ECONOMIC LIBERALIZATION AND THE EQUILIBRIUM REAL EXCHANGE RATE IN DEVELOPING COUNTRIES

By

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Abstract

This paper deals with the relation between commercial policy and "the" equilibrium real exchange rate. The paper clarifies the meaning of real exchange rate by comparing five different definitions that are currently found in the literature. The analysis focuses on the effects of an economic liberalization program that reduces import tariffs on the equilibrium real exchange rate under a number of alternative assumptions regarding capital mobility. From a policy perspective this is an important issue, since countries that embark on liberalization are usually concerned with avoiding real exchange rate misalignment and overvaluation. The effects of terms of trade shocks on the equilibrium real exchange rate are also investigated.

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I. Introduction

Carlos Diaz-Alejandro's interests were remarkably broad; they ranged from the economic history of Latin America, to the functioning of international financial markets, to the technology of cement plants.[1] There were, however, two interrelated topics to which Diaz Alejandro kept coming back time after time: the role of international trade in the development process, and the importance of exchange rate policies. He first addressed the exchange rate problem in his 1961 MIT dissertation, later published as Exchange Rate Devaluation in a Semi-Industrialized Country: The Experience of Argentina, 1955-1961 (MIT Press, 1966). In this work, which has become a classic on the subject, Diaz-Alejandro developed a number of important insights including the by-now popular idea that under certain circumstances devaluations can be contractionary.[2] In his later work, Diaz-Alejandro came back to the exchange rate issue with renewed interest; he was particularly concerned with understanding the behavior of real exchange rates in the developing countries.[3]

Possibly, Diaz-Alejandro's most prominent work on the role of trade policy in the development process is contained in his monumental volume on the economic history of Argentina. In it he forcefully argued that during the post-World War II period Argentina had neglected the potential role of international trade as an engine of growth. The importance of international trade in the development process is also a dominant aspect of Diaz Alejandro's work on the Colombian economy. Throughout his work on the relation between trade and growth Diaz-Alejandro emphasized that maintaining an "appropriate" exchange rate policy was essential for the success of trade liberalization reforms aimed at moving a country towards an export-oriented development strategy. The maintenance of the real exchange rate at its "appropriate" (or realistic) level should be interpreted as meaning that the actual value of the real exchange rate should not depart significantly from its equilibrium value. In other words, in this Diaz-Alejandro context, an "appropriate" real exchange rate is one that does not become misaligned, and especially overvalued (Diaz-Alejandro, 1984).

The purpose of the present paper is to investigate the way in which the adoption of an export oriented policy through the liberalization of the external sector affects the equilibrium value of the real exchange rate. Surprisingly perhaps, in spite of the increasing importance of issues related to trade liberalization, much of the policy discussion on the relation between commercial policies, liberalization, and real exchange rate has been quite confusing.[4] This paper seeks to clarify and integrate some of the issues involved by formally developing two simple general equilibrium models to investigate the relation between changes in commercial policies and the real exchange rate.

II. The Traditional Literature

In the economic development policy literature on tariffs, liberalization and development strategies it has long been recognized that there is a relation between tariffs level and the equilibrium value of the real exchange rate. Most of this discussion, however, has been quite vague and has been carried out in a partial equilibrium context. The vagueness in this policy literature has stemmed in part from the confusion that for some time now has surrounded the concept of "the" real exchange rate. In fact, as discussed in more detail below, there are a number of competing definitions for "the" real exchange rate, and many times one is not sure which concept a particular author has in mind.

The traditionally accepted view among policymakers has been that a reduction in tariffs in a small country will always "require" a real (equilibrium) depreciation to maintain external balance. The argument usually given is based on a partial equilibrium interpretation of the elasticities approach to exchange rate determination, and runs along the following lines: a lower tariff will reduce the domestic price of importables, and consequently increase the demand for imports. This, in turn, will generate an external imbalance (i.e., a trade account deficit), which assuming that the Marshall-Lerner condition holds, will require a (real) devaluation to restore equilibrium. This view is clearly captured by the following quote from Balassa (1982, p. 16): "[E]liminating protective measures would necessitate a devaluation in order to offset the resulting deficit in the balance of payments". On the other hand, according to Harry Johnson (1969, p. 159):

> One of the assumptions commonly made in the context of liberalization of trade by underdeveloped countries is that such liberalization would necessarily involve a balance of payments deficit and the consequent necessity of devaluation....

The proposition that a reduction (or elimination) of tariffs will necessarily result in an equilibrium real depreciation has also been made in the shadow pricing literature. Some authors have proposed that the shadow exchange rate should be computed as the equilibrium real exchange rate under conditions of free trade (Bacha and Taylor 1971). It has then been postulated that an elimination of existing trade impediments will result in a higher equilibrium real exchange rate (i.e., in a real depreciation). For example, for the case of a small country which faces initial trade equilibrium, Bacha and Taylor (1971, p. 216) proposed the following expression for the free trade real exchange rate:

$$e^F = e(1+t)^{\gamma}, \qquad (1)$$

where e^F is the free trade equilibrium (real) exchange rate, e is the existing equilibrium (real) exchange rate prior to the elimination of tariffs, t is the level of the tariffs and $\gamma = \eta_M/(\epsilon_x+\eta_M)$, for η_M elasticity of demand of level of demand for imports and ϵ_x elasticity of supply for exports.

More recently using a slightly different model, Taylor (1979, p. 207) has insisted on this point (where the same notation applies):[5]

> [S]uppose that a preexisting tariff is reduced or removed altogether...[t]hen [the real exchange rate] e will rise...[T]he result can be called the free-trade exchange rate $[e^F]$. [N]aturally, e/e^F is less than 1....

A common feature of most early models is that they ignored, among other things, the presence of intermediate inputs. This problem was acknowledged by Harry Johnson (1969) in an article that uses effective rates of protection to analyze the effect of tariff changes on the equilibrium exchange rate (see also Corden 1971, Ch. 5). Johnson pointed out that once intermediate goods were allowed into the picture the reduction or removal of tariffs could result either in a devaluation or in an appreciation. In Johnson's words (1969, p. 159): "[T]ariffs structures may bring about a situation in which appreciation rather than depreciation would be necessary to preserve equilibrium under liberalization..." The reason for this is intuitively clear. With intermediate goods it is possible that some activities will have a negative effective rate of protection; that is the tariff structure will impose a tax on value-added in those activities. Consequently, the removal of tariffs will reduce the magnitude of this tax and, according to Johnson's model, will result in higher production of these goods. The effects of eliminating the negative rates of effective protection could be such that a balance of payments surplus could result, with the consequent required appreciation of the equilibrium real exchange rate (see also Corden 1971).[6]

Most traditional treatments of the relationship between commercial policy and the real exchange rate have also tended to (implicitly or explicitly) ignore the presence of nontradable goods.[7] However, once nontradables are allowed into the picture the effect of tariff changes on the real exchange rate can be different from those obtained from simpler partial equilibrium models (Edwards, 1987). In Section III and IV of this paper two alternative models with nontradables are used to formally analyze the relation between tariff liberalization and the equilibrium real exchange rate. It is shown that although in principle, within the context of a general equilibrium framework, a commodity trade liberalization can result in either equilibrium real depreciation or appreciation, the real depreciation case is somewhat more plausible.

