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Temporary Import Tariffs, the Real Exchange Rate
and the Current Account*

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Abstract

In this paper a general equilibrium intertemporal model with optimizing consumers and producers is developed to analyze how the imposition of a temporary import tariff affects the path of real exchange rates and the current account. The model is completely real, and considers a small open economy that produces and consumes three goods each period. It is shown that, without imposing rigidities or adjustment costs, interesting paths for the equilibrium real exchange rate can be generated. In particular "equilibrium overshooting" can be observed. Precise conditions under which a temporary import tariff will worsen the current account in period 1 are derived. Several ways in which the model can be extended are discussed.

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Summary

This paper deals with the effects of temporary protection on real exchange rates and the current account. Countries with external payments difficulties have often resorted to protectionism; temporary impediments to trade--in the form of import tariffs or quotas, for example--are frequently imposed to improve the current account or to change the behavior of the real exchange rate. These protectionist policies, however, often fail to achieve their objectives; in spite of higher import tariffs, the current account balance does not improve. Traditional trade theory has explained this phenomenon by claiming that demand for imports and exports is sometimes inflexible. These explanations, however, fail to recognize that the current account basically responds to intertemporal considerations, and that the impact of any policy measures must operate via the country's savings or investment decisions.

In this paper an intertemporal general equilibrium model is developed to analyze how temporary import tariffs affect the current account and how the equilibrium real exchange rate evolves. The model encompasses two periods, three goods--exportables, importables, and nontradables--and consumers that maximize intertemporal utility, while producers maximize the present value of profits. In this setting a temporary tariff affects the equilibrium real exchange rate both in the current and future periods, but the direction of this effect is a priori unclear. In fact, contrary to popular belief, a temporary tariff can cause a real exchange rate depreciation in the current period that is later reversed, while a temporary import tariff can worsen the current account in the period when it is imposed. These results indicate that policymakers should be particularly careful when using temporary protection for balance of payments purposes. Not only will these policies result in welfare-reducing inefficiencies, but may very well fail to achieve their intended objective of improving the current account and competitiveness.

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I. Introduction

Countries have many times resorted to protectionism as a means to face external payments difficulties; the imposition of temporary impediments to trade--in the form of import tariffs or quotas, for example--has been a common practice aimed at improving the current account and/or at changing the behavior of the real exchange rate. In particular, this has been a very common feature of the Latin American countries, which have recurrently tried to use temporary protectionist measures as a way to influence the behavior of the external sector. Many times, however, these protectionist policies have failed to achieve their objectives, and in spite of increased levels of import tariffs the current account balance has not experienced any improvements. ^{1/} Traditional trade theory has explained this phenomenon claiming that in some cases the elasticities of demand for imports and exports can be very low. These explanations, however, fail to recognize the fact that the current account basically responds to intertemporal considerations, and that for any policy measures to have an effect on its balance, it necessarily has to have an impact on the country's savings and/or investment decisions.

The purpose of this paper is to develop a fully real optimizing intertemporal general equilibrium model to analyze how the imposition of temporary import tariffs affect the current account and the evolution of the equilibrium real exchange rate (RER). The model draws on Edwards (1986) and considers a two periods economy that produces and consumes three goods--exportables, importables and nontradables. Consumers maximize intertemporal utility, while producers maximize present value of profits. Although in recent years it has become customary to emphasize the intertemporal nature of the current account, a large number of policy discussions have in practice ignored this proposition and have proceeded along the lines of traditional static textbook models. Also, a number of applied papers have recently discussed the role of tariffs in generating a current account improvement without acknowledging any intertemporal factors. On the other hand, many of the papers that have explicitly used an intertemporal setting have either used ad-hoc assumptions regarding consumers or producers, or have only considered a two goods world, being unable to deal with the effects of import tariffs on the real exchange rate. ^{2/}

^{1/} See Edwards (1988) for a detailed analysis of the effects of tariffs and exchange controls on the balance of payments in a group of Latin American countries.

^{2/} Svenson and Razin (1983), van Wijnbergen (1984) and Edwards and van Wijnbergen (1986), among others, have emphasized the intertemporal nature of the current account. These papers, however, have not considered the role of nontradable goods. On intertemporal models of the current account with nontradables see Frenkel and Razin (1986, 1987), Edwards (1986) and Ostry (1988).

II. The Model

In order to formally analyze the interaction between temporary tariffs, equilibrium real exchange rates, and the current account we develop an intertemporal general equilibrium model of a small open economy.

