THE ORDER OF LIBERALIZATION OF THE CURRENT AND CAPITAL ACCOUNTS AND THE REAL EXCHANGE RATE: A MODEL AND SOME REFLECTION BASED ON THE SOUTHERN CONE EXPERIENCE

By

Sebastian Edwards
University of California, Los Angeles
and
National Bureal of Economic Research

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Abstract

In this paper a general equilibrium intertemporal model with optimizing consumers and producers is developed to analyze how different policies geared at liberalizing the current and capital accounts of the balance of payments affect the equilibrium real exchange rate (RER). In particular, the effects of a reduction in the level of import tariffs and of a change in the tax on foreign borrowing on the equilibrium RER are investigated. In the case of import tariffs, both a temporary and an anticipated liberalization are considered. It is shown that in the case of tariffs reduction it is not possible to know a priori whether the equilibrium RER will appreciate or depreciate. However, a liberalization of the capital account will always result in an equilibrium real appreciation in the current period. It is then argued that analyses of this type are essential to evaluate whether observed movements in the RER represent a misalignement situation or if they are an equilibrium phenomenon. The case of the recent liberalization attempts in the Southern Cone are also discussed.

Sebastian Edwards
Dept of Economics
UCLA
Los Angeles, CA 90024
(213)-204-4545

I. Introduction

The disappointing outcome of the liberalization attempts undertaken in the Southern Cone during the late 1970s has generated a large interpretative literature.[1] Most analyses on these experiences have pointed out that the real exchange rate appreciation observed in Argentina, Chile and Uruguay during the late 1970s and early 1980s was one of the most -- if not the most -- important cause behind the frustration of these experiments.[2] Surprisingly, however, the great majority of these studies have only noted the fact that the real exchange rate appreciated, without embarking on serious discussions on the extent to which these real exchange rate movements were indeed disequilibrium movements, that led to an unsustainable real exchange rate overvaluation. Most studies, in fact, have simply resorted to some type of simple PPP type calculation to compute the magnitude of the real exchange rate "overvaluation".[3]

A major shortcoming of that approach is that it completely ignores the effects of the major structural changes to which these economies were subject (including the liberalizations) on the equilibrium value of the RER. Since real exchange rate overvaluation is defined as a substantial and sustained departure of the actual RER from its equilibrium value, it is absolutely necessary to have at least an approximate idea on how the equilibrium RER has moved during the period under study.

In environments like that of the Southern Cone, where major structural changes take place in a short period of time, it is meaningless to talk

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[1] See, for example, Calvo (1986), Corbo (1985), Edwards (1985), Edwards and Cox-Edwards (1987), Harberger (1983), Foxley (1984).

[2] For example, Corbo (1985), Balassa (1985).

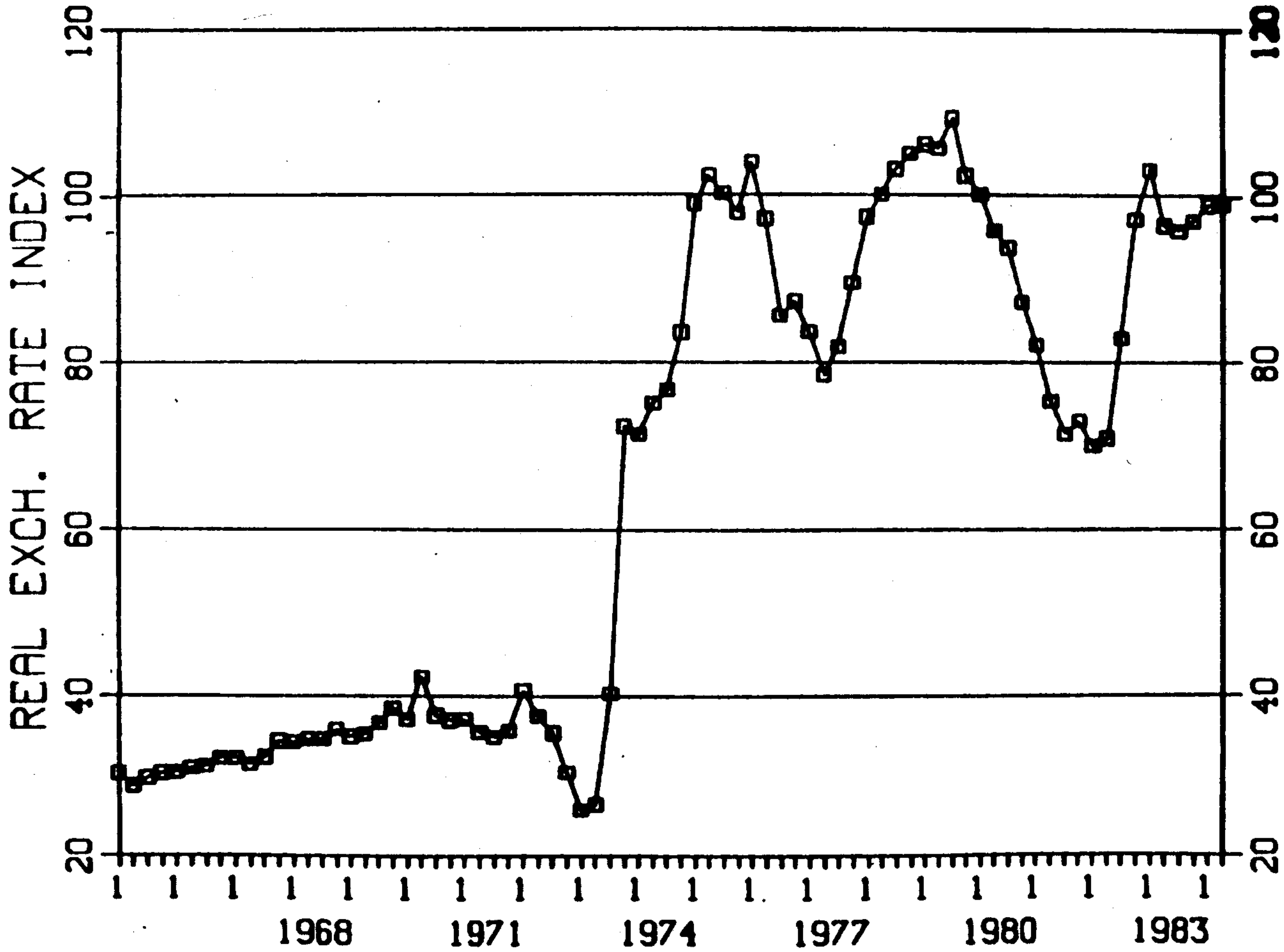
[3] Corbo (1985).