III. Tariffs and the Real Exchange Rate in a Factor-Specific Model

In this section the relation between tariff liberalization policies and the equilibrium real exchange rate in a model with sectoral factor specificity is presented. An important property of this model is that changes in the demand for nontradables play a predominant role in determining the new equilibrium real exchange rate. This contrasts with the more standard model of Section IV where the behavior of the real exchange rate is independent of the demand for nontradables. As is pointed out below the model in this section can be interpreted as capturing the short or medium run effects of the tariff reform.

Since much of the confusion found in the policy literature on the subject stems from the existence of numerous, and often contradictory, definitions of real exchange rate, I begin this section with a brief discussion on what we mean by real exchange rate. In the actual formal analysis I use alternative definitions, as a way to contribute towards the clarification of this issue.

III.1 Real Exchange Rate: Alternative Definitions

Currently there are at least four or five competing definitions of "the" real exchange rate. While this is not *per se* serious, it does generate some communication problems.[8] Although most writers define "the" real exchange rate as a relative price, there are disagreements on which relative price should be called "the" real exchange rate. According to an early definition "the" real exchange rate is equal to the nominal exchange rate (E) corrected (i.e., multiplied) by the ratio of "the" foreign price level (P*) to "the" domestic price level (P). This definition has often been called the Purchasing Power Parity (PPP) real exchange rate $e_{PPP} = EP^*/P$. Depending on whether P and P* are CPIs or WPIs, or GDP deflators, e_{PPP} will be the relative price of consumption or production baskets.[9]

More recently, however, most authors have defined the real exchange rate in the context of dependent economy-type models, as the relative price of tradable to nontradable goods (see, for example, Dornbusch 1974, 1980, Krueger 1978, 1983, Mussa 1984, Frenkel and Mussa 1984). Assuming that the law of one price holds for tradables and that there are no taxes on trade, the real exchange rate is defined by these authors as: $e = EP^*_T/P_N$, where P^*_T is the world price of tradables, and P_N is the domestic price of nontradables.

It is interesting to compare the tradables-nontradables relative price definition with the PPP definition of the real exchange rate. Assuming that P and P^* in the PPP definition are geometrically weighted averages of tradable and nontradable prices, with weights, α, $(1-\alpha)$, β and $(1-\beta)$, it is possible to write $P = P_N^{\alpha} P_T^{1-\alpha}$ and $P^* = P_N^{*\beta} P_T^{*(1-\beta)}$. Further assuming that the country in question is small, that the law of one price holds for tradable goods (i.e., $P_T = P_T^* E$), and that E is fixed and equal to 1, it is possible to find the relation between percentage changes in the real exchange rate (e) and in the PPP real exchange rate (where, as usual, the "hat" operator (^) represents percentage change:

$$\hat{e} = (1/\alpha)\hat{e}_{PPP} + (\beta/\alpha)(\hat{P}_T^* - \hat{P}_N^*).$$

It may be seen that in general changes in the two definitions of the real exchange rate will differ (i.e., $\hat{e} \neq \hat{e}_{PPP}$). Moreover, e and e_{PPP} can even move in opposite directions, depending on the behavior of foreign relative prices (P_T^*/P_N^*).[10]

The above discussion has ignored taxes on international trade. However, if there are these type of taxes a decision should be made on whether to define a real exchange rate inclusive or exclusive of them. If it is assumed that tradables are subject to a uniform protective tax of rate t, an index that takes into account the effect of protection on competitiveness can be defined as $e_T = e(1+t)$. Obviously, if the tax on tradables does not change, e_T and e will move at the same rate: $\hat{e} = \hat{e}_T$.

In fact, most theoretical analyses rooted in the dependent economy model have chosen to use e_T as "the" real exchange rate. However, a limitation of this definition, is that it assumes that all tradable goods are subject to the same tax. In a many goods economy, the different tradable goods are subject to taxes at different rates. For example, most importables are subject to differentiated tariffs or import quotas, while some exportables are many times subject to taxes. For this reason, in applied work, it has been proposed to define sector-specific (or good-specific) indexes of the real exchange rate corrected by the effects of taxes (or subsidies).[11] For example, if sector j is subject to a tax of t_j this index will be $e_{Tj} = EP_j^*(1+t_j)/P_N$. Again, of course, if taxes on j and world relative prices do not change, e and e_{Tj} will move at the same rate. If, on the other hand, the tax on sector j is altered, with relative world prices constant, changes in e_{Tj} and changes in e will be linked by the following simple relationship: $\hat{e}_{Tj}/(1\hat{+}t_j) = 1 + \hat{e}/(1\hat{+}t_j)$. For this reason, and due to the difficulty in obtaining reliable time series of taxes on trade, most empirical studies have concentrated on real exchange rate definitions given by e or e_{PPP} rather than e_T.[12]

The above discussion has clearly illustrated the semantic confusion that surrounds the policy literature on real exchange rates. If authors are not careful to clearly state what concept they are referring to, significant misunderstandings can ensue. An additional difficulty arises with defining the equilibrium real exchange rate.[13]

III.2 Tariff Liberalization and Equilibrium Relative Prices

In this section I use a fairly simple general equilibrium model to analyze how a tariff liberalization affects the equilibrium value of five alternative definitions of the real exchange rate. It is hoped that by looking at this set of definitions, instead of at only one of them, the ongoing confusion in policy discussions will be (somewhat) clarified. In particular I focus on: (1) the PPP definition $e_{PPP} = EP^*/P$; (2) the dependent economy definition of relative prices of tradables to nontradables, excluding taxes on trade, $e = EP_T^*/P_N$; (3) the domestic relative price of tradables to nontradables $e = P_T/P_N$; (4) the domestic relative price of importables to nontradables, $e_{TM} = P_M/P_N$; (5) the domestic relative price of exportables $e_{TX} = P_X/P_N$.