Consider the case of a small country that produces and consumes three goods--importables (M) exportables (X) and nontradables (N). There are two periods--the present (period 1) and the future (period 2)--and foreign borrowing and lending is allowed at the exogenously given world interest rate r^* . The country faces an intertemporal budget constraint that states that the discounted sum of the current account balances is zero. There are a large number of producers and (identical) consumers, so that perfect competition prevails. Consumers maximize utility subject to their intertemporal budget constraint, whereas firms maximize profits in each period, subject to existing technology and availability of factors of production. In order to simplify the exposition it is assumed that there is no investment (see, however, below).

Assuming that the utility function is time separable, with each subutility function homothetic and identical, the representative consumer problem can be stated as follows:

$$\max W\{U^1(C_N^1, C_M^1, C_X^1), U^2(C_N^2, C_M^2, C_X^2)\},$$

subject to:

$$C_X^1 + p^1 C_M^1 + q^1 C_N^1 + \delta^*(C_X^2 + p^2 C_M^2 + q^2 C_N^2) < \text{Wealth} \quad (1)$$

where W is the utility function; U^1 and U^2 are periods 1 and 2 subutility functions assumed to be homothetic; C_N^1 , C_M^1 , C_X^1 are consumption of N, M and X in period $i = 1, 2$; p^i is the (domestic) price of importables relative to exportables in period $i = 1, 2$; q_i is the price of nontradables relative to exportables in period i ; and δ^* is the world discount factor equal to $(1+r^*)^{-1}$.

Wealth is the discounted sum of consumer's income in both periods. Income, in turn, is given in each period by three components: (1) income from labor services rendered to firms; (2) income from the renting of capital stock that consumers own to domestic firms; (3) and income obtained from government transfers. These, in turn, correspond to the proceeds from import tariffs which the government hands back to the public. In this

model, then, as in most of the international trade literature, the government plays no active role besides imposing import tariffs, and handing their proceeds back to households in a nondistortionary way. 1/

Given the nature of preferences, the consumer optimization process can be thought of as taking place in two stages. First, the consumer decides how to allocate his(her) wealth across periods. Second, he(she) decides how to distribute each period (optimal) expenditure across the three goods.

It is assumed that firms use constant returns to scale technology to produce N, X and M. There are three factors of production--capital, labor and natural resources. Consequently, factor price equalization does not hold in either period. Producers' maximization problem can be stated in each period i , in the following way (where V is the vector of factors of production, w is a vector of their rewards, and Q_j^i is output of good j in period i).

$$\max \text{ Profits} = (p^i Q_M^i + q^i Q_N^i + Q_X^i) - w^i V^i \quad (2)$$

subject to the technological constraint.

In this small open economy the price of exportables is given from abroad and the price of importables is in each period equal to the international price of this type of goods (p^{*i}) plus the (specific) import tariff (t^i):

$$p^1 = p^{*1} + t^1; \quad p^2 = p^{*2} + t^2 \quad (3)$$

The simultaneous solutions of the consumers and producers optimization problems, plus the requirement that the nontradable market clears every period, and the full employment conditions will determine the equilibrium path of nontradable prices, equilibrium real exchange rates in both periods, quantities produced and consumed of X, M and N, the current account, and factors rewards. A very convenient way of characterizing this country's full equilibrium is by using duality theory. 2/ Equations (4) through (9) succinctly summarize the internal and external equilibrium conditions.

1/ See, however, Edwards (forthcoming) for a related model where the government uses tariffs proceeds to finance its own consumption.

2/ See Dixit and Norman (1980) for the use of duality in static trade models. Svensson and Razin (1983) and Edwards and van Wijnbergen (1986) use duality in intertemporal models without nontradables.

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., $R^1_{p^1}$ is the partial derivative of period 1's revenue function relative to p^1 (the price of nontradables in period 1); $R^2_{q^2 p^2}$ is the second derivative of R^2 with respect to q^2 and p^2). The price of exportable is taken as the numeraire:

$$R^1(1, p^1, q^1; V) + \delta R^2(1, p^2, q^2, V) + t^1(E_{p^1} R^1_{p^1}) + \delta t^2(E_{p^2} R^2_{p^2}) \\ = E[\pi^1(1, p^1, q^1), \delta \pi^2(1, p^2, q^2), W] \quad (4)$$

$$R^1_{q^1} = E_{q^1} \quad (5)$$

$$R^2_{q^2} = E_{q^2}, \quad (6)$$

$$p^1 = p^{1*} + t^1, \quad (7)$$

$$p^2 = p^{2*} + t^2. \quad (8)$$

$$CA^1 = R^1(\) + r^1(E_{p^1} R^1_{p^1}) - \pi^1 E_{\pi^1} \quad (9)$$

where the following notation is used:

- $R^i(\)$; $i = 1, 2$ Revenue function in period i . Its partial derivative with respect to each price is equal to the respective supply function.
- p^i ; $i = 1, 2$ Domestic relative price of imports in period i .
- q^i ; $i = 1, 2$ Relative price of nontradables in period i .
- V Vector of factors of production, assumed to be fixed.
- t^i ; $i = 1, 2$ Specific tariffs in period i .
- δ^* World discount factor, equal to $(1+r^*)^{-1}$, where r^* is world real interest rates (in terms of exportables).

