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**Trade Liberalization in Developing Countries:
Initial Trade Distortions and Imported Intermediate Inputs**

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Abstract

Trade liberalization in the developing countries is frequently opposed on the grounds that, because it is likely to cause a deterioration in the external balance, it may not be a viable policy option for countries facing foreign exchange constraints. Recent literature suggests, however, an ambiguous relationship between tariff changes and the current account. This paper shows that if liberalization involves reducing tariffs on imported intermediate inputs (a reform that has figured prominently in the developing countries), then the current account may improve or deteriorate, depending on the level of initial trade distortions and the structure of the economy.

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Contents

	<u>Page</u>
I. Introduction	1
II. The Analytic Framework	6
1. Supply	6
2. Demand	9
3. Government	10
4. Equilibrium	11
III. Tariff Reductions on Imported Inputs: Short-Run Distortions Only	12
IV. The Case of Trade Distortions in Both the Short and Long Run	18
1. Permanent Liberalizations	20
2. Temporary Liberalizations	24
V. Conclusion	28
Tables:	
1. The Effect of a Reduction in the Tariff on Imported Intermediate Inputs: Short-Run Distortions Only	19
2. The Effect of a Permanent Reaction in the Tariff on Imported Intermediate Inputs: Short- and Long-Run Distortions	25
References	30

I. Introduction

One of the main objections to proposals of trade reform is that there is an inherent conflict--in the short run at least--between lowering import restrictions and achieving balance of payments objectives. In particular, because a reduction in the level of protection may be expected to bring about a worsening of the trade balance, it has been argued that liberalization may not be a viable policy option for countries that face foreign exchange or borrowing constraints. That balance of payments considerations are viewed as playing a central role in the decision of whether to liberalize trade flows is brought out clearly in a recent comprehensive study of trade reform in the developing countries which concludes:

"[There is] overwhelming evidence attesting to the inference that the fate of a liberalization policy is determined, first and foremost, by developments in the balance of payments position. A significant deficit, involving a substantial loss of foreign exchange reserves, is most likely to abort a liberalization attempt. Without such a loss, on the other hand, even in the presence of other economic hardships in one form or another, liberalization is likely to be sustained. The authors of ten country studies--Argentina, Brazil, Chile, Indonesia, Korea, Pakistan, Peru, the Philippines, Portugal, and Spain--explicitly reach this basic conclusion." (Papageorgiou, et. al., 1986, pp 14-15).

The notion that tariff reductions are likely to bring about a worsening of the external position has its origins in the simple idea that lower tariffs lead to a switch in consumption patterns from domestic toward foreign-produced goods, and hence to an increase in imports. With exports being determined by demand in the foreign country, and thus unaffected by the tariff, a tariff reduction would necessarily reduce the trade surplus (where the change in the latter is identically equal to the increase in imports). 1/

1/ Of course, it has long been realized that there might be offsetting effects stemming from endogenous movements in the equilibrium real exchange rate. Thus, a significant real depreciation associated with tariff reductions might stimulate exports, which would tend to mitigate the worsening in the trade balance caused by the increase in imports. However, the assumption that many developing countries operate with fixed nominal exchange rates, and that wages and prices may not be downwardly flexible in developing countries, led many observers to believe that--in the absence of significant inflation abroad--the real depreciations necessary to prevent a worsening of the external position might not be achievable. See Corden (1987, pp. 21-2) and Dornbusch (1980, pp. 65-6) for a description of the effects of a tariff in a static Keynesian model under fixed exchange rates.

More recently, researchers have argued that, in order to understand the connection between the external current account balance and the level of protection, one needs a model of saving and investment. Since the current account is identically equal to the difference between national saving and investment, a reduction in trade restrictions can only be expected to affect the current account if it brings about a differential response of saving and investment flows. The switch in focus from exports minus imports (net exports) to saving minus investment highlights the potential importance of taking into account the intertemporal effects of policies--including trade liberalization--on the current account.

In contrast to much of the earlier literature, the conclusions which emerge from the saving-investment approach do not suggest that tariff reductions will necessarily lead to a worsening of the external position. Most of the analysis within this approach has focused on the effects of liberalization on saving, with investment effects usually ignored. 1/ In the papers by Razin and Svensson (1983) and Calvo (1987, 1988, 1989), for example, it was emphasized that the effects on the current account of trade reforms depend on how the public perceives their implementation through time. Liberalizations that are perceived as permanent are unlikely to result in sharp movements in the current account in one direction or another. 2/ In addition, a phased reduction in tariffs, in which the rate in future periods is expected to be below today's rate, might even lead to an improvement in the current account. On the other hand, if lack of credibility is an important characteristic of actual liberalizations, then this would lend support to the view that lowering tariffs will result in a worsening of the external position. 3/ This is because, if liberalization policies are expected to be reversed in the future, consumers will increase their demand for imports (reduce saving) while tariffs are temporarily low, thereby contributing to a deterioration in the trade balance.

Extensions of this basic analysis--focusing again mostly on the savings side of the current account--have also supported the view that trade liberalizations have ambiguous effects on the external balance. Edwards (1987, 1988, 1989) showed that the incorporation of nontradable goods could cause the comovement between liberalization policies and the

1/ Two exceptions are Brock (1987) and Sen and Turnovsky (1989). Also see Corden (1988) for a less formal discussion of some of these issues.

2/ The papers by Engel and Kletzer (1986, 1990) also conclude that a permanent liberalization has an ambiguous effect on the current account which depends, inter alia, on the form of the saving function. In their models, a reduction in tariffs could well lead to an increase in savings and thus result in an improvement in the current account. Sen and Turnovsky (1989) also find an ambiguous effect on saving.

3/ Credibility issues associated with trade liberalization are also examined in Engel and Kletzer (1987), Froot (1988), and Rodrik (1989).

current account to become ambiguous. 1/ Murphy (1986) examined the issue of how the accompanying fiscal policies affect the current account response to trade liberalization. He showed that, if the government uses tariff revenues to finance its own consumption, then the current account effects of trade liberalization--which are generally ambiguous--depend on the commodity composition of government spending. 2/ Rodrik (1987) considered how tariff reductions would affect the current account in economies with imperfectly flexible labor markets. Once again, the conclusion emerged that liberalizations had ambiguous effects on the current account, which depended in this case mainly on the relationship between changes in the tariff and the level of employment. 3/

Thus, it is apparent that a large body of recent theoretical research argues against the view that trade liberalizations will necessarily cause the external balance to worsen. The agnostic tentative conclusion, that liberalizations may be expected to have ambiguous effects on the current account which depend on a range of factors including the expected time-path of tariff reductions, the importance of nontraded goods, the role of accompanying fiscal policies, and the extent of labor market rigidities, is also consistent with some available empirical evidence relating to the developing countries. For example, in a multi-country study of trade reform in developing countries undertaken by the World Bank (Thomas, 1989, and Thomas, et. al., 1990), it was found that net exports as a percentage of GDP actually rose in the period following reform in comparison to the pre-reform period. Further, relative to a control group of developing countries, net exports of the trade reformers also increased. These results, which are of course subject to many caveats (see Thomas, 1989, pp. 17-8 and Khan, 1990), suggest that there is no presumption, based on empirical evidence, that reducing trade restrictions systematically results in a worsening of the external position. 4/

1/ See also Dornbusch (1974) for an early analysis of the connection between tariffs and nontraded goods in the context of a static model.

2/ In general, if lump-sum taxation is not available to the government, reducing tariff rates on imports will require increases in other distortionary taxes, for a constant path of government spending. On the current account effects of changes in distortionary taxes, see Frenkel and Razin (1987, chapter 8).

3/ The paper by van Wijnbergen (1987), which examines the relationship between tariff changes and the current account in economies with wage indexation, is of related interest. In that paper, an ambiguous relationship between tariff reductions and the current account is also established. For a similar conclusion relating to the connection between import quotas and the current account, see Djajic (1987).

4/ The experience with trade liberalization of the Southern Cone countries during the 1970s also does not suggest that the liberalizations per se were the main contributors to the deteriorating external position of these countries. See, for instance, Edwards (1984, particularly pp. 1-2, and 1988, p. 1). On the Chilean experience with liberalization, see Edwards (1986) and on the recent Mexican experience, see Ize (1990).

While previous theoretical research tends to support the view that trade liberalization need not worsen the current account, the present paper argues that much of this earlier analysis cannot be applied in a straightforward way to the developing countries because there are reasons to believe that conditions in this group of countries depart in important ways from those that are postulated in much of the existing literature. Two such reasons are central to the analysis that follows. The first is that, in contrast to the circumstances of most developed economies, trade liberalization in developing countries begins from an initial position of relatively high levels of protection. 1/ Thus, the assumption of low (effectively zero) initial trade distortions frequently adopted in the theoretical literature is not appropriate for an analysis of the effects of liberalization in developing countries.