about exchange rate overvaluation without first seriously analyzing the movements of the equilibrium RER. This is perhaps best illustrated in the case of Chile. Figure 1 depicts the evolution of Chile's effective real exchange rate. This index was constructed as $REER = (E^b P*^b)/P$ where E^b is a weighted average of Chile's bilateral nominal exchange rates relative to its 10 major trading partners, $P*^b$ is a weighted average of these partners WPIs and P is Chile's CPI. As can be seen from this figure, between 1965 and 1970 there was a slow and steady real depreciation which broadly corresponds to the mild trade liberalization undertaken by the Frei administration. During this period a crawling peg nominal exchange rate helped to achieve and maintain this depreciating real exchange rate. The period 1970-73 corresponds to the socialist government of Dr. Salvador Allende, where expansive macropolicies and the massive imposition of exchange controls resulted in forces that appreciated the real rate by almost 50%. In terms of other "fundamentals", during this period the terms of trade fluctuated without exhibiting a definitive trend.

The years 1974-84 correspond to the first decade of the Pinochet regime. The first thing that stands out from the diagram is that between the period 1965-73 and 1974-84 there is a clear structural break in the real exchange rate behavior. Throughout 1974-84, in spite of broad fluctuations, the real exchange rate was at all times significantly higher than at any time during the previous ten years. Between mid-1979 and mid-1982 the by-now much discussed real appreciation of the Chilean peso took place.[4] What is fascinating is to notice that although during this period (mid-1979-

[4]This appreciation was the result of two interrelated factors: (1) the opening of the capital account, which resulted in a flooding of the economy with foreign funds; and (2) the fixing of the nominal exchange rate as a way to bring down inflation. Edwards and Cox-Edwards (1987).

CHILE: QUARTERLY REAL EFFECTIVE EXCHANGE RATE
1975=100



SOURCES: IFS and DOT, IMF.

mid-1982) the RER declined by 30%, it was still almost 70% higher than its peak during 1965-73! This, of course, provides a vivid illustration of how changes in fundamentals can greatly change the equilibrium value of the real exchange rate. A RER that would have been excessively "high" in the 1970s, before the tariff liberalization and structural worsening of the terms of trade, was fatally low in the early 1980s.

Surprisingly, the theoretical literature on economic liberalization has treated in an extremely sketchy and even superficial form the crucial question on how the equilibrium RER is affected by the reforms themselves.[5] Most of the existing literature that has focused on the effects of tariff changes on RER has either been partial equilibrium in nature or has ignored intertemporal issues.

The purpose of the present paper is to develop a general equilibrium intertemporal model to analyze formally the effect of different economic liberalization policies on equilibrium RER. The understanding of the economics of equilibrium RER adjustments during a liberalization reform is a fundamental first step in any attempt to analyze whether in a particular country the RER becomes overvalued following a liberalization reform. The rest of the paper concentrates exclusively on the theoretical model, without making an actual attempt to compute the path followed by the equilibrium RER in these countries.[6] The paper is organized as follows: in Section II a very general intertemporal equilibrium model of a small open economy that

[5]There are, of course, a few exceptions. Balassa (1982) discusses rather informally the connection between import tariffs reform and the equilibrium RER. McKinnon (1973) discusses informally the impact of both trade and capital account liberalization on the real exchange rate.

[6]Harberger (1986b) develops a simulation model to deal with some of these issues.

produces three goods (exportables, importables and nontradables) is presented. Here the concept of equilibrium RER in an intertemporal setting is discussed, and the modeling strategy is set forward. Section III deals with tariff liberalization and the equilibrium RER. Here a distinction between temporary and anticipated reduction in import tariffs is made. In Section IV the effects of a capital account liberalization on the equilibrium RER are analyzed. Finally, Section V includes the concluding remarks and some further reflections regarding the case of the Southern Cone.

II. The General Model

In order to keep the exposition at the simplest possible level a number of simplifying assumptions are made. Although the framework used is general enough as to accommodate many goods and factors, it is useful to think of this economy as producing three goods -- exportables (X), importables (M) and nontradables (N) -- using standard technology, under perfect competition. Capital is sector specific, while labor can move freely across all three sectors. There is no investment, capital accumulation or growth. (See, however, Section IV.) We consider two periods only -- periods 1 and 2. In the general case international borrowing is subject to a tax. The intertemporal constraint is that at the end of period 2 the country has paid its foreign debts. The importation of M is subject to specific import tariffs both in periods 1 and 2. Since there is no investment, the current account is exactly equal to savings in each period. If the residents of the country dis-save in period 1, their expenditure will exceed their income, and the corresponding current account deficit will be financed through borrowing from abroad. On the preferences side, it is assumed that the utility function is weakly separable, with preferences in each period being identically homothetical. This assumption turns out to be very convenient, since it permits the use of within-period exact price indexes, as suggested by Svensson and Razin (1983). The nominal exchange rate is fixed and equal to one. The price of X is taken as the numeraire. The model is completely real; all monetary considerations are ignored.