$E(\cdot)$	Intertemporal expenditure function.
$\pi^i(1, p^i, q^i)$	Exact price indexes, which under assumptions of homotheticity and separability, corresponds to unit expenditure functions. (See Svensson and Razin, 1983.)
W	Total utility.
CA^1	Current account in period 1.

Equation (4) is the intertemporal budget constraint, and states that present value of income--generated through revenues from optimized production $R^1 + \delta^* R^2$, plus tariffs revenue--has to equal the present value of expenditure. Given the assumption of perfect access to the world capital market, the discount factor used in (1) is the world discount factor δ^* . Equations (5) and (6) are the equilibrium conditions for the nontradables market in periods 1 and 2; in each of these periods the quantity supplied of N (R_{q1}^1 and R_{q2}^2) has to equal the quantity demanded (E_{q1} and E_{q2}). Given the assumptions about preferences (separability and homothecity) the demand for N in period i can be written as:

$$E_{qi} = E_{\pi q}^i \pi_q^i. \quad (10)$$

Equations (7) and (8) specify the relation between domestic prices of imports, world prices of imports and tariffs (see equation (3)). Equation (9) describes the current account in period 1 as the difference between income and total expenditure in that period.

Given our assumption of time separable utility function, expenditure in periods 1 and 2 are (net) substitutes. As a result all intertemporal cross demand effects are positive (i.e., $E_{p^1 p^2} > 0$, $E_{q^1 p^2} > 0$, $E_{p^1 q^2} > 0$, $E_{q^1 q^2} > 0$).

1. The concept of "equilibrium" real exchange rate

In models with importables and exportables the definition of "the" real exchange rate becomes "tricky", since the by-now traditional concept of relative price of tradables to nontradables loses some meaning. The reason, of course, is that if there are shocks that affect the price of X relative to M , it is not possible to talk about the Hicksian composite "tradables" anymore. In a way, in this type of model there are two RERs: the relative price of importables to nontradables (p/q), and the relative price of exportables to nontradables ($1/q$). For this reason, and in order to simplify the exposition, in this paper we will focus on the (inverse) of

of real exchange rate for exports q . Of course, once it is known how q responds to changes in fundamentals, it is possible to compute, using simple algebraic manipulations, the effect of shocks on any of the traditional indexes of RER.

In the intertemporal model presented above there is not one equilibrium value of the real exchange rate, but rather a path of equilibrium RERs. Within this intertemporal framework the equilibrium (exportable) RER in a particular period is defined as the inverse of q that, for given values of other variables such as world prices, technology and tariffs, equilibrates simultaneously the external and internal (i.e., nontradables) sectors. 1/ In terms of the model, the vector of equilibrium RERs is composed of those $(1/q^1)$ s that simultaneously satisfy equations (4) through (8), for given values of the other fundamental variables.

From the inspection of equations (4)-(8) it is apparent that exogenous negative shocks in, say, the international terms of trade, will affect the vector of equilibrium RERs through two interrelated channels. The first one is related to intratemporal 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. 2/

Equations (4)-(9) can be manipulated to find out how the vector of equilibrium RERs and the current account respond to exogenous shocks such as changes in tariffs, disturbances to the international terms of trade, international transfers, and changes in world interest rates. In order to simplify the exposition it is assumed that initially there are no import tariffs, so that $\tau^1 = \tau^2 = 0$. In Section IV, however, the more general case with positive initial tariffs is discussed.

1/ Notice that implicit in this definition is the requirement of full employment.

2/ Razin and Svensson (1983) derived the relation between tariff changes and the consumption discount factor. See also Svensson and Razin (1983) and Edwards and van Wijnbergen (1986).