Second, imports to developing countries tend to be dominated by intermediate products, whereas previous theoretical literature on the relationship between tariffs and the trade balance has concentrated on trade restrictions on final products. 2/ Evidence presented in Thomas (1989) suggests that only about one fifth of developing country imports consist of final goods, with the remaining four fifths accounted for by imports of intermediate and capital goods. 3/ Intermediate inputs alone seem to account for about half the imports of the typical developing country. Moreover, there are also indications that liberalizing trade in intermediates has received more prominence in actual trade reform packages pursued by the developing countries than have tariff reductions involving

1/ As Krueger (1984) writes in her survey of trade policies in developing countries: "What distinguishes protectionist policies in developing countries [relative to those in developed countries] is the height of protection" (p. 527, emphasis added). Corden (1987) makes essentially the same observation: "Protection in developing countries is generally much higher than in developed countries, covering a much broader range of imports, and is often extremely high by any measure" (p.3).

2/ The issue of intermediate products received extensive treatment in the literature dealing with the effects of oil shocks (see, e.g., Svensson, 1984 and Marion, 1984), and many results concerning the effects of terms of trade shocks involving intermediate products have their counterparts in the analysis of tariff changes when tariffs are initially positive. See Lopez and Rodrik (1989) for a related analysis which assumes, for the most part, zero initial distortions.

3/ There is also evidence (see, e.g., Central Intelligence Agency, 1989) that intermediate inputs make up a similarly large fraction of total imports of the Eastern European and Soviet economies. Although an analysis of trade liberalization issues in the specific context of these economies is beyond the scope of this paper, the importance of imported intermediate inputs in these countries and the high initial level of distortions indicates that the analysis of this paper might also be relevant to such economies.

final products, which makes an analysis of this type of liberalization measure all the more relevant. 1/

Finally, one consequence of examining the relationship between tariff reductions on intermediates and the external balance is that the response of investment will play an important role. While much of the previous literature has focused on saving effects exclusively, it will be argued below that the response of investment to a trade liberalization involving intermediate inputs may be no less important in determining the overall impact on the current account. For this reason, and in contrast to much of the previous literature, the analysis that follows provides a detailed discussion of how a tariff change involving intermediates affects investment. 2/

The main theoretical conclusion of the paper is that the effect on the external balance of trade liberalization involving intermediate inputs depends on both the initial level of protection and on the economic structure (i.e., relative factor intensities across various sectors). From a policy perspective, this implies that, if one accepts the argument that trade reforms will necessarily lead to a deterioration in the external position, one must also be making a judgment about the economic structure of the economy undergoing trade reform. Given the likely diversity of economic structures and initial levels of protection that exist among the developing countries, it seems unlikely that the pessimistic policy conclusion--that trade reform is not a viable option for economies operating under foreign exchange or borrowing constraints--would apply with equal force to all developing countries at all times.

The remainder of the paper is organized as follows. In Section II, an intertemporal, optimizing, general equilibrium model of a small open economy with initial trade restrictions is developed to investigate the effects of reducing tariffs on intermediate inputs on a variety of macroeconomic variables including the real exchange rate, investment, saving, the current account balance, and economic welfare. In Section III, a special case of the general model, in which trade restrictions are assumed to be in place in the short-run only with the long-run being characterized by free trade, is used to derive a set of comparative static results. The more general case, with trade restrictions assumed to be in place in both the short- and long-run, is considered in Section IV. In this case, the distinction between permanent and temporary liberalizations becomes important. Finally, Section V contains the main conclusions.

1/ The bias of liberalization measures in favor of intermediates (Thomas, 1989, p. 14) may reflect the view that increased imports of intermediate products enhance productive efficiency and economic growth (*ibid.*, pp. 24-5).

2/ It may be noted that the related paper of Lopez and Rodrik (1989) does not deal with the investment issue, nor does it discuss the difference between short- and long-run trade distortions, which is explored in Sections III and IV of the present paper.

II. The Analytic Framework

The model developed below is the simplest one capable of addressing the main issues that were set out in the previous section. The model is completely real (i.e., monetary considerations are not considered), and consists of optimizing agents (producers and consumers) who maximize an intertemporal objective function (profits or utility) subject to technological or budget constraints. In order to analyze saving and investment decisions, an intertemporal structure is chosen in which there are only two periods, the present (period 1) and the future (period 2). ^{1/} There is no uncertainty and agents are assumed to have rational expectations (perfect foresight) with respect to all future-period variables.

In addition to two tradable final goods (importables and exportables) and an imported intermediate input, the model incorporates a nontradables sector. The country is assumed to be small in world markets and, therefore, it takes the world prices of all tradable goods as given. ^{2/} The inclusion of a nontradables sector permits an analysis of the effects of trade liberalization on the real exchange rate--defined as the relative price of the exportable in terms of the nontradable good--an issue which has received considerable prominence in the policy literature. ^{3/} Further details of the model are provided in the remainder of this Section.

1. Supply

The supply side of the model consists of competitive firms whose objective is to maximize the present value of current and future profits from production. Four types of goods are considered. Exportables (X), importables (M), and nontradables (N) are produced domestically, while the supply of an intermediate input (m), which is required in the production of final goods X, M, and N, is met entirely by imports from abroad. Profit maximizing firms produce output of final goods using primary factors

^{1/} Since perfect capital mobility and perfect foresight will be assumed, the second period may, without loss of generality, be regarded as comprising a larger (possibly infinite) number of future periods.

^{2/} In addition, the paper will not consider the issue of terms of trade shocks, which has been dealt with elsewhere (e.g., Svensson and Razin, 1983). Therefore, it is legitimate to think of the two final tradable goods as forming a single composite tradable commodity. Although the possibility of tariffs on final good imports is allowed for in the specification of the model, the effects of changes in this tariff rate--which have been analyzed extensively in the literature--are not considered in what follows.

^{3/} See, for instance Dornbusch (1974) and the references therein. For a discussion of the appropriate measure of the real exchange rate in models with more than one tradable good, see Neary (1988).

(labor, capital, and land $\underline{1}$ /) and the intermediate input. It is assumed in what follows that land is sector-specific while labor and capital are mobile across sectors. The reason for making the assumption that capital is intersectorally mobile is that part of the effect of liberalization on the current account will arise through producers' decisions to allocate capital differently across sectors in response to relative price shifts. In order to study such shifts, it is necessary to assume some degree of intersectoral capital mobility.

The presence of additional factors--other than labor and capital--is important because, as is well known from the theory of international trade, the assumption that the number of tradable goods (three--an importable and exportable final good and an imported intermediate input) is less than the number of (internationally) nontradable factors (five--labor, capital and three types of sector-specific land) ensures that the price of nontradable goods will be endogenously determined in a small open economy by the interaction of demand and supply for such goods. $\underline{2}$ / This assumption is therefore appropriate if one wishes to analyze the real exchange rate effects of trade liberalization.

With such large numbers of goods and factors, it proves fairly cumbersome to solve the model by directly working through the first order conditions for profit maximization. A convenient alternative, however, is to use the so-called "dual" approach (see, e.g., Dixit and Norman, 1980). Under this approach, the output supply and intermediate input demand functions are simply the partial derivatives of the economy's revenue or value added functions, which are defined as the maximum value of output (net of the cost of the intermediate input), given prices and endowments of factors. Thus, if R^i is the revenue function in period i , p^i and v^i are vectors of prices and factor endowments in period i , respectively, with p_j^i being the j th element of p^i , then the supply (S_j^i) in period i of the good whose price is p_j^i is given by

$$(1) \quad S_j^i(p^i, v^i) = \partial R^i / \partial p_j^i = R_j^i(p^i, v^i).$$

Defining p^i as the vector $[1, p^i, q^i, r^i]$ where 1 is the price of the exportable (the numeraire), p^i is the price of the importable, q^i is the price of the nontradable, r^i is the price of the intermediate input, then

$$(2) \quad m^i(p^i, v^i) = -R_4^i(p^i, v^i).$$

$\underline{1}$ / There is nothing special about land here. The third factor could equally be some other natural resource that is supplied inelastically.

$\underline{2}$ / The endogenous determination of the price of home goods would also be assured if there were only two types of land since in this case the number of tradable goods would still be less than the number of nontradable factors. Three types of land were assumed mainly for symmetry, and to capture the idea that each sector used one specific factor.