The model is worked out using duality and is given by equations (1) through (5). (On the use of duality in international economics see Dixit and Norman, 1980.) Superscripts refer to periods (i.e., R^2 is the revenue function in period 2); subscripts refer to partial derivatives with respect to that variable (i.e., $R^1_{q^1}$ is the partial derivative of period 1's revenue function relative to the price of nontradables in period 1; $R^2_{q^2p^2}$ is the second derivative of R^2 with respect to the price of nontradables (q^2) and importables (p^2) in period 2):

$$R^1(1,p^1,q^1;K,L) + \delta R^2(1,p^2,q^2,K,L) + \tau^1(E_{p^1} - R^1_{p^1}) + \delta\tau^2(E_{p^2} - R^2_{p^2}) + bNCA =$$

$$E[\pi^1(1,p^1,q^1),\delta\pi^2(1,p^2,q^2),W] \qquad (1)$$

$$R^1_{q^1} = E_{q^2} \qquad (2)$$

$$R^2_{q^2} = E_{q^2}, \qquad (3)$$

$$p^1 = p^{1*} + \tau^1, \qquad (4)$$

$$p^2 = p^{2*} + \tau^2. \qquad (5)$$

where the following notation is used:

$R^i(\ );\ i = 1,2$ Revenue functions in period i. Their partial derivatives with respect to each price are equal to the supply functions.

p^i; $i = 1,2$	Domestic relative price of imports in period i.
q^i; $i = 1,2$	Relative price of nontradables in period i.
K,L	Stock of capital and labor, assumed to be fixed.
τ^i; $i = 1,2$	Tariffs in period i.
$\delta*$	World discount factor, equal to $(1+r*)^{-1}$, where $r*$ is world real interest rates (in terms of tradables).
δ	Domestic discount factor. Since there is a tax on foreign borrowing $\delta < \delta*$.
$b = (\delta* - \delta)$	Present value of tax payments per unit borrowed from abroad.
NCA	Non interest capital account in period 2.
E( )	Intertemporal utility function.
$\pi^i(1,p^i,q^i)$	Exact price indexes, which under assumptions of homothecity and separability, corresponds to unit expenditure functions.
W	Total aggregate welfare.

Equation (1) is the intertemporal budget constraint, and states that present value of income -- generated through revenues from production $R^1 + \delta R^2$, plus tariffs collection, plus tax collection from foreign borrowing (b(NCA)) -- has to equal present value of expenditure. Given the assumption of imperfect access to the world capital market, the discount factor used in (1) is δ lower than the world discount of $\delta*$. Equations (2) and (3) are the equilibrium conditions for the nontradables market in periods 1 and 2; in each of these periods the quantity supplied of N ($R^1_{q^1}$ and $R^1_{q^2}$) has to equal the quantity demanded. Given the assumptions about preferences (separability and homothecity) the demand for N in period i can be written as:

$$E_{q^i} = E_{\pi^i} \pi^i_{q^i}. \tag{6}$$

Equations (4) and (5) specify the relation between domestic prices of imports, world prices and import tariffs.

The current account in period 1 is equal to the difference between income and total expenditure in that period:

$$CA^1 = R^1(\ ) + \tau^1(R_{p^1} - E_{q^1}) - E_{\pi^1}\,\pi^1 \qquad (7)$$

II.1 <u>The Concept of Equilibrium Real Exchange Rates</u>

In models with importables and exportables the definition of "the" real exchange rate becomes "tricky", since the by-now traditional concept of relative price of tradables to nontradables loses some meaning. The reason, of course, is that if there are shocks that affect the price of X relative to M, it is not possible to talk about the Hicksian composite "tradables" anymore. For this reason, and in order to simplify the exposition, in the first part of this paper where we discuss the trade reform, we will focus on the relative price of nontradables to exports q. In Section IV, however, where we analyze the liberalization of the capital account (i.e., an increase in δ) with no changes in tariffs, we concentrate on the more traditional relative price of tradables to nontradables.

In the intertemporal model presented above there is not <u>one</u> equilibrium value of the real exchange rate, but rather a vector of equilibrium RERs: one for each period. Within this intertemporal framework the equilibrium RER in a particular period is defined as the (inverse of the) value of q that, for given values of other variables, such as world prices, technology and tariffs, equilibrates <u>simultaneously</u> the external and internal (i.e., nontradables) sectors. In terms of the model the vector of equilibrium relative prices $\tilde{q} = (\tilde{q}^1, \tilde{q}^2)$ is composed of those q^i's that satisfy equations (1) through (5), for given values of the other fundamental variables. In that regard, since the system given by equations (1)-(5) depicts a full equilibrium, both intertemporal for the external sector and period-by-period for the nontradables market, the initial q's are the initial equilibrium relatice prices for periods 1 and 2. An important question, which is tackled in the rest of this paper, refers to the way in which the equilibrium RERs react to different shocks, including changes in tariffs, the tax on foreign borrowing and to transfers.

From the inspection of equations (1)-(5) it is apparent that exogenous shocks in, say, the international terms of trade, will affect the vector of equilibrium RERs through two interrelated channels. The first one is related to <u>intratemporal</u> effects on resource allocation and consumption decisions. For example, as a result of a worsening of the terms of trade in period 1, there will be a tendency to produce more and consume less of M in that period. This, plus the income effect resulting from the worsening of the terms of trade will generate an incipient disequilibrium in the nontradables market which will have to be resolved by a change in $\tilde{q}$ or equilibrium RER vector. In fact, if we assume that there is an absence of foreign borrowing these intratemporal effects will be the only relevant ones. However, with capital mobility, as in the current model, there is an additional <u>intertemporal</u> channel through which changes in exogenous variables will affect the vector of equilibrium RERs. For example, in the case of a worsening of the terms of trade, the consumption discount factor $\pi^2\delta^*/\pi^1$ will be affected, altering the intertemporal allocation of consumption.