Assume a real model of a small country which produces competitively importables (M), exportables (X) and nontradables (N), using capital and labor. The nominal exchange rate is fixed and imports are initially subject to an import tariff of τ. The capital account is assumed to be closed, and there is no international borrowing (see below, however). Also, in order to focus on the behavior of the equilibrium real exchange rate we set all monetary considerations aside. Capital is sector-specific, whereas labor can move freely across sectors. In this Ricardo-Viner specification domestic factor prices are not linked to foreign factor prices and the Stolper-Samuelson theorem does not hold. Production technology and resource allocation can be summarized by a revenue function (R), which gives the maximum revenue obtainable given factor supplies F and relative prices. It is also assumed that the revenue function is twice differentiable on all arguments.[14] Consumers preferences and consumption decisions, on the other hand, are summarized by a twice differentiable expenditure function (E), which gives the minimum expenditure required to achieve a level of utility W. A useful property of revenue functions is that their partial derivatives with respect to prices yield the corresponding supply functions. In a similar way the partial derivative of E with respect to prices yield the Hicksian demand functions. Assuming that the nominal exchange rate is equal to 1 and using the price of exportables as the numeraire, the model can be written as

$$R(1,p_M,p_N;F) + \tau\left[E_{p_M} - R_{p_M}\right] = E(1,p_M,p_N;W) \qquad (2)$$

$$R_{p_N} = E_{p_N} \tag{3}$$

$$p_M = p_M^* + \tau; \; p_X = p_X^* = 1 \tag{4}$$

$$P = \alpha P_M + \beta P_N + \epsilon P_X; \; \alpha + \beta + \epsilon = 1 \tag{5}$$

$$P_T = \delta P_M + (1-\delta) P_X \tag{6}$$

Equation (2) is the economy's budget constraint, where $(E_{p_M} - R_{p_M})$ are imports and $\tau(E_{p_M} - R_{p_M})$ are import revenues which are assumed to be handled back to the public in a non-distortionary fashion. Equation (3) establishes that the nontradable market is always in equilibrium. Naturally, the combination of (2) and (3) implies that this economy is also in external balance. Equation (4) specifies that in this economy importables are subject to a (specific) tariff τ. P in equation (5) is an index of the general price level, whereas P_T in (6) is an index of the price of tradables.

The equilibrium real exchange rate is defined (for any of the five RER concepts discussed above) as that value of the RER for which internal and external equilibrium hold simultaneously, given (long term sustainable) values of other exogenous variables such as tariffs, international terms of trade, technology, and preferences.[15] According to equations (2) and (3), then, this economy is initially in internal and external equilibrium, and the initial real exchange rate is at its equilibrium level. Then, in this context, changes in the RER induced by exogenous shock should be interpreted as a change in the equilibrium real exchange rate.[16]

The modelling strategy is to first analyze how changes in the tariff will affect the equilibrium relative price of N and then look at how the five different definitions of equilibrium real exchange rate are affected. Totally differentiating (2) and (3) and using (4) we find that

$$\frac{dp_N}{d\tau} = \frac{E_W}{\Delta} \{\tau(E_{p_Mp_M} - R_{p_Mp_M})C_N - (1-\tau C_M)(R_{p_Mp_N} - E_{p_Mp_N})\} \tag{7}$$

where $C_N = E_{p_N}W/E_W$, $C_M = E_{p_M}W/E_W$ are pure income effects on demands for nontradables and tradables. $\Delta = E_W\{\tau(R_{p_Np_M} - E_{p_Np_M})C_N - (1-\tau C_M)(E_{p_Np_N} - R_{p_Np_N})\} > 0$ under stability (see Appendix A).

The sign of $dp_N/d\tau$ in (7) is undetermined, indicating that in this general setting a tariff reduction can result in either a reduction or increase of the price of nontradables relative to exportables. There are two sources for this ambiguity. There are income and substitution effects that work in opposite directions, and there is a possibility of complementarity in consumption between nontradables and importables. That is, $E_{p_Np_M} \gtrless 0$.[17] However, at this level of aggregation it is highly unlikely to have this type of cross effect that results in complementarity in consumption; for this reason in what follows it is assumed that $E_{p_Np_M} > 0$ and $R_{p_Np_M} < 0$ so that $(1-\tau C_M)(R_{p_Mp_N} - E_{p_Mp_N}) < 0$. However, even in this case the ambiguity with respect to the sign of $dp_N/d\tau$ remains.

The term $\tau(E_{p_Mp_M} - R_{p_Mp_M})C_N$ is the income effect, and is only relevant if initially there was a large tariff in place (i.e., $\tau \neq 0$). The reduction in the tariff increases welfare and thus the demand for nontradables, exercising upward pressure on their prices. Under the assumption of gross substitutability in consumption the substitution effect works in the opposite direction: the tariff liberalization reduces the domestic price of importables generating an incipient excess supply of N, which requires a reduction in its price. Whether the income or substitution effects dominate, will depend crucially on the values of C_N and on the initial level of the tariff. Assuming a very small initial tariff $\tau \approx 0$ equation

(7) reduces to:

$$\frac{dp_N}{d\tau} \approx \frac{(R_{p_M p_N} - E_{p_N p_M})}{(E_{p_N p_N} - R_{p_N p_N})} > 0 \qquad (8)$$

In this case we can say unambiguously that a tariff liberalization will result in a reduction of the price of nontradables relative to exports. Of course if $C_N = 0$, $dp_M/d\tau > 0$ even if $\tau > 0$.

In general, under most circumstances it can be expected that unless the initial distortion is <u>very</u> high, (i.e., the initial τ is very large), the substitution effect will dominate. Consequently, although we have seen that rigorously $(dp_N/d\tau)$ cannot be signed, under most plausible assumptions -- that is, when all goods are gross substitutes and the substitution effect dominate -- we have the $(dp_N/d\tau) > 0$.

Having found $(dp_N/d\tau)$ in (7), all we require are straightforward arithmetic manipulations to find how the alternative definitions of equilibrium real exchange rates react to a tariff liberalization policy. Table 1 summarizes the results obtained in the more general case, where the expression for $(dp_N/d\tau)$ is given by (7). From this table it is clear that in general, for many of these definitions, it is not possible to know <u>a priori</u> how the equilibrium real exchange rate will change following a trade liberalization. Moreover, even under the our simplifying assumptions of dominating substitution effect, the changes in some of the different RER definitions result in opposite signs! For example, assuming that the substitution effect dominates in (7), $dp_N/d\tau > 0$ and $(\hat{e}/\hat{\tau}) < 0$ as postulated by traditional partial equilibrium policy analyses. Moreover, even in this case $(\hat{e}_{PPP}/\hat{\tau}) \gtrless 0$ and $(\hat{e}_T/\hat{\tau}) \gtrless 0$.

