0.5 ,$$

$$0 < s_2 = \frac{(1 + \mu - \alpha^*)}{2(1 + \mu - \alpha^* - \alpha^*\mu)} > 0.5 .$$

In Lucas (1982), labor is not productive. Alternatively, it can be interpreted as an ideal world in which all sources of income are tradeable. In that case, $\alpha^i = 0$, and hence $s_i = 0.5$, $i = , *$, will be obtained. With non-tradeable input and reasonable parameter values, the change in portfolio weight can be dramatic. For instance, with labor share α equal to 0.6, quadratic disutility in labor $\mu = 1$, $s_1 = 0.125$. It confirms the calibration results in BJ that non-tradeable input will deepen the international non-diversification puzzle.

3. Concluding remarks

In a one-good world such as the one considered in BJ and here, it is found that non-tradeable input, namely labor, will deepen the non-diversification puzzle. In a two-goods world, it is not necessarily the case. In general, it will depend on the complementarity between the home-produced consumption goods, on the one hand, and leisure (or foreign-produced consumption goods), on the other. It will also depend on the relative 'weights' of the two goods in the preference of the consumers. *Put another way, a one-good world can be understood as a two-goods world with the strong (and implicit) assumptions that the home-produced goods and foreign-produced goods are perfect substitutes in all possible ways. Therefore, the study of the two-goods case effectively examines the importance of the 'perfect substitutes' assumptions.* It is conducted in a companion paper.

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References

Baxter, Marianne and Urban Jermann, 1992, The international diversification puzzle is worse than you think, Mimeo, University of Rochester.

Cole, Harold and Maurice Obstfeld, 1991, Commodity trade and international risk sharing: How much do financial markets matter?, Journal of Monetary Economics 28, 3–24.

Greenwood, Jeremy, Zvi Hercowitz and Gregory Huffman, 1988, Investment, capacity utilization and the real business cycle, American Economic Review 78, 401–417.

Lucas, Robert, 1982, Interest rates and currency prices in a two-country world, Journal of Monetary Economics 10, 335–360.

Stockman, Alan, 1988, Sectoral and national aggregate disturbances to industrial output in seven European countries, Journal of Monetary Economics 21, 387–409.

Stockman, Alan and Harris Dellas, 1989, International portfolio nondiversification and exchange rate veriability, Journal of International Economics 26, 271–289.

Stockman, Alan and Linda Tesar, 1990, Tastes and technology in a two-country model of the business cycle: Explaining international comovements, American Economic Review, in press.

Tesar, Linda, 1994, Evaluating the gains from international risksharing, paper presented in Carnegie–Rochester Conference on Public Policy.

Tesar, Linda and Ingrid Werner, 1992, Home bias and the globalization of securities markets, NBER Working Paper 4207.

Uppal, Raman, 1993, A general equilibrium model of international portfolio choice, Journal of Finance XLVIII, 529–553.