8-2006

Current Account Imbalances, Capital Accumulation, and Foreign Investment: A Theoretical Analysis of Interrelationships and Causalities

Sajal Lahiri
Southern Illinois University Carbondale

A.K.M. Mahbub Morshed
Southern Il

August 11, 2006

Current Account Imbalances, Capital Accumulation, and Foreign Investment: A Theoretical Analysis of Interrelationships and Causalities

By

Sajal Lahiri and AKM Mahbub Morshed

Department of Economics,
Southern Illinois University at Carbondale,
Carbondale, IL 62901, USA
(E-mail: lahiri@siu.edu and mmorshed@siu.edu)

Abstract

This paper develops a unified structure to examine the interrelationships between current account, foreign investment and domestic capital accumulation. In particular, we develop a two-country, two-period model with international mobility of both physical and financial capital, and endogenous domestic capital accumulation. We consider cases where (i) current account is endogenous, but foreign investments are exogenous, and (ii) current account is exogenous, but foreign investments are endogenous. For (i), we examine how inflow and outflow of foreign physical capital affects current account and domestic investments. For the second case, we examine how an increase in current account deficit affects foreign investments.

JEL Classification: F2, F3, F4.
Keywords: Balance of payment, foreign investment, domestic investment.

1 Introduction

Current account imbalances in both developed and developing countries have been receiving a lot of attention lately. We observe a large current account deficit in the United States and a huge current account surpluses in Japan, Euro area, China and other Asian countries. Currency crises resulting from unsustainable current account deficit in East Asia in 1997, in Russia, and in a number of Latin American countries more recently put the obvious research question to the forefront: what are the sources of these worldwide current account imbalances? And, as one would expect a lot has been written. For example, in attempts to explain these large current account imbalances some reexamined the twin deficit theory with emphasis on budget deficit (Corsetti, 2006), while others suggest that "savings glut" in the world is the source of this imbalance (Bernanke, 2005).[1,2]

However, the sources of current account imbalances are not the same for all countries and the thresholds for maintaining a current account imbalance are different for different countries. The large and persistent trade deficit of the US has generated a debate about the sustainability of such a deficit. Some argue that the U.S. economy might be heading for a hard landing with a financial crisis (see, for example, Edwards, 2005; Obstfeld and Rogoff, 2004). Obstfeld and Rogoff (2004) even suggested an exogenously imposed reduction of current account imbalance for the U.S. to achieve a relatively painless adjustment to a more sustainable level of current account imbalance. Others argue that the present large current account deficit in the U.S. is not a cause of concern as it is the manifestation of strength of the economy, since a large amount of capital is now flowing out of the countries with low investment and growth and into the US and other fast growing countries (see, for example, Backus *et al.*, 2005). Savings glut in Asian countries like China and Korea and in oil-rich Middle Eastern countries results in a huge inflow of capital into the US and thus the current account balance of the U.S. is in disarray (Bernanke, 2005; Snow, 2006). According to these researchers and policy makers, the huge inflow of capital into the U.S. is the main source of its massive current account deficit.

[1] Barnanke (2005) argued that the recent decline in the long-run interest rate is a sign of this savings glut.

[2] Another group of researchers put focus on the role of demographic transition in developing and developed countries in generating this imbalance (Domeij and Floden, 2005; Ferrero, 2005).

On the other hand, in the mid 1990s, many developing countries in Latin America and Asia were at the receiving end of significant capital inflow which were allegedly not always used productively. The loss of lender confidence due to poor financial infrastructure and overvalued fixed exchange rates, *inter alia*, created an unsustainable current account deficit (Bernanke, 2005). This current account deficit resulted in a huge outflow of capital and also in some cases a full-blown currency crisis. Thus, the argument is that while in the U.S. an *inflow* of foreign capital caused deficit in the current account,[3] in other countries such as those in Latin America a deficit in the current account caused a large *outflow* of foreign capital. Thus, the direction in the causality of the relationship between current account deficit and movements of foreign capital can go both ways, and it is important that in analyzing the relationship between capital flow and current account one is clear about the endogeniety or otherwise of current account adjustments.[4]

This paper is an attempt to examine the relationship between capital inflow and current account deficit in a two period two country model with an emphasis on endogeneity of current account adjustments. Given the discussions above, we consider a number of variations in our model depending on whether balance of payment affects capital inflow (which is generally a characteristic of a developing country) or whether capital inflow causes balance of payment deficit (which is generally a characteristic of a developed country). Our model is simple but general enough to yield a clear relationship between capital inflow and current account. For example, when foreign capital inflows are exogenous, as suggested by some to be the case of the U.S., present and future foreign investments may have completely opposite effects on the current account. However, when current account balance is exogenous, as in the case of small developing open economies, an expansion of the threshold of current account deficit increases the level of future inward foreign investment when the degree of complementarity between domestic and foreign capital is very large, but will have no effect on the level of contemporaneous foreign investment. Furthermore, in the absence of of complementarity between domestic and foreign capital, an increase in current account deficit in

[3]For a recent attempt related to the U.S. current account deficit see Engel and Rogers (2006).

