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FDI, Foreign Affiliate Operations, and the Transfer Process: Macroeconomic Adjustment to FDI Inflows in the Case of Costa Rica

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The theoretical and empirical literature on the macroeconomic effects of capital inflows posits that a net inflow of foreign capital leads to an equilibrium real exchange rate (RER) appreciation through an expansion in aggregate demand. But this literature fails to distinguish between the different types of flows, or their specific mechanisms of influence. This paper analyses the adjustment process to FDI inflows in the case of Costa Rica, and focuses on whether, to what extent and through what mechanisms such adjustment requires a RER appreciation. It argues that a study of the process of macroeconomic adjustment to a net inflow of FDI –the transfer process- should not be detached from an investigation into the trade and financial practices of the foreign-owned firms towards which FDI flows. A two-sector model is developed to capture the basic interactions between foreign investment, domestic investment and the RER. It shows that the sectoral allocation of FDI, the response of domestic investment to exogenous changes in the foreign capital stock, the input composition of foreign capital, and the financial practices of foreign investors, are crucial determinants of the long-run equilibrium RER. The paper also includes two empirical parts. The first one provides an overview of the general trends of aggregate FDI inflows into Costa Rica between 1970-99, and analyses some data on the trade and financial patterns of foreign affiliates operating in the country. The second undertakes an econometric examination of the impact of FDI on output, investment, exports, imports and the RER, using cointegration techniques. The study is based on annual data for the period 1970-99. It is found that FDI exerts a strong negative impact on the equilibrium RER.

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I. Introduction

The study of the economic impact of foreign direct investment (FDI) on the recipient country has been shaped by diverging theoretical approaches, depending on whether the subject of analysis is the multinational company (MNC) and its foreign affiliates, or FDI as a category within the balance of payments. When the focus is on employment, technology transfer, competition, or taxation, researchers tend to concentrate on the MNC and on specific microeconomic channels of transmission: technology and human capital spillovers, economies of scale and agglomeration, industrial structure, foreign market access. FDI is thus regarded as a bundle of capital, technology and skills.[2] By contrast, the open-economy macroeconomics literature tends to merge FDI with other components of the capital account, in order to explore their effects on aggregate spending. FDI is then treated as an unembodied or unattached financial flow.[3] The divorce of the two strands is particularly apparent in the standard analysis of the macroeconomic adjustment to FDI and other capital inflows, a subject of much current attention.

After a decade of limited access to international financial markets, many Asian and Latin American countries experienced a resurgence of inward foreign capital in the 1990s. While the theoretical benefits for developing economies of increased international financial integration have been acknowledged,[4] particular concern in economic research has turned on the macroeconomic problems associated with large capital inflows: excessive current account deficits, overheating, real exchange rate (RER) appreciation.[5] From a static, balance-of-payments accounting perspective, net resource transfers must be translated –for a given level of international reserves- into an increased trade deficit (or a reduced trade surplus). But a crucial question is how this transfer process is effected; i.e. what is the set of economic adjustment mechanisms through which a net capital transfer is reflected in the trade balance. The standard theoretical explanation, based on the Salter-Swan-Corden dependent economy framework, is that a surge in capital inflows will trigger an expansion in aggregate demand, which –for exogenously given prices of traded goods- will push up the relative price of nontradables –a RER appreciation. This, in turn, will in induce a

[2] See De Mello (1997) for a comprehensive survey of the FDI-growth literature.

[3] White (1986) argues that the analysis of FDI within the macroeconomics literature has been depersonalised –the talk is on FDI, rather than MNCs- and trivialised –FDI is analysed in mere macroeconomic (or accounting) terms, as just another sort of external financing.

[4] In a simple static two-country model, MacDougall (1960) shows that an inflow of capital increases welfare in the recipient (as well as in the capital-exporting) country because it raises the marginal product of labour –and thus wages- by more than the decline in the marginal product of domestically-owned capital. Capital flows may also be beneficial, as posited in the two-gap models of McKinnon (1964) and Chenery and Strout (1966), because they relax savings or foreign exchange constraints on growth in the host country. Furthermore, intertemporal models of the current account (Razin, 1995; Obstfeld and Rogoff, 1996) claim that capital flows can benefit the capital importing country by allowing it to smooth consumption over time.

[5] There are other detrimental effects of capital inflows that the literature has emphasised: surges in bank lending, leading to 'over-borrowing' and inefficient investment; asset price booms, which may fuel bubbles and worsen the overheating of the economy; destabilising financial effects of capital volatility, especially in the case of sudden reversals.For a comprehensive survey of all the relevant issues involved –causes, consequences, and policy implications of capital inflows- see Agenor and Montiel (2000).

shift of demand towards tradable goods and a re-allocation of productive resources into the non-traded sector, thereby expanding the current account deficit.[6]

This literature, however, does not normally make an explicit distinction between the different types of flows or the specific mechanisms through which each of them affects aggregate demand, the current account and the RER.[7] Some analysts have suggested that FDI might have a lower impact on the RER than other flows, for a number of reasons. It is argued that FDI inflows directly finance the imports of capital goods (Kamin and Wood, 1998); that they are not usually intermediated through the domestic banking system, and thus do not lead to an expansion in domestic credit (Calvo, Leiderman and Reinhart, 1993); or that they are likely to crowd in domestic investment, which stimulates imports and expands the supply of home goods in the recipient country (Reisen, 1998). But these claims are hypothetical and not supported with formal analytical examination or empirical evidence.

Another instance of disjunction in the economic treatment of FDI is the issue of its financial contribution. In view of the crises triggered by the sudden reversal of volatile capital flows, many macroeconomists and policymakers have favoured FDI as a comparatively beneficial source of foreign finance. Usually underscored financial advantages of FDI include its greater resilience[8] and the pro-cyclical nature of FDI-related income payments.[9] However, both theoretical and empirical studies on MNC financial operations warn that the net financial contribution by foreign affiliates to the recipient economy might be limited. In its financing decision, a multinational company (MNC) is confronted with a trade-off between cost of capital and host-country risk hedging. The international scope of an MNC's operations imply higher agency costs than those of purely domestic enterprises (Jensen and Meckling, 1976; Lee and Kwok, 1988). Thus, the MNC faces an increasing marginal cost of external funds, and where possible, it will finance its international capital expenditures with internally generated cash flows (i.e. intra-MNC funds). On the other hand, the MNC has incentives to borrow as much as possible in the host country in order to hedge against exchange (and, eventually, political) risk.[10] The evidence suggests that this is the case: the most robust conclusion from empirical studies on MNC's financial

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[6] This sectoral adjustment in demand and supply is analogous to the problem caused by a boom in an export sub-sector, as analysed for instance by Corden (1984) or Neary and van Wijnbergen (1986), and is therefore generally –though somewhat inaccurately- referred to as the "Dutch disease" effect of capital inflows. For a survey and discussion on the transfer problem, in connection with capital inflows, see Eaton (1989). For a recent application of the transfer problem to the analysis of the Asian crisis, see Krugman (1999).

[7] Notable exceptions are Fry (1997) and Vines and Warr (2000).

[8] Empirical studies have generally confirmed that FDI is less volatile (Chuhan, Perez-Quiros and Popper, 1996; World Bank, 1999) or has a larger permanent component (Sarno and Taylor, 1999) than other capital inflows. In a frequently cited paper, Claessens, Dooley and Warner (1995) find that FDI and other long-term flows are no less volatile than other components of the capital account. However, their study is based on the time-series behaviour of *net* capital flows (i.e. deducting investments abroad by domestic residents). As Reisen (1998) argues, what matters for developing countries –in terms of possible reversals- is the volatility of *gross* inflows.

[9] Profits of foreign affiliates tend to be positively linked to the performance of the host economy, and so FDI liabilities are easier to service (UNCTAD, 2000).

[10] See, for instance, the models developed by Stevens (1972), Hartman (1979), Goldsbrough (1979), and Gilman (1981). As Caves (1996) points out, the MNC plays a double role in dealing with risk: as a supplier of diversification services to risk-averse creditors and shareholders, and as a risk-averse actor itself in its international operations. It seems, however, that in financial decisions risk aversion tends to prevail over agency costs and the portfolio diversification motive.

patterns is that the main sources of finance for foreign affiliates are funds accumulated (retained earnings) or borrowed in the host economy.[11] Moreover, because of implicit or explicit guarantees by parent companies, affiliates tend to have preferential access to host country bank lending, and might therefore crowd-out domestic investment (Shapiro, 1978; Caves, 1996). Also, the provision of foreign finance by MNCs to the host country is generally a function of the life cycle of the subsidiary. As the affiliate matures, parent funds tend to fall and investment-income payments from the subsidiary to increase.[12] Finally, some researchers have argued that high profit repatriation ratios make FDI a very expensive source of foreign finance, relative to the cost of international borrowing (Bos, et al., 1974; Lall and Streeten, 1977; Kitchen, 1986). Profit-shifting through intra-firm transfer pricing practices, mostly to minimise global tax payments, might further reduce the net provision of investible resources by foreign direct investors.[13]

This paper analyses the adjustment process to FDI inflows in the case of Costa Rica. It is based and structured on the argument that such macroeconomic adjustment cannot be fruitfully investigated without a study of the trade and financial practices of foreign affiliates in the country. The paper focuses on how the transfer process with regards to FDI inflows is effected, and in particular on whether, to what extent and through which mechanisms adjustment to inward FDI brings about a RER appreciation.

The paper consists of six sections. Section II develops a two-sector model to capture the basic interactions between foreign investment, domestic investment and the RER. It shows that the sectoral allocation of FDI, the response of domestic investment to exogenous changes in the foreign capital stock, the input composition of foreign capital, and the financial practices of foreign investors, are crucial determinants of the long-run equilibrium RER. Section III is divided in two parts. The first provides an overview of the general trends of aggregate FDI inflows into Costa Rica in the period 1970-99: composition, servicing costs, sectoral allocation. In the second part, it analyses some data on the trade and financial patterns of foreign affiliates operating in Costa Rica. The objective is to assess the import and export propensities of foreign-owned firms in Costa Rica, the extent to which they engage in host country borrowing, and the net direct balance of payments impact associated with foreign-owned firms' operations (i.e. the arithmetic sum of their balance of payments transactions in capital and current account). Section IV undertakes an econometric examination of the impact of FDI on output, investment, exports, imports and the RER, using cointegration techniques. The study is based on annual data for the period 1970-99. It is found that FDI exerts a strong negative impact on the equilibrium RER. Section V integrates the theoretical analysis with the microeconomic and econometric evidence to explain the mechanisms through which FDI affects the RER. Section VI concludes.

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[11] See, for instance, Robbins and Stobaugh (1973), Gilman (1981), Martinussen (1988), Feldstein (1994). The latter found that only 20% of the assets owned by US affiliates abroad were financed by cross-border flows of capital from the US.

[12] Prachowny and Richardson (1975); Salorio and Brewer (1997).

[13] Some estimates of the extent of transfer pricing by MNCs are provided by Kopits (1976) and Hines and Rice (1994).

II. A two-sector model of equilibrium RER determination with foreign capital

Consider a small open economy that produces two composite goods, tradables (T) and non-tradables (NT). Both types of goods can be consumed and/or invested. There are two agents in the economy: a) a domestic representative agent, and b) foreign investors. The domestic agent makes consumption and domestic investment decisions. Foreign investment into the economy, however, is determined exogenously. There is also a representative firm in each composite good sector, which acts merely as a passive conduit for the decisions of domestic and foreign investors. The two representative firms combine inputs to produce output in each sector. There is no explicit role for labour in the production function or in the model at large.[14] It is assumed that there are implicit institutional arrangements whereby factors are paid their marginal physical products. There is no government.

Openness implies that the economy is fully integrated into the world's goods markets (i.e. there are no barriers to trade). The model is real: there is no money and no credit markets, foreign or domestic, and thus no foreign borrowing and no international reserves. The only asset is physical capital, which is classified into domestic and foreign, according to the structure of ownership. Hence, FDI is the only component of the capital account of the balance of payments, with FDI flows to each sector assumed to be exogenous. The current account, in turn, is composed of net exports and foreign investment income.

Smallness implies that the economy is a price taker in the international market. Thus, the prices of T, P_T, are exogenous, and normalised to be equal to 1 (so that, where consistency is required, equations are expressed in terms of units of T). By contrast, the prices of NT, P_N, are determined within the system so as to clear the NT goods market. Prices are assumed to be fully flexible. The real exchange rate (RER), defined as the relative price of T to NT ($q = 1/P_N$), is thus a decreasing function of changes in P_N. An increase in q indicates a real depreciation. We also define the equilibrium RER as the relative price of T goods consistent with NT market clearing.

The assumption of full price flexibility and the exclusion of the monetary sector and of government imply that nominal rigidities and fiscal and/or monetary policy responses, which are central for the determination of the short-run evolution of the RER, are not considered. But in contrast with intertemporal-optimisation representative-agent models -such as those by Obstfeld and Rogoff (1996), Turnovsky (1997) or Agenor (1997)-, we do not impose the transversality condition that in the steady state the current account be equal to zero.[15] In this sense, our model can be interpreted as dealing with the *long run*, rather than the very long run (or steady state): it fully incorporates demand and supply responses into the determination of the equilibrium RER, but it excludes short-run nominal adjustments and policy responses and allows the current account to be strictly positive and equal to the net inflow of FDI.

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[14] It might be assumed that there is surplus labour, as in the Lewis (1954) model, so that output is only constrained by capital (as long as the labour supply capacity is not met). Indeed, our simple model reproduces the basic Harrod-Domar and AK growth-model feature of constant returns to capital (in our case, constant returns to aggregate –foreign and domestic- capital).

[15] It might be argued that, in the case of FDI, which is a non-debt creating flow, the need for the current account to become zero in the steady state –so as to avoid Ponzi schemes - is not present.

