ABSTRACT

Why the Welfare Gains from Trade Liberalization are so Small

by

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A common feature in the structural adjustment programs undertaken by developing countries over the past fifteen years is the reduction in, and in some cases elimination of, restrictions on international trade. This paper focuses on the argument that the removal of barriers to trade enhances economic efficiency. While few people doubt that removing trade barriers improves economic efficiency, the authors ask: By how much?

To answer this question, it examines the role of imperfect substitutability between imports and domestic goods in determining the welfare gains from trade liberalization. The authors show that this imperfect substitutability -- expressed in terms of the Armington elasticity -- can play a substantial role in determining the magnitude of the welfare gains. Once the assumption is relaxed that imports and domestic goods are perfect, it finds that the welfare gains fall dramatically. It concludes that the marginal welfare cost of tariffs is equally small, and -- unlike the total welfare cost -- does not rise significantly with the Armington elasticity.

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WHY THE WELFARE GAINS FROM TRADE LIBERALIZATION ARE SO SMALL

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A common feature in the structural adjustment programs undertaken by developing countries over the past fifteen years is the reduction in, and in some cases elimination of, restrictions on international trade. From Argentina to Zambia, countries have dismantled trade barriers, resulting in a significantly more open trade regime than that which existed before. The rationale for trade liberalization is well-known (for a recent statement, see Nash and Thomas [1991]), and can be divided into two separate arguments. First, removing import restrictions enables a country to export more; various studies have shown that export-oriented economies grow faster. Second, barriers to trade distort domestic prices; removing these barriers, therefore, enhances economic efficiency. The reason for separating these arguments is that the first does not necessarily imply that a country should stop when trade is completely liberalized: if export-orientation is so valuable, why not subsidize exports? The second argument, by definition, implies that free trade is the goal. Our concern in this paper is solely with the second argument.

While few people doubt that removing trade barriers improves economic efficiency, the real question is: By how much? Accordingly, since the mid-1970's, economists have been trying to quantify the welfare gains from trade liberalization. The most common tool of analysis has been the computable general equilibrium (CGE) model. Since it links the various markets in the economy through the price system, the CGE model captures the resource pulls attendant to a removal of trade barriers. As it is built up from the behavior of microeconomic agents, the model provides a vehicle for measuring welfare gains or losses in a consistent manner. Early

attempts at using CGE models to simulate trade liberalization revealed a hitherto little-appreciated fact: with perfect competition and constant returns to scale in production, an economy whose trade restrictions are removed will produce only as many traded goods as there are factors of production, plus one. Consequently, these early models (de Melo [1977], Taylor and Black [1978]), while they showed large welfare gains from trade liberalization, also showed their economies specializing to an unrealistic extent.

The literature since then has produced models with much more realistic effects of trade liberalization on the structure of production. Typically, this has been achieved by, first, increasing the number of factors of production (by assuming that capital in each sector is a different factor) and, second, by introducing the notion that imported and domestically-produced goods in the same sector are imperfect substitutes. This second idea, due to Armington [1969], effectively turns import-competing domestic goods into nontradables, so that trade liberalization will not necessarily eliminate them. While models combining these two features show milder production shifts from trade liberalization, they also obtain much smaller welfare gains. A standard result is that the gain from the complete elimination of tariff barriers is of the order of one percent of the pre-reform welfare level (see Srinivasan and Whalley [1988] for a survey of these models).

In a recent paper, Clarete and Whalley [1988] reverse this conclusion by showing that the welfare gains from trade liberalization in the Philippines can be quite large -- of the order of three percent of base welfare -- even though full specialization does not occur. In their

model, capital is sector-specific, but they implicitly drop the Armington assumption of imperfect substitutability between imports and domestic goods. The purpose of our paper is to show that the large welfare gains obtained by Clarete and Whalley are due to their assumption that imports and domestic goods in the Philippines are identical. We contend that this assumption is unrealistic, both for a developing country like the Philippines and for the level of aggregation chosen by Clarete and Whalley. Furthermore, we show that the welfare gains from trade reform can drop quite substantially once this assumption is relaxed. We find that the welfare gains are increasing in the elasticity of substitution between imports and domestic goods. Since this elasticity can be quite low in developing countries, we conclude that the welfare gains from trade liberalization in these countries are quite small.