In other words, the demand for intermediates is equal to minus the partial derivative of the revenue function with respect to the price of the intermediate, r^1 , which is the fourth element of the vector p^1 . 1/

A further point to be made in connection with the supply side of the model relates to investment. First, it is necessary to assume that one of the three goods is either a pure investment good or, as is more conventional, a composite good which may be used either for investment purposes (i.e., to augment the future capital stock) or for current consumption. In order to simplify the analysis, it will be assumed that the composite good corresponds to the numeraire good (X). 2/

Second, since firms are assumed to maximize the present value of profits from investment, in equilibrium it will be the case that the discounted value of the increase in value added in period 2 from a small investment in period 1, $\delta \partial R^2 / \partial I$, is equated to the price of a unit of the investment good, which is unity. Here δ is the discount factor equal to one divided by one plus the world rate of interest in terms of good X, and I is the level of investment. The condition may be stated formally as

$$(3) \quad \delta \partial R^2(1, p^2, q^2, r^2; z^2, k^{1+I}) / \partial I = 1$$

where the initial capital stock, denoted k^1 , is assumed not to depreciate between the two periods. Equation (3) may be used to define an optimal investment level as a function of all variables that affect value added in period 2, namely the relative prices of importables (p^2), of nontradables (q^2), and of imported intermediates (r^2), the vector of factor endowments of land and labor, z^2 , and the discount factor, δ . Thus investment demand is the function

$$(4) \quad I = I(1, p^2, q^2, r^2; z^2; \delta). \quad \underline{3/}$$

Standard properties of the revenue function yield that an increase in the discount factor (a fall in the rate of interest) raises the optimal

1/ The reason for the minus sign preceding the partial derivative of the revenue function is that the intermediate input is like a "negative" output. The demand for the input is therefore equal to minus the partial derivative of the revenue function with respect to r^1 .

2/ The analysis is not fundamentally different if one of the other goods is chosen to be the composite good. See equation (4) and the footnote which follows it.

3/ If the composite good corresponded to good N then the cost of a unit of capital (and hence the optimal investment choice) would also be a function of q^1 , the relative price of nontradables in period 1. A rise in q^1 would tend to lower investment, and conversely. An analysis of this case, which does not alter the main qualitative results of the paper, is available from the author on request.

investment level, i.e., $\partial I / \partial \delta = I_{\delta} > 0$. ^{1/} In what follows, attention focuses not so much on the effects of interest rate changes or factor supply changes (changes in the z^2 vector), but rather on how changes in the domestic price of intermediates brought about by changes in commercial policies affect investment.

Since intermediates are an input, along with capital, into the production process, it should be clear that the effect on investment of a change in the tariff on intermediates depends on the technological relationship (whether complementary or substitutable) between these two inputs. If the two inputs are net complements as is conventionally assumed (see, e.g., Svensson, 1984, pp. 652 and 659), then a tariff reduction in period 2 (a fall in r^2) will tend to raise investment. This will be the maintained assumption for the remainder of this paper so that $\partial I / \partial r^2 = I_{r^2} < 0$.

It should further be noted that the relative price of nontradable goods is also an endogenous variable that will respond to commercial policy changes. The effect of changes in q^2 on investment will in general be determined by relative factor intensities across the various sectors. To take an example, suppose nontradables are more capital intensive than tradables. Then a rise in q^2 (a real appreciation) will increase investment. The reason is that the rise in q^2 shifts resources from tradables to nontradables, where the latter are--relative to the rest of the economy--intensive users of capital. This tends to raise the demand for period 2 capital which stimulates investment. The opposite would hold if tradables were relatively capital intensive. ^{2/}

2. Demand

As far as demand is concerned, consumers are assumed to maximize utility subject to the constraint that the present value of their expenditures not exceed the present value of their resources. It is assumed that the utility function is weakly time separable with each period's subutility function being homothetic. The motivation for this assumption is that it permits a rigorous definition of within-period price

^{1/} This is most easily seen by rewriting the first order condition for investment as $\partial R^2 / \partial I = 1/\delta$ where the left hand side is the marginal product of capital in period 2 and the right hand side is one plus the rate of interest. Since at the optimum the marginal product of period 2 capital must be a decreasing function of the level of period 2 capital, it follows that an increase in δ (a fall in the rate of interest), which lowers the right hand side, must necessarily lower the left hand side (other things equal), by increasing investment and hence the period 2 capital stock.

^{2/} This is simply an application of the well-known Rybczynski theorem of international trade. This theorem is also useful for predicting the response of investment to changes in the tariff on final products (see, e.g., Dixit and Norman, 1980, pp. 49-59).

indices which measure the cost of the consumption basket in each period. Given world interest rates, movements in the within-period price indices determine the relative cost of current in terms of future consumption, or the consumption rate of interest. The latter, in turn, is a key determinant of saving behavior, and hence of the current account.

The relevant information for optimal consumption choice may be summarized in the present value (or lifetime) expenditure function,

$$(5) \quad E = E[\pi^1(1, p^1, q^1), \delta \pi^2(1, p^2, q^2); W],$$

which gives the minimum lifetime expenditure necessary to achieve utility level, W , for a given set of prices. As can be seen, $E(\cdot)$ is separable between first and second period prices, reflecting the underlying separability of preferences. The functions, $\pi^i(1, p^i, q^i)$, $i = 1, 2$, correspond to exact price indices for each period's consumption basket.

By analogy with the supply side, if one defines P^i to be the vector of prices $[1, p^i, q^i]$, with p_{ji}^i as its j th element, then the demand (D_j^i) in period i for the good whose price is p_{ji}^i is given by

$$(6) \quad D_j^i = \partial E / \partial p_{ji}^i = E_{ji}.$$

For example, the demand for nontradables in period 1 is given by $\partial E / \partial q^1 = E_{q1}$; similarly, E_{q2} equals the consumption of good N in period 2.

In addition to the demand for a single good, one may be interested in the demand for total consumption in a given period. If C^1 denotes real consumption spending in period 1, then, by analogy with equation (6),

$$(7) \quad C^1 = \partial E / \partial \pi^1 = E_{\pi 1}$$

since π^1 is the price of the consumption basket, C^1 . It follows, therefore, that the value of nominal (i.e., measured in units of the numeraire good) spending in period 1 is given by the product of the price index in period 1, π^1 , and C^1 , i.e., $\pi^1 E_{\pi 1}$. Finally, it follows from standard properties of the expenditure function that all goods must be intertemporal substitutes. This means that an increase in π^2 must raise real spending in period 1, so that $E_{\pi 1 \pi 2} > 0$. Equally, if one considers a particular good, it must be the case that $E_{q1 q2} > 0$.

3. Government

Since the main focus of this paper is on commercial policies, activist fiscal policies are not considered. ^{1/} Accordingly, the sole function of the government in this model is to levy tariffs and to redistribute the resulting revenues to consumers in a lump sum fashion.

^{1/} See Murphy (1986) for a discussion of the effects of commercial policies when tariff revenues are used to finance government expenditures.

This allows one to focus on the important substitution effects (both intratemporal and intertemporal) from trade liberalizations rather than on the combined effects of budgetary and commercial policies.

Accordingly, the budget constraint for the government states that the present value of transfers to the public, G , equal the present value of the revenues from levying tariffs. If t^i is the tariff on intermediates in period i and T^i is the tariff on final good imports, then

$$(8) \quad G = T^1(E_{p1} - R_2^1) + \delta T^2(E_{p2} - R_2^2) - t^1 R_4^1 - \delta t^2 R_4^2$$

where, as mentioned previously, R_j^i is the derivative of the revenue function, R^i , with respect to its j th argument (so that e.g., $R_2^1 \equiv \partial R^1(1, p^1, q^1, r^1; z^1, k^1) / \partial p^1$ equals the supply of importables in period i , $i=1,2$). 1/ From the properties of the revenue and expenditure functions discussed previously, the first two terms represent the present value of revenues from tariff collections on final goods, while the last two terms represent tariff collections from imported intermediates. Finally, in this expression, the world prices of importables and intermediate inputs have both been normalized to unity by suitable choice of units.

4. Equilibrium

The first condition that must hold in equilibrium is the economy-wide budget constraint which states that the present value of utility-maximizing consumption, E , plus the profit-maximizing investment level, I , be equal to the present value of income from production, $R^1 + \delta R^2$, and rebated tariff revenues, $T^1(E_{p1} - R_2^1) + \delta T^2(E_{p2} - R_2^2) - t^1 R_4^1 - \delta t^2 R_4^2$, viz.:

$$(9) \quad E(\pi^1(1, p^1, q^1), \delta \pi^2(1, p^2, q^2); W) + I = R^1(1, p^1, q^1, r^1; z^1, k^1) + \delta R^2(1, p^2, q^2, r^2; z^2, k^1 + I) + T^1(E_{p1} - R_2^1) + \delta T^2(E_{p2} - R_2^2) - t^1 R_4^1 - \delta t^2 R_4^2.$$

Clearly, equation (9) allows for trade imbalances in each period but requires that the discounted sum of these imbalances be equal to zero. 2/

While equation (9) represents the requirement of external balance (or intertemporal solvency), internal balance is achieved when the market for home goods clears in each of the two periods:

$$(10) \quad E_{q1} = R_3^1$$

1/ Note that the capital stock in period 2, $k^2 \equiv k^1 + I$, since there is no depreciation.