The model is set in discrete time. To simplify notation, the time subscript t is not included in any equation where all variables are contemporaneous.

2.1 Supply side:

Goods are produced by a representative firm in each sector via a Cobb-Douglas technology, which combines two inputs, domestic capital and foreign capital, as follows:

$$Q_N = KD_N^{a} KF_N^{1-a} \qquad (1)$$

$$Q_T = KD_T^{b} KF_T^{1-b}, \qquad (2)$$

where Q_i is total supply in the i^{th} sector, KD_i and KF_i are the stocks of domestic and foreign capital in each sector, ∀ i = N, T; and 0 ≤ α, β ≤ 1[16]. There are no intermediate goods in the economy, and thus Q_N and Q_T represent both total output and total value added in each sector.

The domestic and foreign capital stocks evolve according to:

$$KD_{i,t} = KD_{i,t-1} + I_{i,t-1}^{D} \qquad (3)$$

$$KF_{i,t} = KF_{i,t-1} + I_{i,t-1}^{F}, \qquad (4)$$

∀ i = N,T, and where I^D (I^F) is domestic (foreign) capital formation. There is no depreciation.

The economy's real gross domestic product (GDP) in terms of tradables (Y), is given by:

$$Y = \frac{1}{q} Q_N + Q_T \qquad (5)$$

If foreign investment income (FY) is deducted from GDP, one obtains the economy's gross national product, GNP, which in this case is equal to disposable income (Y^d):

$$GNP = Y^d = Y - FY \qquad (6)$$

Constant returns to scale in the production function imply that income is exhausted by factor payments. Also, we assume that factors are paid their marginal products. Since

[16] Since we are not interested in the explicit modelling of productivity growth, we have left it out of the analysis. However, it could be assumed that the production functions (1) and (2) implicitly incorporate a Hicks-neutral productivity shifter, so that the stocks of inputs are measured in effective units. Alternatively, it could be assumed that technological growth is foreign-capital augmenting and already embedded in KF_i, or that it is a function of foreign capital, as in Borensztein, et al (1998), so that the combined supply impact of foreign investment and technological progress is reflected in KF_i and its output elasticity parameters (1-α) and (1-β).

GNP is equal to the share of GDP accruing to domestic agents, from (1) and (2) it stems that Y^d can alternatively be expressed as:

$$Y^d = \frac{1}{q} aQ_N + bQ_T \qquad (7)$$

2.2 Demand side:

Aggregate demand consists of consumption, investment and net exports.

Consumption. The domestic representative agent makes the consumption decision following a two-stage process. First, the consumer decides how much to spend in total consumption, and then she allocates that amount between the consumption of T and NT. Total consumption levels are constrained at any time by current disposable income, following a simple Keynesian function:

$$C = cY^d, \qquad 0 \leq c \leq 1 \qquad (8)$$

The consumer allocates total consumption between T and NT so as to maximise a utility function V (C_N, C_T), subject to the intra-temporal budget constraint:

$$\frac{1}{q} C_N + C_T = C \qquad (9)$$

Let us assume that V(·) takes a Cobb-Douglas form, so that

$$V(C_N, C_T) = C_N^s C_T^{1-s}, \quad 0 \leq \sigma \leq 1 \qquad (10)$$

Optimal consumption allocation is then given by:

$$\frac{C_N}{C_T} = \frac{s}{1-s} q \qquad (11)$$

By substituting (11) into (9), one can derive expressions for the optimal levels of C_N and C_T as functions of q and overall consumption:

$$C_N = sqC \qquad (12)$$

$$C_T = (1-s)C \qquad (13)$$

Investment. Capital is accumulated using T and NT goods as inputs. It is assumed that capital production technologies are the same regardless of the sector of destination of the capital goods.

Foreign investment flows, their composition (retained earnings plus cross-border equity and debt flows), their sectoral allocation, and the breakdown of foreign investment income into retained earnings and profit remittances, are all exogenously determined. A fraction γ of foreign investment is financed with host-country funds, and the rest via FDI. Thus:

$$I^F = I_N^F + I_T^F = \frac{FDI}{(1-\gamma)} \qquad (14)$$

where $0 \leq \gamma \leq 1$ and γI^F is the net amount of domestic savings flowing to foreign investors in each period, once debt servicing payments to the domestic agent have been discounted.[17] From (1) and (2), and the assumption that factors are paid their marginal products, foreign investment income (FY) can be expressed as:

$$FY = \frac{1}{\theta}(1-\alpha)Q_N + (1-\beta)Q_T \qquad (15)$$

Domestic investment follows a three-step process: first, the aggregate amount of investment is determined; then the agent combines T and NT inputs to produce capital goods; and finally she decides how to allocate investment between the two sectors.

Since there is no foreign borrowing and no assets other than physical capital, savings equals investment at all times, and national income (GNP) must be either consumed or invested. Also, local borrowing by foreign investors directly crowds out domestic investment by an amount γI^F.[18] From (8), it follows that aggregate domestic investment (I^D) is equal to

$$I^D = I_N^D + I_T^D = (1-c)Y^d - \gamma I^F, \qquad (16)$$

where (1-c) is the marginal propensity to save out of disposable income.

The production function for capital goods exhibits a Cobb-Douglas (unitary elasticity of substitution) technology, so that the agent's input allocation problem can be described as:

$$\max_{N,T} I = N_I^{\delta} T_I^{1-\delta} \qquad (17)$$

$$\text{s.t. } \frac{1}{\theta} N_I + T_I = I \qquad (18)$$

where N_I (T_I) is the number of units of NT (T) goods used in the production of I units of capital, measured in terms of T, and $0 \leq \delta \leq 1$. If the technological parameters are allowed to differ between domestic and foreign investors, the optimal input combinations are given by:

[17] In principle, total debt servicing by foreign investors could exceed the amount of new host-country funds they receive in any given period. However, we assume that γ is a parametric constant, and impose a non-negativity constraint on it. We could therefore think of γ as a long-run average of the ratio of net resource transfers to foreign investors over I^F.

[18] There is no explicit treatment of the financial sector, but this direct crowding-out effect could be seen as the outcome of foreign firms having preferential access to domestic credit.

$$N_{I^D} = qd_1 I^D ; N_{I^F} = qd_2 I^F \qquad (19)$$

$$T_{I^D} = (1 - d_1) I^D ; T_{I^F} = (1 - d_2) I^F \qquad (20)$$

To allocate domestic investment between sectors, the domestic agent chooses in period t the sectoral domestic capital stocks for t+1 which maximise GNP subject to the accumulation constraints (3), (4) and (16), taking the sectoral foreign capital stocks and q for t+1 as given. Domestic capital is assumed to be freely mobile across sectors. Expectations are formed rationally with perfect foresight and there is no uncertainty. Thus, the problem can be expressed as[19]:

$$\max_{KD_{N,t};KD_{T,t}} Y_t^d = \frac{1}{q_t} aKD_{N,t}^a KF_{N,t}^{1-a} + bKD_{T,t}^b KF_{T,t}^{1-b} \qquad (21)$$

$$\text{subject to } KD_{N,t} + KD_{T,t} = KD_{N,t-1} + KD_{T,t-1} + (1-c)Y_{t-1}^d - gI_{t-1}^F \qquad (22)$$

$$\text{and } KF_{i,t} = KF_{i,t-1} + I_{i,t-1}^F \qquad (4)$$

The constraint (22) can be used to obtain an expression for KD_T, and substitute it into the objective function (21). After some rearrangement and simplification, the first-order condition can be written as:

$$\frac{1}{q} a^2 \frac{Q_N}{KD_N} = b^2 \frac{Q_T}{KD_T} \qquad (23)$$

This is an intuitively simple arbitrage condition: the domestic agent should invest in each sector up to the point where the (expected) marginal return to domestic capital is equalised in both sectors.[20] Since (23) reflects the optimal domestic capital stocks in every period, the domestic investment demand functions can be derived from there. It can be shown -by using (1) and (2) in (23) and taking total differentials- that investment in T (NT) is an increasing (decreasing) function of q.

Net exports. Foreign demand for T is assumed to be infinitely inelastic at the given price, and hence the trade balance is given residually as resulting from the balance between domestic demand for and supply of T.

Aggregate demand. Aggregate demand, D, for each sector is thus:

$$D_N = q\, s c Y^d + qd_1 \left[(1-c)Y^d - gI^F \right] + qd_2 I^F \qquad (24)$$

$$D_T = (1-s)cY^d + (1-d_1)\left[(1-c)Y^d - gI^F \right] + (1-d_2)I^F \qquad (25)$$

[19] It can be shown that this problem is equivalent to an inter-temporal optimisation exercise where the objective function is to maximise the net present value of disposable income subject to the future stream of accumulation constraints over an infinite horizon. In essence, the lack of inter-temporal substitution -posed by the absence of borrowing and the Keynesian specification of consumption and investment- makes the inter-temporal optimisation framework collapse into one of single-period optimisation.

[20] Here, the marginal rate of return to domestic capital is measured as the marginal contribution of domestic capital to GNP, in units of T. Since capital is held and expressed in terms of the tradable good, whose nominal price is assumed fixed, there are no capital gains in the model.

2.3 Market clearing condition and flow constraints

The RER (q) adjusts so that the NT market clears at all times:

$$Q_N = D_N \qquad (26)$$

The economy's overall budget constraint is given by:

$$Y + FDI_N + FDI_T = C + I^D + I^F + FY \qquad (27)$$

Since (27) is obtained residually from the specific constraints on C, I^D and I^F, it is not separately binding. The balance of payments equilibrium is also obtained residually as:

$$FDI_N + FDI_T = D_T - Q_T + FY, \qquad (28)$$

where the left-hand side of (28) is the capital account and the right-hand side is the current account.[21] Therefore, the economy permanently runs a current account deficit equal to the total inflow of FDI.[22]

2.4 Equilibrium real exchange rate and comparative statics

Plugging (24) into (26), using (7), (8), (12), (14) and (16), and solving for q, one obtains the equilibrium RER (q*) as a function of sectoral output and FDI:

$$q^* = \frac{\left[1 - \sigma c\alpha - \delta_1(1-c)\alpha\right]Q_N}{\left[\sigma c\beta + \delta_1(1-c)\beta\right]Q_T + (\delta_2 - \delta_1\gamma)\left(\dfrac{FDI}{1-\gamma}\right)} \qquad (29)$$

Since $0 \le \sigma, c, \alpha, \delta_1 \le 1$, then $[1 - \sigma c\alpha - \delta_1(1-c)\alpha] \ge 0$.[23] Similarly, the bracketed expression to the left of Q_T is positive. Therefore, (29) implies that the equilibrium RER depreciates with Q_N and appreciates with Q_T.

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[21] This is consistent with the balance-of-payments accounting convention of recording all foreign investment income, including retained earnings, as an outflow in the current account, while simultaneously including retained earnings as an FDI inflow in the capital account.

[22] Note, however, that the trade balance (= Q_T - D_T) can be in surplus or in deficit depending on whether foreign investment income is greater or less than the net inward flow of FDI (or, in other words, whether dividend remittances are greater or less than cross-border FDI flows).

[23] This might not be immediately apparent. But consider the limiting case first: if parameters σ, α, and δ_1 all took a value of 1 (the maximum possible value within the restrictions imposed), then, whatever the value of c, $\sigma c\alpha + \delta_1(1-c)\alpha = 1$, and hence the expression in square brackets would be equal to zero. For any other combination of parameter values equal to or greater than zero and strictly less than one, the expression in square brackets would be strictly positive.

The contemporaneous impact of Q_N on q* operates through two channels: supply and demand. By increasing the supply of NT goods, a rise in Q_N tends to lower their relative price (i.e. to increase q). However, an increase in Q_N also expands disposable income (see equation 7), thereby triggering an increase in the demand for NT goods, which in turn appreciates the RER. But, given that $[1 - sc\boldsymbol{a} - \boldsymbol{d}_1(1-c)\boldsymbol{a}] \geq 0$, the supply effect unambiguously dominates the demand effect. Q_T, on the other hand, only affects the equilibrium RER through the disposable income channel (demand effect); hence its unambiguously negative impact.

The impact of FDI on the equilibrium RER

There are two different mechanisms through which foreign investment affects q*: a) a direct, intra-temporal demand effect; and b) inter-temporal supply and demand effects.

The intra-temporal *demand effect* depends on the sign of (δ_2 - $\delta_1\gamma$), and is therefore ambiguous.[24] If there is no financial crowding-out of domestic firms by foreign investors ($\gamma = 0$), then FDI –regardless of the sector into which it flows- would have an unambiguously negative direct impact on q*. The size of this effect would depend on the extent to which foreign firms use NT goods for capital formation (δ_2). This is the typical RER appreciation mechanism –an aggregate demand increase- highlighted by the literature on the potential “Dutch disease” problem associated with foreign capital inflows. But if ($\gamma \geq 0$), the (negative) demand impact of FDI on q* is weakened, and could even turn positive, if $\delta_1\gamma \geq \delta_2$. The reason for this is that the introduction of a direct financial crowding out mechanism reduces aggregate demand –and the demand for NT- for any given value of the relevant parameters and any given level of domestic output and FDI. Whereas with $\gamma = 0$, FDI represents a net addition to aggregate demand, it now partially displaces domestic investment demand. And, for a sufficiently large differential in the NT share of investment expenditure between domestic and foreign agents, FDI could even trigger a RER depreciation. Though the latter outcome is improbable, because γ is likely to be significantly less than one, the main implication of the analysis is that financial crowding out might reduce the intra-temporal real appreciation effect of FDI for plausible values of the input demand parameters.

In addition to the intra-temporal demand channel, foreign investment also affects the RER through its impact on the sectoral foreign capital stocks, and thus on Q_N and Q_T. But this effect is inter-temporal rather than contemporaneous: it only comes into force from the next period onwards, as per equations (4) and (14), and so does not affect the equilibrium RER at time t.