[4]Debelle and Galati (2005) argue that the literature does not clearly identify whether the current account adjustments are endogenous or exogenous. Their empirical findings suggests that current account adjustments in developed countries are endogenous event. Chinn and Prasad (2003) found that developed and developing countries adjust current account imbalances very differently.

a country unambiguously reduces the inflow of foreign capital into that country, as in the case of many Latin American countries in the 1990s.

There is a second related issue that we analyze in this paper, and it is the relationship between capital inflow/outflow and capital accumulation or domestic investment. Recently, Lane and Milesi-Ferretti (2006) found that foreign investment accounts for about 75 percent of developing countries equity liabilities. They also found that the correlation between current account and changes in net foreign assets for the period 1971-2004 for the industrial countries is 0.41 while the same figure for the emerging market economies is 0.66.

Mody and Murshid (2005), using a more recent data, report that the extent of the positive effect of incoming foreign investment on domestic investment becomes weaker as countries liberalized their capital account. They contend that the inability to absorb external capital is a limiting factor in developing countries. However, they found that on average each dollar of long-run capital flow raised domestic investment by 66 cents in their sample of 60 developing countries. Moreover, the surge of capital flows to emerging market economies during the 1990s was driven by diversification motive, they argued. If the marginal returns to capital are high in relation to world interest rate, substantial capital inflow will induce domestic investment and this will generate a strong positive relationship between foreign capital flows and domestic investment. Blanchard and Giavazzi (2002) observed this relationship in Greece and Portugal in the context of their joining the European Monetary Union. However, if an economy opens up for capital inflow but domestic returns are low or no higher than the world interest rate, foreign capital might come into a country due to diversification motive of the capital owners (Kraay and Ventura, 1999) and then we should not expect foreign capital to boost domestic investment.

On the other hand, using a larger cross-section of OECD countries, Desai *et al.* (2005) confirmed the Feldstein's (1995) finding that outward foreign investment reduce domestic capital formation almost dollar for dollar. However, a time-series data of the U.S. multinational firms yield a complementary relationship between outflow of foreign investment and domestic capital accumulation. An additional dollar of foreign capital expenditure is associated with 3.9 dollars of

domestic capital expenditures for U.S. multinationals. They argue that this contradictory evidence may be due to a number of issues including omitted variable bias. The authors believe that the U.S. time-series evidence is more reliable than that obtained from the OECD cross-section data. Firm level study by Desai *et al.* (2004) also provides support to the complementary relationship between the outflow of foreign investment and domestic investment.

In this paper foreign capital has been treated as a complementary input and thus increases the marginal productivity of domestic capital. Since the level of domestic investment depends on the marginal productivity of capital in period 2, foreign investment in period 2 increases domestic capital formation. This is the direct positive effect of foreign investment in period 2 on domestic investment. We also identify a second indirect channel via which foreign investment in period 2 affects domestic investment, and this operates via changes in the interest or discount rate. This indirect effect via the interest rate is shown to reduce domestic investment unambiguously. Thus, foreign investment in period 2 may as well reduce domestic investment. As for the effect of period 1 foreign investment, the indirect effect is the only effect that is present, and we derive a necessary and sufficient condition for foreign investments in period 1 to reduce the interest rate and thus increase domestic investment.

The layout of the paper is as follows. The following section starts with the derivation of our basic framework for analysis. After the setting up of the basic model, It is then divided into two subsections. In subsection 2.1 current account is endogenous, but foreign investments are exogenous. In contrast, in subsection 2.2, foreign investments are endogenous but the host country of foreign investment faces a binding current account constraint. There we examine how the levels of foreign investments are affected by the relaxation of the current account constraint.

2 The Basic Framework of Analysis

We consider two countries - labeled a and b, each with a two-period horizon, indexed by $t = 1, 2$ respectively. They produce a single good per period. The price of the good is normalized to unity,

and ρ^i is the discounted value of one unit of the good in period 2 in terms of the period-1 price in country a. Goods are labeled 1 and 2 respectively, depending on the period of production. Country i $(i = a, b)$ has an endowment of capital $\bar{K}^i$ in period 1 and invests I^i in that period making the endowment of capital $\bar{K}^i + I^i$ in period 2.[5]In addition to domestic capital, country a receives foreign investment from country b in each period and the amounts in periods 1 and 2 are F_1 and F_2 respectively. We assume that foreign capital and domestic capital are non-homogeneous in country a.