2/ Since the trade balance is the main endogenous variable of interest, it is necessary to have at least two periods so that within-period imbalances are possible. For an analysis of trade liberalization in a model where the current account is exogenously fixed by a quota on foreign borrowing, see Edwards and van Wijnbergen (1986) and Edwards (1989).

$$(11) \quad E_{q2} = R_3^2.$$

In equations (10) and (11), the left hand side represents the demand for nontradable goods in a given period while the right hand side represents the corresponding supply. 1/

Equations (9) through (11) summarize the model's equilibrium. The three endogenous variables are the level of welfare, W , and the two prices for nontradables, q^1 and q^2 . In general, one may expect that commercial policy changes will influence all three of these variables. Once the effect of tariff changes on real exchange rates (reciprocals of q^1 and q^2) and welfare are known, the current account (ca) effects of such policies may also be derived, by differentiating the following expression:

$$(12) \quad ca = R^1 - t^1 R_4^1 + T^1(E_{p1} - R_{p1}^1) - \pi^1 E_{\pi 1} - I. \quad 2/$$

Thus the current account in period 1 is equal to saving minus investment. Saving, in turn, is equal to the difference between income (both from production and rebated tariff revenues), $R^1 - t^1 R_4^1 + T^1(E_{p1} - R_{p1}^1)$, and consumption, $\pi^1 E_{\pi 1}$. 3/ As can be seen, ca depends on all the endogenous variables of the model (through the revenue and expenditure functions) and directly on the various tariff rates. By combining equation (12) with the economy-wide budget constraint (equation 9), it may be verified that any trade deficit in period 1 must be offset by a trade surplus of equal present value in the second period. 4/

III. Tariff Reductions on Imported Inputs: Short-Run Distortions Only

This section presents comparative static results for the effects of tariff reductions in the case in which distortions are assumed to exist only in the first period, while Section IV deals with the general case in which distortions may exist in both periods. The main reason for analyzing the special case first is that this will help to isolate some of the main channels through which liberalization affects the current account, in the absence of the additional complications that arise in the presence of second period distortions.

1/ Recall that the derivatives appearing on the right hand side of equations (10) and (11) are the supplies of nontradables since the third element of the price vector, p^i , is the relative price of nontradables, q^i .

2/ It should be noted that the current account and trade account balances are equal in period 1 by the assumption that the economy does not inherit any external debt commitment from periods before the first period.

3/ Using the property that the revenue function is linear homogeneous in prices, it may be verified that the saving minus investment definition is equivalent to the more usual definition of exports minus imports.

4/ It may be noted that the current account in period 2 is equal to saving since there is no investment in the second period.

Before proceeding with the details, it is useful to introduce the discussion by contrasting the analysis with the more usual one involving tariff reductions on final goods. In much of the previous literature (see Section I), a tariff reduction on final goods affects the current account mainly as a result of an intertemporal substitution effect on saving. 1/ Reducing the tariff on imports directly lowers the cost of the consumption basket by lowering the domestic relative price of importables faced by consumers. If the trade liberalization is regarded as temporary (or non-credible), imports, and hence the consumption basket, are cheap today relative to their expected price in the future. This tends to raise demand for imports (and, other things equal, increase total consumption), hence worsening the trade balance. In contrast, a liberalization that is regarded as permanent will not have much effect on saving (and hence the trade balance) because the future price of imports is not expected to differ much from the current price. For this reason, consumers do not perceive an advantage in "dissaving" or borrowing in order to finance purchases of imports today, and the trade balance does not deteriorate.

In the case of trade liberalization involving intermediate inputs, tariff reductions do not directly affect the price of any final good. Thus, the impact on the current account, if there is one, must be through a different channel. As it turns out, there are three main channels through which a reduction in the tariff on intermediates affects the current account: (a) real income or wealth effects on saving; (b) intertemporal substitution effects on saving; and (c) investment effects. The wealth effect arises because a tariff reduction allows for a more efficient combination of primary factors and intermediate inputs to be used in the production of an existing output mix; it also allows for a more efficient output mix. Although the first mechanism is fairly clear-cut--liberalization allows producers to use more "intermediate-intensive" production techniques than were previously available--the second is perhaps more subtle. It arises because, with different sectors using intermediates in different intensities (owing to differences in their production technologies), the tariff on intermediates will in general lead to a mix of outputs which does not maximize value added for the country. Important determinants of this output-mix effect are first, relative factor intensities across sectors, and second, movements in relative prices of final goods between sectors (essentially movements in the real exchange rate). The latter determines the direction in which resources move when trade is liberalized while the former determines the extent to which this resource movement increases national income.

How will these movements in real income affect saving? The answer depends on the distribution of gains over time. If they are concentrated in the present, consumption-smoothing dictates that saving increases. Conversely, if they are concentrated in the future, saving will decline.

1/ As indicated previously, investment effects have, for the most part, been ignored in the previous literature.

The intertemporal substitution effect on saving arises because liberalization causes the equilibrium real exchange rate (the rate that simultaneously clears the nontradables market--internal balance, and ensures that the discounted sum of trade imbalances is zero--external balance) to change. This in turn affects the cost of present consumption in terms of future consumption--the consumption rate of interest--and hence saving.

Two main factors influence the behavior of the real exchange rate--relative factor intensities and welfare effects. If nontradables use intermediates intensively, reducing the tariff on imported inputs causes the supply of nontradables to rise, and their relative price to fall, a real depreciation. The opposite holds if tradables are intensive users of intermediates. In addition, however, liberalization tends to raise the economy's welfare or real income level. This causes demand for nontradables to increase which puts upward pressure on their price, thus favoring a real appreciation. In general, the behavior of the real exchange rate depends on both these factor intensity and real income effects.

Finally, it may be noted that intertemporal substitution effects are also important in determining real exchange rate behavior. If the price of nontradables falls today, agents will reduce their demand for nontradables in the future and consume more (relatively cheaper) home goods today, as long as there is some degree of intertemporal substitution in consumption. The resulting incipient excess supply of future nontradables favors a reduction in their relative price. Thus, the intertemporal substitution effect generates a positive comovement between the current and future price of nontradables. Of course, to determine the overall effect on saving, it is necessary to know whether the price of the consumption basket rises by more or less in the present than in the future. This depends both on the relative degree of appreciation or depreciation of the real exchange rate in each period, and on the relative magnitudes of the expenditure shares on home goods in the two periods.

As to investment effects, the previous section suggested how changes in the future tariff influence investment behavior today. What was not discussed however was the fact that, because of the intertemporal substitution effects mentioned above, liberalizations today could influence the real exchange rate in the future and hence investment behavior. For this reason, the factors influencing the real exchange rate--factor intensities and welfare effects--also will affect the response of investment to tariff reductions.

With these preliminaries in hand, it is now possible to proceed with the main derivations. Accordingly, assuming that the only distortion facing the economy is a positive tariff on intermediates in period 1 (t^1), equations (9) may be totally differentiated in order to obtain the wealth equivalent of the welfare change ($E_w dW$) from a reduction in t^1 as

$$(13) \quad E_w dW/dt^1 = -t^1(R_{44}^1 + R_{43}^1 dq^1/dt^1)$$

which is simply the product of the initial distortion, t^1 , and the change in the volume of imports of intermediate inputs, $-(R_{44}^1 + R_{43}^1 dq^1/dt^1)$. Reducing the tariff on intermediates ($dt^1 < 0$) has two effects on imports. First, there is a direct increase in import levels associated with the reduction in their relative price (represented by the own price effect, $R_{44}^1 > 0$ in equation 13); second, there is an indirect effect operating through the response of the real exchange rate (RER) in period 1. This indirect effect, which is ambiguous in sign, depends on both the RER response, dq^1/dt^1 , and on the sign of the Rybczynski derivative, R_{43}^1 . ^{1/} The latter is negative if, relative to tradables, nontradables use intermediates intensively, and conversely. ^{2/} The intuition is that if $R_{43}^1 < 0$, the tariff on intermediates results in too little nontradables being produced and consumed. If lowering the tariff on intermediates results in a depreciation of the RER ($dq^1/dt^1 > 0$), production will shift away from nontradables and an initial distortion will be magnified. In this case, the indirect effect operating through the RER will mitigate against the direct increase in welfare from lowering tariffs.