In the case of FDI_N, the inter-temporal mechanism consists of a direct output effect, an indirect investment effect, and an indirect demand effect:

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[24] $$\frac{\partial q^*}{\partial FDI} = \frac{\left(\frac{\boldsymbol{d}_1 g - \boldsymbol{d}_2}{1-g}\right)\left[1 - sc\boldsymbol{a} - \boldsymbol{d}_1(1-c)\boldsymbol{a}\right]Q_N}{\left(\left[sc\boldsymbol{b} + \boldsymbol{d}_1(1-c)\boldsymbol{b}\right]Q_T + (\boldsymbol{d}_2 - \boldsymbol{d}_1 g)\left(\frac{FDI}{1-g}\right)\right)^2}$$

- FDI_N expands KF_N and therefore the supply of NT, with a direct positive output effect on q.
- Also, FDI_N exerts a positive effect on the RER arising from the input complementarity property of the Cobb-Douglas production technology. Thus, increases in KF_N push up the marginal return to domestic capital in the NT sector[25], attracting more domestic investment into NT, which further increases the output of NT goods and pushes down their relative price, until the marginal revenue product of capital in both sectors is equalised.
- Finally, the increase in Q_N expands disposable income and thus tends to appreciate the RER. But, as stated above, parameter restrictions imply that this second-round demand effect is dominated by the supply effect.

By contrast, the inter-temporal FDI_T effect only operates through the indirect investment and demand (disposable income) channels. Because of input complementarity, an expansion in KF_T leads to a larger share of domestic investment in T over total investment, thus reducing the expansion of the domestic capital stock and of output in the NT sector, and appreciating the RER, ceteris paribus. The disposable income channel also has a negative impact on q.

In sum, the intra-temporal and inter-temporal effects of foreign investment into NT work in opposite directions, and the net effect of FDI_N on q* is therefore ambiguous. On the contrary, flows of foreign investment into the T sector exert unambiguous pressure towards RER appreciation through both channels.

FDI and the Harrod-Balassa-Samuelson effect:

The relative prices of NT goods tend to be downward trending and higher in rich countries than in poorer ones. This empirical regularity was pointed out by Harrod, Balassa and Samuelson, and explained analytically by a number of authors in the dependent economy, two-sector tradition.[26] In essence, the theoretical argument is that, in developed countries, productivity growth differentials between the T and the NT sectors are not only positive and increasing (the time-series dimension) but also higher than in poorer countries (the cross-country dimension). If labour is mobile across sectors, productivity differentials lead to a higher economy-wide wage, and thereby to higher relative prices of NT.[27]

Our model reproduces the time-series dimension of the Harrod-Balassa-Samuelson effect through an analogous mechanism. A relatively high exogenous rate of foreign investment in the T sector pushes q down by increasing disposable income and the demand for NT relative to supply. High foreign investment in T could be thought of

[25] Complementarity derives from the fact that the marginal physical product of domestic (foreign) capital in sector i increases with the foreign (domestic) capital stock in the same sector. Thus, for instance, in (1):

$$\frac{\partial(\partial Q_N / \partial KD_N)}{\partial KF_N} = a(1-a) KD_N^{a-1} KF_N^{-a} \geq 0$$

, and similarly for the T sector.

[26] For a comprehensive survey on the theory and the empirical evidence, see Froot and Rogoff (1995). See also De Gregorio, et al. (1994) and Obstfeld and Rogoff (1996).

[27] The effect is magnified if the NT sector is relatively labour-intensive, because then the wage effect has a stronger impact on relative prices (i.e. the overall income effect outweighs the substitution effect).

as consistent with (or as leading to) higher productivity growth in that sector, if FDI involves positive technological spillovers or technological growth is a function of foreign capital (see, for instance, de Mello, 1997; or Borensztein, et al.,1998).

Input composition of foreign investment, financial crowding-out, and the equilibrium RER

Finally, we are interested in isolating the impact of two specific parameters on q*: the tradable-good-intensity of foreign capital formation (1-δ_2), and the extent of financial crowding-out of local firms by foreign investors (γ).

The equilibrium RER is decreasing in δ_2[28]. The higher the NT share of foreign investment, the more appreciated the RER will have to be in equilibrium. Therefore, the more intensive I^F is in T goods (or, analogously, the higher the import-propensity of foreign-owned firms), the lower the RER appreciation effect of FDI.

On the other hand, the sign of the partial derivative of (29) with respect to the financial crowding-out parameter (γ) is ambiguous, and depends on the relative size of δ_1 and δ_2.[29] If, for instance, $\delta_1 \geq \delta_2$, that is, the share of NT in investment expenditure is greater for domestic agents (δ_1) than for foreign agents (δ_2) -a likely scenario- then the larger the extent of financial crowding out, the more depreciated the RER in equilibrium. This is because the displacement of relatively NT-intensive domestic investment by foreign investment would reduce the demand for NT goods and therefore their relative price, ceteris paribus.

In the next section, evidence on some of the mechanisms identified by the model as crucial for the analysis of adjustment to FDI will be examined.

III. Costa Rica: FDI inflows and foreign affiliate operating patterns

3.1 FDI inflows to Costa Rica: Overview of aggregate trends, 1970-99

Political stability and relatively skilled labour have allowed CR to attract large inflows of FDI. The FDI/GDP ratio averaged 2.7% between 1970 and 1999, and has not fallen below 1% of GDP in any year. But the pattern has been uneven. FDI inflows increased sharply between 1970 and 1975, both in absolute terms and as a share of GDP. In the second half of the 1970s, as the economy expanded fast through a commodity price boom and fiscal reflation, the FDI/GDP ratio dipped. It recovered somewhat in 1981, and fell again in 1982 with the debt crisis, but remained stable

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28 $$\frac{\partial q^*}{\partial \delta_2} = \frac{-FDI}{\left(\left[sc\beta + \delta_1(1-c)\beta\right]Q_T + (\delta_2 - \delta_1\gamma)\left(\frac{FDI}{1-\gamma}\right)\right)^2} \leq 0$$

29 $$\frac{\partial q^*}{\partial \gamma} = \frac{\frac{(\delta_1 - \delta_2)}{(1-\gamma)^2}\left[1 - sc\alpha - \delta_1(1-c)\alpha\right]Q_N}{\left(\left[sc\beta + \delta_1(1-c)\beta\right]Q_T + (\delta_2 - \delta_1\gamma)\left(\frac{FDI}{1-\gamma}\right)\right)^2}$$

until 1986. After that year, FDI inflows started a notorious upward trend, reaching US$619 million in 1999, from a level of US$60 million in 1986. Between those same years, the FDI/GDP ratio increased from 1.4% to 5.5% (see charts 1 and 2 in Appendix 1). This surge in FDI has coincided with a substantial change in economic policies.

As most other Latin American countries, CR moved from a protectionist, import-substituting model of development in the 1960s and 1970s to an export-oriented strategy from the second half of the 1980s onwards. The transition was marked by the debt crisis of 1982, when GDP fell by 7.28% and annual inflation reached 91%. After undergoing an orthodox stabilisation programme, the country embarked on a process of liberalisation and deregulation, including the opening up of trade and the capital account. In the mid 1980s, a number of tax subsidies and incentive regimes (free trade zones and temporary admission) for export-oriented foreign and domestic firms were introduced. The incentives were intended to make up for the anti-export bias of the previous development strategy, and to foster the expansion and diversification of the export sector. In terms of attracting FDI, the new policies proved a success: FDI increased substantially in the 1990s, and started to flow towards higher-wage, high-tech industries. The process culminated in 1996, when Intel Corp. set up a large micro-processor assembly plant in CR.

FDI flows are the sum of two components: cross-border flows (parent company equity and debt flows), and retained earnings. Contrary to the experience of other countries, retained earnings have not been a very substantial part of FDI flows to CR (see chart 1 in Appendix 1). As shown in table 1, the average ratio of retained earnings to FDI has ranged between 7.4% for the period 1980-89 to 23.2% in the 1990s. Therefore, on average, more than three quarters of net FDI inflows to the country have been made up of fresh, cross-border flows.

Table 1. FDI inflows to Costa Rica: Composition, cost and related resource transfer 1970-99

	Composition			**Cost**		**Net FDI transfer**
	FDI inflows (Period sum, US$ million)	Retained earnings (Period sum, US$ million)	Ret Ear/FDI (average)	FDI income/FDI stock (average)	Profit remitt/FDI stock (average)	FDINRT/FDI [1] (average)
1970-79	444.3394	76.4712	0.1425	0.0311	0.0174	0.6823
1980-89	716.7150	79.3240	0.0741	0.0167	0.0105	0.7738
1990-99	3513.0020	817.2514	0.2326	0.0746	0.0472	0.6121[2]

[1] FDINRT: FDI-related net resource transfers (FDI inflows minus FDI income)
[2] Average for the period 1990-98. If 1999 (an outlier year) is included, the figure becomes 0.3879
Source: Author's own calculation, with data from Banco Central de Costa Rica

The return on FDI, as measured by total FDI income (retained earnings plus profit remittances) over the FDI stock, has also been relatively low, ranging between an average of 1.7% in the 1980s to an average of 7.46% in the 1990s (table 1).[30] The

[30] Admittedly, these figures underestimate the true cost of FDI, as they do not include interest payments on parent company debt, royalty payments and other fee outflows often used by foreign investors to

ratio of profit remittances (only) to the FDI stock replicate the same pattern. The figures suggest that the cost of FDI has been very pro-cyclical: income as a share of total FDI stock fell substantially during the 1980s, a decade of poor growth performance for the economy after the debt crisis, and picked up during the 1990s. 1999 was an outlier year: profit remittances grew from US$266 million to US$1,512 million (or 31% of the FDI stock), mostly reflecting large profit repatriations by Intel. But even if that year is excluded, there seems to have been a slight increase in the cost of FDI in the 1990s. As a share of FDI levels, FDI income remained at moderate levels in the 1970-99 period. Thus, FDI-related net resource transfers (FDI inflows minus FDI income) as a ratio of FDI inflows averaged 68.2% in the 1970s, 77.4% in the 1980s, and 61.2% in the 1990s (table 1).

The pattern of FDI allocation by sector has also fluctuated over the 1970-99 period. In the 1970s, most FDI inflows (54.3% of total) went into manufacturing, while agriculture only accounted for 40.4%. In the 1980s, the picture shifted: agriculture took 58.6% of the FDI inflows, while the share of manufacturing fell to 32.5%. This probably reflects the fact that, when export incentive regimes were introduced in the 1980s, the fastest growing sector was that of non-traditional agricultural exports, such as citric fruits, melons, pineapples, fish, and flowers, and foreign investment flew mainly to these activities. In the 1990s, however, foreign investment in export processing plants –first textiles, later higher technology industries- dominated: the share of manufacturing in total FDI inflows rose to 54%. FDI to other (tertiary) sectors remained comparatively small in the 1970s and 1980s. But a boom in tourism into the country has attracted large foreign investments in hotels and restaurants, and there has also been an increase in FDI into call centres and other customer service facilities. As a result, the share of tertiary activities in total FDI overtook agriculture and reached an average of 28.1% in the 1990s. But the stock of FDI in agriculture and manufacturing together account for over 80% of the total FDI stock.

Table 2. FDI inflows to Costa Rica: Sectoral allocation 1970-99

	Agriculture		Manufacturing		Other	
	(period sum, US$ million)	(share of total)	(period sum, US$ million)	(share of total)	(period sum, US$ million)	(share of total)
1970-79	179.701	0.4045	241.3061	0.5431	23.358	0.0526
1980-89	419.8905	0.5859	232.6782	0.3247	64.0253	0.0893
1990-99	629.4621	0.1792	1896.832	0.5399	986.7306	0.2809

Source: Author’s own calculation, with data from Banco Central de Costa Rica

3.2 Trade and financial patterns of foreign affiliates in Costa Rica

This section seeks to present briefly some background microeconomic evidence to support and inform the analysis of aggregate data. Two main sets of data will be used:

repatriate funds. Unfortunately, balance of payments data published by the Central Bank of Costa Rica or the IMF do not distinguish between payments on these accounts made by foreign or domestic agents.

- A firm-level data set I assembled on the operations of foreign-owned companies as well as CR firms (to be used as a control group) in the Free Trade Zone (FTZ) and temporary admission (TA) regimes, based on the annual reports submitted by the companies. Results are presented for the year 1998. The sample includes a total of 213 firms: 25 domestic and 113 foreign-owned in FTZ; 26 domestic and 49 foreign-owned in TA. The total sample accounted for 21.1% of total CR exports in 1998 (and foreign firms alone for 19.5%) and 15.2% of CR's gross fixed private investment (foreign firms in the sample account for 14.2% of that figure). The sample, on the other hand, is dominated by FTZ firms, which made up 86% of exports, 93% of gross fixed investment, 85% of gross property, plant and equipment, and 75% of total assets (78%) in 1998. Because of this, and because of the larger number of foreign-owned firms in FTZ, this sub-sample is deemed more representative.

- Data published by the US Department of Commerce's Bureau of Economic Analysis (BEA) on affiliates of US MNCs operating in CR.[31] The latter includes financial and operating data on majority-owned foreign affiliates (MOFAs) for the period 1989-97[32], as well as information on FDI and balance of payments transactions between all US foreign affiliates in CR and their US parents for the period 1982-98. US MOFAs represent a substantial fraction of CR's total GDP, fixed investment and exports (figures for 1997 were 5.7%, 4.4%, and 40.4%, respectively). Also, the FDI stock of US affiliates surveyed by BEA accounted for 48.5% of CR's total FDI stock in 1998.