The production side of country a in periods 1 and 2 are represented by the revenue functions $R^{1a}(\bar{K}^a, F_1)$ and $R^{2a}(\bar{K}^a + I^a, F_2)$ respectively, and that of country b in the two periods are $R^{1b}(\bar{K}^b - F_1)$ and $R^{2b}(\bar{K}^b + I^b - F_2)$.[6] We assume that domestic capital and foreign capital are complements in Country a.[7] Formally,

ASSUMPTION **1** $\qquad R^{ia}_{12} \geq 0, \quad i = 1, 2.$

Furthermore, since we assume that there are factors of production other than the two types of capital in country a (see footnote 6), we also have

$$\Delta_1 = R^{2a}_{11} R^{2a}_{22} - (R^{2a}_{12})^2 > 0. \tag{1}$$

The consumption sides of the two countries are given by the two inter-temporal expenditure functions $E^a(1, \rho^a, u^a)$ and $E^b(1, \rho^b, u^b)$ where u^a and u^b are the total utility of a representative consumer in country a and b respectively.[8]

[5]For simplicity, we rule out depreciation of capital.

[6] All factors other than capital and contemporaneous output price (which is unity) are suppressed in the revenue functions as they do not change in our analysis. As is well known the partial derivative of a revenue function with respect to the price of a good gives the output supply function of that good. Similarly, the partial derivative of a revenue function with respect to a factor endowment gives the price of that factor. The revenue functions are positive semi-definite in prices and negative semi-definite in the endowments of the factors of production. In particular, they satisfy $R^{ia}_{jj} < 0$ and $R^{ib}_{11} < 0$ for $j = 1, 2$ and $i = 1, 2$. For these and other properties of revenue functions see Dixit and Norman (1980).

[7]Since most foreign investments come through joint ventures and also through mergers and acquisition of companies (Giovanni, 2005) the complementary between foreign capital inflow and domestic investment is a reasonable assumption to make.

[8]The partial derivative of an expenditure function with respect to the price of a good gives the Hicksian compensated demand function for that good. Moreover, the the matrix of second order partial derivatives of the prices, which represent the own- and cross- price effects, is negative semi-definite. For this and other properties of expenditure function see, for example, Dixit and Norman (1980).

The budget balance equations for the representative consumers in the two countries are given by

$$E^a(1, \rho^a, u^a) + I^a = R^{1a}(\bar{K}^a, F_1) + \rho^a R^{2a}(\bar{K}^a + I^a, F_2) - R_2^{1a} F_1 - \rho^a R_2^{2a} F_2, \tag{2}$$

$$E^b(1, \rho^b, u^b) + I^b = R^{1b}(\bar{K}^b - F_1) + \rho^b R^{2b}(\bar{K}^b + I^b - F_2) + R_2^{1a} F_1 + \rho^b R_2^{2a} F_2, \tag{3}$$

The left hand sides are the present value of expenditures and the right hand sides are the discounted present value of gross domestic products, and the present value of repatriated incomes. The repatriated incomes are negative for country a and positive for country b since foreign capital flow assumed to to be from the latter to the former.

The levels of domestic investments are determined optimally for given level of ρ and the factor prices. Differentiating (2) and (3) and setting $\partial u^a/\partial I^a = 0$ and $\partial u^b/\partial I^b = 0$, we get respectively

$$\rho^a R_1^{2a} = 1, \tag{4}$$

$$\rho^b R_1^{2b} = 1. \tag{5}$$

The right hand side is the marginal cost of investment (loss of consumption in period 1) and the left hand side is present value of the marginal benefit (increased consumption in period 2).

Finally borrowing by country a, denoted by B, and lending by country b, denoted by L, in period are defined as

$$B \equiv E_1^a + I^a - (R^{1a} - R_2^{1a} F_1), \tag{6}$$

$$L \equiv R^{1b} + R_2^{1a} F_1 - E_1^b - I^b, \tag{7}$$

which are respectively the excess of expenditure over income in period 1 in country a and the excess of income over expenditure in period 1 in country b. Note that a positive borrowing in our framework is equivalent to a deficit in current account.

We shall assume that the rental rates of capital in country a (the recipient of foreign investment) is larger than that in country b (the source) in both periods.

ASSUMPTION **2** $\qquad R_2^{1a} > R_1^{1b} \quad \textit{and} \quad R_2^{2a} > R_1^{2b}.$

The discount factors $\rho^i,\ i = a, b$, are determined in the market-clearing condition in the international financial capital and they may be different in the presence of some friction in the market. For the determination of the discount rates we shall consider two scenarios. In the first (subsection 2.1), the levels of foreign investments are exogenous, but the international credit market is perfect so that $\rho^a = \rho^b$. In the second which is taken up in subsection 2.2, we assume that country a is subject to a current account constraint and the levels of foreign investments are endogenous.

2.1 Exogenous Foreign Investment

In this section we take F_1 and F_2 as exogenous and the common discount rate $\rho = \rho^a = \rho^b$ is determined by equation B and L defined in equations (6) and (7) respectively. That is,

$$E_1^a + I^a - (R^{1a} - R_2^{1a}F_1) = R^{1b} + R_2^{1a}F_1 - E_1^b - I^b. \tag{8}$$

We now have five equations in (2)-(5) and (8), and five endogenous variables $u^a,\ u^b$, $I^a,\ I^b$, and ρ.