Obviously, equation (13) is not a reduced form since it depends on the response of the RER. Totally differentiating equations (10) and (11) and substituting from equation (13), one obtains:

$$(14) \quad \Delta dq^1/dt^1 = a_{11}R_{43}^1 + a_{12}t^1$$

$$(15) \quad \Delta dq^2/dt^1 = a_{21}R_{43}^1 + a_{22}t^1$$

where Δ is the determinant of the matrix multiplying the vector $(dq^1 \ dq^2)'$ from equations (10) and (11) and is positive (Dixit and Norman, 1980, pp. 131-2), and

$$a_{11} = E_{q2q2} - R_{33}^2 + (R_{36}^2)^2/R_{66}^2 < 0,$$

$$a_{12} = R_{44}^1 [E_{q1w}(E_{q2q2} - R_{33}^2 + (R_{36}^2)^2/R_{66}^2) - E_{q2w}E_{q1q2}]/E_w < 0,$$

$$a_{21} = -E_{q1q2} < 0,$$

$$a_{22} = \{R_{44}^1 [E_{q2w}E_{q1q1} - E_{q1w}E_{q2q1}] - E_{q2w}[R_{44}^1 R_{33}^1 - (R_{43}^1)^2]\}/E_w < 0. \quad 3/$$

Further, it should be noted that by substituting equation (14) into equation (13), and making use of standard properties of the value added and expenditure functions, one obtains unambiguously that $dW/dt^1 < 0$ for $t^1 > 0$, i.e., reducing the tariff on imported intermediates raises

^{1/} On the interpretation of Rybczynski derivatives when factors outnumber goods, see Dixit and Norman (1980, p.57).

^{2/} Because the relative price between importables and exportables is constant, tradable final goods may be grouped into a Hicksian composite commodity.

^{3/} The signs of these coefficients follow directly from the convexity of the value added function and concavity of the expenditure function.

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$$a_{21} = -E_{q1q2} < 0,$$

$$a_{22} = \{R_{44}^1 [E_{q2w}E_{q1q1} - E_{q1w}E_{q2q1}] - E_{q2w}[R_{44}^1 R_{33}^1 - (R_{43}^1)^2]\}/E_w < 0. \quad \underline{3/}$$

Further, it should be noted that by substituting equation (14) into equation (13), and making use of standard properties of the value added and expenditure functions, one obtains unambiguously that $dW/dt^1 < 0$ for $t^1 > 0$, i.e., reducing the tariff on imported intermediates raises

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welfare. Thus, while the indirect effect (operating through the change in q^1) may contribute to a reduction in welfare, the direct welfare effect of a tariff reduction (which is always positive) will necessarily dominate.

From equations (14) and (15), the effect on the real exchange rate depends on two terms. The sign of the substitution effect (the first term) depends on factor intensity assumptions. If, relative to tradables, nontradables are intensive users of intermediates ($R_{43}^1 < 0$), then reducing the tariff leads to a real depreciation in both periods according to the substitution effect, and conversely. The substitution effect arises because liberalization leads to an expansion of the sector using intermediates intensively and hence to a reduction in the relative price of the good produced by that sector. Thus, if $R_{43}^1 < 0$, the substitution effect favors a depreciation of the RER in period 1 when t^1 is lowered. Moreover, there will also be a real depreciation in period 2 because the reduction in q^1 induces substitution of (relatively cheaper) period 1 nontradables for period 2 nontradables. This intertemporal substitution requires a reduction in q^2 to clear the period 2 nontradables market.

In addition to the substitution effect, the income effect of a tariff reduction always favors an appreciation of the RER because the resulting welfare improvement raises demand for nontradables in both periods (second term in equation 14 and 15). In summary therefore, if $R_{43}^1 < 0$, a reduction in the tariff on intermediates leads to a real depreciation if the substitution effect outweighs the income effect; in the case where $R_{43}^1 > 0$, the liberalization necessarily results in an appreciation of the real exchange rate in both periods.

It is now possible to determine the effects on the current account. Differentiating equation (12), one obtains:

$$(16) \quad dca/dt^1 = E_w(1-C_w^1)dW/dt^1 - \pi^1(E_{\pi 1 q^1}dq^1/dt^1 + E_{\pi 1 q^2}dq^2/dt^1) - I_{q^2}dq^2/dt^1$$

where $1-C_w^1$ is the marginal propensity to consume out of wealth in period 2 which is assumed positive. Equation (16) shows that a trade liberalization affects the current account through three main channels. The first two summarize the effects on saving while the last gives the effect on investment. Accordingly, the first term in equation (16) is the consumption-smoothing effect--the reduction in t^1 raises real income by reducing a distortion. Because agents allocate their wealth optimally across periods, part of the real income gain is saved. Thus, the consumption-smoothing effect favors an improvement in the current account. The second term is the intertemporal substitution effect which depends on how movements in the RER in both periods affect the CRI. Finally, the third term is the investment effect. Its sign depends on which sector uses capital more intensively and on the behavior of the RER in period 2.

While the total effect on the current account is in general ambiguous, some insight into the main factors influencing it may be gained by considering some particular cases. Accordingly, suppose one considers the two-sector analogue of the model under consideration here, in which

there are no nontradable goods. In this case, it is straightforward to show that the expression in equation (16) reduces to

$$dca/dt^1 = -t^1(1-C_w^1)R_{44}^1 < 0.$$

In this case, therefore, one obtains the "perverse" result that a trade liberalization necessarily improves the current account if the initial trade distortion is positive. 1/ The reason of course is that without nontradables, all the prices in the model are exogenous for the small country so that there are no effects on consumption or investment rates of interest. Although consumption rises as a result of the real income gain from reducing the distortion, its proportional rise will necessarily be less than the proportional rise in the value of period 1 output because of consumption-smoothing. 2/ Thus, saving necessarily rises. Put somewhat differently, while imports of intermediates rise as a result of the liberalization, net exports of final products will necessarily rise by a greater amount, leading to an improvement in the resource balance.

Alternatively, consider the case with nontradables but in which initial trade distortions are small. In this case, equation (16) becomes

$$dca/dt^1 = -k_1 R_{43}^1 - I_{q2} dq^2/dt^1 \text{ where}$$

$$k_1 = \pi^1 \{ E_{\pi 1 q 1} [E_{\pi 2 \pi 2 q 2} - R_{33}^2 + (R_{36}^2)^2 / R_{66}^2] + (\pi_{q2}^2)^2 \pi_{q1}^1 [E_{\pi 1 \pi 1} E_{\pi 2 \pi 2} - E_{\pi 1 \pi 2}^2] / \Delta > 0$$

by the concavity of the expenditure function. In this case, the effect on saving, $-k_1 R_{43}^1$, takes on a particularly simple form. A reduction in t^1 reduces (raises) saving if nontradables (tradables) use imported intermediates intensively. 3/ The intuition is essentially that if $R_{43}^1 < 0$, trade liberalization leads to a relative expansion of the nontradables sector and hence to a real depreciation in period 1, which lowers the CRI. 4/ With real income unaffected because of the assumption that initial distortions are small, saving must decline.

1/ This is in fact a very different result from the case of trade liberalization involving final goods, in which the current account response is in general ambiguous when $t^1 > 0$. Note that if t^1 is initially "small", the trade liberalization will leave ca unchanged. In contrast, a reduction in the period 1 tariff on final goods would in this case necessarily worsen the current account.

2/ Clearly, what is important here is that the change in t^1 does not affect the value of output in the second period because of the assumption that t^2 is initially zero.

3/ This result is established in Lopez and Rodrik (1989) under the case in which all goods are substitutes.

4/ Of course, there is also a real depreciation in period 2 which tends to raise the CRI. What the expression for saving tells us is that the effect of the depreciation in period 2 cannot dominate the effect of the depreciation in period 1.

However, the behavior of the current account is not given by the response of saving alone. In particular, the reduction in t^1 also affects investment behavior through the response of the period 2 RER. Suppose, for example, that $R_{43}^1 < 0$. Then, as shown previously, the reduction in t^1 generates a real depreciation in period 2 (as long as initial distortions are not too large). This in turn lowers the marginal productivity of investment (and hence the optimal level of investment) if nontradables are capital intensive, but increases investment otherwise. Alternatively, if $R_{43}^1 > 0$, the reduction in t^1 raises q^2 . In this case, a trade liberalization causes investment to decline if tradables are capital intensive, and to rise otherwise. In general, the nature of the current account response depends both on the behavior of investment and saving, which in turn depend on factor intensity assumptions across the various sectors.

Finally, consider the general case with nontradables but in which initial trade distortions are significant. As is clear from equation (16), consumption-smoothing favors an improvement in the current account as income gains are spread across the two periods. RER effects (and hence the intertemporal substitution effect on saving) now depend both on factor intensity assumptions and on the relative magnitudes of income and substitution effects. This is also true of the investment response since now the behavior of the marginal productivity of capital in period 2 does not depend solely on factor intensity assumptions (as it did in the case without initial trade distortions).

The main results are summarized in Table 1. If initial tariffs are very high then, other things equal, liberalization will generate increased saving. If trade distortions are less severe, however, then saving rises if tradables use intermediates intensively, but falls otherwise. As regards investment, if tariffs are initially relatively high then, other things equal, the RER is more likely to appreciate in period 2 which implies that investment will rise if nontradables are capital intensive, but fall otherwise. If trade distortions are small, then investment rises if nontradables are intensive in intermediates but not in capital or if tradables are intensive in intermediates but not in capital; in all other cases, investment declines. Clearly, detailed knowledge of the economic structure is required to predict saving, investment and therefore current account responses to trade liberalization.