3.2.1 Balance of payments effects:

Table A.1 provides a summary view of FDI and balance of payments data for US MOFAs in CR, for selected years in the period 1982-1998. It shows that reinvested earnings made up a more significant fraction of total FDI flows –an average of 39% over the period- than is the case for the country's aggregate data. The BEA data set includes interest payments as part of net FDI income, and it also records royalties and other service payments from affiliates to parents. From these data, a more comprehensive figure for the return on FDI, based on the ratio of total FDI income plus net service payments to the FDI stock, was computed. The average return over the period is 21.74%, much higher than the corresponding aggregate figures for CR.[33] From Table A1 one can also infer that reinvested earnings in the 1990s accounted for most of FDI income, and that cross-border FDI flows and FDI-related net resource transfers for US MOFAs are much lower as a share of total FDI flows than the equivalent figures for CR. Finally, I estimated a proxy for the direct balance-of-payments effects of US MOFAs in CR. The trade balance was approximated as the difference between total exports and imports from the US by the foreign affiliates.[34]

[31] The BEA does not publish data on firms owned by US individuals. Therefore, at any point in time, BEA statistics record only a fraction of total US FDI.
[32] MOFAs accounted for 95% of all US affiliates in CR surveyed by the BEA, and an equally large share of all sales, assets and employment.
[33] However, if we deduct reinvested earnings –which are not a true leakage- from FDI income, to obtain distributed profits, and use this figure (plus service payments) instead in the computation of the cost of FDI, the resulting average for 1982-1998 is 5.73%. This suggests that most of the return to US FDI in CR is reinvested in the country.
[34] Unfortunately, BEA does not produce statistics on total imports by foreign affiliates, but only their imports from the US. Though presumably these constitute a substantial fraction of total imports (if

The total net direct effect[35] was estimated as the sum of the trade balance proxy plus cross-border FDI inflows less distributed profits less net service payments to parents.[36] The resulting net direct balance of payments effect has been positive, very large, and increasing in the 1990s.

Therefore, overall US foreign affiliate operations in CR produce a surplus of foreign exchange, which ceteris paribus would appreciate the RER.

3.2.2 Trade patterns: Import and export propensities

As table A2 shows, the export ratios (exports/total sales) of all firms in FTZ and TA are very high –not surprising given the nature and objectives of those regimes-. While export ratios are higher for foreign firms, the difference is only statistically significant in the case of TA firms. Information on import ratios (as a share of purchases) is more enlightening. Total import and input import ratios are much higher for foreign-owned firms, and statistically significantly so in the case of FTZ.[37] Since machinery and equipment tend to be mostly imported (even outside special regimes), the propensity to import intermediate inputs provides a better indicator of the linkages of the different groups of firms with the domestic economy. The data suggests that links with local suppliers are very poor in the case of foreign-owned firms in FTZ, many of which are assembly plants importing most of their inputs from the parent company.

Data for US MOFAs broadly confirms these findings (see table A3). Export propensities for US affiliates -both as a share of sales and as ratio of the firms' value added-, are very high, and have increased markedly over the 1990s. Indeed, while the average exports/GDP ratio for CR over the 1989-1998 period was 0.39, for US MOFAs it was 2.34 (the corresponding figures for 1998 were 0.54 and 6.14). Unfortunately, BEA does not publish data on total imports by US MOFAs, but only on their imports from the US. Thus, the figures only provide a lower bound on import propensities. The average 1989-98 US import/value-added ratio for US MOFAs was 40%, compared to an average goods imports/GDP ratio of 37% for CR as a whole (and a US imports/GDP ratio of 15%). It is therefore possible to infer that US MOFAs' output has a higher import content than the CR economy as a whole.

3.2.3 Financial operations: Extent of host-country borrowing

Do foreign firms use host-country non-commercial credit as a substantial source of finance? For the FTZ and TA data sets, it was not possible to determine the name and country of origin of the financial lenders for some of the firms that reported strictly positive financial liabilities. But table A2 shows the results for the cases where identification was possible. The pattern is unmistakable: whereas 97.5% of all

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imports are equally US-driven as exports are), clearly our approximation of the trade balance will overstate the trade surplus.

[35] We stress that it is only a *direct* effect. The operations of US foreign affiliates are likely to indirectly impact on a number of components of the balance of payments.

[36] BEA does not publish data on total net service payments by foreign affiliates, but only on payments to their parents. The former could be greater or smaller than the latter, but it is reasonable to assume that, in the net, foreign affiliates in CR would be net payers of royalties and license fees.

[37] Despite being much higher on average than those of their domestic counterparts, import and input import ratios for foreign firms in TA have a very large within-group variance, which drives the F-statistic downwards in the ANOVA tests.

financial liabilities contracted by CR firms in the FTZ came from CR-owned banks or other CR financial institutions, the ratio is 44% for foreign-owned firms[38], a statistically significant difference at the 1% level. The same result emerges when the ratio of domestic financial liabilities to total liabilities is considered, an indicator that conveys more clearly the idea that domestic borrowing by foreign-owned firms is truly negligible (less than 2% on average in both FTZ and TA) as a share of total liabilities. Furthermore, foreign firms' ratio of non-financial long-term liabilities to other sources of non-commercial finance was more than double that for CR firms (and again, the difference is significant at the 1% level).[39] Out of 73 foreign firms with non-financial long-term liabilities, we identified 49 (67%) which had contracted these liabilities with related parties (mainly the parent company or shareholders). Moreover, these identified cases amount to 86% of total non-financial long-term liabilities. It is therefore valid to infer that these ratios measure the extent of related-party financing.[40]

In sum, foreign-owned firms do not appear to resort much to host-country financial credit. Most of their non-commercial financing derives from intra-MNC debt.

3.2.4 Relationship between FDI and gross fixed investment by foreign-owned firms

A mistake commonly made in economic analyses of FDI is to identify FDI flows with gross fixed capital formation (GFCF) by foreign firms.[41] FDI –as recorded in the balance of payments- is an entirely financial concept. FDI might be used to finance GFCF, but also current assets or the acquisition of already-existing fixed assets (as in cross-border mergers and acquisitions).[42] Moreover, GFCF by foreign-owned firms might be financed with alternative sources other than FDI; for instance, domestic borrowing, local equity or bond issues, or foreign borrowing from unrelated parties.[43] The BEA data set allows for an analysis of the relationship between FDI and US

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[38] Corresponding figures for TA are 90% for foreign firms and 57% for CR firms.

[39] Similarly, the ratio of non-financial long-term debt to assets is considerably and statistically significantly higher for foreign firms than for domestic firms in both FTZ and TA.

[40] Unfortunately, BEA statistics do not include information on local financial borrowing by US affiliates in CR. But the leverage ratio and the FDI stock/asset ratio can usefully be interpreted to provide a ceiling to host-country borrowing: total local financing relative to assets cannot exceed the leverage ratio or the difference between 1 and the FDI stock/asset ratio, whichever is smaller. (The ratio can actually be much smaller than the ceiling if –as is often the case- a good part of non-parent company debt is accounted for by trade payables, or by loans from non-US shareholders). For instance, the local borrowing/asset ratio in 1998 must have been less than 25%, although the ceiling was as high as 50% in 1990-91(see table A3).

[41] For instance, in a frequently cited paper, Boreznstein, et al. (1998) argue that, in a regression of total investment on FDI, "…since data on total investment include FDI, a coefficient equal to one would imply that FDI does not affect the total level of investment" (p. 128). As Feenstra put it, "there is a good deal of confusion about even the most elementary aspects of FDI…Some of this confusion is due to contradictory data, but in other cases, it represents genuine conceptual misunderstandings about FDI." (Feenstra, 1999: 332).

[42] There are no consistent data series on the extent of cross-border mergers and acquisitions (CBM&As) in CR. UNCTAD's annual World Investment Report, however, reports some figures starting in 1989. The cumulative sum of CBM&As between 1989 and 1999 is US$311 million, or only 0.086 of inward FDI flows. Furthermore, CR has not carried out any major privatisations, another common source of CBM&As. Therefore, it is likely that most recorded FDI into CR has been in the form of greenfield investment or the financing of already set-up affiliates by their parents.

[43] However, data on foreign affiliates' capital expenditures are not normally available, and thus FDI flows may justifiably be used as a proxy.

foreign affiliates' GFCF in CR. Indeed, the average 1994-98 FDI/GFCF ratio was 4.21 (see table A3). Thus, on average, only 23.75% of FDI translates into fixed investment. The bulk of FDI to US MOFAs finances current assets, including inventories and trade receivables.[44] If these findings are extrapolated to FDI flows to CR as a whole, it is then possible to expect that FDI flows while have little direct impact on total (or private) GFCF.

IV. Econometric analysis

4.1 Methodology

In this section, I analyse the impact of FDI inflows to Costa Rica on output, investment, exports, imports and the RER, using annual data for the period 1970-99. The focus is on the long-run effects of FDI –in particular on the RER-. Since most of the variables involved are nonstationary[45], I use cointegration techniques for econometric estimation. Moreover, cointegration has a very useful economic interpretation. For there to be a meaningful long-run relationship between nonstationary variables, there must be a time-invariant linear combination between them. That linear combination -the cointegrating vector- defines a long-run equilibrium to which the system, even if subject to stochastic short-run shocks, converges over time. Thus, cointegrating solutions may be interpreted as long-run equilibria between the variables.

Given the shortness of the sample period, a full dynamic single-equation estimation framework is used.[46] In its most general form, a dynamic specification may be represented by an autoregressive distributed lag ADL (p,q;m) model:

$$A(L)y_t = \alpha_0 + \sum_{j=1}^{m} B_j(L)x_{jt} + \varepsilon_t \qquad (1)$$

where L is the lag operator $L^i x_t = x_{t-i}$, $A(L) = 1 - \sum_{i=1}^{p} \alpha_i L^i$ is a pth-order polynomial, $B_j(L) = \sum_{i=1}^{q} \beta_{ji} L^i$ is a qth-order polynomial, and m is the number of right-hand side (RHS) variables. The long-run equilibrium solution to (1) is:

$$y_t = \left(1 - \sum_{i=1}^{p} \alpha_i\right)^{-1} \left[\alpha_0 + \sum_{j=1}^{m} \sum_{i=1}^{q} \beta_{ji} x_{jt}\right] = k_0 + \sum_{j=1}^{m} k_j x_{jt}\,, \qquad (2)$$

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[44] Indeed, current assets accounted for 61% of total assets of US MOFAs in 1998 (non-inventory current assets alone –comprising mainly receivables-, was 54.49% of total assets), while net property, plant and equipment was only 23.79%.

[45] Results of ADF unit roots are not shown for brevity, but may be obtained from the author upon request.

[46] Johansen's systems approach is asymptotically optimal, but the dimensionality problem –the number of parameters to be estimated in a VAR rises geometrically with the number of variables and the lag length- preclude its use in small samples. Dimensionality is exacerbated by the cross-contamination problem of systems estimation: the biases from misspecifying one equation are carried over to the rest, which then requires full specification of any variable included. Monte Carlo simulations suggest that Johansen's technique performs very poorly in small samples, with very large standard errors, fat tails (skewed distributions) and substantial mean biases. See Hargreaves (1994).

where $k_j = \left(\sum_{i=1}^{q} \beta_{ji}\right) / \left(1 - \sum_{i=1}^{p} \alpha_i\right)$ is the long-run multiplier of y with respect to x_j. The parameters of the long-run equilibrium relationship may thus be obtained by estimating (1) by OLS and then solving for k_j. It is apparent that the long-run solution in (2), though linear in variables, is non-linear in parameters.[47] Hence, standard errors for the long-run parameters must be obtained using a non-linear algorithm.[48]

There are a number of possible linear transformations of (1) which imply equivalent projections of y on to the data. In particular, (1) might be transformed into an error-correction (ECM) specification. In the ADL (1,1;1) case, this would yield:

$$\Delta y_t = \alpha_0 + (\alpha_1 - 1)(y_{t-1} - k_1 x_{t-1}) + \beta_0 \Delta x_t + \varepsilon_t \qquad (3)$$

where, as before, $k_1 = (\beta_0 + \beta_1)/(1 - \alpha_1)$. Sims, Stock and Watson (1990) show that the statistical properties of ECM models –in particular, consistent and asymptotically normal estimators- extend to the family of unrestricted ADL linear transforms such as (1). The intuition is straightforward: a model contains exactly the same information as any of its unrestricted linear transformations. The OLS estimation of an ADL model therefore presents a number of statistical advantages when dealing with nonstationary data and small samples:

a. Asymptotic and finite sample properties. In an ECM model such as (3) -as long as the nonstationary variables are cointegrated, so that $(y_{t-1} - k_1 x_{t-1}) \sim I(0)$-, all the terms will be stationary, and their coefficient estimators will not only be consistent but also have asymptotically normal joint distributions. Thus, standard statistical inferences using t- and F- tests are valid. By extension, these properties apply to the unrestricted ADL model.[49] Moreover, dynamic specifications such as the ADL or ECM eliminate or substantially reduce the finite-sample biases arising from static estimation of long-run equilibrium parameters.[50]

b. Cointegration tests. The estimation of dynamic models allows for a direct test of cointegration, based not on Dickey Fuller tests of the residuals –as in the standard Engle-Granger two-step procedure- but on estimated coefficients. If there is cointegration between nonstationary variables, it must be possible to represent them in ECM form (Engle-Granger Representation Theorem). Therefore, a t-test on whether the ECM coefficient ([α_1-1] in (3)) is statistically significantly different from zero would be a valid test under the null of no cointegration. Given the statistical equivalence between ECM and ADL, the corresponding t-test for the generalised

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[47] The long-run parameters (k_j) entail ratios of sums of individual parameters (α and β) in the full dynamic ADL model (3).
[48] PcGive, for instance, uses a procedure that involves numerical differentiation.
[49] Banerjee, et al. (1993) show that OLS estimation of an ADL specification yields numerical estimates of the long-run multipliers (k), hypothesis test statistics, and explanatory powers which are all identical to those of its corresponding ECM transform.
[50] See Banerjee, et al. (1993), Inder (1993), Hendry (1995), and Patterson (2000), which find negligible biases in the dynamic estimation of the long-run multipliers, even for small samples, and a substantial correction vis-à-vis the static model. The implication is that the lag specification should be "as general as the constraints of data and sample allow" (Banerjee, et al., 1993: 168).