Figure 1 summarizes the initial equilibrium in the nontradables market in periods 1 and 2. 1/ Schedule H^1H^1 depicts the combination of q_1 and q_2 consistent with equilibrium in the nontradable goods market in period 1. Its slope is equal to:

$$\left. \frac{dq_1}{dq_2} \right|_{H^1H^1} = \frac{E_{q_1 q_2}^{12}}{[R_{q_1 q_1}^1 - E_{q_1 q_1}^{11}]} > 0 \quad (11)$$

where $E_{q_1 q_2}^{12}$ is an intertemporal cross demand term that captures the reaction of the demand for N in period 1 ($E_{q_1}^1$) to an increase in nontradables prices in period 2. Given the fact that there are only two periods and the time separable nature of the utility function, expenditure in periods 1 and 2 are substitutes, and thus this term is positive. 2/ $R_{q_1 q_1}^1$ is the slope of the supply curve of N in period 1 and $E_{q_1 q_1}^{11}$ is the slope of the compensated demand curve. Then, $(R_{q_1 q_1}^1 - E_{q_1 q_1}^{11})$ is positive. The intuition behind the positive slope of H^1H^1 is the following: An increase in the price of N in period 2 will make consumption in that period relatively more expensive. As a result there will be a substitution away from period 2 and towards period 1 expenditure. This will put pressure on the market for N in period 1, and an incipient excess demand for N in that period will develop. The reestablishment of nontradable equilibrium in period 1 will require an increase the relative price of N.

Schedule H^2H^2 depicts the locus of $q_1 q_2$ compatible with nontradable market equilibrium in period 2. Its slope is positive and equal to:

$$\left. \frac{dq_1}{dq_2} \right|_{H^2H^2} = \frac{[R_{q_1 q_1}^2 - E_{q_1 q_1}^{22}]}{E_{q_1 q_2}^{12}} > 0$$

The intuition behind this positive slope is analogous to that of the H^1H^1 schedule: an increase in q_1 will make current consumption relatively more expensive, shifting expenditure into the future. As a result there

1/ This type of diagram has a long tradition in international economics. See, for example, Dornbusch (1980). See also Haaparanta and Kahkonen (1986).

2/ The exact expression for $E_{q_1 q_2}^{12}$ is obtained after taking the derivative of equation (10).

will be a pressure on q^2 , which will have to increase to reestablish equilibrium. Stability requires that the H^2H^2 schedule be steeper than the H^1H^1 curve (see Appendix).

The intersection of H^1H^1 and H^2H^2 at A characterize the (initial) relative prices of the nontradable goods market in periods 1 and 2 ($\bar{q}^1, \bar{q}^2$) compatible with the simultaneous attainment of intertemporal external equilibrium and internal equilibrium in both periods. In order to make the exposition clearer we have assumed that these equilibrium prices $\bar{q}^2$ and $\bar{q}^1$ are equal; the 45° line passes through the initial equilibrium point A. Notice that the existence of intertemporal substitution in consumption is what makes these schedules slope upward. If there were no intertemporal substitution H^1H^1 would be completely horizontal, while H^2H^2 would be vertical. Also, if this country had no access to borrowing in the international financial market, these schedules would be vertical and horizontal and there would be no intertemporal relation across nontradable markets.

III. Temporary Import Tariffs, Equilibrium Real Exchange Rates and the Current Account

Consider the imposition of a temporary import tariff, assuming that the initial condition is characterized by no import tariffs in either period ($t^1 = t^2 = 0$). This assumption greatly simplifies the exposition, since in this case there will be no first order income effect. Later, however, we look at the more general case of positive initial tariffs.

1. Equilibrium real exchange rates

A temporary import tariff in period 1 will shift both the H^1H^1 and H^2H^2 schedules, generating a new vector of equilibrium relative prices of nontradables. Let's first consider the case of H^2H^2 . A temporary import tariff means that the price of imports in period 1 will increase, making present consumption relatively more expensive. Consequently, via the intertemporal substitution effect, consumers will substitute expenditure away from period 1 and into period 2. This will result in an increase in the demand for all goods in period 2, including nontradables, and in a higher q^2 . Consequently the H^2H^2 curve will shift to the right. The magnitude of this horizontal shift is equal to:

$$\left. \frac{dq^2}{dq^1} \right|_{dq^1=0}^{H^2H^2} = \{E_{q^2 p^1} / (R_{q^2 q^2}^2 - E_{q^2 q^2})\} dt^1. \quad (12)$$

This movement in the H^2H^2 curve is a reflection of the intertemporal degree of substitutability in consumption: it will be greater or smaller depending on whether $E_{q^2 p^1}$ is large or small. In the extreme case of no

Figure 1

Figure 2

intertemporal substitution ($E_{q^2 p^1} = 0$), the $H^2 H^2$ schedule will be vertical, and will not shift as a result of a temporary tariff.