Differentiating (2) and (3) and using (8), we get:[9]

$$E_u^a\ du^a = \frac{B}{\rho}\cdot d\rho - F_1 R_{22}^{1a} dF_1 - \rho F_2 R_{22}^{2a} dF_2 - \rho F_2 R_{21}^{2a} dI^a, \tag{9}$$

$$\begin{aligned} E_u^b\ du^b = &-\frac{L}{\rho}\cdot d\rho + [R_2^{1a} - R_1^{1b} + F_1 R_{22}^{1a}]dF_1 \\ &+ [\rho R_2^{2a} + \rho F_2 R_{22}^{2a} - 1]dF_2 + \rho F_2 R_{21}^{2a} dI^a \end{aligned} \tag{10}$$

The first terms in (9) and (10) are the intertemporal terms-of-trade effects. An increase in ρ (which means a decrease in the implicit interest rate) makes the borrower better off and the lender worse off. The last three terms in (9) are due to changes in repatriated profits via changes in the rental rates of capital: an increase in F_1 reduces the rental rate in period 1 and that in

[9] Since $E^a(\cdot)$ and $E^b(\cdot)$ are homogeneous of degree 1 in the prices $(1,\ \rho)$, one can derive that $B = \rho[R^{2a} - E_2^a - R_2^{2a}F_2]$ and $-L = \rho[R^{2b} - E_2^b + R_2^{2b}F_2]$. These two expression have been used to simplify the following two equation.

either F_2 or I^a reduces the rental rate of capital in period 2. An increase in F_1 has two effects on the utility level in country b. First, it reduces utility because of a reduction in repatriated income in period 1 ($F_1 R_{22}^{1a}$). Second, it increases utility as it commands a larger rental rate in country a than in country b ($R_2^{1a} - R_1^{1b}$). F_2 has similar two effects on u^b. Finally, an increase in I^a reduces repatriated profits in period 2 and thus welfare in country b.[10]

As for the effects on the levels of domestic investments, differentiating (4) and (5), we get

$$dI^a = -\frac{R_1^{2a}}{\rho R_{11}^{2a}} \cdot d\rho - \frac{R_{12}^{2a}}{R_{11}^{2a}} \cdot dF_2, \tag{11}$$

$$dI^b = -\frac{R_1^{2b}}{\rho R_{11}^{2b}} \cdot d\rho + dF_2. \tag{12}$$

An increase in ρ raises the marginal benefit of domestic investments and thus the levels of it in the two countries. An increase in F_2 raises the rental rate of domestic capital in country a as the two types of capital are assumed to be complements (assumption 1) and thus the marginal benefit of domestic investment. Thus an increase in an inward foreign investment stimulates domestic investment. An outward foreign investment from country b, i.e., an increase in F_2 raises the rental rate of capital there and thus the level of domestic investment. Note that F_1 affects domestic investments only via changes in the discount rate.

For determining the effects on the discount parameter ρ, we differentiate (8) and use (9)-(12) to obtain

$$\begin{aligned} \Delta \, d\rho = & \left[R_2^{1a}(c_y^{1a} - c_y^{1b}) \left\{ -\epsilon_{22}^{1a} + 1 - \frac{R_1^{1b}}{R_2^{1a}} \right\} + (1 - c_y^{1a})(R_2^{1a} - R_1^{1b}) \right] \, dF_1 \\ & + \left[\frac{\rho F_2 \Delta_1 (c_y^{1a} - c_y^{1b})}{R_{11}^{2a}} - c_y^{1b}(\rho R_2^{2a} - 1) + \frac{R_{12}^{2a}}{R_{11}^{2a}} - 1 \right] \, dF_2, \end{aligned} \tag{13}$$

where

$$c_y^{1a} = \frac{E_{1u}^a}{E_u^a}, \quad c_y^{1b} = \frac{E_{1u}^b}{E_u^b}, \quad \epsilon_{22}^{1a} = -\frac{\partial R_2^{1a}}{\partial F_1} \cdot \frac{F_1}{R_2^{1a}}$$

$$\Delta = E_{12}^a + E_{12}^b + \frac{B(c_y^{1a} - c_y^{1b})}{\rho} + F_2 R_1^{2a}(c_y^{1a} - c_y^{1b}) \cdot \frac{R_{12}^{2a}}{R_{11}^{2a}} - \frac{R_1^{2a}}{\rho R_{11}^{2a}} - \frac{R_1^{2b}}{\rho R_{11}^{2b}}$$

[10] Note that the direct effects of I^a and I^b on u^a and u^b are absent as these two are optimally chosen (the Envelope property).

c_y^{1i} is the marginal propensity to spend in period 1 in country i ($i = a, b$), and Δ is the slope of the uncompensated excess demand for loan function with respect to ρ. Since ρ varies inversely with the implicit interest rate, Δ has to be positive for the Walrasian stability of the international credit market.