IV. The Case of Trade Distortions in Both the Short and Long Run

This section considers the effects of liberalization in the general case in which trade restrictions are expected to persist into the second period. This is arguably the more reasonable assumption to make in the context of trade reform in the developing countries, which has typically envisaged that some positive level of import protection would remain over the indefinite future. ^{1/}

^{1/} This is the conclusion reached in the World Bank study on trade liberalization (Thomas, 1989, p. 6).

Table 1. The Effect of a Reduction in the Tariff on Imported Intermediate Inputs: Short-Run Distortions Only 1/

a. Low Initial Tariffs

Sector Using Intermediates Intensively		
	Tradables	Nontradables
Welfare	+	+
Real Exchange Rate	appreciates	depreciates
Saving	+	-
Investment	+ <u>2/</u> - <u>3/</u>	+ <u>3/</u> - <u>2/</u>

b. High Initial Tariffs

Sector Using Intermediates Intensively		
	Tradables	Nontradables
Welfare	+	+
Real Exchange Rate	appreciates	appreciates
Saving	+	+
Investment	+ <u>2/</u> - <u>3/</u>	+ <u>2/</u> - <u>3/</u>

1/ The first panel of the table assumes that tariffs are sufficiently low so that the distortionary (income or wealth) effects associated with liberalization do not dominate the substitution effects. The second panel makes the opposite assumption, in which tariffs are initially sufficiently high, so that income effects dominate substitution effects.

2/ If nontradables are capital intensive.

3/ If tradables are capital intensive.

With the initial position being characterized by positive tariffs on intermediates in both periods (assumed to be the only distortion), it is necessary to distinguish the effects of permanent liberalizations from those of temporary (or non-credible) policies. The first part of this section considers the case of a permanent liberalization, while the second deals with the temporary case. It will be seen that the implications for the current account of non-credible policies involving intermediate inputs are quite different from those considered in the previous literature dealing with liberalization of trade in final products.

1. Permanent Liberalizations

Consider an initial equilibrium with a positive tariff on intermediates in both periods ($t^1, t^2 > 0$). The government announces a permanent tariff reduction of amount dt in both periods. In this case, the wealth equivalent of the welfare change is given by

$$(17) E_w dW/dt = -t^1(R_{44}^1 + R_{43}^1 dq^1/dt) - \delta t^2 [R_{44}^2 - (R_{46}^2)^2/R_{66}^2 + (R_{43}^2 - R_{36}^2 R_{46}^2/R_{66}^2) dq^2/dt].$$

Thus, the welfare change is proportional to the period 1 distortion, t^1 , and the change in the volume of imported inputs in that period, $-(R_{44}^1 + R_{43}^1 dq^1/dt)$, plus the (present value of the) period 2 distortion, δt^2 , and the change in the volume of period 2 imports, $-(R_{44}^2 - (R_{46}^2)^2/R_{66}^2 + (R_{43}^2 - R_{36}^2 R_{46}^2/R_{66}^2) dq^2/dt)$. The intuition of these expressions is completely analogous to that given in Section III following equation (13). The only difference is that in equation (17), the effect on the volume of imports in period 2 of the reduction in t^2 now involves an investment response. 1/

To solve for the reduced form of the welfare change, one needs to substitute for the RER effects which are now given by

$$(18) \Delta dq^1/dt = a_{11} R_{43}^1 + a_{12} (R_{43}^2 - R_{36}^2 R_{46}^2/R_{66}^2) + a_{13} t^1 + a_{14} \delta t^2$$

$$(19) \Delta dq^2/dt = a_{21} R_{43}^1 + a_{22} (R_{43}^2 - R_{36}^2 R_{46}^2/R_{66}^2) + a_{23} t^1 + a_{24} \delta t^2 \quad \text{where}$$

$$a_{11} = E_{q2q2} - R_{33}^2 + (R_{36}^2)^2/R_{66}^2 < 0$$

$$a_{12} = -E_{q1q2} = a_{21} < 0$$

$$a_{13} = R_{44}^1 [E_{q1w} (E_{q2q2} - R_{33}^2 + (R_{36}^2)^2/R_{66}^2) - E_{q2w} E_{q1q2}] / E_w < 0$$

1/ To see this, note that $\partial R_{44}^2/\partial t = R_{44}^2 + R_{46}^2 I_{r2}$ and $\partial R_{44}^2/\partial q^2 = R_{43}^2 + R_{46}^2 I_{q2}$ and from equation (3), $I_{q2} = -R_{36}^2/R_{66}^2$ and $I_{r2} = -R_{46}^2/R_{66}^2$. Upon substitution, one obtains exactly the expression for the change in the volume of period 2 imports given in equation (17).

$$a_{14} = ([E_{q1w}E_{q2q2} - E_{q1q2}E_{q2w}][R_{44}^2 - (R_{46}^2)^2/R_{66}^2] - E_{q1w}[(R_{33}^2 + (R_{36}^2)^2/R_{66}^2)(R_{44}^2 - (R_{46}^2)^2/R_{66}^2) - (R_{43}^2 - R_{36}^2R_{46}^2/R_{66}^2)^2] - E_{q2w}R_{43}^1(R_{43}^2 - R_{36}^2R_{46}^2/R_{66}^2)]/E_w < 0$$

$$a_{22} = E_{q1q1} - R_{33}^1 < 0$$

$$a_{23} = (R_{44}^1[E_{q2w}E_{q1q1} - E_{q1w}E_{q2q1}] - E_{q2w}[R_{44}^1R_{33}^1 - (R_{43}^1)^2] - E_{q1w}R_{43}^1(R_{43}^2 - R_{36}^2R_{46}^2/R_{66}^2))/E_w < 0$$

$$a_{24} = ([R_{44}^2 - (R_{46}^2)^2/R_{66}^2][E_{q2w}(E_{q1q1} - R_{33}^1) - E_{q1w}E_{q1q2}] < 0$$

and Δ is the determinant of the matrix multiplying the RER vector from equations (10) and (11) which is positive. ^{1/} It may be noted also that substitution of equations (18) and (19) into (17) yields the result that equiproportionate reductions in t^1 and t^2 necessarily increase welfare. ^{2/}

^{1/} Δ is not the same as the determinant in Section III which assumed $t^2=0$. In what follows, Δ will always be taken to be the determinant of the matrix multiplying the RER vector in equations (10) and (11). Under standard assumptions, its sign is always positive (Dixit and Norman, 1980, pp. 131-2). Note also that in signing the a_{ij} s, it has been assumed, in addition to standard curvature assumptions, that there are no factor intensity reversals in the sense that the sign of the effect of a change in the tariff on the supply of nontradables is the same in periods 1 and 2. This is somewhat stronger than the assumption that $\text{sign}(R_{43}^1) = \text{sign}(R_{43}^2)$ since in period 2, the tariff affects the supply of nontradables also through an investment effect. Therefore, the assumption of no factor intensity reversals is interpreted as $\text{sign}(R_{43}^1) = \text{sign}(R_{43}^2 - R_{36}^2R_{46}^2/R_{66}^2)$.

^{2/} The proof is available upon request. Its outline is as follows. First, define the present value revenue function $R' = \max[R^1 + \delta R^2 - I]$ where the maximization is taken with respect to the choice of I . Note that R' is convex in prices because R^1 and R^2 are convex in prices. Note further that the partial derivatives of R' with respect to a price is the same as the partial derivative of R^i , $i=1,2$ with respect to that price (by the envelope theorem). Since R' is convex and E is concave in prices, the Hessian matrix $R'_{ij} - E_{ij}$ is positive semidefinite (pdf). Call this Hessian matrix A . Consider the fourth order principal minor of A in q^1, q^2, t^1, t^2 . Call this four by four matrix B . Partition B into four two by two submatrices, $B_{11}, B_{12}, B_{21}, B_{22}$. In particular, B_{22} is a two by two matrix whose first row vector is given by $[R_{44}^1 \ 0]$ and whose second row vector is $[0 \ R_{44}^2 - (R_{46}^2)^2/R_{66}^2]$. Consider the inverse of B , call it C , which will also be pdf. Use the formula for the inverse of partitioned matrices (e.g., Dhrymes, 1978, pp. 458-9) to compute the lower right element of C , C_{22} . Note that the two by two matrix, C_{22} , is pdf. Therefore the diagonal elements and determinant of C_{22} will be nonnegative. These two facts can be used to sign the expression in equation (17) in the case of equiproportionate reductions in t^1 and δt^2 . I am grateful to Avinash Dixit for suggesting this proof.

