An Analysis of Some Trade Theoretic Aspects of Investment and The Balance of Payments

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I. Introduction

Several excellent studies, both theoretical and empirical, focusing on the balance of payments disequilibrium are now available in the international finance literature (see, for example, Despres, Kindleberger, and Salant; Halevi). While the role of savings and investment in the balance of payments disequilibrium is well documented in these models, the fact that saving and investment decisions derive from the production structure of the economy is generally ignored. The pure theory of international trade, on the other hand, has focused in the past on the trade implications arising from the production structure of the economy, but has largely ignored issues of domestic investment and the balance of payments disequilibrium.

The recent spurt in activity in the intertemporal modeling of international trade appears to have been dictated by the realization that issues of domestic investment and balance of payments cannot be analyzed in the framework of conventional trade models. Dornbusch, Svensson and Razin analyzed the effects of changes in the terms of trade on the balance of payments in the context of intertemporal trade models focusing largely on the con-

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absence of any technological change, production functions in both sectors are assumed to be identical in both periods and are characterized by:

$$(1) \quad X^t = X(L^t_x, K^t_x)$$

$$(2) \quad Y^t = Y(L^t_y, K^t_y)$$

where the superscript t = 1, 2 stands for the two periods, and the subscripts denote the two sectors.

Let p^t, W^t and Z^t be the relative price of Y, the real wage rate and the domestic rate of discount respectively in period t and I^t_j, the rate of t^{th} period real investment in the j^{th} sector. It is also assumed that all values are expressed in units of X. Producers in both sectors, facing perfect markets, maximize the present value of the cash flows over the two periods. Given that the stock of capital is fixed in the short run in both sectors, the representative firm each sector chooses the level of inputs L^1_i, L^2_i and K^2_i, $(i = x, y)$, such that the value of marginal product of a factor is equated with the corresponding factor price which is, by virtue of perfect competition, the same in both sectors. this implies that

$$(3) \quad X^1_L = w^1 = p^1 Y^1_L$$

$$(4) \quad X^2_L = w^2 = P^2 Y^2_L$$

and

$$(5) \quad X^2_K = D^2 + \delta = P^2 Y^2_K$$

where X^t_j, and Y^t_j are the marginal products factor j in period t in sectors X and Y respectively, δ is the rate of depreciation of

the goods are stock-flow goods, they can be used both for consumption and for investment. This assumption, along with the usual neoclassical assumption of meliability of capital, eliminates any problem that might arise from incompatibility between the units of measurement of the capital stock K and the units of measurement of the goods X and Y.

domestic rate of interest Z^t. This borrowing or lending is done is accordance with the intertemporal budget constraint, given by:

$$(9)\quad \overline{V}R^1 + I^1 + \frac{I^2}{R^2} + C^1 + \frac{C^2}{R^2} = Q,$$

Where $\overline{V}$ is the initial level of foreign debt, which could be positive, zero, or negative, $C = C_x^t + P^t C_y^t$ is real consumption spending in period t, $R^t = 1 + r^t$, $I^2 = \delta K^2$ is the replacement investment in the long run, and Q is real wealth.[4] The real wealth Q equals the present value of total income stream over the two periods or:

$$(10)\quad Q = (X^1 + P^1 Y^1) + (X^2 + P^2 Y^2)/R^2 = Q^1 + Q^2/R^2.$$

It should be noted that our assumption of immobility of capital implies that the domestic rates of return and the international rates of interest are in general *not* the same. This assumption, Batra and Naqvi argue, is most likely to describe that situation in developing as well as many developed countries and allows a comparison of this model with the standard two-sector models of trade theory, which have also had a tradition of assuming international immobility of factors. Despite international immobility of the factors of production, free trade in goods can equalize the factor prices internationally if the endowment rays of the trading countries lie within the same cone of diversification. While it is assumed that the small open economy and its trading partner are completely diversified in the production of both goods, we mrely assume that the endowment ray of each country belongs to a cone of diversification, not necessarily the same cone. Hence, the spread between the domestic and the international rates of interest is maintained.