ADL is based on the null that the sum of the $a_i\,(i = 1,..., p)$ in (3) is equal to 1.[51] Monte Carlo simulations conducted by Banerjee, et al. (1993) show that the power of this t-test is higher than that of the residuals-based unit root test.

c. Simultaneity. Hendry (1995) shows that the inclusion of dynamic terms in the ADL 'corrects' for contemporaneity (i.e. one or some of the regressors are contemporaneously correlated with the equilibrium error term), and ensures valid single-equation inference.[52]

d. Failure of weak exogeneity. Weak exogeneity fails when the cointegrating relationship enters not only into the conditional model but also into the marginal process determining one or more of the variables upon which the model is conditioned. If this is the case, single-equation dynamic regressions lead to consistent but inefficient and biased estimates, and their t-statistics do not have asymptotically normal distributions. Monte Carlo experiments indicate that when weak exogeneity fails, the ADL estimator may be slightly biased in small samples. But, if contemporaneity is also present –as is often the case-, the adverse effects are very limited (Inder, 1993; Patterson, 2000). Moreover, the ADL estimator performs better than alternative single-equation estimators developed to deal with weak exogeneity failure, such as Philip and Hansen's fully modified (FM) estimator, or Stock and Watson's dynamic OLS (DOLS) estimator.[53]

Econometric estimation proceeds using Hendry's general-to-specific modelling approach. One or two lags are chosen according to the number of regressors in the most general specification[54]. If there is cointegration in the full model (with all lags), model reduction is carried out according to the Schwartz criterion and diagnostic tests.

4.2 Data and sector classification

The econometric analysis is based on annual data for the period 1970-99. Definition and data sources for variables are provided in Appendix 2.

CR's national accounts statistics are divided into ten industries. Industry classification was based on their *average* level of tradability, regardless of the tradability of individual goods within them. Two quantitative criteria were used: a) Tradedness: the ratio of the country's actual trade values for the category of goods or services produced by each industry relative to the industry's value added). b) International arbitrage and cross-border price convergence, as measured by the co-movement

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[51] For the dynamic model to converge to a long-run solution, $\sum a_i$ must be less than one.

[52] Moreover, Monte Carlo simulations suggest that small-sample biases of long-run estimators are almost negligible for single-equation dynamic OLS models when regressors are contemporaneous. Indeed, contemporaneity seems to have a beneficial impact on small-sample long-run parameter estimators (Patterson, 2000).

[53] Inder (1993) finds that the ADL estimator is less biased than the FM estimator, especially when the data generating process (DGP) is dynamic. Montalvo (1995) compares DOLS with other estimators. He does not include ADL, but since he uses Inder's (1993) DGP, his results are fully comparable with those of Inder. It emerges that ADL performs much better than DOLS when weak exogeneity fails.

[54] ADL (2,2) general specifications were used for all regressions except those for investment and the RER, which –given the large number of regressors involved- only used one lag.

between traded and foreign good prices and an industry's price deflators.[55] Co-movements were assessed through simple correlation coefficients and regression analysis. I classified agriculture (includes forestry, hunting, and fishing) and manufacturing (includes mining and quarrying) as tradable, and the remaining eight industries (mainly services) as nontradable.[56]

4.3 Results

4.3.1 Output and growth

Aggregate and sectoral production functions are specified as Cobb-Douglas and estimated in log-linear form:

$$LnY(i) = a_0 + a_1 LnEmpl(i) + b_1 LnKst(i) + b_2 LnFDIKst(i) \ ,$$

where i = aggregate, T or NT, LnEmpl is the log of employment (total number of employees), LnKst is the log of the fixed capital stock, and LnFDIKst is the log of the FDI capital stock. Variable definition and data sources are provided in Appendix 2. The FDI stock is used as a proxy for the stock of foreign-owned fixed capital, albeit the data on US foreign affiliates in CR and the investment regressions –discussed below- suggest that the FDI-fixed foreign investment relationship may not be strong in any sector.

The production function results are shown in table A4. It emerges that FDIKst has a strong and highly statistically significant impact on long-run equilibrium output levels in both the aggregate production function and the T production function, while the fixed capital stock is not statistically significant. The impact of FDIKstNT on long-run NT output, though positive and significant, is found to be very small (a coefficient of only 0.05).

The results of the ECM model are similar. The impact effect of the stock of FDI on growth in aggregate output is substantial. But it is the result of dissimilar cases at the sectoral level. While a 1% increase in the rate of growth of the FDI stock results in a 0.72% increase in T output growth, the stock of FDI in NT appears to have a negligible and not statistically significant impact on growth in that sector. In all cases, the error correction mechanism is highly significant, but speed of adjustment varies: from very low in the case of the NT sector (0.23% of any disequilibrium corrected in every period), to high for aggregate output (0.74%). And, in the case of T, there is actually "over-correction": the coefficient on ECM is greater than 1. This is because the sum of the impact effects of all arguments in the T growth function is large and much greater than 1, meaning that the ECM must overcompensate so that T output returns to its long-run equilibrium path.

[55] For each of the industries, price deflators can be simply obtained by dividing current price value-added by constant price value-added.
[56] The results of the tradability tests for sector classification are not presented, but may be obtained from the author upon request.

4.3.2 Investment

Based on the extensive literature on the determinants of private investment demand in developing countries[57], the aggregate and sectoral private gross fixed investment functions were specified to include the following potential explanatory elements:

- an 'accelerator' term (GDP, consumption)
- public investment
- changes in the stock of net domestic credit to the private sector
- cost of capital (including the real interest rate and the relative price of capital goods)
- macroeconomic instability measures (inflation level, volatility in prices, volatility in inflation)
- measures of potential financial crowding out by the public sector (such as credit to the public sector as a share of total credit, or changes in the stock of public domestic debt)
- the real exchange rate
- measures of foreign exchange availability (net resource transfers; non-FDI capital inflows to the non-financial private sector)
- FDI inflows

Many different combinations were tested. It emerged that coefficients on most variables were not robust to specification, and many were very sensitive to the inclusion or exclusion of GDP. The results, shown in table A5, correspond to the runs where consumption was used as a proxy for the accelerator. Only the best performing variables in the different combinations were included in the final set of regressions.

In line with the empirical literature, the two most robust explanatory variables in all alternative specifications, and in both long-run cointegrating solutions and ECMs, were consumption and domestic credit to the private sector. The RER had the expected negative influence on long-run NT investment. However, it also had a negative, though not statistically significant, impact on private investment in T. This suggests that capital formation in T is not sensitive to relative price incentives, or alternatively, that a RER appreciation is a proxy for an improvement in the investment climate not sufficiently controlled for by the accelerator and FDI. Aggregate investment also responds negatively to the RER, not a surprising result given that NT private fixed investment accounted for over two thirds of private fixed capital formation during the sample period. FDI inflows were found to have no *direct* long-run or short-run impact on private investment levels or their rate of growth, neither at the aggregate nor at the sectoral level. This could be interpreted as the result of three, not mutually exclusive, factors. a) Though FDI does exert a strong *indirect* positive effect on investment through its large impact on output and growth, particularly in the T sector, econometrically the accelerator could be absorbing all or most of any positive effect. Indeed, the long-run and short-run elasticities of investment in all sectors with respect to the accelerator were found to be greater than one. This could be driving the coefficients of FDI downwards. However, dropping the accelerator terms, while resulting in larger positive coefficients for FDI, considerably worsened the fit and expanded standard errors, so that no significance was found for most

[57] See, for instance, Serven and Solimano (1993) and Rama (1993).

explanatory variables (except credit). b) FDI flows, as shown by the microeconomic evidence analysed in the last section, does not add one-to-one to fixed capital; a substantial fraction of it finances current assets. Thus, FDI is a poor proxy for gross fixed investment by foreign firms. c) A third possibility is, of course, that FDI crowds out domestic investment. The microeconomic data suggest that financial crowding out is not likely to be a major factor. On the other hand, they also indicate that linkages of foreign firms, especially those operating in the FTZ and TA regimes, with domestic suppliers are scant, so that direct complementarity between foreign and domestic investment is weak at best. Crowding out at product and labour markets can also explain the result. The former is unlikely to be large, given that most foreign investment in CR, a very small and open economy, is export-oriented rather than local-market oriented. Labour market crowding out, especially through an increase in real wages, is more likely, but analysing such hypothesis is beyond the scope of this paper.[58]

In any event, the econometric evidence indicates that the hypothesis of input complementarity between foreign and domestic investment is not warranted.

4.3.3 Exports and imports

Export supply is specified as a function of domestic demand (with an expected negative sign); foreign demand (given by a geometric weighted average index of trade partners' GDP); relative prices (either the price of exports relative to domestic goods, or the external REER -as defined in Appendix 2-, which measures international competitiveness); and total and sectoral FDI stocks. Results are shown in table A6 for the runs with the external RER[59]. It emerges that domestic and foreign demand had the expected signs in the long-run regression with total FDI stock (regression 1), but the signs were reversed when sectoral FDI stocks were used (runs 2 and 4). The external REER, on the other hand, has the expected positive sign and was significant in all cases but one. The FDI stock, as expected, exerts a very strong and statistically significant impact on export levels and, in particular, on their growth rate (the elasticity of export growth with respect to the total FDI stock is 2.18). Though much lower than that for the FDI stock in T, cumulative FDI in the NT sector has a considerable positive impact on exports. This suggests that FDI into industries classified as NT, such as wholesale trade, could be financing the operations of export trading firms.

Import demand, in turn, is specified as a function of domestic demand; the relative prices of imports; exports (to account for any possible foreign exchange constraint); and FDI inflows.[60] Results are displayed in table A7. All control variables had the expected signs and showed strong and statistically significant long-run and short-run

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[58] Results for other variables are as follows. Public investment, while exhibiting a strong positive impact on investment in NT, had no explanatory power in the other two sets of regression. The real interest rate had always the expected sign, but is not statistically significant. It was only kept where its exclusion affected diagnostic tests or the Schwarz criterion. Instead, the relative price of capital goods, as expected, has a negative effect on long-run investment in all sectors (though not its rate of growth). Similarly, the volatility of producer prices was found to reduce aggregate and NT investment levels and rates of growth, but has no impact on fixed capital formation in T.

[59] The relative price of exports, though not always significant, had a negative sign. This suggests that exports are driven more by foreign demand and international competitiveness, than by relative domestic profitability.

effects on imports. Aggregate and sectoral FDI inflows, also as expected, exert a positive impact on the long-run equilibrium levels of imports, although after controlling for the indirect impact through exports and GDP, the direct effects are small. FDIT shows a larger impact than FDINT, but its coefficient becomes negative (though still small) in the ECM model.

Overall, the evidence suggests that the presence of foreign firms has a positive long-run and short-run impact on exports and imports, regardless of the industry in which they operate.

4.3.4 The real exchange rate

The specification of the RER model was based on a combination of the theoretical and empirical literature on RER determination in developing countries[61], and our supply-side model of section II. The regressions, therefore, include conventional determinants of the RER as control variables: the terms of trade[62], government expenditure/GDP[63], trade policies[64], and non-FDI capital inflows. I also include two alternative measures of productivity growth differentials between T and NT sectors (to account for the Harrod-Balassa-Samuelson effect referred to above): the output growth differential, and the ratio of labour productivity indices for T and NT. Finally, the nominal exchange rate is used in both in long-run and short-run regressions. Two sets of regressions are estimated.

In the first one, total FDI inflows and FDI net resource transfers –FDINRT- (i.e. FDI inflows minus total FDI income) are used alternatively, to account for the demand-side effects of flows. It is expected that FDI inflows will have a stronger negative effect than FDINRT, as the latter considers FDI-related outflows on current account. For consistency, FDI is used along with other (non-FDI) capital inflows, and FDINRT with total net resource transfers excluding FDI (i.e. imports minus exports minus FDINRT). The results are shown in tables A8 and A9. The government expenditure/GDP ratio and trade policies had the expected signs (except for implicit tariffs in regression 3 of table A9) and are fairly robust to specification, but implicit tariffs produces better results than openness (although the two are very closely –negatively- correlated). The terms of trade, in turn, have very erratic coefficients. The two measures of sectoral productivity differentials exert the expected negative impact on the RER, both in the long-run and in the ECM model, but while coefficients on growth differentials are almost always statistically significant (they are in the short-run), labour productivity differentials are not significant in any of the chosen specifications. The nominal exchange rate has, as expected, no substantial impact on

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[60] FDI stocks were also used, but produced serious problems of serial correlation and non-normality of residuals.

[61] See, for instance, Edwards (1989), Elbadawi (1994), and Baffes, et al. (1999).

[62] A positive terms of trade shock increases national income, and triggers a spending effect that appreciates the RER. But the income effect could be overcome by substitution effects on the demand and supply sides. The net impact is therefore ambiguous.

[63] Public expenditure is expected to be tilted towards NT goods, and thus to have a negative effect on the RER.

[64] Tighter trade policies compress imports. To restore equilibrium, the RER will tend to appreciate. We use to alternative measures of trade policies: openness (exports plus imports/GDP), expected to have a positive sign, and implicit tariffs (ratio of total tariff revenues to total imports), with an expected negative effect.

the long-run RER, although it does exert a positive effect in the short run. When total FDI flows are used, other capital inflows have no discernible influence over the equilibrium RER or its short-run adjustment. But the FDI/GDP ratio does have a strong and highly statistically significant negative impact on the long-run equilibrium level of the RER and on its short-run evolution.[65] By contrast, FDINRT has –as expected- no significant long-run real appreciation effect, and seems moreover to have a positive impact on RER changes, while other net resource transfers do carry negative (and statistically significantly so in most cases) long-run and impact coefficients.