TABLE 1

Tariffs and "the" Equilibrium Real Exchange Rate:

The Special Factor Case

Real Exchange Rate Definition	
(A) $e_{PPP} = EP^*/P$;	$\hat{e}_{PPP}/\hat{\tau} = -\{\gamma_M(\tau/P_M) + \gamma_N(\tau/P_N)\ (dp_N/d\tau)\}$
(B) $e = EP_T^*/P_N$;	$\hat{e}/\hat{\tau} = -(\tau/P_N)(dp_N/d\tau)$
(C) $e_T = P_T/P_N$;	$\hat{e}_T/\hat{\tau} = \{\phi_M(\tau/P_M) - (\tau/P_N)\ (dp_N/d\tau)\}$
(D) $e_{TM} = P_M/P_N$;	$\hat{e}_{TM}/\hat{\tau} = \{(\tau/P_M) - (\tau/P_N)\ (dp_N/d\tau)\}$
(E) $e_{TX} = P_X/P_N$;	$\hat{e}_{TX}/\hat{\tau} = \hat{e}/\hat{\tau}$

Notes: γ_M, γ_N and ϕ_M are positive weights.

The results in equation (7) of Table 1 were derived assuming that tariffs on all importables were reduced by the same amount. In reality, however, liberalization reforms seldom work that way. In most instances only some tariffs are reduced. If only tariffs on a subset k of importables are reduced while for the m other importables tariffs are maintained, we have that $dp_N/d\tau_k = (E_W/\Delta)\{(E_{p_kp_k} - R_{p_kp_k})C_N - (1-\tau C_M)(R_{p_Np_R}) + \tau(E_{p_kp_M} - R_{p_kp_M})C_N\}$. Of course, since $E_{p_kp_M}, R_{p_kp_M} \gtrless 0$ additional sources of sign ambiguity emerge for $d_{p_N}/d\tau_k$.

III.3 Extensions

Wage Rigidity

The previous discussion has been carried out under the assumption of fully flexible factor and commodity prices. This, however, may not be the more relevant case for a number of LDCs. The analysis can be easily expanded to the case where some factors have a fixed price. Assume, for example, that as is the case in numerous developing countries, the wage rate (w) is fixed at a level $\tilde{w} \geq R_L$, where R is the unconstrained revenue function, and L is the labor force. In this case, then, we have to define a constrained revenue function $(\tilde{R})$:[18]

$$\tilde{R}(\tilde{w}, p_M, p_M, K) = \max_{q,L} \left\{ \left(q^X + p_M q^M + p_N q^N \right) - \tilde{w}L \right\}, \tag{9}$$

where q^i, $i = X,M,N$ refers to output of exportables, importables and nontradables. Also, the nontradable market equilibrium condition is replaced by:

$$\tilde{R}_{p_N} = E_{p_N}, \tag{10}$$

where $\tilde{R}_{p_N}$ is the partial derivative of the constrained revenue function (9) with respect to the price of nontradables. Neary (1985) has shown that under fix factor prices the following relation exists between restricted and unrestricted revenue functions:

$$\tilde{R} = R[p_M, p_N, \tilde{L}(\tilde{w}, p_M, p_N, K)] - \tilde{w}\tilde{L}(\tilde{w}, p_M, p_N, K) \tag{11}$$

where $\tilde{L}$ is the amount of labor employed in the constrained case.

It is easy to find how the relative price of nontradables reacts to a tariff reduction in an economy with factor specificity and fix real wages.[19] In order to facilitate the comparison with the case of flexible factor prices $d\tilde{p}_N/d\tau$ is expressed in terms of the derivatives of the <u>unconstrained</u> revenue function:

$$\frac{d\tilde{p}_N}{d\tau} = \frac{E_W}{\tilde{\Delta}} \left\{ \left[\tau C_N \left(E_{p_M p_M} - R_{p_M p_M} \right) - (1-\tau C_M) \left(R_{p_M p_N} - E_{p_M p_N} \right) \right] + \left[\left(R_{Lp_M}/R_{LL} \right) \tau C_N + (1-\tau C_M) \left(R_{Lp_N}/R_{LL} \right) \right] \right\} \tag{12}$$

where

$$\tilde{\Delta} = \Delta - \left\{ \tau \left(R_{Lp_M}/R_{LL} \right) C_N + (1-\tau C_M) \left(R_{Lp_N}/R_{LL} \right) \right\} \tag{13}$$

Since R_{Lp_M}, $R_{Lp_N} > 0$ and $R_{LL} < 0$ it follows that $\tilde{\Delta} > \Delta$. Also the inspection of (12), (13) and (7) reveals that,

$$\frac{d\tilde{p}_N}{d\tau} < \frac{dp_N}{d\tau} . \tag{14}$$

That is, under wage rigidity the equilibrium relative price of nontradables will be less responsive to changes in tariffs. This means that under these circumstances it is not sufficient that the substitution effect dominates in order for a tariff liberalization to result in a decline of the relative price of nontradables. Moreover, it is now possible to have a number of pseudo-paradoxes where changes in tariff levels can result in a real depreciation with wage flexibility, but in a real appreciation under wage rigidity.

Import Quotas

The case import quotas can be analyzed in a quite straightforward fashion by defining "virtual prices" as in Neary and Roberts (1980). The use of virtual prices, of course, assumes that the quota is allocated competitively via an auction mechanism. In this case the relaxation of a binding import quota will result in a lower virtual price for importables, which can be analyzed in a way perfectly analogous to our previous discussion. Obviously, the reason why our tariff discussion can be directly applied to the case of quotas is that under the assumptions made here there is an equivalence between tariffs and quotas.

Intermediate Goods

Intermediate goods can also be incorporated quite easily through the definition of net-outputs (Dixit and Norman 1980, p. 160). In this case an additional source of ambiguity with respect to the sign of $dp_N/d\tau$ emerges. The reason, of course, is related to Johnson's (1969) effective protection case discussed above. The tariff liberalization, by reducing the tax on the importation on inputs, not only eliminates negative effective protection in some importable sectors, but also reduces costs of nontradables generating forces towards a downward shift in the supply of nontradables.