The intuition of equation (18) and (19) is straightforward. The first two terms are substitution effects while the last two are income (or distortion-magnification) effects. Consider first equation (18). The first term reflects the effect on q^1 of the reduction in t^1 while the second term represents the effect of the reduction in t^2 on q^1 . Accordingly, as seen previously, the reduction in t^1 increases the supply of nontradables if the latter use imported inputs intensively ($R_{43}^1 < 0$) and conversely. Therefore, if $R_{43}^1 < 0$, this within-period substitution effect generates a real depreciation in period 1, and conversely.

Analogously, the reduction in t^2 raises the supply of period 2 nontradables if these are intensive users of intermediates ($R_{43}^2 < 0$). In addition, however, the fall in t^2 raises the period 2 marginal product of capital (under the assumption that intermediates and capital are complementary inputs). If nontradables use capital intensively ($R_{36}^2 > 0$), then the fall in t^2 has a secondary impact on the supply of period 2 nontradables which operates in the same direction as the direct effect, and conversely. If, taking into account the indirect effect operating through investment, nontradables are relatively intensive users of intermediates, then $R_{43}^2 - R_{36}^2 R_{46}^2 / R_{66}^2 < 0$, and conversely.

Consider the case where $R_{43}^2 - R_{36}^2 R_{46}^2 / R_{66}^2 < 0$. Then the reduction in t^2 increases the supply of period 2 nontradables which tends to depress q^2 . Agents will substitute consumption of (relatively cheaper) period 2 nontradables for period 1 nontradables. This further reduces excess demand for period 1 nontradables and hence also favors a depreciation of the real exchange rate in period 1. This intertemporal substitution effect explains the second term in equation (18).

Finally, the last two terms in equation (18) are income effects. Accordingly, reducing the tariff in periods 1 and 2 reduces a distortion, which raises real income and, therefore, the demand for nontradables. Other things equal, this channel favors an appreciation of the RER.

To sum up, if nontradables are intensive users of intermediates in both periods (taking into account, in period 2, the effect of the liberalization on investment) and substitution effects outweigh income effects, then a permanent liberalization causes a real depreciation in period 1. On the other hand, if tradables use intermediates intensively, the real exchange rate necessarily appreciates. A completely analogous interpretation carries over to equation (19).

Having discussed the welfare and RER effects of a permanent liberalization, it is now possible to derive the current account response which is given by

$$(20) \quad dca/dt = -t^1(R_{44}^1 + R_{43}^1 dq^1/dt) - \pi^1 E_{\pi 1 q 1} dq^1/dt - \pi^1 E_{\pi 1 q 2} dq^2/dt \\ - \pi^1 E_{\pi 1 w} dw/dt - I_{r 2} - I_{q 2} dq^2/dt.$$

In equation (20), the first four terms represent the effect on saving while the last two are investment effects. As far as saving is concerned, the main difference between the analysis of this section and that of Section III is that, even in the absence of RER effects, a permanent liberalization has an ambiguous effect on saving when there are period 2 distortions whereas saving necessarily rises when trade distortions are confined to the first period. The reason is simply that when there are period 2 distortions, a permanent liberalization raises real income in both periods. As before, period 1 gains serve to increase saving via consumption-smoothing. However, period 2 gains contribute to increased dissaving (borrowing) via the same channel. In general, it is not possible to determine which of these effects will dominate. This implies that the overall effect on saving is in general ambiguous.

Another main difference between equation (20) and the analysis of Section III (equation 16) is that, even if there are no nontradable goods, investment will be affected by a permanent liberalization. In particular, under the assumption of complementarity between intermediates and capital, liberalization causes investment to rise, which contributes to a worsening of the current account position. This contrasts with the earlier case in which liberalization did not affect investment.

Third, if initial distortions are small, so that we can ignore income effects, then the effect on saving (S) is given by

$$dS/dt = -k_2 R_{43}^1 + k_3 (R_{43}^2 - R_{36}^2 R_{46}^2 / R_{66}^2) \quad \text{where}$$

$$k_2 = \pi^1 \{ E_{\pi_1 q_1} [E_{\pi_2} \pi_{q_2}^2 - R_{33}^2 + (R_{36}^2)^2 / R_{66}^2] + (\pi_{q_2}^2)^2 \pi_{q_1}^1 [E_{\pi_1 \pi_1} E_{\pi_2 \pi_2} - E_{\pi_1 \pi_2}^2] / \Delta \} > 0$$

$$k_3 = \pi^1 E_{\pi_1 q_2} (R_{q_1 q_1}^1 - E_{\pi_1} \pi_{q_1 q_1}^1) > 0.$$

Thus, in contrast to the case with period 1 distortions only, a permanent liberalization need not reduce saving even if nontradables are intensive users of intermediate inputs. The reason is that if nontradables use intermediates intensively, a liberalization depreciates the RER in both periods. While the depreciation in period 1 lowers saving via intertemporal substitution, the depreciation in period 2 tends to increase saving. In general, the overall effect is ambiguous.

Fourth, investment behavior does not depend exclusively on the behavior of the period 2 RER as it did in the case with short-run distortions only. Specifically, as previously indicated, the reduction in t^2 directly contributes to a rise in investment in the case in which capital and intermediates are complementary inputs. If tariff levels are initially quite high, liberalization causes an appreciation of the RER in period 2 which further increases investment if nontradables are capital intensive. If, on the other hand, tariffs are not too high initially, then the effect of the RER will serve to reduce investment if either (a) nontradables are intensive in intermediates and capital or (b) tradables are intensive in both intermediates and capital. In either case, the overall response of investment to a liberalization will be ambiguous.

The main differences between the analysis of this section (see Table 2) and that of section III may be summarized as follows: First, if there are no nontradable goods, a reduction in t^1 necessarily increases saving if there are no distortions in the second period; in contrast, a permanent liberalization was shown to have an ambiguous effect on saving if trade is initially distorted in both periods. Second, if tariffs are relatively low and there are nontradable goods, a reduction in t^1 (with $t^2 = 0$) was shown to increase saving if nontradables are intensive in intermediates, but reduce it otherwise. This need no longer be the case if t^1 and t^2 are reduced simultaneously as in a permanent liberalization. Finally, the effect on investment of a permanent liberalization consists of a direct effect (which raises investment under the assumption that intermediates and capital are complementary inputs) and an indirect effect operating through the response of the period 2 RER. This contrasts with the analysis in Section III in which the investment effect only depended upon the response of the RER in period 2.

2. Temporary Liberalizations

An important issue that has received considerable theoretical attention and that may have relevance for understanding the effects of actual episodes of trade reform concerns the credibility of policies. In this section, the effects on welfare, the RER, and the current account of temporary liberalizations are considered. One may wish to think of these results as having relevance in situations in which the government cannot credibly commit to a permanent reduction in tariffs. In this case, the public will come to expect that future tariff levels will not be reduced alongside current tariffs (as was the case in the previous subsection). As will be shown, liberalizations need no longer be welfare-improving in this case. Moreover, this fact has important implications for the response of other variables including the current account. ^{1/} Although qualitatively similar results have been obtained in earlier literature (e.g., Calvo, 1987, 1988, 1989), these results have emphasized mainly the consumption channel as a means through which temporary policies may reduce welfare. Thus, temporary liberalizations might be immiserizing (i.e., welfare-reducing) if they led to significant over-consumption during the liberalization years. By contrast, when liberalization takes the form of reductions in tariffs on intermediates, the welfare effects hinge more on how such policies affect production decisions, either as regards investment in physical capital, or in relation to the channelling of resources among the various sectors of the economy.

^{1/} In general, because the welfare effects of liberalizations are ambiguous in this case, the response of other variables which depend on the welfare effects (the RER, saving, and investment) are also ambiguous even under specific factor intensity assumptions.

Table 2. The Effect of a Permanent Reduction in the Tariff on Imported Intermediate Inputs: Short- and Long-Run Distortions 1/

a. Low Initial Tariffs

Sector Using Intermediates Intensively		
	Tradables	Nontradables
Welfare	+	+
Real Exchange Rate	appreciates	depreciates
Saving	?	?
Investment	+ <u>2/</u>	+ <u>3/</u>

b. High Initial Tariffs

Sector Using Intermediates Intensively		
	Tradables	Nontradables
Welfare	+	+
Real Exchange Rate	appreciates	appreciates
Saving	?	?
Investment	+ <u>2/</u>	+ <u>2/</u>

1/ The first panel of the table assumes that tariffs are sufficiently low so that the distortionary (income or wealth) effects associated with liberalization do not dominate the substitution effects. The second panel makes the opposite assumption, in which tariffs are initially sufficiently high, so that income effects dominate substitution effects.

2/ Assuming nontradables are capital intensive.

3/ If tradables are capital intensive.