The imposition of a temporary import tariff will also affect the $H^1 H^1$ schedule. In this case, however, there will also be an intratemporal effect related to the change in relative prices in period 1. The higher domestic price of M in period 1, resulting from the higher tariff, will reduce the quantity demanded of M in that period. Depending on whether importables and nontradables are substitutes or complements in consumption, in that period, the quantity demanded of N will increase or decline. The $H^1 H^1$ schedule can shift either up or down. Formally, the vertical shift of $H^1 H^1$ is equal to:

$$\left. \frac{d q^1}{d q^2=0} \right|^{H^1 H^1} = \frac{[E_{q^1 p^1} - R_{q^1 p^1}^1]}{[E_{q^2 q^1}]} dt^1 \begin{matrix} > \\ < \end{matrix} 0. \quad (13)$$

It is clear from (13) that this indeterminacy stems from the fact that $E_{q^1 p^1}$ can be either positive or negative. A sufficient condition for the $H^1 H^1$ schedule to shift up is that N and M are substitutes, so that $E_{q^1 p^1} > 0$. On the other hand, a necessary condition for the $H^1 H^1$ to shift down is that $E_{q^1 p^1} < 0$.

At this level of aggregation, however, the most plausible case corresponds to all goods being substitutes. Notice that even in this case it is not possible to know a priori whether the $H^1 H^1$ or the $H^2 H^2$ schedules will shift by more (compare (12) with (13)). In terms of the diagram, if $E_{q^1 p^1} > 0$, the new equilibrium can be above or below the 45° line. This gives rise to the possibility of some interesting equilibrium paths for the RERs. For example, it is possible to observe an "equilibrium overshooting", where (relative to the no-tariff case) q^1 increases by more than q^2 . This would be the case if the $H^1 H^1$ shifts up by more than what $H^2 H^2$ shifts to the right. This will be the case if the new equilibrium point is above the 45° line, and is illustrated in Figure 2.

Figure 3 illustrates two possible new equilibria. Point A characterizes the initial equilibrium. Point B corresponds to the case when N and M are substitutes and the intratemporal effect is strong enough, so that the $H^1 H^1$ shifts up significantly. The new (after tariff imposition) equilibrium schedules are $\tilde{H}^1 \tilde{H}^1$ and $\tilde{H}^2 \tilde{H}^2$. In this case the temporary import tariff results in a higher relative price of nontradables in periods 1 and 2. That is, the equilibrium exportables RER appreciates in both periods, as a result of the temporary tariff. Point C in Figure 3 is

the new equilibrium under the assumption that nontradables and importables are complements in consumption in period 1 and that this effect dominates so that the H^1H^1 schedule will shift down to a position such as $\tilde{H}^1\tilde{H}^1$. A possible outcome is the one described by point c in Figure 3, where as a result of an temporary tariff the equilibrium path of the real exchange rate will be characterized by wide swings: it will depreciate in period 1, and it will appreciate significantly in period 2. Although this path is clearly characterized by equilibrium movements in each period, observers may think that the RER has moved in the "wrong direction" in period 1.

From equations (4) through (8) it is possible to formally find the equilibrium changes in q^1 and q^2 as a result of the temporary import tariff:

$$\frac{dq^1}{dt^1} = - \left(\frac{1}{\Delta^1} \right) \{ (E_{p^1q^1}^1 - R_{p^1q^1}^1)(R_{q^2q^2}^2 - E_{q^2q^2}^2) + E_{q^2p^1}^2 E_{q^1q^2}^1 \} \quad (14)$$

$$\frac{dq^2}{dt^1} = - \left(\frac{1}{\Delta^1} \right) \{ E_{q^2q^1}^2 (E_{p^1q^1}^1 - R_{p^1q^1}^1) + E_{q^2p^1}^2 (R_{q^1q^1}^1 - E_{q^1q^1}^1) \} \quad (15)$$

where $\frac{1}{\Delta^1}$

$$\Delta^1 = - [(R_{q^1q^1}^1 - E_{q^1q^1}^1)(R_{q^2q^2}^2 - E_{q^2q^2}^2) - E_{q^2q^1}^2 E_{q^1q^2}^1] < 0.$$

Equations (14) and (15) formally confirm the preceding diagrammatic analysis, showing that in this three good-two period model, a temporary import tariff can, in principle, generate interesting dynamic paths of the equilibrium real exchange rate under a pure real equilibrium analysis. 2/

2. The current account

From equation (9) it is possible to find out how the current account in period 1 will respond to the temporary tariff:

$$\frac{dCA^1}{dt^1} = - \pi^1 E_{\pi^1 \pi^1 p^1}^1 - \pi^1 E_{\pi^1 \pi^1 q^1}^1 \left(\frac{dq^1}{dr^1} \right) - \delta^* \pi_q^2 E_{\pi^1 \pi^2}^2 \left(\frac{dq^2}{dr^1} \right) \quad (16)$$

1/ The minus sign of Δ^1 is a result of stability (see Appendix).

2/ The discussion presented above has focused on the real exchange rate for exportables ($1/q$). The effects of the tariff on the domestic relative price of importables to nontradables can easily be found by analyzing the behavior of (p/q) .