In the second set of specifications, I used sectoral FDI/Y ratios, to account more clearly for the potential supply-side effects of foreign fixed capital investment on the RER, as developed in the model.[66] The same control variables are used, and as shown in table A10, their coefficients are mostly robust.[67] As expected, FDIT has a statistically significant negative impact on the equilibrium RER, and on its rate of change. The effect is much stronger than that of the non-FDI net resource transfer ratio. On the other hand, FDI inflows to the NT sector have a statistically significant negative impact on the equilibrium RER, and indeed a slightly higher coefficient than that on FDIT. In the short-run, however, FDINT does not have a distinct impact on the RER.

To analyse the results of the FDI coefficients in the RER regressions requires integrating the theoretical insights of the model of section II, with the empirical evidence of sections III and IV. This is carried out in the next section.

V. Macroeconomic adjustment to FDI inflows: Integrating theory and evidence

The RER acts as a summary indicator of the macroeconomic adjustment mechanisms taking place to absorb a foreign capital inflow. If FDI has a statistically significant negative impact on the equilibrium RER, it indicates that, in the long run, FDI flows contribute to generate excess aggregate demand for NT goods. How is this result brought about? I will approach the analysis from two different, but complementary perspectives.

- An examination of the balance-of-payments effects of foreign-owned firms in CR, based on the evidence on their capital and current account transactions. This is intended to determine whether there is indeed a net positive foreign exchange effect of FDI, and therefore whether a transfer process is required at all
- A dynamic analysis of the impact of FDI on relative demand for and supply of NT goods, as a means of explaining how the transfer is effected.

[65] Notice, however, that the size of the FDI/GDP coefficient varies substantially between regression 1 and regressions 2 and 3.

[66] Moreover, the sectoral FDI/GDP ratios are measured as ratios of real variables, where both FDIT and FDINT were deflated using the implicit investment deflator. This is consistent with the use of sectoral FDI as a proxy for sectoral foreign investment. By contrast, the total FDI/GDP ratio in tables A8 and A9 was defined as a ratio of variables in current prices.

[67] There are two exceptions: the terms of trade and the nominal exchange rate. In the regressions reported in table A10, the former exert a statistically significant negative long-run real appreciation effect, but a positive one in the short-run. Thus, contrary to theoretical expectations, substitution effects of terms of trade shocks seem to have a stronger RER impact in the short run, while in the long-run the income effect prevails.

I argue that the finding of a long-run RER appreciation effect of FDI is consistent with what the theory and evidence, seen from those two standpoints, would predict.

5.1 Balance-of-payments effects

An analysis of cross-border resource flows suggests that, if the total balance-of-payments effects of foreign-owned firms operating in CR are positive, there has to be a RER appreciation in order to restore external balance.[68] Here, external balance is understood as a zero-overall-balance-of-payments condition, as opposed to the standard notion of external balance as meaning a zero-current-account. In my view, an economy can permanently run a current account deficit based on a surplus of FDI flows because –as stated above- they are non-debt creating. But it cannot permanently run an overall balance-of-payments surplus. Accumulation of reserves through sterilised intervention is both expensive –because of the interest rate differentials between domestic and foreign bonds- and self-defeating, because upward interest-rate pressures from the placement of sterilising bonds in domestic credit markets contribute to attract further capital inflows. Therefore, an excess supply of foreign exchange will eventually generate the RER appreciation required to absorb it.

The overview of aggregate FDI-related flows shows that FDI generates positive and large net resource transfers, although, as expected, their impact on the RER is much lower than that of total FDI inflows. However, this analysis is incomplete. Foreign firms engage in many transactions on current account not linked to FDI by the balance-of-payments accounting procedures. Thus, payments of interest, royalties and other fees, and the net export balance of their operations, is not considered in our measure of FDINRT. But the BEA data set shows that, at least in the case of US MOFAs, their total balance-of-payments impact is large and positive. This is complemented by the results from the econometric analysis of exports and imports. Although the FDI coefficients are not fully comparable, because we use stocks for exports and flows for imports, it appears that the impact of FDI on exports is larger than that on imports. If this is indeed the case, the total impact of FDI on net exports should be positive. This would add to the RER appreciation effect of FDI.

5.2 Intra-temporal and inter-temporal supply and demand effects

The model of section II anticipates an unambiguous appreciation impact of FDIT on the equilibrium RER. This is because of both a direct demand effect, and an inter-temporal supply (Harrod-Balassa-Samuelson) effect. The demand effect could be weakened or reversed if there is substantial financial crowding out. There is no evidence that foreign-owned firms borrow significantly in the CR credit markets. On the other hand, the supply effect of FDIT –its strong impact on output and growth in T- has a second round positive impact on the demand for NT goods, via increases in disposable income. This, in our view, is the main driver of the RER appreciation effect of FDIT. However, it is interesting that this effect remains strong even when controlling for growth differentials across sectors. Finally, the fact that FDIT does not exert a positive impact on fixed investment in T implies that a second mechanism

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[68] Of course, the net positive effects could be matched –and undone- by capital outflows, without a need for relative price adjustment. But there is no strong reason to presume that net FDI inflows should create incentives for net capital outflows.

through which FDIT could appreciate the RER –a displacement of domestic fixed investment from NT towards T- is not present.

In the case of FDINT, its effect on the RER is predicted to be ambiguous, and contingent on the relative sizes of the demand and supply effects, which work in opposite directions. However, the econometric evidence indicates that FDINT's impact on NT output and its rate of growth is immaterial, and is further weakened by the fact that FDINT does not contribute to fixed investment in NT. Thus, the demand (RER appreciating) effect of FDINT should be expected to prevail. The fact that the negative RER impact of FDINT is larger than that of FDIT is, nevertheless, unanticipated. It suggests that the direct demand effect of FDINT is stronger than the demand and supply effects of FDIT put together. This could be the case if the NT-intensity of foreign firms operating in NT industries (e.g. hotels, restaurants, banks) is much higher than that of foreign firms in T, a reasonable scenario.

Finally, it is not surprising that the RER impact of total FDI inflows should be negative, if its sectoral components both exert RER appreciation effects.

VI. Conclusion

This paper has argued that a study of the process of macroeconomic adjustment to a net inflow of FDI –the transfer process- should not be detached from an investigation into the trade and financial practices of the foreign-owned firms towards which FDI flows. Analysis of such practices is necessary for an understanding of the overall balance-of-payments effect of foreign firms' operations, and of the interactions between FDI, foreign fixed investment, and domestic fixed capital formation. The study of direct balance-of-payments effects provides a useful perspective on whether and to what extent absorption of FDI flows requires a relative price adjustment.

On the other hand, the link between FDI and foreign fixed investment, and therefore, between FDI and output, is crucial for the explanation of how such adjustment is effected. But usually this link is either ignored -in the literature on the macroeconomic impact of capital inflows- or assumed to be perfect –in the literature on the growth or investment impact of FDI-. Of course, neither procedure is warranted. FDI could finance the accumulation of current assets, or the purchase of existing fixed assets. But fixed investment by other firms could also be financed by other means, and the empirical literature suggests that host country borrowing is often one of them. Nevertheless, however poor, there is a connection between FDI and the production functions of recipient firms in different sectors.

The model developed in this paper integrates some of these elements into the explanation of RER equilibrium determination in the presence of FDI and foreign-owned capital. Its main implication is that the impact of FDI on the equilibrium RER depends on both direct demand mechanisms and inter-temporal supply channels. In particular, it shows that FDI into the T sector unambiguously appreciates the RER, whereas the impact of FDINT is not determined a priori. It also indicates that the extent of host country borrowing and the NT-intensity of foreign firms' operations are major explanatory factors of the RER impact of FDI.

The major empirical findings of the paper are:

- FDI inflows to CR have increased dramatically after 1986. While the share of FDINT grew markedly in the 1990s, it is still relatively small. Most of the stock of FDI is in the T sector.
- Foreign affiliates do not appear to resort to much host-country borrowing to finance their operations. Instead, related-company financing is central.
- Only a small fraction of FDI appears to finance fixed investment in the case of US MOFAs. The rest finances current assets. If this pattern is extrapolated to the country as a whole, it could explain the fact that FDI does not have a discernible econometric effect on aggregate or sectoral private fixed investment.
- FDI has a large negative impact on the RER, although the RER appreciation effect weakens when only FDI-related net resource transfers are considered. As expected, FDIT exerts a strong negative impact on the RER. But so does FDINT, and its coefficient is in fact slightly larger than that of FDIT.
- From a static, balance-of-payments perspective, the negative impact of FDI on the RER is associated with the evidence that foreign firms seem to have a positive overall balance-of-payments effect. Indeed, retained earnings and distributed profits have remained at low levels relative to total FDI inflows to CR, so that the net resource transfers associated with FDI have been very large. If retained earnings are excluded, the cost of FDI (profit repatriations and other payments on current account) is low relative to the stock of FDI for US foreign affiliates. The foreign-owned firms operating in CR have high import and export propensities, and for the firms in FTZ and TA regimes, statistically significantly higher than domestic firms. The econometric impact of FDI on exports and imports is positive, but it appears that the former is larger, so that the effect on net exports is also positive. Finally, the total direct balance-of-payments effect of US MOFAs is large and has increased substantially.
- The RER appreciation effect of FDIT is associated with the supply channel: the strong coefficient of FDIT in the T production functions, both in the long-run levels and the growth regressions. But there is no discernible impact of FDIT on fixed investment in the T sector. In the case of FDINT, there is no major supply-side effect, neither directly through the production function, nor indirectly through domestic fixed investment. Hence its negative effect on the RER. But the fact that its impact is larger than that of FDIT suggests that the direct demand channel (purchases of NT goods) must be very large for FDINT.

The findings of this paper suggest areas for potential further research. In particular, two issues appear to be of central importance: an analysis of the factors explaining the lack of a direct fixed investment effect of FDI (other than through the accelerator channel), and a consideration of the impact of FDI on real wages. Indeed, the latter –a labour market crowding out effect- could be a contributing factor behind the investment function results.

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Appendix 1
Charts and Tables

Chart 1
Costa Rica. FDI inflows and their compostion, 1970-99
(US$ millions)

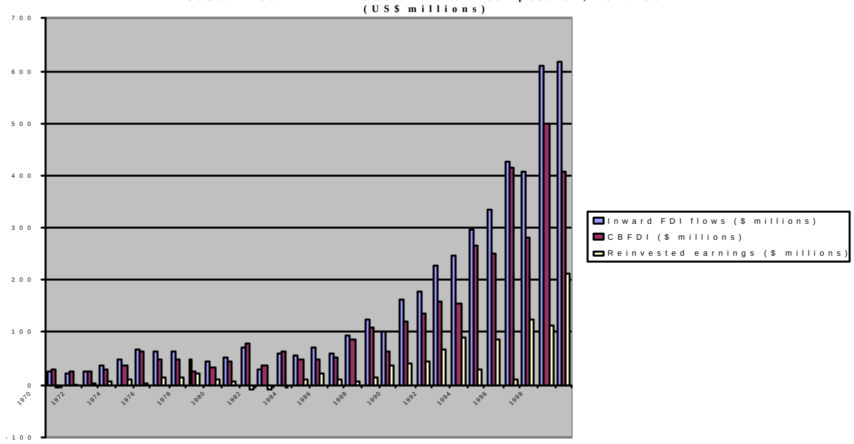

Chart 2
Costa Rica. FDI and related flows as a share of GDP, 1970-99

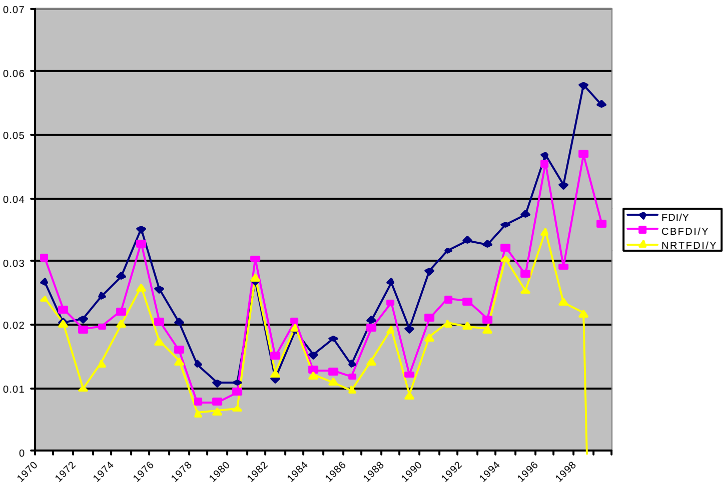

Table A1. US MOFAs in CR: FDI and other Balance of Payments Data
Selected years (1982-1998)
(in millions of current US$, where applicable)

	FDI Stock	**FDI Inflows**		**Reinv. ear/Total FDI**	**FDI Income**[1]	**Net service payments**[2]	**Return on FDI**	**Balance of payments effects**	
	(A)	**Total**	**Reinves-ted earnings**		**(B)**	**(C)**	**(B+C/A)**	**Trade balance**[3]	**Total effect**[4]
1998	2,080	599	-97	-16.19%	-79	20	-2.84%	1,244	1,902
1997	1,580	316	245	77.53%	252	21	17.28%	1,535	1,578
1996	1,284	362	302	83.43%	307	9	24.61%	1,441	1,487
1995	921	271	334	123.25%	343	8	38.11%	1,291	1,211
1990	251	43	31	72.09%	41	3	17.53%	122	121
1985	123	-32	-7	21.88%	2	8	8.13%	N/A	N/A
1982	142	0	4	N/A	10	1	7.75%	N/A	N/A