From equations (9) and (10) we get:

[4] The domestic rate of interest Z^t is used for discounting profits of the domestic producer. However, the foreign rate of interest r^t is the rate at which the economy borrows or lends in the international credit market, hence the presence of foreign interest rates r^t in the intertemporal budget constraint of the economy (9). Since the economy considered is a small open economy, its trading and borrowing-lending activities have no appreciable influence either on the relative prices or on the international rates of interest.

$$(14)\quad X_L^1\ (L_x^1) = p^1\, Y_L^1(\bar{L}^1 - L_x^1)$$

$$(4)\quad X_L^2 = p^2\, Y_L^2$$

$$(5)\quad X_K^2 = p^2\, Y_K^2$$

$$(15)\quad (1+\delta/R^2)\,(K_x^2+K_y^2) - (1-\delta)\bar{K}^1 + \bar{V}R^1 = s^1 Q^1 + s^2 Q^2/R^2$$

where (14) has been obtained using (6) and (3), and (15) by combining (6), (8), and (12). In (14), the arguments of the function are presented explicitly to show that with K_x^1 and K_y^1 fixed, L_x^1 can be solved from (14) itself as a function of p^1 and $\bar{L}^1$. With L_x^1 determined, L_y^1 can be obtained from the labor constraint, and with K_x^1 and K_y^1 already known, X^1 and Y^1 and hence Q^1 can be determined as functions of p^1 and $\bar{L}^1$. Hence all the short run variables, except I^1 and B^1, can be determined, as functions of p^1 and $\bar{L}^1$, once (14) is solved.

Next, from (4), (5), and (15) we can solve for L_x^2, K_x^2 and K_y^2 as functions of the exogenous variable vector $\omega = (\bar{L}^1, \bar{L}^2, s^1, s^2, r^1, r^2, p^1, p^2, \bar{V})$. With L_x^2 determined, L_y^2 can be obtained from the labor constraint in the second period. With all this information, all the long run variables, and the short run investment and balance of payments, can be determined, and expressed as functions of the exogenous variable vector ω.

Since all endogenous variables, including investment and the balance of payments, depend upon the exogenous variable vector ω, the following regression moels follow from the theoretical intertemporal model of international trade.

$$(16)\quad I_t = f(L_t, L_{t+1}, s_t, s_{t+1}, r_t, r_{t+1}, p_t, p_{t+1}, V_t) + e_t$$

$$(17)\quad B_t = g(L_t, L_{t+1}, s_t, s_{t+1}, r_t, r_{t+1}, p_t, p_{t+1}, V_t) + u_t$$

where e_t and u_t are normally distributed random errors with zero mean and finite variance, and I_t and B_t are the endogenous cur-

distributed random error of expectation with zero mean and finite variance, and is temporally independent of the variable in whose expectation formation it arises. That is, we assume that on the average the expectation about the next period terms of trade, world interest rate and the average rate of saving turn out to be correct.

In view of (16) — (20), assuming $f(\cdot)$ and $g(\cdot)$ of (16) and (17) are linear, and the previous discussion, the following linear hypotheses are obtained from the theoretical model of section 1:

$$(21)\quad I_t = \alpha_0 + \alpha_1 L_t + \alpha_2 s_t + \alpha_3 s^*_{t+1} + \alpha_4 \gamma_t + \alpha_5 \gamma^*_{t+1} + \alpha_6 p_t + \alpha_7 p^*_{t+1} + \alpha_8 V_t + e'_t,$$

$$(22)\quad B_t = \beta_0 + \beta_1 L_t + \beta_2 s_t + \beta_2 s_t + \beta_3 s^*_{t+1} + \beta_4 r_t + \beta_5 r^*_{t+1} + \beta_6 p_t + \beta_7 p^*_{t+1} + \beta_8 V_t + u'_t$$

where, it may be noted that $e'_t = e_t + \alpha_7 \varepsilon^1_t + \alpha_3 \varepsilon^2_t + \alpha_5 \varepsilon^3_t$, and $u'_t = u_t + \beta_7 \varepsilon^1_t + \beta_3 \varepsilon^2_t + \beta_5 \varepsilon^3_t$ are normally distributed random variables with zero mean and finite variance.

Before we proceed to the estimation of (21) and (22), a methodological remak is in order. Our maintained hypothesis is the structural, theoretical trade model. We translate this hypothesis into a set of testable hpotheses, namely the comparative static properties of the theoretical model arising from its reduced form, which depicts the general equilibrium relationships among the endogenous and exogenous variables. Since the properties of the reduced form model are being tested empirically, a confirmation does not mean that the structural model reflects the true picture: indeed, an infinite number of structural models could have the sme comparative static properties. However if the data contradict any one of the comparative static properties, then it follows that the structural theoretical trade model definitely does not reflect the true picture.