Figure 3

Where the $E_{\pi_i \pi_j}$ capture the reaction of real expenditure in period i (E_i) to a change in the exact price index in period j . The presence of an $E_{\pi_i \pi_j}$ term in every one of the RHS terms of equation (16) clearly highlights the fact that the temporary tariff will affect the current account via intertemporal channels. The first term in the RHS of equation (16) is positive and captures the direct effect of the temporary tariff on the current account in period 1. The intuition for this positive effect is straightforward. The temporary tariff makes period 1 consumption relatively more expensive, and as a result of this the public substitutes consumption away from period 1 into period 2, generating an improvement of the current account balance in period 1. The magnitude of this effect will depend both on the term $E_{\pi_1 \pi_1}$ and on the initial share of imports on period 1 expenditure π_p^1 .

The second and third terms on the RHS of equation (16) are indirect effects, that operate via changes in periods 1 and 2 equilibrium real exchange rates. Since, as was established above, the signs of (dq^1/dt^1) and (dq^2/dt^1) cannot be determined a priori, the signs of these two terms in (16) are generally undetermined, as will be the sign of equation (16) as a whole. However, the interpretation of these two indirect terms is quite straightforward. If the temporary tariff results in an equilibrium real appreciation in period 1, $(dq^1/dt^1) > 0$, there will be an additional force towards a current account improvement. The reasoning is again simple. If the temporary tariff results in a higher equilibrium price of nontradables in period 1 (i.e., in a real appreciation in 1), there will be substitution away from period 1 expenditure, generating an improvement in the current account in that period. The third term on the RHS relates the change in period 2's RER to period 1's current account. If as a consequence of the temporary tariff q^2 increases, there will be a tendency to substitute expenditure away from period 2 into period 1, generating forces that will tend to worsen period 1's current account. Notice that the presence of these two terms involving the real exchange rate introduce important differences to the more traditional analysis such as Svensson and Razin's (1983).

The total effect of the temporary import tariff on period 1's current account will depend on the strength of the intertemporal price effects on the initial expenditure on income and nontradables, and on the effects of the tariff on the RER vector. It is possible, however, that under some extreme conditions the current account will worsen in the period when the temporary tariff is imposed, generating a quasi-perverse effect. This indicates that policy makers should be very careful when imposing temporary trade restrictions as a way to improve the current account.

IV. Positive Initial Tariffs

In the above discussion we have assumed that tariffs are initially equal to zero. This is a very convenient assumption since in this case there are no first order income effects. In reality, however, things are different, since most countries have already tariffs and other types of import restrictions in effect.

With positive initial tariffs further changes in protection will generate first order income effects. Figuring out the nature, magnitude and direction of these effects is not trivial. For example if initially there are import tariffs in periods 1 and 2 a tariff liberalization in one of the periods only can have either a negative or a positive welfare effect, due to well known second best reasons. Only in the rather extreme case where there is a permanent liberalization and no other distortions, can we be sure that the tariff reduction will have a positive welfare effect.

Assuming that initial tariffs in periods 1 and 2 are positive and equal, $t_1 = t_2 = t$, the effect of a temporary change in t_1 on the equilibrium relative prices of nontradables will be given by:

$$\begin{aligned} \frac{dq^1}{dt^1} = \frac{1}{\Delta} \{ & t [R_{p1p1}^1 - E_{p1p1} - \delta^* E_{p2p1}] (E_{q1q2} \pi_q^2 E_{\pi W}^2 + \pi_q^1 E_{\pi W}^1 (R_{q2q2}^2 - E_{q2q2}^2) \\ & - (E_{p1q1} - R_{p1q1}^1) [(R_{q2q2}^2 - E_{q2q2}^2) \epsilon_3 - t (E_{p1q2} + \delta^* E_{p2q2} - \delta^* R_{p2q2}^2) \pi_q^1 E_{\pi W}^1] \\ & - E_{q2p1} [t (E_{p1q2} + \delta^* E_{p2q2} - R_{p2q2}^2) \pi_q^1 E_{\pi W}^1 + E_{q1q2} \epsilon_3] \} > 0, \end{aligned} \quad (17)$$

and

$$\begin{aligned} \frac{dq^2}{dt^1} = \frac{1}{\Delta} \{ & t (R_{p1p1}^1 - E_{p1p1} - \delta^* E_{p2p1}) [(R_{q1q1}^1 - E_{q1q1}^1) \pi_q^1 E_{\pi W}^1 + \pi_q^1 E_{\pi W}^1 E_{q2q1}^1] \\ & - (E_{p1q1} - R_{p1q1}^1) [t (E_{p1q1} - R_{p1q1}^1 + \delta^* E_{p2q1}) \pi_q^2 E_{\pi W}^2 + \epsilon_3 E_{q2q1}^1] \\ & - E_{q2p1} [\epsilon_3 (R_{q1q1}^1 - E_{q1q1}^1) - t [(E_{p1q1} - R_{p1q1}^1) + \delta^* E_{p2q1}] \pi_q^1 E_{\pi W}^1] \} > \end{aligned} \quad (18)$$

where Δ is the determinant of the system (4)-(7), which is negative and where:

$$\varepsilon_3 = E_W(1 - r^1 \pi_p^1 E_{\pi_1 W} - \delta^* \pi_p^2 E_{\pi_2 W})$$