As mentioned before, an increase in F_1 increases income in country a in period 1 and reduces it in country b via changes in repatriated income, and the magnitude of this effect is given by the size of ϵ_{22}^{1a}. The former effect would reduces demand for loan and the latter would reduce supply of loan. The magnitude of these two effects depends on the sizes of $(1 - c_y^{1a})\epsilon_{22}^{1a}$ and $(1 - c_y^{1b})\epsilon_{22}^{1a}$ respectively. The demand-side and the supply-side effects on equilibrium value of ρ are conflicting, and the net effect on ρ is positive if and only if $c_y^{1a} < c_y^{1b}$. An increase in F_1 also increases income in country b as $R_2^{1a} > R_1^{1b}$. This would increase the supply of loan and thus the equilibrium value of ρ. The overall net effect on ρ is positive if $(c_y^{1a} - c_y^{1b})(1 - \epsilon_{22}^{1a} - R_1^{1b}/R_2^{1a}) > 0$. An increase in F_2 also changes income in the two countries via reduction in repatriated profits in period 2, and the net effect of it on the equilibrium value of ρ once again is positive if and only if $c_y^{1a} < c_y^{1b}$. Like F_1, F_2 also increases income in country b as the rental rate of foreign capital in country a in period 2 (R_2^{2a}) is larger that the rental rate of capital in country b in the same period (R_1^{2b}), the latter being equal to $1/\rho$ (see (5)). Finally, an increase F_2 increases domestic investments in both countries and this reduces the demand for loan in country a and reduces the supply of loan in country b. The effect on the equilibrium ρ is negative and is given by the last two terms in the coefficient of dF_2 in (13).

We now make the further assumption that the propensity to spend in period 1 is higher in the foreign investment receiving country than in the source country. That is:

ASSUMPTION **3** $\qquad c_y^{1a} > c_y^{1b}$.

From assumptions (1)-(3), it follows that a sufficient condition for an increase in F_1 to

increase ρ is that $\epsilon_{22}^{1a} + R_1^{1b}/R_2^{1a} < 1$, and that in F_2 always reduces ρ. That is,

$$\frac{\partial \rho}{\partial F_1} > 0 \quad \text{if} \quad \epsilon_{22}^{1a} + \frac{R_1^{1b}}{R_2^{1a}} < 1,$$

$$\frac{\partial \rho}{\partial F_2} < 0. \tag{14}$$

The effect on an inward shift in the demand for loan curve (due to an increase in F_1) outweigh the shift to the left of the supply of loan curve if $\epsilon_{22}^{1a} + R_1^{1b}/R_2^{1a} < 1$, reducing the interest rate (or, increasing the discount factor). As discussed after (13), an increase in F_2 shifts the demand for loan curve outward, but the supply for loan function could shift either to the left or to the right, and if c_y^{1b} is not very large the supply function would in fact shift to the left. Under our assumption that $c_y^{1a} > c_y^{1b}$, the net effect on the discount factor of an increase in F_2 is always negative.

From (11), (12) and (14), it follows that an increase in F_1 increases domestic investments in both countries if $\epsilon_{22}^{1a} + R_1^{1b}/R_2^{1a} < 1$ as in this case the direct effect and the terms-of-trade effect work in the same direction. However, the effects of an increase in F_2 has two opposite effects: the direct effects increase domestic investments, but the indirect effects via changes in the intertemporal terms of trade reduces the levels of domestic investments. In general the net effect is ambiguous, but the terms-of-trade effect will be large if, for example, $c_y^{1b} \simeq 0$ and the intertemporal substitution effect in consumption in country a (E_{12}^a) is large, in which case an increase in F_2 will reduce the levels of domestic investments. Formally,

PROPOSITION **1** *An increase in the level of foreign investment in the first period increases the levels of domestic investment in both countries if* $\epsilon_{22}^{1a} + R_1^{1b}/R_2^{1a} < 1$. *An increase in foreign investment in the second period may or may not increase domestic investments, and will reduce domestic investments if the terms of trade effect is strong, which is the case when* $c_y^{1b} \simeq 0$ *and* $E_{12}^a >> 0$.

As mentioned in the introduction, Desai *et al.* (2005) observe a positive relationship between an outflow of capital and domestic investment while examining time-series data of U.S. multinational firms; but cross-section data from OECD countries yield a negative relationship between

the two variables. Mody and Murshid (2005) found a complementary relationship between capital inflow and domestic investment. All these results can be nested in our model with different assumptions about (a) the degree of complementarity between domestic and foreign capital, (b) the strength of the terms of trade effect, and (c) the timing of foreign capital inflow.