II.2 <u>The Modeling Strategy</u>

Since the manipulation of the model in equations (1)-(5) can be quite cumbersome, in the rest of this paper the liberalization of trade and of the capital account will be analyzed sequentially, making some simplifying assumptions. In particular, the following strategy will be used. First in Section III the effect of a commercial policy reform (i.e., reduction in tariffs) will be analyzed under the assumption that there are no taxes on foreign borrowing. That is, it will be assumed that $b = 0$ and $\delta = \delta^*$. In Section IV the effects of capital account liberalization on the equilibrium path of the real exchange rate are analyzed assuming that the relative price of X and M do not change; consequently in this section a composite tradables good is used. Moreover, in order to further simplify the discussion in that section it is assumed that the initial tariffs are equal to zero. While this modeling strategy greatly simplifies the exposition, it does not affect the main results. Moreover in Sections III and IV we discuss the directions in which the relaxation of these simplifying assumptions affect the results.

III. Trade Liberalization and the Equilibrium Real Exchange Rate

In this section we investigate how tariff changes affect the equilibrium path of the real exchange rate in an intertemporal model with foreign borrowing. In order to simplify the exposition we assume that there are no impediments to international trade and that $\delta = \delta^*$. Differentiating (1)-(5) we can write:

$$\begin{bmatrix} \epsilon_1 & \epsilon_2 & -\epsilon_3 \\ (R^1_{q^1q^1} - E_{q^1q^1}) & -E_{q^2q^1} & -\pi^1_{q^1} E_{\pi^1 W} \\ -E_{q^1q^2} & (R^2_{q^2q^2} - E_{q^2q^2}) & -\pi^2_{q^2} E_{\pi^2 W} \end{bmatrix} \begin{bmatrix} dq^1 \\ dq^2 \\ dW \end{bmatrix} = \begin{bmatrix} \beta_1 & \beta_2 & \beta_3 & \beta_4 \\ \gamma_1 & 0 & 0 & \gamma_2 \\ \alpha_1 & 0 & 0 & \alpha_2 \end{bmatrix} \begin{bmatrix} dp_1 \\ d\tau^1 \\ d\tau^2 \\ dp_2 \end{bmatrix} \tag{8}$$

where, as already noted, subindexes stand for partial derivatives with respect to that particular variable (i.e., $R^1_{p^1p^1}$ is the slope of the supply curve for M in period 1.) Also, the following notation has been used:

$$\epsilon_1 = \tau^1\left(E_{p^1q^1} - R_{p^1q^1}\right) + \delta*\tau^2\, E_{p^2q^2}$$

$$\epsilon_2 = \delta*\tau^2\left(E_{p^2q^2} - R^2_{p^2q^2}\right) + \tau^1\, E_{p^1q^2}$$

$$\epsilon_3 = E_W\left(1 - \tau^1\pi^1_{p^1}\, E_{\pi_1 W} - \delta*\pi^2_{p^2}\, E_{\pi_2 W}\right)$$

$$E_{p^1p^1} = E_{\pi^1}\, \pi^1_{p^1p^1} + \pi^1_{p^1}\, E_{\pi^1\pi^1}\, \pi^1_{p^1}$$

$$E_{p^1q^1} = E_{\pi_1}\, \pi^1_{p^1q^1} + \pi^1_{p^1}\, E_{\pi^1\pi^1}\, \pi^1_{q^1}$$

$$E_{p^1p^2} = \pi^1_{p^1}\, E_{\pi^1\pi^2}\, \pi^2_{p^2}\, \delta*$$

$$E_{p^1q^2} = \delta*\, \pi^1_{p^1}\, E_{\pi^1\pi^2}\, \pi^2_{q^2}$$

$$E_{p^2p^2} = E_{\pi^2}\, \pi^2_{p^2p^2} + \pi^2_{p^2}\, E_{\pi^2\pi^2}\, \pi^2_{p^2}$$

$$E_{q^1q^1} = E_{\pi^1}\, \pi^1_{q^1q^1} + \pi^1_{q^1}\, E_{\pi^1\pi^1}\, \pi^1_{q^1}$$

$$E_{q^2p^1} = E_{\pi^1}\, \pi^1_{p^1q^1} + \pi^1_{q^1}\, E_{\pi^1\pi^1}\, \pi^1_{p^1}$$

$$E_{q_2q_2} = E_{\pi^2}\, \pi^2_{q^2q^2} + \pi^2_{q^2}\, E_{\pi^2\pi^2}\, \pi^2_{q^2}$$

$$E_{q^1q^2} = \pi^1_{q^1}\, \delta*\, E_{\pi^1\pi^2}\, \pi^2_{q^2}$$

$$E_{q^1p^2} = \pi^1_{q^1} \delta^* E_{\pi^1\pi^2} \pi^2_{p^2}$$

$$\beta_1 = \left[\tau^1(R_{p^1p^1} - E_{p^1p^1}) + (E_{p^1} - R^1_{p^1}) - \delta^*\tau^2 E_{p^2p^1}\right]$$

$$\beta_2 = -\left(E_{p^1} - R^1_{p^1}\right)$$

$$\beta_3 = -\delta^*\left(E_{p^2} - R^2_{p^2}\right)$$

$$\beta_4 = \left[\delta^*\left(E_{p^2} - R^2_{p^2}\right) + \delta^*\tau^2\left(R^2_{p^2p^2} - E_{p^2p^2}\right) - \tau^1 E_{p^1p^2}\right]$$

$$\gamma_1 = (E_{p^1q^1} - R_{p^1q^1})$$

$$\gamma_2 = E_{q^1p^2}$$

$$\alpha_1 = E_{q^2p^1}$$

Notice that given the fact that there actually are six goods -- X, M and N in periods 1 and 2 -- there is room for numerous combinations of substitution effects -- both intratemporal and intertemporal -- that make the signing of some of the terms in (8) impossible without making further assumptions.