Changes in International Terms of Trade

This model can be directly used to analyze how exogenous changes in the international terms of trade will affect the equilibrium real exchange rate. This was another topic of great interest to Carlos Diaz-Alejandro. For example, in 1982 he published an empirical study on the relation between exchange rates and the Argentinian real exchange rate between 1913 and 1976, where he found strong evidence that in that country improvements in the international terms of trade had led to real exchange rate appreciation (see Diaz Alejandro 1982). The empirical relation between the international terms of trade and the real exchange rate was again picked up in his "In Toto I don't think we are in Kansas any more".

In terms of the model presented above the main difference between an exogenous change in the international price of importables and a policy induced change in the import tariff of the same magnitude resides on the different magnitudes of the income effects. In particular $dW/dp_M^* = dW/d\tau + (E_{p_N p_N} - R_{p_N p_N})(E_{p_M} - R_{p_M})/\Delta$, where the second term on the RHS is negative. The effect of a reduction of the international price of M on p_N is given by:

$$\frac{dp_N}{dp_M^*} = \frac{dp_N}{d\tau} - \frac{E_W}{\Delta}\left(E_{p_M} - R_{p_M}\right)C_N, \tag{15}$$

where the second term on the RHS is positive. It is interesting to compare the effects on p_N of changes in τ and in p_M^*. For example, a number of authors, including Carlos Diaz Alejandro (1982, pp. 32-33) have argued that whereas a tariff reduction will lead to a real depreciation (i.e., $dp_N/d\tau > 0$ for the e definition of RER), an improvement in the terms of trade will result in a real appreciation (i.e., $dp_N/dp_M^* < 0$). It is clear from equation (15) that for these results to hold simultaneously, $E_W(E_{p_M} - R_{p_M})C_N/\Delta$ has to be "sufficiently large"; that is the income effect associated with the terms of trade deterioration has to be sufficiently large. (For a detailed discussion on this subject see Edwards and van Wijnbergern 1986b).

Transfers

This model can also be used to analyze the effects of international transfers. Denoting the transfer as H it follows that:[20]

$$\frac{dp_N}{dH} = \frac{E_W}{\Delta} C_N > 0. \tag{16}$$

It is interesting to interpret a transfer from abroad as capital inflows resulting from a relaxation of capital controls in a small country. This means that if, as was the case in the recent Southern Cone liberalizations, following the opening of the capital account foreign funds flow into the country $(dH > 0)$, the relative price of nontradables will increase, generating a real appreciation for every definition of the RER used here. In fact Diaz Alejandro (1981) was one of the first observers who perceptively noticed the importance of this real appreciation in the frustrating Southern Cone experiments.

The (highly likely) possibility of dp_N/dH and $dp_N/d\tau$ have the same sign is at the core of recent policy discussions on the appropriate order of economic liberalization in the developing countries (Edwards 1984). Equation (16) also highlights the fact that once capital inflows are reduced p_N will have to decline. If, however, due to wage rate rigidities this is not possible, unemployment will result as was the case in Chile (see Edwards and Cox Edwards 1986).[21]

International Borrowing and Lending

Although the transfer problem framework provides a useful benchmark for analyzing the effects of opening the capital account, the results obtained may be somewhat misleading. Alternatively the model of Section III.2 can be transformed into a two period model with endogenous investment and restricted foreign borrowing as in Edwards and van Wijnbergen (1986a), and

Edwards (1986c). The results, in terms of the reaction of p_N, will under most circumstances be the same as those discussed here.[22] An interesting application of the two period model is to investigate how expected changes in the tariff in the future will affect the path of p_N. Since in that setting, foreign borrowing is possible, consumers will try to smooth consumption and will increase their demand for nontradables both in periods 1 and 2. As a result in the first period there will be positive pressure on p_N, even though the tariff in that period will still be on. On the other hand, the expected reduction of τ will affect the consumption rate of interest, and present consumption on all goods will tend to be reduced. The final outcome can be either a higher or lower p_N in period 1. In Edwards (1986c), the case with foreign borrowing is analyzed in great detail, emphasizing the distinction between permanent and temporary changes in tariffs. However, in order to provide some idea on how this case with foreign borrowing works, in Appendix B the general model is presented.

IV. Trade Reform and the Equilibrium Real Exchange Rate in the Mobile Factor Case

The discussion of the preceding section assumed that capital was fixed and that it could not move across sectors folowing a commodity relative price shock. The importance of that assumption lays on the fact that factor prices become independent of world commodity prices. As a result demand conditions for nontradables play a crucial role in determining the real exchange reaction to changes in τ or p_M^*. In the present section the more traditional case with full intersectoral factor mobility is analyzed. To the extent that the fixed factors Ricardo-Viner model of Section III is considered a short-run model, the one in the present section can be viewed as a medium or intermediate run model.[23] The comparison of both cases will give us some (rough) idea on the dynamics of the real exchange rate following a trade liberalization reform.

Consider the case of a small economy that, as before, produces exportables (X), importables (M) and nontradables (N), using two intersector mobile factors of production, capital (K) and labor (L). As before, it is assumed also that the worldwide common technology is characterized by constant returns to scale, that there is perfect competition, that there is a fixed unitary nominal exchange rate and that there is an initial tariff on the importation of M. Under these circumstances, and ruling out specialization, the world prices of exportables (p_X^*) and importables (p_M^*) plus the tariff (τ) determine uniequivocally the rewards of both factors (w and r).[24] These factors rewards, and under the assumption of competition, determine the nominal price of nontradables (p_N). Demand conditions for nontradables, in turn, determine total production of nontradables and total factors used in their production. This leaves a certain amount of factors (K and L) that are used in the production of exportables and importables in a traditional Heckscher-Ohlin fashion. For a discussion of the effects of changes in tradable goods prices on production in the context of similar models see Corden and Neary (1982), Edwards (1986a), and Edwards and van Wijnbergen (1987).