To see this, consider the effect of reducing the tariff in period 1 alone (that is, leaving t^2 unchanged) which is given by 1/

$$(21) \quad dW/dt^1 = -t^1 k_4 + \delta t^2 k_5 \text{ where}$$

$$k_4 = (R_{44}^1 [E_{q1q1} E_{q2q2} - E_{q1q2}^2] + R_{44}^1 E_{q1q1} [-R_{33}^2 + (R_{36}^2)^2 / R_{66}^2] - [R_{44}^1 R_{33}^1 - (R_{43}^1)^2] [E_{q2q2} - R_{33}^2 + (R_{36}^2)^2 / R_{66}^2]) / (E_w \Delta) > 0,$$

$$k_5 = ([R_{43}^2 - R_{36}^2 R_{46}^2 / R_{66}^2] E_{q1q2} R_{43}^1) / (E_w \Delta) > 0.$$

As can be seen, if the period 2 tariff is initially zero, reducing the tariff in period 1 is necessarily welfare-improving. This result was obtained in Section III. Equally, however, it is clear that with an initial trade distortion in period 2, it may no longer be optimal to liberalize in the first period alone. Put differently, the optimal first period tariff subject to a fixed distortion in the second period (which may simply be the public's expectation that there will be some positive level of protection that will persist indefinitely) is in general different from zero (here, it is simply equal to the ratio $\delta t^2 k_5 / k_4$).

To see how this might come about, consider an example in which tradable goods are intensive in both capital and intermediates relative to nontradables. 2/ In this case, it is easily verified that a reduction in t^1 necessarily causes the RER to appreciate in period 2. Note, however, that with t^2 positive, protection in period 2 has resulted in over-production of nontradables relative to tradable goods. Essentially, with imports of intermediates restricted below their free trade level, the sector that uses these inputs intensively (tradables) is too small relative to the rest of the economy. The real appreciation in period 2 leads to a further shift of resources toward the nontradable sector. The magnification of an initial production distortion reduces welfare.

Furthermore, under the assumption that tradables are relatively capital intensive, the real appreciation in period 2 causes investment to decline when tariffs are lowered in period 1. But, with $t^2 > 0$, the capital stock in period 2 is already below its optimal level under the assumption that capital and intermediates are complementary inputs. Thus, in addition to the magnification of a production distortion, the reduction in t^1 tends to magnify an initial investment distortion.

1/ Note that the expression in equation (21) is a reduced form since it already incorporates the response of the RER on which the welfare effect depends.

2/ The result that temporary liberalizations may be immiserizing does not depend on this specific choice of factor intensity assumptions.

The possibility of an immiserizing liberalization has important implications for the response of the current account. However, the implications are somewhat at variance with those found in previous literature. At issue here is the interpretation one wishes to give to the performance of one macroeconomic indicator, the current account, during the process of liberalization. As previously mentioned, lack of credibility in trade reforms has been argued to contribute to a significant worsening of the current account at the same time as it might bring about a reduction in the level of social welfare. Thus, in previous models, the "adverse" movement in the current account has clear welfare implications. In the present case, however, the possibility of an immiserizing liberalization may actually make it less likely that one would observe a significant deterioration of the current account during a non-credible liberalization. To see this, recall that the current account effect is given by

$$(22) \quad dca/dt^1 = -t^1(R_{44}^1 + R_{43}^1 dq^1/dt^1) - \pi^1 E_{\pi 1 q 1} dq^1/dt^1 - \pi^1 E_{\pi 1 q 2} dq^2/dt^1 \\ - \pi^1 E_{\pi 1 w} dW/dt^1 - I_{q 2} dq^2/dt^1.$$

The main qualitative difference between this expression and the one given in equation (16) in the case in which $t^2=0$, is that now dW/dt^1 need no longer be negative. Moreover, in the immiserization case, the welfare effect contributes to an increase in saving since the reduction in welfare depresses current consumption. Although the presence of a second period distortion need not imply that the current account will improve, there is at least one case in which the fact that $t^2>0$ unambiguously contributes to such a perverse outcome. This is the case previously discussed in which tradables are intensive users of both capital and intermediates. In this particular case, a temporary liberalization results in an appreciation of the RER in both periods, and a decline in investment (which, as seen previously, is unambiguously welfare-reducing). While the response of saving and the current account is in general ambiguous, it can be said unambiguously in this case that the role of the second period distortion, or put somewhat differently, the consequence of the government's inability to credibly commit to free trade in the second period, is to make an improvement in the current account more rather than less likely (i.e., the coefficient on t^2 in the reduced form version of equation (22) is necessarily negative). At the same time, the second period distortion also makes the immiserization outcome more likely (i.e., the larger is t^2 , the smaller will be the welfare gains, or the larger will be the welfare losses, from reducing t^1). This argument may suggest that, in contrast to previous results, the behavior of the current account may not be an appropriate signal to look at when judging the success of a liberalization episode. In particular, depending on the economic structure, the fact that the current account does not deteriorate much, or even improves, may reflect a reduction in efficiency and welfare (stemming from less-than-optimal investment levels and greater-than-optimal production levels of nontradable goods in period 2) rather than the usual static gains in economic efficiency that arise when producers face prices that reflect more closely marginal costs in world markets.

Finally, before concluding this section, it should be noted that many of the same issues that arise when governments cannot credibly commit to free trade in the future also arise in the case of anticipated liberalizations. In practice, decisions to liberalize are often preceded by lengthy national debates; alternatively, governments may simply announce that tariff reductions are likely to take place beginning at some future date. If, as would normally be the case, trade is not liberalized at the time of the public announcement, much of the analysis of this section concerning the welfare and current account effects of liberalization, would become relevant. Formally, the issue would simply involve switching the two periods, and considering the effects of anticipated reductions in t^2 from an initial situation in which t^1 is positive. In this case as well, the possibility of immiserization also arises, and for essentially the same reasons as previously. Of course, the consequences for the current account are also analogous.

V. Conclusion

This paper has examined an issue of current policy concern in the developing countries, namely, how will the current account respond to a reduction in the tariff on imports? Previous analytical research has been unable to offer definite predictions, and this conclusion seems consistent with the empirical observation that there is no systematic tendency among the developing countries for trade liberalization to lead to a deterioration in the external position.

The main motivation for adding to the theoretical literature in this area was to see what new channels from liberalization to the current account were present when tariffs were reduced on intermediate inputs rather than on final products. It was shown that the effects on saving depended on detailed information about the economic structure, in particular the relative factor intensities across the various sectors. Further, wealth effects emanating from the reduction in initial distortions were also shown to have an important effect on the response of saving. In addition, the model incorporated investment behavior and it was shown that investment might rise or fall when tariffs on intermediates were reduced, depending both on the initial level of trade restrictions and on the economic structure of the country. The behavior of investment was also shown to be of some importance in evaluating both the current account and welfare implications of non-credible liberalization policies. In particular, previous literature has argued that non-credible reforms might lead to a situation of over-consumption, and hence to a lower level of economic welfare. Thus, in such models, the "adverse" movement in the current account has clear welfare implications. In contrast, the results obtained here suggest that an equally plausible outcome of non-credible policies would be a situation of under-investment. In this case, with investment falling, the correlation between movements in the current account and changes in welfare would be opposite to the case in which the liberalization policy led to over-consumption.

To illustrate some of the considerations affecting the relationship between tariff reductions on intermediates and the external current account balance, consider the case (analyzed in Section III) in which distortions are assumed to exist only in the short-run. To focus on the role that economic structure plays, suppose further that initial tariff levels are sufficiently small so that wealth effects may be ignored. Assume also that, in the particular country under consideration, the tradables sector uses intermediate inputs intensively (relative to nontradables). In this case, reducing the tariff on imported inputs leads to a relative expansion of the tradables sector (the sector using intermediates intensively), and hence to a decline in the relative price of the goods produced by that sector, i.e., a real appreciation. This real appreciation raises the cost of current consumption in terms of future consumption, thereby stimulating national saving. In addition, the possibility of substituting consumption across periods implies that the higher relative price of nontradables today will create an incipient excess demand for nontradables in the future. Market clearing will therefore require an appreciation of the real exchange rate in the future. The consequent fall in the future-period relative price of tradables will lower the economy's demand for future-period capital, and hence the optimal investment level, if (and only if) tradables are, relative to the rest of the economy, intensive users of capital. In summary, therefore, if tradables use both capital and intermediates intensively relative to the rest of the economy, liberalization leads to an increase in the level of saving and a decline in the level of investment, and hence unambiguously to an improvement in the external current balance. Equally, however, it is clear that under alternative assumptions (e.g., with nontradables intensive in both intermediates and capital), liberalization would cause the external position to deteriorate. What ultimately happens to the current account is thus an empirical issue, and cannot be determined ex ante on theoretical grounds.

To conclude, the main policy implication of the paper is that, given the likely differences in economic structure and in initial levels of protection that exist among the developing countries, trade liberalizations cannot be expected to systematically affect the current account of these countries in one direction or another. As a consequence, the frequently-made argument that a trade liberalization in a given country cannot be contemplated because of the adverse consequences for the external position of that country, loses much of its force unless it is based on detailed information about that country's specific economic structure.

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