The plan of the paper is as follows. First, we present the simplest possible general-equilibrium model which captures the effect of the Armington assumption on the welfare gains from trade liberalization. The model is solved both analytically and graphically to demonstrate the result mentioned above, namely, that the welfare gains are increasing in the Armington elasticity of substitution. Next, in section II, we present the results of simulation exercises with a larger CGE model of Cameroon, where the elasticity of substitution between imports and domestic goods is varied parametrically, to capture quantitatively the dependence of this parameter on the welfare effects of trade reform. Only when the elasticity is raised to absurd levels are the welfare gains close to those obtained by Clarete and Whalley. For reasonable levels of these elasticities, the welfare gains are minuscule. Section III contains our concluding remarks.

I. The Analytical Model

In this section, we demonstrate the result that the welfare gains from trade liberalization are increasing in the Armington elasticity of substitution. We do so by presenting the simplest possible general equilibrium model capable of deriving the result. In the next section, we show that the qualitative nature of the result is preserved in a more realistic, empirical model.

We turn now to the simple, general-equilibrium model where the Armington assumption plays a crucial role. As this model has been documented elsewhere (de Melo and Robinson [1989], Devarajan, Lewis and Robinson [1990], [1993]), we do not treat its properties in detail here. We focus instead on using the model to calculate the welfare gains from trade liberalization. Consider an economy which produces only two goods, exports (E) and domestic goods (D). Assume that the production of the two goods can be described by a constant elasticity of transformation function[1]:

$$Q = A[\lambda D^{\rho} + (1-\lambda)E^{\rho}]^{1/\rho} \tag{1}$$

Since this is a small, open economy, exporters face a parametrically given world price, P_E^*, which we take to be equal to the domestic price, P_E, there being no taxes on exports. The price of the domestic good, P_D is endogenous. Given these two prices, the first order conditions for profit maximization imply that:

[1]This assumption is not crucial. It is made for analytical convenience. Furthermore, if the underlying production functions for the two sectors (E and D) are Cobb-Douglas, then the derived transformation frontier will locally exhibit a constant elasiticity (see Devarajan, Lewis and Robinson [1990]).

$$D/E = [(1-\lambda)/\lambda]^{\Omega}(P_D/P_E)^{\Omega} \tag{2}$$

While D and E are the only two goods produced in the economy, there is one other good which is consumed, namely, imports, M. Again, the world price of imports is parametrically given as P_M^*. The domestic price, P_M is equal to this world price augmented by the ad valorem import tariff, T:

$$P_M = P_M^*(1+T) \tag{3}$$

We assume that consumers preferences for the two goods, D and M can be expressed by a CES utility function (this is the Armington assumption in this three-good model):

$$U = B[\delta D^{-\gamma} + (1-\delta)M^{-\gamma}]^{-1/\gamma} \tag{4}$$

Maximizing utility subject to a budget constraint (see below) yields the following first-order condition:

$$C/M = [\delta/(1-\delta)]^{\sigma}(P_M/P_D)^{\sigma} \tag{5}$$

Finally, we assume that all tariff revenues are rebated to the consumer in a lump-sum fashion, so that the consumer's budget constraint is given by:

$$P_D D + P_E E + TP_M^* M = P_D D + P_M M \tag{6}$$

Note that by cancelling terms and incorporating equation (3) gives us the equation for balance of trade in this economy:

$$P_E^* E = P_M^* M \tag{7}$$

A. Analytical Solution

We can now log-differentiate the system (1) - (7) to obtain analytical solutions for the response of welfare (or utility, the case of this one-consumer economy) to a small change in the tariff rate, T. Letting lower-case letters stand for the log-derivative of the upper-case letters in (1) - (7), we obtain the following set of linear equations:

$$0 = \mu d + (1-\mu)e \quad where \quad \mu = \lambda D^{\rho}/[\lambda D^{\rho} + (1-\lambda)E^{\rho}]$$

$$d - e = \Omega p_D$$

$$p_M = \eta t \quad where \quad \eta = T/(1+T)$$

$$c - m = \sigma(p_M - p_D)$$

$$m = e$$

$$u = \psi c + (1-\psi)m \quad where \quad \psi = \delta D^{-\gamma}/[\delta D^{-\gamma}+(1-\delta)M^{-\gamma}]$$

A preliminary result of manipulating the relationships in (8) - (13) is that the response of P_D to a change in the tariff rate is a function of the elasticity of substitution:

$$p_D = \sigma\eta t/(\sigma+\Omega)$$

Note that as σ approaches infinity, the change in P_D is equal to the tariff change. This is intuitive, since as σ approaches infinity, the two goods, D and M, become perfect substitutes.