The model can be presented in traditional Jones (1965) notation by equations (17) and (18), where once again the price of X is taken as the numeraire. Note that, as long as there is no specialization there is no need to specify the demand side to find the effects of tariff changes on prices, factor rewards and the real exchange rate. However, to find its effect on output demand considerations are required.

$$a_{LW}W + a_{KM}r = p_M; \quad a_{LX}w + a_{KX}r = 1; \quad a_{LN}W + a_{KN}r = p_N. \tag{17}$$

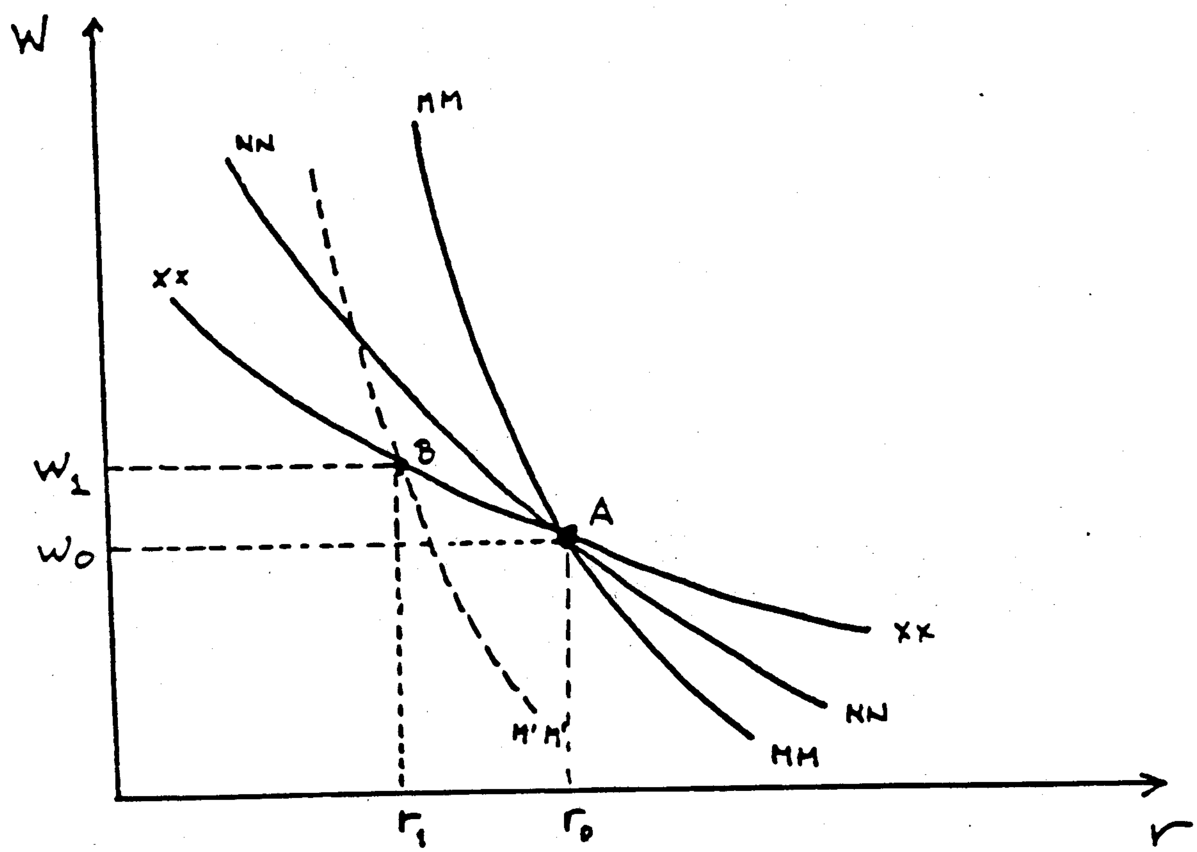
$$p_M = p_M^* + \tau; \quad p_X = p_X^* = 1 \tag{18}$$

where the a_{ij}'s are input-output coefficients. As in Section III I will analyze how changes in τ will affect the five different definitions of real exchange rate e_{PPP}, e, e_T, e_{T_M} and e_{T_M}.

Consider first the more plausible case for LDCs where exports are the most labor intensive commodity, with imports being the more capital intensive. The capital labor ratio for nontradables lays in between $(K/L)_M$ and (K/L_X).[25] As before the strategy is to first find how p_N reacts to changes in τ. From (18) it is clear that this requires knowledge of how wages and the rate of return will change.

The effect of a reduction of price of M on factor rewards and the relative price of nontradables p_N can be analyzed using Figure 1, which is the dual to the well-known Lerner-Pearce diagram. The initial equilibrium is given by the intersection of the three isocosts MM, XX, and NN. These curves present the combinations of wages and rental rates of capital that result in a constant cost of producing these goods at the existing technology. The slopes of these curves are equal to the capital labor ratio. The reduction of the price of M will result in a leftward shift of the MM curve towards M'M'. This is because now, in order to maintain equilibrium between domestic costs and the world price of importables, plus the tariff, lower combinations of wages and rental rates will be required. New long-run equilibrium will be obtained at B where the new M'M' curve intersects the XX curve. As the Stolper-Samuelson theorem indicates, the reduction of the price of M in an economy where exportables are labor intensive, will result in higher wages and lower rental rates (i.e., $W_1 > W_0$, and $r_1 < r_0$). The new equilibrium point B is below the NN isocost, indicating that as a consequence of the tariff reduction, the price of nontradables in

Figure 1



terms of exportables has to decline. As a result the isocost for N will move down until it intersects the other two curves at B.

Straightforward manipulation of (17) and (18) gives us the formal expression for the change in p_N following a change in τ:

$$\frac{\hat{p}_N}{\hat{\tau}} = \left[\frac{\theta_{KX}-\theta_{KN}}{\theta_{KX}-\theta_{KM}}\right] (\tau/p_M) \tag{19}$$

where $\theta_{KX} = a_{KX}r/p_X$; $\theta_{LX} = 1 - \theta_{KX}$; $\theta_{KM} = a_{KM}r/p_M$; and $\theta_{LM} = 1 - \theta_{KM}$. Since our capital intensity assumptions mean $\theta_{KX} < \theta_{KN} < \theta_{KM}$, equation (19) implies that $\hat{p}_N/\hat{\tau} > 0$.

It is interesting to notice that in the present case of full factor mobility the degree of ambiguity regarding $\hat{p}_N/\hat{\tau}$ is much reduced in relation to the model in Section III. For example, if the relative capital intensities are reversed to $\theta_{KX} > \theta_{KN} > \theta_{KM}$, we still get that $\hat{p}_N/\hat{\tau} > 0$. Only if it is assumed that nontradables are at an extreme of the capital intensity ranking (i.e., $\theta_{KM} < \theta_{KX} < \theta_{KN}$ or $\theta_{KN} < \theta_{KX} < \theta_{KM}$) we can get $\hat{p}_N/\hat{\tau} < 0$. This, however is a rather implausible case for a developing country. Moreover, when nontradables are at one of the extremes of the relative capital labor ranking, it is more likely that we will have specialization in production; in that case of course the present framework has to be modified by explicitly bringing in the demand for nontradables.