The $E_{\pi_i W}$ terms capture the income effects of small changes in an already existing tariff. In fact, it can be seen that if we assume that $E_{\pi_i W}$ equations (17) and (18) reduce to the case with zero initial tariffs discussed above.

Equations (17) and (18) illustrate the fact that under more general conditions our intertemporal general equilibrium model can get quite complicated. However, these long equations tend to hide a somewhat straightforward intuition. If, for example, the hike in period 1's tariff reduces welfare via traditional efficiency costs, there will be a negative income effect in both periods. If nontradables are normal goods, there will be a decline in the demand for these goods and a tendency for their price to go down in each period. It is easy to establish from the inspection of equations (17) and (18) that if all goods are substitutes in demand and the substitution effect dominates the income effect, an increase in period 1's tariffs will generate an equilibrium real exchange rate appreciation in both periods.

In this case of positive initial tariffs the expression for the change in period one's current account becomes more complicated:

$$\begin{aligned} \frac{dCA}{dt^1} = & \{t^1 (E_{p^1 p^1} - R_{p^1 p^1}^1) - \pi^1 E_{\pi^1 \pi^1} \pi_{p^1}^1\} \\ & + \{t^1 (E_{p^1 q^1} - R_{p^1 q^1}^1) - \pi^1 E_{\pi^1 \pi^1} \pi_{q^1}^1\} \frac{dq_1}{dt^1} \\ & + \{t^1 (E_{p^1 q^2} - \delta^* \pi_{q^2}^2 E_{\pi^1 \pi^2})\} \frac{dq_2}{dt^1} \\ & + E_{\pi^1 W} \{t^1 \pi_{p^1}^1 - \pi^1\} \frac{dW}{dt^1} \end{aligned} \quad (19)$$

where (dW/dt^1) is the welfare effect of the temporary increase in the tariff. Not too surprisingly, given our previous discussions, equation (14) is fairly intractable, and cannot be signed a priori.

V. Permanent and Anticipated Future Tariffs

The model developed above can be easily used to analyze the effects of anticipated and permanent tariffs on the path of equilibrium RERs and on the current account. In particular, still assuming zero initial tariffs the diagrammatic analysis can handle both of these cases. In the case of an anticipated import tariff in period 2 only, the HH schedule will always shift to the left, while the HH curve can shift either to the left or to the right.

Assuming, once again, zero initial tariffs, equations (20) and (21) capture the change in q^1 and q^2 as a result of a permanent imposition of a tariff: $dt^1 = dt^2 = dt$:

$$\begin{aligned} \frac{dq^1}{dt} = & - \left(\frac{1}{\Delta^1} \right) \{ (E_{p^1 q^1} - R_{p^1 q^1}^1 + E_{q^1 p^2}) (R_{q^2 q^2}^2 - E_{q^2 q^2}) \\ & + E_{q^1 q^2} (E_{q^2 p^1} - R_{q^2 p^2}^2 + E_{q^2 p^2}) \} \end{aligned} \quad (20)$$

and

$$\begin{aligned} \frac{dq^2}{dt} = & - \left(\frac{1}{\Delta^1} \right) \{ (R_{q^1 q^1}^1 - E_{q^1 q^1}) (E_{q^2 p^1} - R_{q^2 p^2}^2 + E_{q^2 p^2}) \\ & + E_{q^2 p^1} (E_{q^2 p^1} + E_{q^2 p^2} - R_{q^2 p^2}^2) \} \end{aligned} \quad (21)$$

Under substitutability everywhere both of these terms are positive, indicating that the imposition of a permanent tariff will result in a real appreciation of the exports' real exchange rate in both periods. Whether this real appreciation will be larger in period 1 or in period 2, will depend on whether:

$$\begin{aligned} & (E_{p^1 q^1} - R_{p^1 q^1}^1 + E_{q^1 p^2}) (R_{q^2 q^2}^2 - E_{q^2 q^2}) \\ & > < (R_{q^1 q^1}^1 - E_{q^1 q^1}) (E_{q^2 p^1} + E_{q^2 p^2} - R_{q^2 p^2}^2). \end{aligned}$$