Finally, calculating the change in utility for a small change in the tariff rate, we obtain the relationship:

$$u = -[P_D/(P_D D+P_M M)][P_E E/(P_D D+P_E E)]\Omega\sigma\eta t/(\sigma+\Omega)$$

Two observations can be made of equation (15). First, for a positive tariff, an increase in the tariff rate unambiguously worsens welfare. Second, the responsiveness of utility to a reduction in the tariff rate depends on σ. In particular, as sigma increases, so does the effect of t on u. Put another way, the welfare gain from trade liberalization (a reduction in T) will be greater the greater is σ.

B. Graphical Solution

This same result can be demonstrated in a four-quadrant diagram. In Figure 1, let the lower right quadrant represent the transformation frontier PP between exports and domestic

goods. Since trade balance requires that $P_E^*E = P_M^*M$, any point on the PP frontier has associated with it a specific level of imports. Furthermore, the amount of D produced has to equal the amount consumed. Combining these two facts, we obtain the consumption possibility locus AA in the upper left quadrant. If there were no tariffs, equilibrium will be at points F and H.

Now suppose a tariff is introduced. Note that the imposition of a tariff does not affect the AA locus, which represents the amount the consumer can hope to consume given world prices and the economy's production possibilities. However, as the consumer is now paying higher prices for imports, the new equilibrium will lie on the AA locus at a point where the indifference curve cuts the locus with a slope equal to the new price ratio between domestic and imported goods. Recall that for any finite σ, the domestic price rise will be less than the import price rise, so the relative price of domestic to imported goods must fall. Figure 2 illustrates the new equilibrium.

How would the new equilibrium differ if the elasticity of substitution between D and M were greater, i.e, if the indifference curves were "flatter"? Figure 3 shows that, if the indifference curves were flatter, the new equilibrium will be at a lower level of utility. This is because the indifference curve will now cut the AA locus at a steeper slope. Given a flatter indifference curve, this will occur at a point further away from the original equilibrium than was the case in Figure 2.

Figure 1.

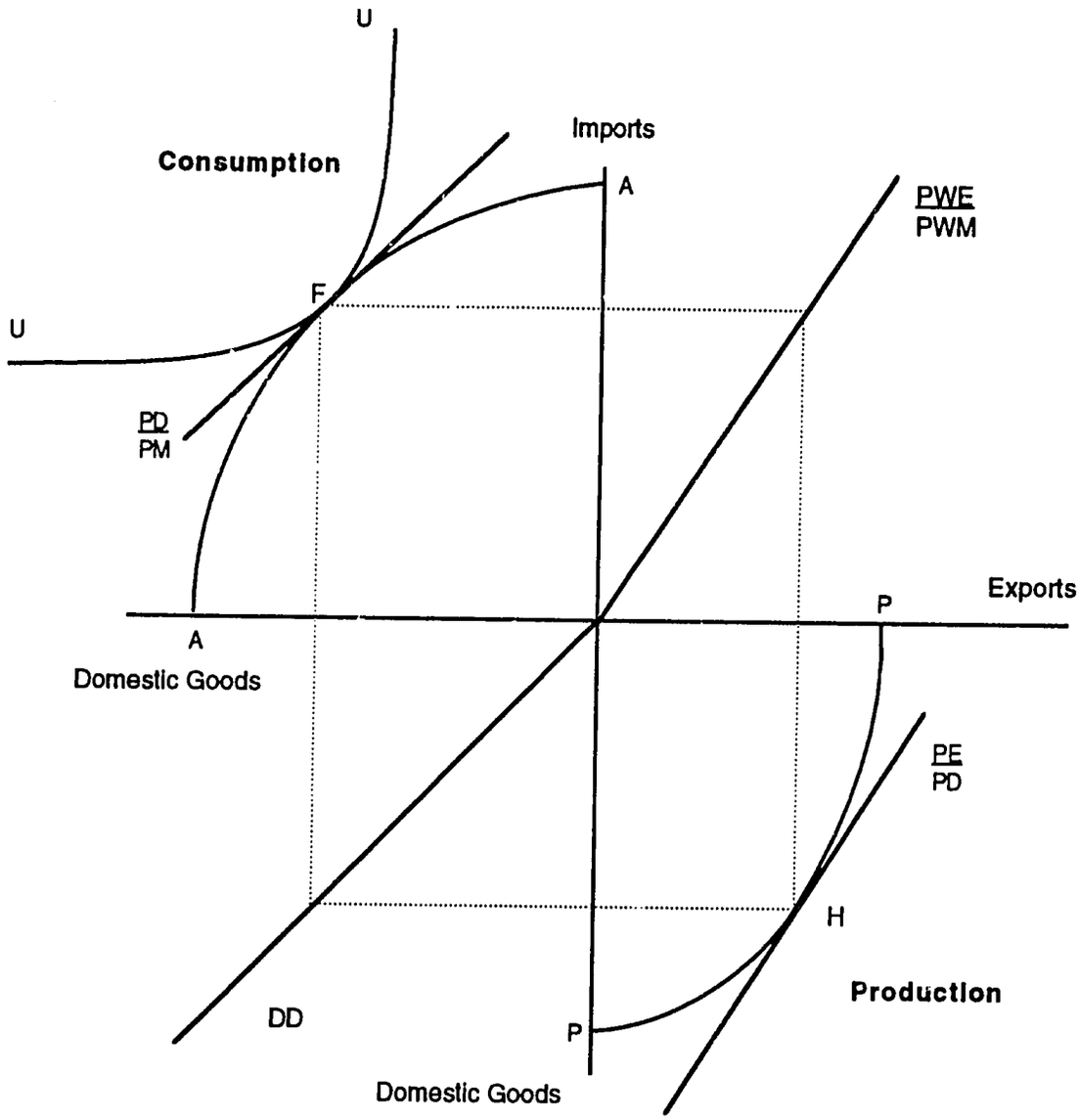
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Figure 3.