1/ Includes parents' claims on the earnings of the affiliates (whether retained or distributed) as well as parents' net interest receipts on loans to the affiliates, net of withholding taxes.
2/ Includes net payments of royalties, license fees and other charges for services from the affiliates to their parents, net of withholding taxes.
3/Total exports minus imports from the US
4/Trade balance + FDI inflows – FDI income – Net service payments to parents on current account
Source: Author's own calculations, from Bureau of Economic Analysis, US Department of Commerce

Table A2. Trade and financial patterns of domestic and foreign-owned firms in the FTZ and TA regimes: Summary of ANOVA tests (1998)

		FTZ regime		Temporary Admission regime	
		Costa Rican	Foreign-owned	Costa Rican	Foreign-owned
Export ratio[1]	Group mean	0.8977	0.9567	0.8	0.98
	p-value		0.1701		0.00183**
Import ratio[2]	Group mean	0.6255	0.8148	0.56	0.74
	p-value		0.0525+		0.23336
Input import ratio[3]	Group mean	0.3889	0.7679	0.53	0.66
	p-value		0.0001**		0.39014
Related-party fin. 1[4]	Group mean	0.3139	0.6779	0.28	0.75
	p-value		0.002**		0.00051**
Related-party fin. 2[5]	Group mean	0.0473	0.3064	0.16	0.5
	p-value		0.0369*		0.09843+
Local borrowing 1[6]	Group mean	0.975	0.4424	0.9	0.57
	p-value		0.0067**		0.08149+
Local borrowing 2[7]	Group mean	0.3002	0.0191	0.24	0.01
	p-value		0.00000001**		0.00002**

Notes: The null hypothesis in the ANOVA tests is that between-group means are equal. +: significant at the 10% level; *: significant at the 5% level; **: significant at the 1% level
1/Exports/Total sales
2/Total imports (inputs + machinery and equipment)/Total purchases
3/Input imports/Total input purchases
4/ Non-financial long-term liabilities/(Total financial liabilities + non-financial long-term liabilities)
5/ Non-financial long-term liabilities/Total assets
6/ Local bank liabilities/Total financial liabilities
7/ Local bank liabilities/Total liabilities
Source: Data assembled by the author and based on annual reports by firms in the FTZ and TA regimes

Table A.3. US MOFAs in CR: Trade and financial patterns Selected years (1989-1998)

	Trade propensities			Leverage ratio	Parent-company (FDI) financing	
	Exports/ Sales	Exports/ GDP	US Imports/ GDP	Total liabilities/ Total assets	FDI stock/Total assets	FDI inflows/ Gross fixed Investment
1998	0.6997	6.1458	0.9625	0.2535	0.7058	2.2268
1997	0.7601	3.1005	0.3447	0.3208	0.5363	5.1803
1996	0.7608	2.7414	0.2569	0.3240	0.5000	7.3878
1995	0.7438	2.4922	0.2625	0.4545	0.4029	2.8526
1994	0.7275	2.6481	0.2803	0.4737	0.2875	3.4035
1990	0.3784	1.1829	0.4857	0.6920	0.5020	N/A
1989	0.5511	1.8558	0.4093	0.6008	0.4049	N/A

Source: Author's own calculations, with data from Bureau of Economic Analysis, US Department of Commerce

Table A4. Aggregate and sectoral production functions: Long-run cointegrating solutions to a reduced ADL (2,2) model and corresponding ECM regressions, 1970-99

Long-run cointegrating solutions Dependent variable: LnY(i)				**Total short-run impact (ECM model)** Dependent variable: ΔLnY(i)			
i=	Total (1)	T (2)	NT (3)	i=	Total (4)	T (5)	NT (6)
Constant	--	3.199**	--	Constant	--	--	0.018*
		(0.875)					(0.009)
LnEmpl(i)	0.467**	0.066	0.374**	ΔLnEmpl(i)	0.464**	0.502*	-0.015
	(0.061)	(0.084)	(0.057)		(0.148)	(0.204)	(0.182)
LnKst(i)	0.038	0.025	0.366**	ΔLnKst(i)	0.846**	0.953**	0.666**
	(0.164)	(0.065)	(0.082)		(0.262)	(0.259)	(0.169)
LnFDIKst(i)	0.299**	0.498**	0.052*	ΔLnFDIKst(i)	0.266*	0.715**	0.032
	(0.1)	(0.061)	(0.02)		(0.134)	(0.137)	(0.041)
dummy1982	-0.145**	-0.139**	-0.253**	dummy1982	-0.143**	-0.175**	-0.084**
	(0.041)	(0.037)	(0.089)		(0.023)	(0.046)	(0.014)
				ECM_1	-0.744**	-1.36**	-0.231**
					(0.164)	(0.318)	(0.07)
R^2	0.999	0.995	0.999	R^2	0.909	0.901	0.808
AR 1-2	0.565	0.129	0.629	AR 1-2	0.2	0.518	0.48
ARCH 1	0.985	0.794	0.975	ARCH 1	0.482	0.831	0.813
Normality	0.991	0.282	0.554	Normality	0.722	0.265	0.309
Heteroscedast.	0.574	0.806	0.883	Heteroscedast.	0.901	0.929	0.941
RESET	0.824	0.271	0.965	RESET	0.086	0.744	0.404
Cointegration	-5.023*	-5.54**	-3.187†				

* (**) denotes statistically significant at the 5% (1%) level.

† The ADF statistic for the cointegration test on the residuals is –5.87. The null of no cointegration is rejected at the 1% level using appropriate critical values (see Banerjee, 1993: 213).

Notes: Long-run solutions were obtained using *PcGive 9.30*. Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; AR 1-2 is a Breusch-Godfrey LM test for serial autocorrelation up to the second lag; ARCH is a test for autoregressive conditional heteroscedasticity up to the first lag; Normality is the Doornik-Hansen test for the normality of the residuals; Heteroscedast. is White's test for heteroscedasticity; RESET is Ramsey's general test of misspecification. *Cointegration test:* It is a t-test of the null of no cointegration, based on whether the coefficient on the lagged dependent variable is statistically significantly less than one. *Data definition and sources:* See Appendix 2

Table A5. Aggregate and sectoral investment demand functions: Long-run cointegrating solutions to a reduced ADL (1,1) model and corresponding ECM regressions, 1970-99

Long-run cointegrating solutions Dependent variable: LnIpri(i)				**Total short-run impact (ECM model)** Dependent variable: ΔLnIpri(i)			
i=	Total (1)	T (2)	NT (3)	i=	Total (4)	T (5)	NT (6)
Constant	--	--	--	Constant	--	--	--
LnConPr	1.407**	1.545**	1.111**	ΔLnConPr	1.75**	1.244**	1.502**
	(0.089)	(0.186)	(0.084)		(0.205)	(0.387)	(0.198)
LnIpub	--	--	0.253**	ΔLnIpub	--	--	0.301**
			(0.049)				(0.068)
DCredPr(i)	0.109**	0.547*	0.127*	ΔDCredPr(i)	0.102**	0.481**	0.096*
	(0.034)	(0.264)	(0.06)		(0.021)	(0.124)	(0.046)
RIntR(i)	--	--	-0.124	ΔRIntR(i)	--	-0.329	--
			(0.154)			(0.199)	
Ln(Pk/P)	-0.638**	-1.269**	-0.467**	ΔLn(Pk/P)	--	--	--
	(0.126)	(0.296)	(0.145)				
LnPvolat	-0.133**	--	-0.079*	ΔLnPvolat	-0.139**	--	-0.083**
	(0.028)		(0.029)		(0.029)		(0.025)
LIRERPRO	-0.662**	-0.387	-0.499**	ΔLIRERPRO	--	0.104	--
	(0.153)	(0.331)	(0.103)			(0.406)	
LnFDI(i)	0.004	0.078	0.004	ΔLnFDI(i)	0.052	0.093	0.002
	(0.037)	(0.093)	(0.004)		(0.037)	(0.065)	(0.003)
				ECM_1	-0.927**	-0.489**	-0.819**
					(0.172)	(0.145)	(0.185)
R^2	0.999	0.999	0.999	R^2	0.88	0.712	0.999
AR 1-2	0.668	0.896	0.87	AR 1-2	0.759	0.482	0.898
ARCH 1	0.75	0.966	0.116	ARCH 1	0.729	0.885	0.385
Normality	0.866	0.974	0.904	Normality	0.712	0.263	0.952
Heteroscedast.	0.957	0.601	--	Heteroscedast.	0.976	0.921	0.876
RESET	0.129	0.622	0.785	RESET	0.598	0.899	0.234
Cointegration	-7.652**	-3.876†	-6.809**				

* (**) denotes statistically significant at the 5% (1%) level.

† The ADF statistic for the cointegration test on the residuals is -4.872. The null of no cointegration is rejected at the 5% level using appropriate critical values (see Banerjee, 1993: 213).

Notes: Long-run solutions were obtained using *PcGive 9.30*. Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; see table A4 for description of diagnostic tests. *Data definition and sources:* See Appendix 2

Table A6. Export supply function: Long-run cointegrating solutions to a reduced ADL (2,2) model and corresponding ECM regressions, 1970-99

Long-run cointegrating solutions Dependent variable: LnX	(1)	(2)	**Total short-run impact from ECM** Dependent variable: ΔLnX	(3)	(4)
Constant	--	--	Constant	--	--
LnY	-0.789**	1.987**	ΔLnY	1.017**	1.998**
	(0.242)	(0.466)		(0.287)	(0.307)
LnY*	2.15*	-0.571**	ΔLnY*	0.241	-0.721
	(0.995)	(0.127)		(0.425)	(0.369)
LnExtREER	0.084	0.188**	ΔLnExtREER	0.191*	0.285**
	(0.12)	(0.054)		(0.084)	(0.054)
LnFDIKst	0.696*	--	ΔLnFDIKst	2.184**	--
	(0.263)			(0.358)	
LnFDIKstT	--	0.318*	ΔLnFDIKstT	--	1.272**
		(0.139)			(0.226)
LnFDIKstNT	--	0.244**	ΔLnFDIKstNT	--	0.648**
		(0.034)			(0.087)
			ECM_1	-0.639**	-1.038**
				(0.103)	(0.129)
R^2	0.999	0.999	R^2	0.892	0.963
AR 1-2	0.934	0.983	AR 1-2	0.217	0.672
ARCH 1	0.389	0.15	ARCH 1	0.308	0.339
Normality	0.144	0.298	Normality	0.151	0.164
Heteroscedast.	0.749	--	Heteroscedast.	0.984	0.995
RESET	0.74	0.066	RESET	0.469	0.496
Cointegration	-4.681*	-8.543**			

* (**) denotes statistically significant at the 5% (1%) level.

Notes: Long-run solutions were obtained using *PcGive 9.30.* Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; see table A4 for description of diagnostic tests. *Data definition and sources:* See Appendix 2

Table A7. Import demand function: Long-run cointegrating solutions to a reduced ADL (2,2) model and corresponding ECM regressions, 1970-99

Long-run cointegrating solutions Dependent variable: LnM	(1)	(2)	ECM (total short-run impact) Dependent variable: ΔLnM	(3)	(4)
Constant	2.015**	--	Constant	--	--
	(0.627)				
LnY	0.655**	0.921**	ΔLnY	0.515*	0.667**
	(0.098)	(0.058)		(0.255)	(0.214)
Ln(Pm/Pd)	-0.679**	-0.58**	ΔLn(Pm/Pd)	-0.484**	-0.441**
	(0.063)	(0.047)		(0.096)	(0.07)
LnX	0.336**	0.241**	ΔLnX	0.259*	0.481**
	(0.059)	(0.041)		(0.108)	(0.112)
LnFDI	0.11**	--	ΔLnFDI	0.086**	--
	(0.025)			(0.024)	
LnFDIT	--	0.085**	ΔLnFDIT	--	-0.047**
		(0.018)			(0.017)
LnFDINT	--	0.012**	ΔLnFDINT	--	0.013**
		(0.003)			(0.003)
			ECM_1	-0.477**	-0.552**
				(0.137)	(0.114)
R^2	0.996	0.999	R^2	0.921	0.963
AR 1-2	0.096	0.58	AR 1-2	0.272	0.46
ARCH 1	0.847	0.304	ARCH 1	0.204	0.51
Normality	0.637	0.92	Normality	0.634	0.118
Heteroscedast.	0.956	0.73	Heteroscedast.	0.895	--
RESET	0.69	0.839	RESET	0.64	0.466
Cointegration	-12.641**	-9.07**			

* (**) denotes statistically significant at the 5% (1%) level.