The term $E_{\pi^1\pi^2}$, is the channel through which intertemporal substitution takes place; it is the response of (real) consumption on all goods in period 1 to changes in period 2's (exact) price index. Given the two periods nature of this model there is gross substitutability of (all) goods across both periods, so that $E_{\pi^1\pi^2} > 0$. Likewise, by property of the expenditure function we know that $E_{\pi^1\pi^1} < 0$, $E_{\pi^2\pi^2} < 0$. Terms β_2 and β_3 can also be signed since they are equal to minus imports in period 1 and minus the discounted value of imports in 2; consequently they are both negative. The terms $\pi^1_{q^1} E_{\pi^1 W}$ and $\pi^2_{q^2} E_{\pi^2 W}$ capture the income effects and are positive.[7]

Since the price indexes π^1 and π^2 are unit expenditure functions, their derivatives with respect to the different prices are positive and are interpreted as consumption shares. Without imposing additional structure to the model, we know the following sign for the relevant terms: $E_{p^1p^1} < 0$, $E_{p^2p^2} < 0$, $E_{q^1q^1} < 0$, $E_{q^2q^2} < 0$, $E_{p^1q^1} \gtrless E_{p^1p^2} > 0$, $E_{p^1q^2} > 0$, $E_{p^2q^2} \gtrless 0$, $R^1_{q^1q^1} > 0$, $R^1_{p^1p^1} > 0$, $R^1_{q^1p^1} < 0$, $R^2_{q^2q^2} > 0$, $R^2_{p^2p^2} > 0$, $R^2_{q^2p^2} < 0$, $\epsilon_1 \gtrless 0$, $\epsilon_2 \gtrless 0$, $\epsilon_3 > 0$, $\beta_1 \gtrless 0$, $\beta_2 < 0$, $\beta_3 < 0$, $\beta_4 \gtrless 0$, $\gamma_1 \gtrless 0$, $\gamma^2 > 0$, $\alpha_1 > 0$, $\alpha_3 \gtrless 0$. In order to determine the signs of $E_{p^1q^1}$ and $E_{p^2q^2}$ it is not enough to assume that the goods are either gross substitutes or complements in the intratemporal sense (that is signing $\pi^1_{q^1p^1}$ or $\pi^2_{q^2p^2}$); it is also necessary to determine whether the inter- or intratemporal effect dominates. Finally, notice that the strong result that $E_{p^1q^2} > 0$. $E_{p^1p^2} > 0$ is the consequence of the restrictive assumption of separable utility functions.

III.1. Temporary Changes in Tariffs

In this section we investigate the effects of a temporary change in period 1's tariff on the vector of equilibrium real exchange rates. In order to simplify the notation assume that initially tariffs in period 1 and 2 are equal: $\tau^1 = \tau^2 = \tau$. From (8), setting $d\tau^1 = dp^1$ and $d\tau^2 = dp^2 = 0$ we obtain the following expressions for changes in the equilibrium RERs in

[7] Notice that $\pi^i_{p^i} E_{\pi^i W} = C_{iE} E_W$, where C_{iE} is the marginal propensity to consume on imported goods in period i (see Edwards and van Wijnbergen, 1986).

periods 1 and 2:

$$\frac{dq^1}{d\tau^1} = \frac{1}{\Delta}\Big\{\tau\Big[(R_{p^1p^1} - E_{p^1p^1} - \delta^* E_{p^2p^1}) \Big(E_{q^1q^2}\, \pi^2_{q^2}\, E_{\pi^2 W}$$

$$+ \pi^1_{q^1}\, E_{\pi^1 W} \Big(R^2_{q^2q^2} - E_{q^2q^2}\Big)\Big)\Big]$$

$$- (E_{p^1q^1} - R_{p^1q^1})\Big[(R^2_{q^2q^2} - E_{q^2q^2})\epsilon_3 - \tau(E_{p^1q^2} + \delta^* E_{p^2q^2} - \delta^* R^2_{p^2q^2})\pi^1_{q^1} E_{\pi^1 W}\Big]$$

$$- E_{q^2p^1}\Big[\tau(E_{p^1q^2} + \delta^* E_{p^2q^2} - R^2_{p^2q^2})\pi^1_{q^1}\, E_{\pi^1 W} + E_{q^1q^2}\, \epsilon_3\Big]\Big\} \gtrless 0, \tag{9}$$

and

$$\frac{dq^2}{d\tau^1} = \frac{1}{\Delta}\Big\{\tau(R^1_{p^1p^1} - E_{p^1p^1} - \delta^* E_{p^2p^1})\ \Big[(R^1_{q^1q^1} - E_{q^1q^1})\pi^1_{q^1}\, E_{\pi^2 W} + \pi^1_{q^1}\, E_{\pi^1 W}\, E_{q^2q^1}\Big]$$

$$- (E_{p^1q^1} - R_{p^1q^1})\Big[\tau(E_{p^1q^1} - R^1_{p^1q^1} + \delta^* E_{p^2q^1})\pi^2_{q^2}\, E_{\pi^2 W} + \epsilon_3\, E_{q^2q^1}\Big]$$

$$- E_{q^2p^1}\Big[\epsilon_3(R^1_{q^1q^1} - E_{q^1q^1}) - \tau\Big[(E_{p^1q^1} - R^1_{p^1q^1}) + \delta^* E_{p^2q^1}\Big]\pi^1_{q^1}\, E_{\pi^1 W}\Big] \gtrless 0 \tag{10}$$

where Δ is the determinant of the LHS matrix in (8), which under usual stability conditions is negative (see Appendix.)