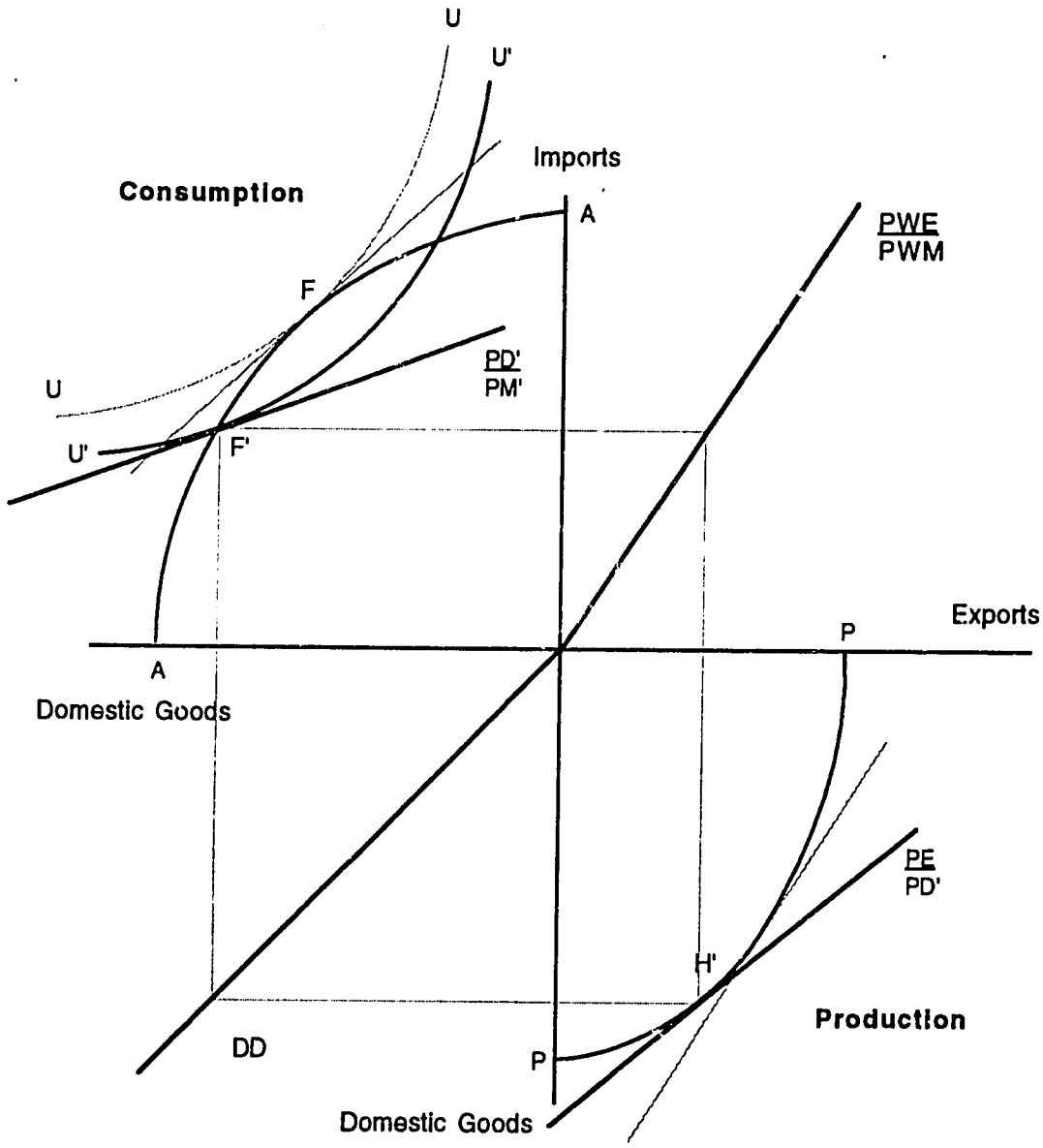
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