Notes: Long-run solutions were obtained using *PcGive 9.30.* Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; see table A4 for description of diagnostic tests. *Data definition and sources:* See Appendix 2

Table A8. Real exchange rate determination using FDI and FDINRT: Long-run cointegrating solutions to a reduced ADL (1,1) model, 1970-99

	Dependent variable: LIRERPRO					
	With FDI/Y			**With FDINRT/Y**		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	2.225**	3.799*	4.578**	2.853*	4.959**	5.125**
	(0.704)	(1.078)	(0.778)	(1.141)	(1.542)	(1.52)
Ln(Gov/Y)	-0.77**	-0.702**	-0.821**	-0.692**	-0.366	-0.095
	(0.104)	(0.18)	(0.153)	(0.214)	(0.298)	(0.27)
LnImplTariff	-0.132**	--	-0.219**	-0.134**	--	-0.175*
	(0.022)		(0.052)	(0.041)		(0.085)
LnOPEN	--	1.084**	--	--	0.779	--
		(0.327)			(0.455)	
LnToT	0.138	0.047	-0.422**	0.061	-0.063	-0.214
	(0.129)	(0.226)	(0.147)	(0.184)	(0.311)	(0.243)
GrowthdiffTNT	-0.646**	-0.19	--	-1.121*	-1.555	--
	(0.258)	(0.469)		(0.405)	(0.919)	
LnLabprodTNT	--	--	-0.094	--	--	-0.488
			(0.185)			(0.292)
LnNER	0.006	-0.052*	0.037*	-0.034*	-0.0231	-0.039
	(0.009)	(0.0253)	(0.016)	(0.014)	(0.047)	(0.032)
NKF(exclFDI)/Y	0.406	0.028	-0.596	--	--	--
	(0.283)	(0.548)	(0.432)			
NRT(exclFDI)/Y	--	--	--	-0.861	-2.239*	-3.274**
				(0.633)	(1.005)	(0.801)
FDI/Y	-3.379**	-9.574**	-10.13**	--	--	--
	(0.979)	(2.645)	(1.644)			
FDINRT/Y	--	--	--	-2.83	-5.378	0.118
				(1.864)	(3.702)	(0.801)
R^2	0.978	0.976	0.926	0.969	0.965	0.895
AR 1-2	0.491	0.228	0.224	0.094	0.125	0.969
ARCH 1	0.473	0.681	0.347	0.916	0.934	0.409
Normality	0.525	0.31	0.10	0.283	0.256	0.396
Heteroscedast.	--	--	0.831	--	--	0.926
RESET	0.343	0.091	0.268	0.085	0.077	0.332
Cointegration	-7.152**	-5.116*	-6.519**	-6.207**	-3.449	-4.701*

* (**) denotes statistically significant at the 5% (1%) level.

Notes: Long-run solutions were obtained using *PcGive 9.30.* Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; see table A4 for description of diagnostic tests. *Data definition and sources:* See Appendix 2

Table A9. Real exchange rate determination using FDI and FDINRT: Total short-run impact coefficients from the error-correction models, 1971-99

	Dependent variable: ΔLIRERPRO			
	With Δ(FDI/Y)		With Δ(FDINRT/Y)	
	(1)[1]	(2)[2]	(3)[3]	(4)[4]
Constant	--	-0.011	--	--
		(0.007)		
ΔLn(Gov/Y)	-0.508**	-0.445**	-0.269**	-0.407**
	(0.068)	(0.12)	(0.066)	(0.126)
ΔLnImplTariff	-0.001	-0.103**	0.018	-0.033
	(0.002)	(0.022)	(0.021)	(0.027)
ΔLToT	0.29**	0.17*	0.191**	-0.115
	(0.038)	(0.06)	(0.045)	(0.073)
ΔGrowthdiffTNT	-0.336**	--	-0.221**	--
	(0.077)		(0.079)	
ΔLnLabprodTNT	--	-0.054	--	-0.209
		(0.078)		(0.107)
ΔLnNER	0.217**	0.108**	0.256**	0.047
	(0.022)	(0.036)	(0.031)	(0.031)
Δ(NKF(exclFDI)/Y)	0.085	-0.165	--	--
	(0.093)	(0.129)		
Δ(NRT(exclFDI)/Y)	--	--	-0.076	-0.759**
			(0.123)	(0.212)
Δ(FDI/Y)	-1.678**	-3.889**	--	--
	(0.511)	(0.823)		
Δ(FDINRT/Y)	--	--	1.258*	0.229
			(0.397)	(0.262)
ECM_1	-0.495**	-0.39**	-0.43**	-0.288**
	(0.053)	(0.073)	(0.048)	(0.071)
R^2	0.953	0.915	0.961	0.843
AR 1-2	0.854	0.619	0.838	0.772
ARCH 1	0.73	0.395	0.715	0.998
Normality	0.498	0.447	0.289	0.712
Heteroscedast.	0.576	0.996	--	0.844
RESET	0.39	0.42	0.639	0.531

* (**) denotes statistically significant at the 5% (1%) level.
[1]Corresponds to regression 1 in Table 1
[2]Corresponds to regression 3 in Table 1
[3]Corresponds to regression 4 in Table 1
[4]Corresponds to regression 6 in Table 1
Notes: Long-run solutions were obtained using *PcGive 9.30*. Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; see table A4 for description of diagnostic tests. *Data definition and sources:* See Appendix 2

Table A10. Real exchange rate determination using sectoral FDI: Long-run cointegrating solutions to a reduced ADL (1,1) model and corresponding ECM regressions, 1970-99

Long-run cointegrating solutions Dependent variable: LIRERPRO			**Total short-run impact from ECM** Dependent variable: ΔLIRERPRO		
	(1)	(2)		(3)	(4)
Constant	4.81**	4.865**	Constant	--	0.017
	(0.461)	(0.563)			(0.01)
Ln(Gov/Y)	-0.415**	-0.346*	ΔLn(Gov/Y)	-0.305**	-0.532**
	(0.113)	(0.122)		(0.061)	(0.142)
LnImplTariff	-0.151**	-0.14**	ΔLnImplTariff	-0.096**	-0.072**
	(0.026)	(0.031)		(0.017)	(0.02)
LnToT	-0.261**	-0.238*	ΔLToT	0.137**	0.144*
	(0.09)	(0.106)		(0.047)	(0.054)
GrowthdiffTNT	-0.638*	--	ΔGrowthdiffTNT	-0.167*	--
	(0.295)			(0.081)	
LnLabprodTNT	--	-0.034	ΔLnLabprodTNT	--	-0.13
		(0.151)			(0.073)
LnNER	0.01	0.004	ΔLnNER	0.017	-0.06
	(0.011)	(0.015)		(0.018)	(0.05)
NRT(exclFDI)/Y	-1.361**	-1.459	Δ(NRT(exclFDI)/Y)	-0.555**	-0.759**
	(0.294)	(0.343)		(0.121)	(0.167)
FDIT/Y	-6.185**	-5.544**	Δ(FDIT/Y)	-3.936**	-3.456**
	(1.105)	(1.198)		(0.552)	(0.547)
FDINT/Y	-7.548*	-6.712*	Δ(FDINT/Y)	0.955	-2.047
	(2.544)	(2.947)		(1.449)	(1.207)
			ECM_1	-0.613**	-0.619**
				(0.07)	(0.085)
R^2	0.969	0.961	R^2	0.957	0.961
AR 1-2	0.655	0.333	AR 1-2	0.612	0.749
ARCH 1	0.191	0.225	ARCH 1	0.485	0.396
Normality	0.662	0.318	Normality	0.615	0.213
Heteroscedast.	--	--	Heteroscedast.	--	--
RESET	0.245	0.324	RESET	0.965	0.477
Cointegration	-10.431**	-9.236**			

* (**) denotes statistically significant at the 5% (1%) level.

Notes: Long-run solutions were obtained using *PcGive 9.30.* Numbers in brackets are standard errors. *Diagnostic tests:* all numbers provided are p-values; see table A4 for description of diagnostic tests. *Data definition and sources:* See Appendix 2

Appendix 2

Variable definitions and data sources

General notes and notation:

- Prefix Ln or L denotes the natural logarithm of a variable
- Δ denotes first differences
- Total refers to country total
- T refers to the tradable sector, calculated in every case as the sum of agriculture (including forestry, hunting and fishing) and manufacturing (including mining and quarrying)
- NT refers to the nontradable sector, constructed in every case (except FDI) as the sum of wholesale and retail trade, restaurants, and hotels, general government services, electricity and water, construction (construction), transport, storage, and communications (transport), finance, insurance, and business services (finance), real estate services, and other personal services. For FDI, apart from agriculture and manufacturing, there are only series for "commerce" (wholesale and retail trade, restaurants and hotels) and "other services". These two categories are added up and used as NT for FDI.
- ECM_1 is the first lag of the error-correction mechanism
- BCCR: Central Bank of Costa Rica

Unless otherwise indicated, the source for all data is BCCR. Variables are listed in the order in which they appear (tables A4 to A10).

Variables:

Y (Total, T, NT): Real GDP per sector, in millions of 1966 colones.

Empl (Total, T, NT): Total number of workers employed in the sector. The Costa Rican Central Bank (BCCR) publishes data on employment only from 1976 onwards. To extend the series back to 1970, World Bank *World Development Indicators* figures for the total labour force are used. It is assumed that the rate of unemployment remains constant, so that variations in total labour force are translated directly into variations in employment. Also, employment per sector is extended by keeping the 1976 sectoral shares constant.

Kst (Total, T, NT): Total fixed capital stock per sector, in millions of 1966 colones. Figures for the aggregate and capital stocks per industry for the period 1976-1992 are taken from a series constructed and published by the BCCR. The stocks were constructed by the BCCR through a careful study of capital composition in each sector, so that different depreciation rates could be applied accordingly (for a detailed explanation on the methodologies used, see Azofeifa, 1990). (Depreciation rates for buildings and premises are much lower than those for machinery and equipment, and for the latter there is a wide range of rates). To accumulate capital, the BCCR used the following formula:

$$K_{t+1} = (1-\delta)K_t + I_{t+1} \quad (1),$$

where δ is the rate of depreciation. In order to extend the series back and forward to complete values for 1969-1999, I proceeded as follows. First, by using the gross fixed investment series per sector, and solving for δ in (1), I estimated the implicit depreciation rates for 1976-1992. Then I used a 3-year moving average of those rates and the series for gross fixed investment per industry to accumulate the capital stocks (in the case of extending the series back to 1969, this involved solving for K_t in (1)).

FDIKst (Total, T, NT): Total FDI stock per sector, in millions of 1966 colones. FDI stocks per industry in 1959 are used as initial values and taken from Thome Loria (1980, chart 3). Thereafter, FDI stocks per sector were accumulated using:

$$FDIK_{t+1} = FDIK_t + FDI_{t+1} \quad (2).$$

No depreciation is used to accumulate stocks of FDI, because the FDI figures are already net of depreciation.

Ipri (Total, T, NT): Gross fixed private investment per sector, in millions of 1966 colones. Ipri is calculated by deducting public fixed investment from total gross fixed investment. The BCCR published series of total gross fixed investment per industry until 1996 (figures after 1996 have not been estimated by the BCCR), but the series for the country total and for public fixed investment are up to date. In order to extend the series to 1999, I estimated the shares of total gross fixed investment per industry in total gross fixed investment, and used 3-lag moving averages of those shares over total gross fixed investment in 1997-99.

ConPr: Private consumption, in millions of 1966 colones.

Ipub: Gross fixed investment by the consolidated public sector, in millions of 1966 colones.

DCredPr (Total, T, NT): Change in the stock of total bank credit to the private sector, per industry, in millions of 1966 colones.

RIntR (Total, T, NT): Real interest rate, estimated as:

$$RIntR = (1 + r_t)/(1 + PPI\inf_{t+1}) \quad (3)$$

where r is the nominal lending interest rate (average lending rates for manufacturing used for T; average lending rates for commerce used for NT; simple mean of lending rates for manufacturing and commerce used for country total); and PPIinf is the rate of change of the producer price index.

Pk/P: Relative price of capital goods, estimated as the ratio of the implicit investment deflator to the producer price index.

Pvolat: Volatility in the producer price index, measured as a 12-month average of the coefficient of variation of the producer price index during the previous 36 months

IRERPRO: Internal real exchange rate index, measured as the ratio of the prices of T to the prices of NT. The prices of T (NT) are estimated as the geometric weighted average of the implicit deflators for all T (NT) industries, where the weights are the current-year shares of each industry in total real GDP in T (NT). Implicit price deflators per industry, in turn, are calculated by dividing the current-price value added by the constant-price value added, as published in the national accounts.

FDI: Gross foreign direct investment inflows, in millions of 1966 colones.

X: Total exports of goods and services, in millions of 1966 colones.

Y*: index of foreign demand, measured by the geometric weighted averages of real GDP indices of the nine main trading partners for Costa Rica (US, Japan, Germany, Mexico, Venezuela, Guatemala, Honduras, El Salvador, Nicaragua). The weights are given by the current-year shares of each trading partner's bilateral trade (exports plus imports) with Costa Rica in Costa Rica's total trade (exports plus imports). Source for real GDP indices of trading partners: IMF's *International Financial Statistics*.

ExtREER: External real effective exchange rate index, defined as a ratio of trade partners' and competing third countries' consumer price indices to Costa Rica's consumer price index. Source: IMF (series back to 1970 provided to author by Claudio Paiva)

Pm/Pd: Relative prices of imports, defined as the ratio of the import price index to the domestic good price index. The latter is calculated following the procedure described in Hinkle and Nsengiyumva (1999), as the ratio of (GDP plus imports of intermediate goods minus exports in current prices) to (GDP plus imports of intermediate goods minus exports in constant prices).

Gov/Y: Ratio of total government expenditure to GDP, both in current colones.

ImplTariff: Implicit tariffs, defined as the ratio of total tariff revenues to total imports.

OPEN: Openness index, measured as the ratio of (exports plus imports)/GDP, all in current colones.

ToT: Index of the internal terms of trade, calculated as the ratio of the export price index to the import price index, from national accounts.

GrowthdiffTNT: Sectoral GDP growth differential, measured as GDP growth rate in T minus GDP growth rate in NT.

LabprodTNT: Ratio of average labour productivity in T (output per worker) to average labour productivity in NT.

NER: Official nominal exchange rate used in national accounts (annual averages).

NKF(exclFDI)/Y: Net capital inflows, excluding FDI/GDP, both measured in current prices.

NRT(exclFDI)/Y: Net resource transfers, excluding FDI (i.e. imports minus exports minus FDINRT, as defined below)/GDP, all in current prices.

FDI/Y: FDI inflows/GDP, all in current prices.

FDINRT/Y: FDI-related net resource transfers (i.e. FDI inflows minus total FDI income)/GDP, all in current prices.

FDIT/Y: FDI flows to T/total GDP, all in 1966 colones. FDIT was deflated using the implicit investment deflator.

FDINT/Y: FDI flows to NT/total GDP, all in 1966 colones. FDINT was deflated using the implicit investment deflator.