Table 2 contains a summary of the reaction of the different definitions of e to changes in τ. Ruling out the case where nontradables are at an extreme of the capital intensities ranking, we get unambiguous signs for a number of definitions of e:

$$(\hat{e}_{PPP}/\hat{\tau}) < 0; \quad (\hat{e}/\hat{\tau}) < 0; \quad (\hat{e}_{TX}/\hat{\tau}) < 0.$$

This, of course is the traditional result which indicates that a tariff

TABLE 2

Tariffs and Real Exchange Rates:

The Mobile Factor Case

Real Exchange Rate Definition	
(A) $e_{PPP} = EP^*/P$;	$\hat{e}_{PPP}/\hat{\tau} = -(\tau/P_M)\left\{\gamma_M + \gamma_N \frac{(\theta_{KX}-\theta_{KN})}{(\theta_{KX}-\theta_{KM})}\right\}$,
(B) $e = eP^*_T/P_N$;	$\hat{e}/\hat{\tau} = -(\tau/P_M)(\theta_{KX}-\theta_{KN})/(\theta_{KX}-\theta_{KM})$
(C) $e_T = P_T/P_N$;	$\hat{e}_T/\hat{\tau} = (\tau/P_M)\,\{\phi_M - (\theta_{KX}-\theta_{KN})/(\theta_{KX}-\theta_{KM})\}$
(D) $e_{TM} = P_M/P_N$;	$\hat{e}_{TM}/\hat{\tau} = (\tau/P_M)\,\{1 - (\theta_{KX}-\theta_{KN})/(\theta_{KX}-\theta_{KM})\}$
(E) $e_{TX} = P_X/P_N$;	$\hat{e}_{TX}/\hat{\tau} = \hat{e}/\hat{\tau}$

Notes: γ_N, γ_M and ϕ_M are positive weights.

liberalization will result in an equilibrium real depreciation. Also, notice that since under $\theta_{KX} < \theta_{KN} < \theta_{KM}$, $(\theta_{KX}-\theta_{KN})/(\theta_{KX}-\theta_{KM}) < 1$, $(\hat{e}_{TM}/\hat{\tau}) < 0$.

By assuming nonspecialization, in the above discussion it has been possible to ignore the role of the demand for nontradables. However, it is possible that as a result of the relative price shock this country will specialize in the production of X and N, while consuming M, X and N. Using the notation from Section III in this case we have:

$$(\hat{p}_N/\hat{\tau}) = (\tau/P_M)E_W \{\tau E_{p_M p_M} C_N + (1-\tau C_M)E_{p_M p_N}\}/\Delta' \qquad (20)$$

where as before $\Delta' > 0$.

As in Section III the analysis presented here can be easily extended in several directions. With full intersectoral factor mobility, the existence of factor price rigidities is likely to lead to specialization in the nontradable and one of the tradables, as Brecher (1974) has shown.[26] The case of quotas can also be analyzed using the "virtual prices" trick. The consequences of opening the capital account will, to a large extent, depend on whether as a consequence specialization in N and X will result. It is interesting to note that in this case if, as it is the most plausible case, $(\hat{p}_N/\hat{\tau}) > 0$, then $(\hat{p}_N/\hat{p}^*_M)$ can never be positive.

V. Concluding Remarks

In this paper the effects of tariff changes on the equilibrium real exchange rate have been analyzed in some detail. It was indicated that according to the traditional policy literature in small countries a tariff reduction will necessarily lead to an equilibrium real depreciation, and that a terms of trade improvement will provoke an equilibrium real appreciation. It was then shown that these propositions are theoretically not strictly correct. More specifically, it was shown that within the context of two simple general equilibrium models of a small open economy with no capital movements the effects of terms of trade and tariff changes on "the" equilibrium real exchange rate are ambiguous, and will depend on factors such as relative capital intensities among importables, exportables and nontradables; sign and magnitudes of cross-elasticities of demand and supply and relative importance of income effects. (This was the case for all 5 definitions of RER considered.)

The discussion presented above has ignored the welfare effects of trade liberalization and has taken for granted that it is desirable for the LDCs to actually open their economies to the rest of the world. Although a complete analysis of this issue is well beyond the scope of this paper, it is important to briefly discuss a few issues. First, in all but one of the models presented here (the factor specific model with wage rigidities), it is desirable to fully liberalize the economy, opening up to commodities trade. Moreover, if the country in question is small, under these models the first best is to reduce tariffs to zero instantaneously. Of course, from an actual policy perspective this sounds both inapplicable and incorrect. The reason, of course, is that in most of the models discussed above there are no distortions or rigidities besides the initial tariffs. The exception is the factor specific model with real wage rigidity in Section III.2. In that case the reduction of an import tariff will lead to unemployment, and <u>may</u> result in a welfare reduction of the complete operation. However, in order to add additional real world features, more general intertemporal models, with different types of rigidities should be built (Edwards and van Wijnbergen 1987a).

This paper has shown that the analytics of the relation between commercial policies and the equilibrium real exchange rate are fairly simple. At the empirical level, however, we still don't know too much about the magnitudes of the coefficients involved. The lack of completely adequate data should by no means detract analysts from seriously attempting to understand the reaction of the RER to exogenous shocks. As Carlos Diaz Alejandro (1986, p. 418) argued: "...policy makers groping for a real effective exchange rate compatible with a more open and stable economy would gain much from knowing how that variable relates at least to the expected terms of trade and to "normal" capital movement".

APPENDIX A

Stability Condition in the Nontradable Market

Dynamic adjustment in the nontradable market is given by:

$$\dot{p}_N = \sigma(E_{p_N} - R_{p_N}) \quad \text{for} \quad \sigma > 0 \tag{A.1}$$

Stability reauires that

$$\frac{d\dot{p}_N}{dp_N} < 0.$$

Totally differentiating (A.1) we obtain:

$$\frac{d\dot{p}_N}{dp_N} = (E_{p_N p_N} - R_{p_N p_N}) + C_N \, E_W \, \frac{dW}{dp_N} \tag{A.2}$$

Using equation (3) in the text to eliminate dW we obtain:

$$E_W \{(R_{p_N p_M} - E_{p_N p_M}) C_N \tau - (1 - \tau C_M) \; (E_{p_N p_N} - R_{p_N p_N})\} > 0.$$

This means that the determinant Δ in equation (7) is positive.