Equations (9) and (10) are quite interesting. First, they show that, contrary to the more traditional literature on trade reform, in the present general equilibrium intertemporal setting (temporal) reductions in import tariffs don't necessarily result in a real depreciation. Depending on the direction of the substitution effects and of the importance of the income effects $dq_1/d\tau^1$ and $dq^2/d\tau_1$ can be positive or negative. Second, it is possible to see that a temporary change in τ in period 1 (only) will affect the equilibrium real exchange rate in future periods. This, of course, is only possible in an intertemporal model with borrowing where agents can use the international capital market to smooth through time the effect of exogenous shocks.

It is interesting to notice that contrary to some of the more recent static general equilibrium analyses (Dornbusch 1980, Corden 1985, Edwards 1986) the signs of (8) and (10) cannot be determined by resorting to the assumption of intratemporal gross substitutability (i.e., $\pi^1_{p^1q^1} > 0$, $\pi^2_{p^2q^2} > 0$). We now have two additional sources of indeterminacy. First due to intertemporal substitution, even if goods are gross substitutes intratemporally, $\pi^i_{p^iq^i} > 0$, $E_{p^iq^i}$ can be negative due to the intertemporal effect operating via $E_{\pi^1\pi^2}$. Second, in the current model there are income effects which can, and generally will, operate in the opposite direction than the substitution effect. The importance of the income effects will depend on the initial levels of the distortions τ^1 and τ^2 and on E_W, E_{π^2W} and E_{π^1W}.

Another important property of (9) and (10) is that as a result of a temporary tariff the equilibrium RERs can move in opposite directions in periods 1 and 2. For example, it is possible that as a result of a temporary hike in τ the equilibrium RER will increase in the first period, and will decline in the second. This, of course, makes the evaluation of actual movements of RER's, and the determination of whether they represent equilibrium or disequilibrium movement, particularly difficult.

One way to get a more definite result is by evaluating the effects of tariffs around a very small initial tariff $(\tau^1 = \tau^2 \approx 0)$. In this case there are only substitution effects.[8] In this case equation (9) becomes:

$$\frac{dq^1}{d\tau^1} = - \frac{E_W}{\Delta^1} \left\{ \left(E_{p^1q^1} - R^1_{p^1q^1} \right) \left(R^2_{q^2q^2} - E_{q^2q^2} \right) + E_{q^2p^1} E_{q^1q^2} \right\} \tag{11}$$

where[9]

$$\Delta^1 = -E_W \left[\left(R^1_{q^1q^2} - E_{q^1q^1} \right) \left(R^2_{q^2q^2} - E_{q^2q^2} \right) - E_{q^2q^1} E_{q^1q^2} \right] < 0.$$

If, in addition, it is assumed that importables and nontradables are gross substitutes in period 1 $(E_{p^1q^1} > 0)$ we obtain:

$$\frac{dq^1}{d\tau^1} > 0.$$

This assumption of gross substitutability in period 1 requires that $E_{\pi^1} \pi^1_{p^1q^1} > 0$ and that $|\pi^1_{p^1} E_{\pi^1\pi^1} \pi^1_{q^1}| < E_{\pi^1} \pi^1_{p^1q^1}$, so that $E_{p^1q^1} > 0$. Only in this case, then, we obtain the more traditional result that suggests that higher tariffs induce an equilibrium real depreciation hold.

Assuming no first order income effect, equation (10) becomes:

$$\frac{dq^2}{d\tau^1} = - \frac{E_W}{\Delta^1} \left\{ E_{q^2q^1} \left(E_{p^1q^1} - R^1_{p^1q^1} \right) + E_{q^2p^1} \left(R^1_{q^1q^1} - E_{q^1q^1} \right) \right\}, \tag{12}$$

which under the assumption of gross substitutability everywhere is also positive.

In sum, then, in this general equilibrium intertemporal setting with foreign borrowing it is not possible to determine a priori whether temporary tariff hikes will appreciate or depreciate the equilibrium real exchange

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[8] Under very small (or zero) initial tariffs there is no first order income effect. This is, in fact, what Dornbusch (1980) and Corden (1985) do in their static models.

[9] The negative sign of Δ^1 follows from stability. See Appendix.

rate. This result is in contradiction to the more traditional, and generally accepted, policy oriented literature on tariff reforms and shadow pricing. The sources of ambiguity in the present model are two: first, the intra- and intertemporal substitution effects can move the q's in any direction, and second, the income effects associated to the tariff changes, can operate in the opposite direction than the substitution effect.

III.2 Anticipated Future Tariff Changes

We now consider the case of an anticipated change in future import tariffs. In order to focus the discussion we assume, (as we will do for the rest of the section, unless otherwise indicated), that initial tariff levels are close to zero, and that there is gross substitutability in consumption everywhere.

$$\frac{dq^1}{d\tau^2} = -\frac{E_W}{\Delta^1}\left\{E_{q^1p^2}\left(R^2_{q^2q^2} - E_{q^2q^2}\right) + E_{q^1q^2}\left(E_{q^2p^2} - R^2_{q^2p^2}\right)\right\} > 0 \qquad (13)$$

$$\frac{dq^2}{d\tau^2} = -\frac{E_W}{\Delta^1}\left\{\left(R^1_{q^1q^1} - E_{q^1q^1}\right)\left(E_{q^2q^2} - R^2_{q^2p^2}\right) + E_{q^1p^2}\,E_{q^2p^1}\right\} > 0 \qquad (14)$$

According to equation (13) a <u>future expected</u> tariff increase will appreciate the equilibrium real exchange rate in the current period. Of course, the mechanism via which this takes place is the intertemporal substitution in consumption, captured in equation (14) by terms $E_{q^1p^2}$ and $E_{q^1q^2}$. Notice that if there is no intertemporal substitution, $E_{\pi^1\pi^2} = 0$ and $E_{q^1q^2} = E_{q^1p^2} = 0$ and in equation (15) $dq^1/d\tau^2 = 0$. The case of a future anticipated tariff increase is particularly relevant for the analysis of the Chilean case, since it has been argued that towards late 1981 and early 1982 there was a significant loss in the degree of credibility on the sustainability of the reforms, with people expecting a reversal of the trade liberalization (Edwards and Cox-Edwards 1987, Frankel et al. 1986).