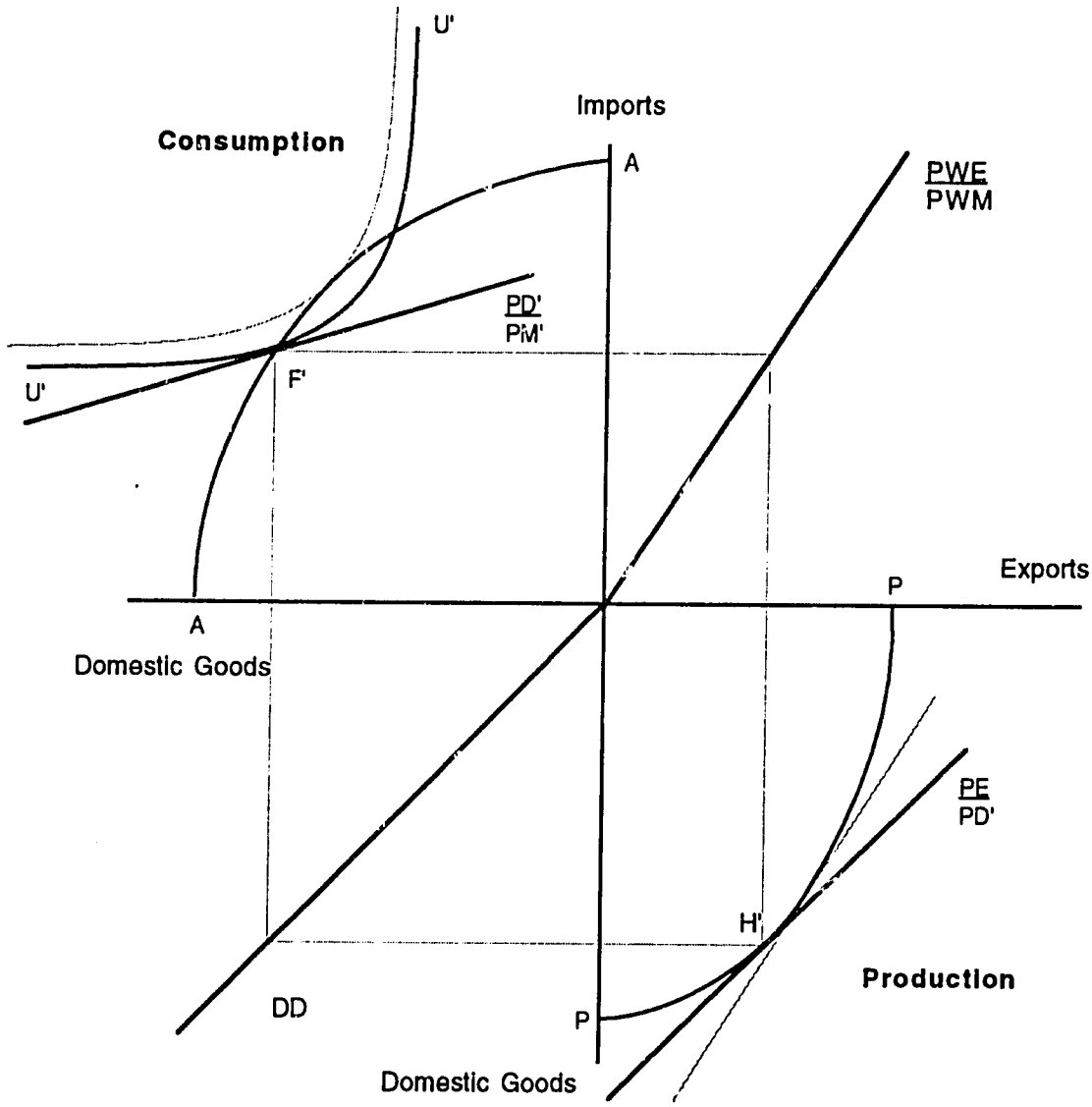
Figure 2.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II. Simulation Results