Finally, in order to examine the effect of increased international mobility of physical capital on the mobility of financial capital or borrowing, we differentiate the left hand side of (8), we obtain

$$dB = \left[E_{12}^{a} + \frac{c_y^{1a} B}{\rho} + F_2 R_1^{2a} c_y^{1a} \cdot \frac{R_{12}^{2a}}{R_{11}^{2a}} - \frac{R_1^{2a}}{\rho R_{11}^{2a}} \right] d\rho \tag{15}$$

$$+ F_1 R_{22}^{1a} (1 - c_y^{1a})\, dF_1 - \frac{\rho F_2 c_y^{1a} \Delta_1 + R_{12}^{2a}}{R_{11}^{2a}}\, dF_2.$$

There are two opposite effects on the equilibrium amount of borrowing. An increase in F_1 reduces the demand for loan (for a given level of ρ) by increasing period-1 income, but increases the amount of borrowing by reducing the interest rate (increasing the discount factor) if $\epsilon_{22}^{1a} + R_1^{1b}/R_2^{1a} < 1$. An increase in F_2 on the other hand, increases the demand for loan (for a given level of ρ) by increasing period-2 income, but reduces the amount of borrowing by increasing the interest rate. That is, when the terms-of-trade effect is not strong, borrowing will go down with an increase in period-1 foreign investment, but will go up with an increase in period-2 foreign investment. When, on the other hand, the terms-of-trade effect is strong, borrowing may go up with an increase in period-1 foreign investment, but may go down with an increase in period-2 foreign investment. That is, the qualitative effect of a change in foreign investment on the level of borrowing may depend whether the foreign investment is contemporaneous or in the future. Note that the terms of trade effect will be strong when $c_y^{1b} \simeq 0$ and $E_{12}^{a} >> 0$.

PROPOSITION **2** *Period-1 and period-2 foreign investments may have completely opposite qualitative effects on the level of current account deficit.*

The large current account deficit (borrowing) resulting from exogenous capital inflow into the U.S., as suggested by Bernanke (2005) and Snow (2006), can be easily derived from our model

provided we consider the inflow of capital to be contemporaneous and the terms-of-trade effect be strong. However, if the terms-of-trade effect is weak their suggestion may not hold. The effect of future foreign investment is just the opposite: their suggestion would hold for future foreign investment if the terms-of-trade effect is weak, but not if it is strong.

2.2 Current account constraint

In this section we assume that country a is subject to a current account (borrowing) constraint. In other words, the the level of borrowing defined in (6) is exogenously given at the level $\bar{B}$. That is,

$$E_1^a + I^a - (R^{1a} - R_2^{1a} F_1) = \bar{B}. \tag{16}$$

Because of this constraint, which we shall assume to be binding, there will be a wedge between the discount rates in the two countries, and in particular we shall have $\rho^a < \rho^b$. The loan supply function defined in (7) is then also restricted by

$$R^{1b} + R_2^{1a} F_1 - E_1^b - I^b = \bar{B}. \tag{17}$$

Furthermore, the levels of foreign investments in the two periods are determined by equating the rates of return in the two countries in the two periods separately, i.e.,

$$R_2^{1a} = R_1^{1b}, \tag{18}$$

$$R_2^{2a} = R_1^{2b}, \tag{19}$$

Finally, domestic investments in the two countries are determined as before from (4) and (5) which are repeated here for the sake of completion:

$$\rho^a R_1^{2a} = 1, \tag{4a}$$

$$\rho^b R_1^{2b} = 1. \tag{5a}$$

The source of the current account constraint can be a number of agents in our model. It can represent a control on the inflow of financial foreign capital imposed by government in the borrowing country (country a). It can also represent a control of the outflow of financial imposed

by the government in the lending country (country b). Finally, it can be imposed by the private banking sector in the lending country.[11] In this paper we shall leave the interpretation open and simply write equations (16) and (17) as

$$B(\rho^a) = \bar{B}, \tag{20}$$

$$L(\rho^b) = \bar{B}, \tag{21}$$

where $B(\cdot)$ and $L(\cdot)$ are respectively the compensated loan demand and loan supply functions with $B' > 0$ and $L' < 0$.[12]

The endogenous variables in this model which are $I^a,\ I^b,\ \rho^a,\ \rho^b,\ F_1$ and F_2 and these are solved from the six equations in (18)-(21). Under this framework, we shall analyze the effects of a relaxation of the current account constraint on the levels of domestic investments in the two countries I^a and I^b, and foreign investments in the two periods F_1 and F_2.

First of all from (18) it is evident that a change in $\bar{B}$ will have no effect on the level of foreign investment in period 1. That is,

$$\frac{dF_1}{d\bar{B}} = 0.$$

Differentiating (4a) and (5a), we get

$$dI^a = -\frac{R_1^{2a}}{\rho^a R_{11}^{2a}} \cdot d\rho^a - \frac{R_{12}^{2a}}{R_{11}^{2a}} \cdot dF_2, \tag{22}$$

$$dI^b = -\frac{R_1^{2b}}{\rho^b R_{11}^{2b}} \cdot d\rho^b + dF_2. \tag{23}$$

The explanations are similar to those of (11) and (12).