Equation (14) states that under our assumptions the equilibrium real exchange rate will also go up in period 2. From an inspection of (13) and (14) it is apparent that it is not possible to know whether q will go up by more in period 1 or 2.[10]

IV. Capital Account Liberalization and the Equilibrium Real Exchange Rate

In this section we analyze the way in which a liberalization of the capital account restrictions affect the equilibrium real exchange rate. In order to simplify the exposition we first assume that there are no initial import tariffs, and that international prices of X and M don't change. These two goods can then be aggregated into a composite tradable good (T). (See below, however, for a discussion on what happens if $\tau \neq 0$.) We now denote the relative price of nontradables to tradables in period i as f^i. That is, f^1, f^2 are the inverse of the more traditional definition of real exchange rate. The model in (1)-(5) is now rewritten in the following way:

$$R^1(1,f^1;K,L) + \delta R^2(1,f^2;K,L) + b(NCA) = E[\pi^1(1,f^1),\delta\pi^2(1,f^2),W] \qquad (15)$$

$$b = (\delta^* - \delta) > 0 \qquad (16)$$

$$R^1_{f^1} = E_{f^2} \qquad (17)$$

$$R^2_{f^2} = E_{f^2} \qquad (18)$$

where a notation consistent with Section III has been used. As noted, the term $b(NCA)$ is the discounted value of the proceeds from the taxation of

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[10] For the case of a permanent tariff change $(d\tau^1 = d\tau^2)$ and of international terms of trade shocks see Edwards (1986).

foreign borrowing. b is the discounted value of the tax per unit borrowed.[11] Since it is assumed that international borrowing is taxed, $\delta < \delta^*$.[12] A capital account liberalization, then, is depicted by an increase in δ towards its world value δ^*.

Totally differentiating (15)-(18) we can find out how the equilibrium RER reacts to a liberalization of the capital account:

$$\frac{df^1}{d\delta} = -\left(\frac{E_W \pi^2}{\Delta''}\right)\left(\pi^1_{f^1} E_{\pi^1\pi^2} R^2_{f^2f^2} - \pi^1_{f^1} E_{\pi^1\pi^2} E_{\pi^2} \pi^2_{f^2f^2}\right)$$

$$-b\pi^2\left[\frac{R^2_{f^2f^2} - E_{\pi^2}\pi^2_{f^2f^2}}{\Delta''}\right]\left(E_{\pi^2W}\pi^2\pi^1_{f^1}E_{\pi^1\pi^2} - E_{\pi^1W}\pi^2\pi^1_{f^1}E_{\pi^2\pi^2}\right) > 0 \qquad (19)$$

where Δ'' is the determinant of the system (15)-(18) and is negative (see Appendix). This expression is positive indicating that a liberalization of the current account (i.e., a reduction in the tax on foreign borrowing) will result in an increase in the relative price of nontradables, or in a real appreciation in period 1. This real appreciation takes place through two channels. The first, which is captured by the first term on the RHS of equation (19), is an intertemporal substitution effect, which operates via movements in the consumption rate of interest. The reduction of the tax on foreign borrowing (i.e., the increase in δ) makes future consumption relatively more expensive. As a result, people substitute intertemporally, consuming more of everything in period 1. This, of course, exercises

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[11] See, for example, Edwards and van Wijnbergen (1986) and van Wijnbergen (1985).

[12] In this model the tax on borrowing is a policy variable. Alternatively one can assume, as in Edwards and van Wijnbergen (1986) that there is a quantitative limit to foreign borrowing. In that case δ becomes an endogenous variable.

pressure on the price of nontradables in period 1, generating the real appreciation. Notice that if there is no intertemporal substitution (i.e., $E_{\pi^1\pi^2} = 0$) the first term on the RHS of (19) vanishes.

The second channel through which the liberalization of the capital account affects the real exchange rate is the income effect captured by the second term on the RHS of equation (19). An increase in δ towards its world level $\delta*$ reduces the only distortion in this economy, generating a positive welfare effect. Consequently people increase consumption exercising a positive pressure on f^1. The magnitude of this income effect basically depends on two factors: (1) the initial level of the distortion b. In fact, if initially the tax is very low $b \simeq 0$, the second term on the RHS of (19) will tend to disappear. (2) The propensity to consume in periods $E_{\pi^1 W}$ and $E_{\pi^2 W}$.

While in this model the effect of the capital account liberalization on the equilibrium real exchange rate is unambiguous, its effect on f^2 cannot be signed a priori:

$$\frac{df^2}{d\delta} = \frac{E_W E_{\pi^1\pi^2}\,\pi^2}{\Delta''}\left\{(R_{f^1f^2}^1 - E_{f^1f^1})\,\frac{\pi^1}{\pi^2}\,\pi^2_{f^2} - \pi^1_{f^1}\right\} \gtrless 0 \qquad (20)$$

IV.1 Investment and Initial Import Tariffs

The model developed in this section has assumed, for expositional convenience, that import tariffs are initially equal to zero. The relaxation of this assumption will have an impact on the income effect term in equation (19). The reason is that once tariffs are allowed, the tax on foreign borrowing ceases to be the only distortion and we now enter the world of second best. It is now possible that the relaxation of one distortion (b) may have a negative overall impact on welfare, inducing a reduction in expenditure in all periods.[13] Notice, however, that in order to reverse the result in equation (19) it will be necessary that the overall income effect is negative, and that it exceeds the substitution effect.