It is interesting to compare the reaction of the RER in period 1 to the imposition of a temporary and a permanent tariffs. From the comparison of equations (21) and (14) we find unequivocally that a permanent

tariff will appreciate the equilibrium real exchange rate in period 1 by more than a temporary tariff imposed in that period only. In fact (20) can be rewritten as:

$$\frac{dq^1}{dt} = \left(\frac{dq^1}{dt}\right)^{\text{Temp.}} - \frac{1}{\Delta^1} \{E_{q^1 p^2} (R_{q^2 q^2}^2 - E_{q^2 q^2}) + E_{q^1 q^2} (E_{q^2 p^2} - R_{q^2 p^2}^2)\} \quad (22)$$

VI. Investment

Up to now we have assumed that there is no investment. As a result, all of the intertemporal action has come from the demand side. If investment is incorporated, we will also have intertemporal effects on supply. Once investment is added the capital stock in period 2 becomes an endogenous variable. More specifically, it is possible to relate additions to the capital stock (dK) to changes in tariffs and to real exchange rate changes. Perhaps the easiest way to introduce investment is by adding a Tobin's "q" type equation. Assuming that investment goods are of the numeraire type, investment is guided by:

$$\delta * R_K^2 = 1 \quad (23)$$

Thus the capital stock reaction to a permanent change in tariffs will be:

$$\left(\frac{dK}{dt}\right) = - \left(\frac{R_{Kp}^2}{R_{KK}^2}\right) - \left(\frac{R_{Kq}^2}{R_{KK}^2}\right) \left(\frac{dq^2}{dt}\right) \quad (24)$$

where $R_{KK}^2 < 0$ is the slope of the marginal product of capital schedule; R_{Kp}^2 and R_{Kq}^2 are Rybczynski terms whose signs will depend on the relative ordering of factor intensities across sectors.

VII. Concluding Remarks

In this paper we have developed an intertemporal, fully optimizing model of a small open economy with nontradable goods to analyze how the imposition of temporary import tariffs affects the current account. In this general setting changes in the (equilibrium) real exchange rate--or relative price of nontradables--will provide an important channel through

which a change in tariffs will influence the current account. For this reason the analysis of the current account behavior should be preceded by an analysis of the determinants of real exchange rates.

It was shown in the paper that in this general equilibrium inter-temporal setting a temporary tariff will affect the equilibrium real exchange rate both in the current and future periods. However, it is not possible to know a priori the direction of this effect. In fact, it is possible that, contrary to popular belief, a temporary tariff will result in a real exchange rate depreciation in the current period, which is later reversed.

The analysis also shows that it is possible for a temporary import tariff to worsen the current account in the period when it is imposed. This indicates that policy makers should be particularly careful when using temporary protectionist policies for balance of payments purposes. Not only will these policies result in welfare reducing inefficiencies, but may very well fail to achieve their intended objective of improving the current account and of improving the degree of competitiveness.

Stability Conditions

The dynamic behavior of nontradable prices are depicted by equations (A.1) and (A.2), where $\lambda_1, \lambda_2 > 0$.

$$\dot{q}^1 = \lambda_1 [E_{q^1}^1 - R_{q^1}^1] \quad (\text{A.1})$$

$$\dot{q}^2 = \lambda_2 [E_{q^2}^2 - R_{q^2}^2] \quad (\text{A.2})$$

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

$$\begin{pmatrix} \dot{q}^1 \\ \dot{q}^2 \end{pmatrix} = \begin{pmatrix} \lambda_1 (E_{q^1 q^1}^1 - R_{q^1 q^1}^1) & \lambda_1 E_{q^1 q^2}^1 \\ \lambda_2 E_{q^2 q^1}^2 & \lambda_2 (E_{q^2 q^2}^2 - R_{q^2 q^2}^2) \end{pmatrix} \begin{pmatrix} q^1 - q^{1*} \\ q^2 - q^{2*} \end{pmatrix}$$

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

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

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

This means that:

$$\{(E_{q^1 q^1}^1 - R_{q^1 q^1}^1)(E_{q^2 q^2}^2 - R_{q^2 q^2}^2) - E_{q^2 q^1}^2 E_{q^1 q^2}^1\} > 0$$

and

$$\{(E_{q^1 q^1}^1 - R_{q^1 q^1}^1) + (E_{q^2 q^2}^2 - R_{q^2 q^2}^2)\} < 0.$$

These requirements can then be used to sign the determinant of the system of equations in the text. Also, it follows directly from these requirements that the $H^2 H^2$ schedule is steeper than the $H^1 H^1$ schedule.

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