APPENDIX B

The Intertemporal Case

In this Appendix a two-period version of the model developed in the paper is presented. As before, 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 q^1 (the price of nontradables in period 1); $R^2_{q^2p^2}$ is the second derivative of R^2 with respect to q^2 and p^2):

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

$$E[\pi^1(1,p^1,q^1),\delta{*}\pi^2(1,p^2,q^2),W] \qquad (B.1)$$

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

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

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

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

where the following notation is used:

τ^i; i = 1,2	Specific tariffs in period i.
$\delta*$	World discount factor, equal to $(1+r*)^{-1}$, where r* is world real interest rates (in terms of tradables).
E( )	Intertemporal expenditure function.
$\pi^i(1,p^i,q^i)$	Exact price indexes, which under assumptions of homothecity and separability, corresponds to unit expenditure functions.

(See Edwards and van Wijnbergen, 1986.)

W Total aggregate welfare.

Equation (B.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 -- had to equal present value of expenditure. Given the assumption of perfect access to the world capital market, the discount factor used in (B.1) is the world discount factor $\delta*$. Equations (B.2) and (B.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 $R^2_{q^2}$) 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:

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

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

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

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

From the inspection of equations (B.1)-(B.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, which has been subject to some discussion in the literature, is related to <u>intratemporal</u> effects of terms of trade shocks on resource allocation and consumption decisions. For example, as a result of a temporary worsening of the terms of trade, 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 the equilibrium q. 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 a second intertemporal channel through which changes in exogenous variables will affect the vector of equilibrium RERs. For example, in the case of a temporary worsening of the terms of trade, the consumption discount factor $\pi^2\delta^*/\pi^1$ will be affected, altering the intertemporal allocation of consumption. In the rest of the paper we will emphasize the role of this intertemporal effect.

Footnotes

[1]See for example Diaz-Alejandro (1970, 1972).

[2]On contractionary devaluations see, for example, Katseli (1983), van Wijnbergen (1986) and Edwards (1986).

[3]See, for example, Diaz-Alejandro (1984, 1986).

[4]Of course, there have been some exceptions. See for example, Krueger (1978) and Harberger (1986).

[5]It should be noted that Bacha and Taylor (1971) and Taylor (1979) are using slightly different models. See the original references for details.

[6]On modern criticisms of the concept of effective rate protection see, for example, Bhagwati and Srinivasan (1983), Jones and Neary (1984), and Corden (1984).

[7]A notable exception is Corden (1971, Ch. 5). See also Dornbusch (1974).

[8]See Edwards (1988) for a discussion on real exchange rate measurement problems.

[9]For simplicity we are ignoring issues related to multilateral exchange rates. See, however, Edwards (1988).

[10]A common confusion that sometimes appears in the literature is to use the concepts of the real exchange rate and the terms of trade interchangeably. Of course, since the terms of trade are defined as the relative price

of exportables to importables, and the real exchange rate is usually defined as the relative price of tradables to nontradables, there is no reason for them to be equivalent. In fact, there are circumstances where these two variables will tend to move in the opposite direction. Williamson (1983) has recently stressed the importance of distinguishing between the terms of trade and the real exchange rate. Also Katseli (1984) has recently shown, using a cross-country data set, that these two variables have tended to behave quite differently in recent years.

[11]See, for example Krueger (1978).

[12]Recently, Harberger (1986) has proposed yet another definition for the real exchange rate: $e_H = E/P_G$, where as before E is the nominal exchhange rate, and P_G is a "general" domestic price level. In this case e_H is the relative price of the domestic basket in terms of a unit of foreign currency. In terms of the discussion in this paper e_H is equivalent to e. For this reason we will not deal specifically with e_H.

[13]For the purpose of the present paper a general definition that can be applied to any of the competing concepts of real exchange rate is provided. The equilibrium real exchange rate is defined as that relative price which simultaneously equilibrates the external and internal sectors, for given long term equilibrium values of other key variables such as international terms of trade, capital inflows and commercial policies. These other variables are usually called the "fundamental" determinants of the equilibrium real exchange rate. "Internal equilibrium" implies that there is full employment. For discussions see, for example, Williamson (1983), Katseli (1984) and Edwards (1988).

[14]The existence of more factors than goods assures that R is twice differentiable.

[15]Since in this model there is no foreign borrowing the equilibrium RER is defined in temporal terms. In models with foreign borrowing and lending the equilibrium RER is defined in intertemporal terms. For this type of intertemporal model see, for example, Edwards (1987b) and the section on extensions below.

[16]In this model it is assumed that the actual RER is always at its equilibrium level. In that sense, there is no RER misalignment. On equilibrium and disequilibrium RERs see, however, Edwards (1987a).

[17]Of course the possibility of complementarity between any two goods arises because we have a three goods model.

[18]See Neary (1985). See also Chapter 8 of Dixit and Norman (1980). Notice that in the analysis that follows it is assumed that throughout all three goods are produced. This is possible thanks to the assumption that the Stolper-Samuelson theorem does not hold. See Section IV below for further discussions on the subject.

[19]An important point is whether real wages are actually fix, or if they are only inflexible downward.

[20]Edwards (1984) used transfers to analyze the behavior of the real exchange rate following a liberalization of the capital account.

[21]On the Southern Cone also see Diaz Alejandro (1981), Edwards (1985), Corbo (1985), Hanson and de Melo (1985), and Calvo (1986).

[22]The main difference will be that under that framework the funds obtained from abroad will also be used to increase the capital stock.

[23]The long run will be given by the case with capital accumulation and population growth.

[24]An important question that crucially impinges on the nature of the results that follow is whether it is reasonable to assume nonspecialization. Jones (1974) discusses the case of many commodity (one of them nontradable) and two factors and shows that the production possibilities frontier will be flat. Changes in world price of importables and exportables or in tariffs, however, will shift the position of the production possibilities frontier. The case I focus on here corresponds to that depicted in Fig. 9 of Jones (1974) paper, where over a reasonable range the two tradables and the nontradable are produced. This, of course, requires thatthe aggregate capital-labor ratio <u>net</u> of capital and labor employed in the NT sector, falls between the capital-labor ratios in each traded sector that guarantee zero profits at positive activity levels for given world traded goods prices. Since these latter two ratios will in general be different, the set of equilibria characterized by incomplete specialization has positive measure. In Section IV.2 I discuss the case of specialization in nontradables and one of the tradables.

[25]It is assumed that there are no capital intensity reversals and that the capital intensities in value terms correspond to those in physical terms.

[26] Notice, however, that starting from nonspecialization rigid real wages will generate not additional problems. The reason of course is that under our assumptions of relative capital intensities the tariff removal will result in an <u>increase</u> in the real wage.

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