It may also be noted that no explanatory variable has been introduced or dropped in (21) and (22) on an ad-hoc basis, but just

Table 1

EMPIRICAL RESULTS

Dependent Variables	Constant	Explanatory Variables										
		$\ln L_t$	$\ln s_t$	$\ln s^*_{t+1}$	$\ln r_t$	$\ln r^*_{t+1}$	$\ln p_t$	$\ln p^*_{t+1}$	V_t	D-W	R^2	Method
$\ln I_t$	-62.784	6.874	0.252	-0.492	1.298	.350	0.266	2.038	0.127×10^{-3}	2.003	0.997	OLS
		(8.854)	(1.026)	(2.395)	(3.287)	(3.235)	(0.535)	(4.204)	(2.448)			
B_t	21615.0	-3098.4	-2022.7	741.50	3801.1	-1310.4	3704.4	-3605.7	-0.427×10^{-1}	2.741	0.872	ML (Grid Search)
		(2.710)	(5.317)	(2.200)	(6.624)	(1.861)	(4.940)	(4.830)	(0.494)			

payments equation, with B_t and V_t entering the equation linearly because these variables were not positive in every year. Hence we adopted the following functional specification of the balance of payments equation.

$$(24)\quad B_t = \beta_0 + \beta_1 \ln L_t + \beta_2 \ln s_t + \beta_3 \ln s^*_{t+1} + \beta_4 \ln r_t + \beta_5 \ln r^*_{t+1}$$

$$+ \beta_6 \ln p_t + \beta_7 \ln p^*_{t+1} + \beta_8 V_t + u''_t.$$

The results of the maximum likelihood estimation of the balance of payments equation (24), with an autocorrelation correction employing a grid search, are presented in Table 1.

In Table 2 the comparative static properties of the theoretical model (see Batra and Naqvi) are presented. Table 3 contains a summary of the qualitative results of the estimation of the investment and the balance of payments equation (23) and (24). For a comparison of the theoretical and empirical results, we shall refer to Tables 2 and 3.

Table 2

THEORETICAL RESULTS*

Dependent Variables	Independent Variables							
	$\bar{L}^1$	s^1	s^2	r^1	r^2	p^1	p^2	$\bar{V}$
I^i	(+)	(+)	(+)	(-)	(?)	(?)	(?)	(-)
B^i	(?)	(?)	(?)	(+)	(?)	(?)	(?)	(+)

Korean economy. Further, the empirically obtained signs of $dI^1/dr^1(>0)$ *and* $dI^1/ds^2(<0)$ do have an intuitive basis. For an increase in the world rate of interest, given that physical capital is not perfectly mobile, while it does not increase the domestic rate of interest, it does reduce lucrative investment opportunities abroad, and induces a partial movement of capital into the economy in question, thereby increasing the rate of domestic investment. Also the expectation of a higher average rate of saving in the next period could conceivably be the cause of postponing some of the investment to the next period, thereby reducing the current rate of investment. In the next section we shall address ourselves to the remodeling intertemporal trade on these empirical violations of the theoretical results.

B. The Balance of Payments Function

Again, from Table 1 it is apparent that while the long run international rate of interest and the outstanding foreign debt are statistically insignificant in explaining the extent of balance of payments disequilibrium, the supply of labor, the average rates of saving both in the short and in the long run, the terms of trade in both periods, and the current international interest rate are statistically significant explainers of the extent of current balance of payment disequilibrium. The importance of the rates of saving and the international rates of borrowing and lending in explaining the balance of payments is well documented in the literature. In addition, our results highlight the importance of labor supply in explaining the balance of payments of an economy.

From Table 2 and 3 it is clear that on the current balance of payments the effects of changes in current labor supply, average rate of saving and the world rate of interest obtained theoretically ly are confirmed by the data. Further, the effects on the current balance of payments of changes in the terms of trade in both periods, world interest rate in the second period, the long-run average rate of saving and the foreign debt in the current period are not contradicted by the data. Hence the empirically obtained results on the effects on balance of payments of the various exogenous changes do not contradict any of the theoretically obtrained results.