Finally, differentiating (19)-(21) and using (19), (20) and (21), we get:

$$\frac{d\rho^a}{d\bar{B}} = \frac{1}{B'} > 0, \tag{24}$$

$$\frac{d\rho^b}{d\bar{B}} = \frac{1}{L'} < 0, \tag{25}$$

$$\frac{\Delta_1}{(-R_{11}^{2a})} \cdot \frac{dF_2}{d\bar{B}} = \frac{R_2^{2a}}{\bar{B}} \cdot \left[\frac{\epsilon_{21}^{2a}}{\epsilon_{11}^{2a} \epsilon_{B}} - \frac{1}{\epsilon_{L}} \right], \tag{26}$$

[11] See Jafarey and Lahiri (2004) for a micro-foundation of the borrowing constraint.

[12] Note that the discount factors are inversely related to the interest rates.

where

$$\epsilon_{21}^{2a} = \frac{\partial R_2^{2a}}{\partial \bar{K}^a + I^a} \cdot \frac{\bar{K}^a + I^a}{R_2^{2a}} = R_{21}^{2a} \cdot \frac{\bar{K}^a + I^a}{R_2^{2a}} \geq 0, \tag{27}$$

$$\epsilon_{11}^{2a} = -\frac{\partial R_1^{2a}}{\partial \bar{K}^a + I^a} \cdot \frac{\bar{K}^a + I^a}{R_1^{2a}} = -R_{11}^{2a} \cdot \frac{\bar{K}^a + I^a}{R_1^{2a}} > 0, \tag{28}$$

$$\epsilon_{_B} = \frac{\partial B}{\partial \rho^a} \cdot \frac{\rho^a}{B} = B^{'} \cdot \frac{\rho^a}{\bar{B}} > 0, \tag{29}$$

$$\epsilon_{_L} = -\frac{\partial L}{\partial \rho^b} \cdot \frac{\rho^b}{L} = -L^{'} \cdot \frac{\rho^b}{\bar{B}} > 0. \tag{30}$$

An increase in $\bar{B}$ affects F_2 via changes in I^a and I^b. An increase in I^a increases the marginal productivity of F_2 in country a since domestic and foreign capital are assumed to be complementary (see assumption 1), and therefore the level of inward foreign investment. An increase in I^b reduces the rate of return on capital in country b and therefore encourages the level of outward investment from country b. Since an increase in $\bar{B}$ reduces ρ^a and increases ρ^b and an increase in the discount rate in a country is related positively with the level of domestic investment in that country, the net effect of an in increase in $\bar{B}$ on the level of foreign investment in period 2 (F_2) is in general ambiguous as can be seen from (26). However, it is also clear from (26) that an increase in $\bar{B}$ will increase F_2 is the degree of complementarity between domestic and foreign capital in country a, represented by the elasticity ϵ_{21}^{2a} is sufficiently high. Intuitively, if the degree of complementarity is high, then an inflow of foreign capital in period 2 increases domestic investment in country a significantly increasing the demand for loan by a large amount. On the other hand, if the degree of complementarity domestic and foreign capital is very low , i.e., $\epsilon_{21}^{2a} \simeq 0$, then an increase in $\bar{B}$ (the the level of current account deficit in country a) unambiguously reduces the inflow of foreign capital there.

Turning to the effects of domestic investments, first of all note from (22) that if ϵ_{21}^{2a} is sufficiently high for F_2 to increase with $\bar{B}$, the level of domestic investment in country a (I^a) will also increase with $\bar{B}$, but the effect on I^b is still ambiguous since F_2 and ρ^b move in the opposite direction. An increase in F_2 (outflow of capital from country b) increases the rate of return on capital in country b and thus the level of investment in that country. However, a decrease in ρ^b

would reduce I^b. However, one can show that if ϵ_{21}^{2a} is very large then the former effect will dominate the latter one, and an increase in $\bar{B}$ will also increase I^b. Furthermore, if $\epsilon_{21}^{2a} \simeq 0$, an increase in $\bar{B}$ unambiguously reduces F_2. These results are summarized in the following proposition.

PROPOSITION **3** *An increase in current account deficit in country a increases the level of inward foreign investment in that country in period* 2 *and the levels of domestic investments in both countries if the degree of complementarity between domestic and foreign capital in country a is sufficiently high, and it has no effect on the level of foreign investment in period 1. If the degree of complementarity between domestic and foreign capital in country a is zero, an increase in current account deficit there unambiguously reduces the inflow of foreign capital into that country.*

To summarize, we find that when the degree of complementarity between domestic and foreign capital is high, the relationship between the inflow of financial and physical capital is a positive one. Also, under the same condition, the endogenous relationship between domestic investment and inward foreign investment and that between domestic investment and outward foreign investment (both induced by an exogenous increase in the flow of financial capital) are positive.

As mentioned in the introduction, it is widely believed that a large current account deficit in some countries in Latin America in the 1990s, led to a significant decrease in foreign investment in those countries. The above proposition can be reconciled with this fact provided the degree of complementarity between domestic and foreign capital in those countries is small.