The model discussed in this paper has also assumed that there is no investment. This simplifying assumption can be relaxed quite easily. Possibly the most convenient way of introducing investment is by assuming that investment decisions are governed by the condition that in equilibrium Tobin's "q" equals 1. Assuming, without loss of generality that all investment goods are tradable goods, the investment equation is:

$$\delta R_K^2 = 1.$$

The incorporation of investment may have an effect on the way capital liberalization affects the equilibrium real exchange rate in period 2. This is because the liberalization of the capital account -- that is the increase of δ -- will encourage capital accumulation. Depending on whether nontradables are capital or labor intensive, total production of nontradables may increase. If nontradables are capital intensive, output of this type of goods will increase in period 2, generating downward pressures on f^2.

V. Concluding Remarks

Much of the discussion on the recent liberalizations attempts in the Southern Cone have focused on the role of exchange rates behavior in those countries. In fact a large number of analysts -- and especially popular interpretations -- have argued that the real appreciation of these countries

[13]The negative welfare effect will result because a lower b induces higher expenditure in 1, including higher imports in that period. This negative welfare effect, however, should be compared with the positive effects on welfare of lower b.

currencies represented an unsustainable real overvaluation, which was responsible for the disappointing outcome of the reforms. These contentions, however have been sustained by extremely simplistic PPP type calculations, that don't make any attempt to evaluate the evolution of the equilibrium RER in these countries.

Surprisingly, both the historical and theoretical literature on economic liberalization has been extremely informal regarding the reaction of the equilibrium RER after a liberalization reform that relaxes restrictions on commodities and assets trade. Moreover, the recent literature on real exchange rate misalignment has been equally informal. This is a serious gap, since it is only possible to talk about exchange rate misalignment after comparing actual and equilibrium real exchange rates.

In this paper an intertemporal general equilibrium model of a small open economy was developed to analyze formally the way in which economic liberalization reforms affect the equilibrium vector of real exchange rates. Several important results were obtained. (1) Contrary to traditional static partial equilibrium models a tariff reduction will not necessarily generate an equilibrium real depreciation. (2) Assuming that all goods are gross substitutes in consumption, both intra and intertemporally, and that the substitution effect dominates the income effect, a temporary tariff reduction will result in an equilibrium real depreciation in both periods. (3) Expected future tariff changes will generally affect the current equilibrium real exchange rate. More specifically, under the conditions described in (2) an expected future hike in tariffs will appreciate the equilibrium real exchange rate today. (4) Assuming no (or very low) initial tariffs, a capital account liberalization will generate an equilibrium real appreciation.

APPENDIX

a. Stability Conditions

In order to simplify the analysis of the stability conditions, and to sign of the determinant, we work with the tradables nontradable model of Section III.

The dynamic behavior of nontradable prices are depicted by equations (A.1) and (A.2):

$$\dot{f}^1 = \lambda_1[E_{f^1} - R^1_{f^1}] \tag{A.1}$$

$$\dot{f}^2 = \lambda_2[E_{f^2} - R^2_{f^2}] \tag{A.2}$$

Using Taylor expansions of (A.1) and (A.2) and dropping second and higher order terms, we obtain

$$\begin{pmatrix} \dot{f}^1 \\ \dot{f}^2 \end{pmatrix} = \begin{pmatrix} \lambda(E_{f^1f^1} - R^1_{f^1f^1}) & \lambda_1 E_{f^1f^2} \\ \lambda_2 E_{f^2f^1} & \lambda_2(E_{f^2f^2} - R^2_{f^2f^2}) \end{pmatrix} \begin{pmatrix} f^1 - f^{1*} \\ f^2 - f^{2*} \end{pmatrix}$$

Denoting the RHS matrix as A, stability of the system requires

$$\text{Det } A > 0$$

$$\text{tr } A < ;0$$

b. The Determinant

The matrix of the system in Section III is:

$$B = \begin{bmatrix} -(b\pi^2 E_{\pi^2\pi^1} \pi^1_{f^1}) & -b\delta E_{\pi^2\pi^2} \pi^2_{f^2} & -(b^2 E_{\pi^2 W} + E_W) \\ (R^1_{f^1 f^1} - E_{f^1 f^1}) & -\delta E_{f^1 f^2} & -\pi^1_{f^1} E_{\pi^1 W} \\ -E_{f^1 f^2} & (R^2_{f^2 f^2} - E_{f^2 f^2}) & -\pi^2_{f^2} E_{\pi^2 W} \end{bmatrix}$$

where

$$E_{f^1 f^1} = (E_{\pi^1} \pi^1_{f^1 f^1} + \pi^1_{f^1} E_{\pi^1 \pi^1} \pi^1_{f^1})$$

$$E_{f^1 f^2} = \pi^1_{f^1} E_{\pi^1 \pi^2} \pi^2_{f^2}$$

$$E_{f^2 f^2} = (E_{\pi^2} \pi^2_{f^2 f^2} + \delta \pi^2_{f^2} E_{\pi^2 \pi^2} \pi^2_{f^2})$$

The determinant of B is equal to:

$$\det B = \Delta'' = \Big\{ -E_W |A| - b\pi^2 E_{\pi^2 W} (R^1_{f^1 f^1} - E_{f^1 f^1}) R^2_{f^2 f^2}$$

$$+ b\pi^2 E_{\pi^2 W} \pi^2_{f^2 f^2} E_{\pi^2} (R^1_{f^1 f^1} - E_{f^1 f^1}) \Big\} < 0.$$

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