Comparing the results in subsection 2.1 (the case of exogenous foreign investments) with those in subsection 2.2 (the case of current account constraint), we note the following interesting contrasts. An increase in F_1 does have an effect on the level of borrowing, but a change in the level of borrowing has no effect on F_1. Similarly, the relationship between F_2 and the level of current account deficit can depend on the causality, i.e., which one is exogenous and which one is endogenous. Finally, the relationship between domestic investments and the foreign capital mobility

depends on the nature of the foreign capital, i.e.. whether it is physical or financial ot whether foreign investment is in period 1 or period 2.

3 Conclusion

The interrelationships between current account imbalances, foreign investment (both inward and outward) and domestic investment have been subject to a lot of discussions in the literature. There are two strands in the literature. One examines the relationships between current account imbalance and foreign investment, and the second considers the relationship between domestic and foreign investments. This paper develops a united structure to examine both issues.

As for the first relationship, the direction of causality is thought to depend on the country one considers. For example, in countries such as the U.S., inward foreign investment is sometimes blamed for massive current account deficit. On the other hand, in many Latin American countries huge current account deficits appear to have caused large scale capital outflow. We deal with the issue of causality by considering two versions of the model: one in which foreign investment is exogenous and another in which current account deficit (or borrowing) is exogenous. In the first case, we find the present and future foreign investments may have completely opposite effects on current account. For the second case, an increase in current account deficit can actually increase the inflow of future foreign investment if domestic and foreign capital are sufficiently complementary. However, in th absence of complementarity between domestic and foreign capital, an increase in current account deficit in a country unambiguously reduces the inflow of foreign capital into that country.

As for the relationship between domestic and foreign investments, we derive conditions under which present and future foreign investments increase domestic capital accumulation. The effect of foreign investments on the interest rate, and thus on the level of domestic capital accumulation, can go either way.

To summarize, our analysis shows that the the nature of interrelationship between current

account deficit, foreign investment and domestic capital accumulation depends crucially on the degree of complementarity between domestic and foreign capital and on the causality in their relationships.

References

[1] Backus, D., E. Henriksen, F. Lambert, and C. Telmer (2005). Current Account Fact and Fiction, mimeo, New York University.

[2] Bernanke, B. (2005). The Global Saving Glut and the U.S. Current Account Deficit, *Sandridge Lecture*, Virginia Association of Economics, Richmond, VA.

[3] Blanchard, O., and F. Giavazzi (2002). Current Account Deficits in the Euro Area: the End of the Feldstein-Horioka Puzzle? *Brookings Papers on Economic Activity* 2, 147-210.

[4] Blonigen, Bruce A., (2005). A Review of the Empirical Literature on FDI determinants, mimeo, Department of Economics, University of Oregon.

[5] Bosworth, B., and S. M. Collins (1999). Capital Flows to Developing Economies: Implications for Savings and Investment, *Brookings Papers on Economic Activity* 1,143-169.

[6] Chinn, M., and E. Prasad (2003). Medium-Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration, *Journal of International Economics* 59, 47-76.

[7] Debelle , G. and G. Galati (2005). Current Account Adjustment and Capital Flows, BIS Working Paper No. 169, Basel; Bank of International Settlements.

[8] Desai, Mihir A., C. Fritz Foley, and James R. Hines Jr.,(2004). Foreign Investment and Domestic Economic Activity, mimeo, Harvard University.

[9] Desai, Mihir A., C. Fritz Foley, and James R. Hines Jr.,(2005).Foreign Direct Investment and the Domestic Capital Stock, *NBER Working Paper 11075*, January.

[10] Dixit, Avinask K. and Victor Norman (1980). *Theory of International Trade*, Cambridge University Press.

[11] Domeij, D. and M. Floden (2005). Population Aging and International Capital Flows, mimeo., Stockholm School of Economics.

[12] Edwards, E. (2005). Is the U.S. Current Account Deficit Sustainable? If Not, How Costly Is the Adjustment Likely to Be?, Brookings Papers on Economic Activity, 1, pp. 211-288.

[13] Engel, C. and J. Rogers (2006). The U.S. Current Account Deficit and the Expected Share of World Output, mimeo.

[14] Feldstein, Martin S.(1995). The Effects of Outbound Foreign Direct Investment on the Domestic Capital Stock, in Martin Feldstein, James R. Hines Jr. and R. Glen Hubbard, eds., *The Effects of Taxation on Multinational Corporations*. Chicago: University of Chicago Press, pp 43-66.

[15] Kraay, A., and J. Ventura (1999). Current Account in Debtor and Creditor Countries, *The Quarterly Journal of Economics* 115, 1137-1166.

[16] Lane, Philip R., and Gian Maria Milesi-Ferretti (2006). The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liablilities, 1970-2004, *IMF Working Paper* 69, March.

[17] Mody, Ashoka, and Antu Panini Murshid (2005). Growing Up With Capital Flows, *Journal of International Economics* 65, 249-266.

[18] Obstfeld, M and K Rogoff (2004). The Unsustainable US Current Account Position Revisited, National Bureau of Economic Research Working Paper 10869.

[19] Snow, J.W. (2006). Don't Blame Just Us, Washington Post, Friday, April 21, 2006; A 23.