The results in the previous section demonstrated, using a starkly simple model, that the welfare gains from trade liberalization rise with the Armington elasticity of substitution. The results did not indicate the empirical magnitude of this relationship, nor its significance to the debate over whether these welfare gains are indeed large in developing countries. Yet, it is this empirical magnitude which is important given that, as noted in the introduction, Clarete and Whalley [1988] have shown that the welfare gains can be substantial, in contrast to the other studies which preceded them. We turn therefore in this section to a set of simulation results from a computable general equilibrium model of Cameroon. The model is broadly comparable to the one of the Philippines used by Clarete and Whalley. The main difference is that the Cameroon model permits the elasticity of substitution between domestic and imported goods in each sector to be varied parametrically (rather than being set at infinity). Consequently, we are able to test our hypothesis that the large welfare gains obtained by Clarete and Whalley were due to their assumption about perfect substitutability between imports and domestic goods.

Before proceeding, we note that the justification of the Armington assumption are two. First, for a large number of commodities, imports and domestically-produced goods are in fact imperfect substitutes. The difference could be due to quality or simply consumer tastes (foreign and domestic beer is a good example of the latter). In any event, both casual observation and hard empirical evidence point to the fact that imports and domestic goods do not command the

same price. Second, most CGE models are disaggregated to about fifteen sectors. At this level of disaggregation, it is very difficult to sustain the notion that imports and domestic goods in the same sector are perfect substitutes. The reason is that in a sector called "consumer goods", say, the imported component consists of a different bundle of commodities from those produced domestically. Typically, a country like the Philippines imports consumer electronics and luxury items, while producing textiles and such domestically. Thus, even if one rejected the idea that there were differences in quality or tastes, the fact that CGE models deal with a coarse degree of disaggregation forces one to adopt the Armington assumption.

The Cameroon CGE model has been widely documented elsewhere (see, for example, Benjamin *et al.* [1989], Devarajan and Offerdal [1990]), so we will not describe it in detail here. Instead, we will highlight those aspects of the model which distinguish it from the simple, three-good model of section I, as well as those aspects which are useful in interpreting the results we will present later.

The Cameroon model is a generalization of the three-good model presented above in the sense that each of the eleven sectors of the Cameroon model exhibits the properties of the three-good model. For example, in each sector, imports and domestically-produced goods are imperfect substitutes. Furthermore, in each sector, exports and goods produced for the domestic market are imperfectly transformable (and the elasticity of transformation is constant). The initial pattern of these elasticities (of substitution and transformation) was determined by some estimation, "guesstimates" and looking at the model's ability to track historical data. The actual

pattern is not what is important, however. What matters is how the model's responsiveness changes as these elasticities increase. For this reason, whenever we vary the Armington elasticites, we do so in a manner which keeps the relative elasticities across sectors unchanged.

In addition to the imperfect substitutability in production and consumption, the Cameroon model has two other features which could reduce the welfare benefits of trade liberalization (and which are not captured in the simple model of section I). First, there are other taxes in the model. In particular, the level of domestic indirect taxation is very high (and non-uniform). Lowering import tariffs could harm welfare if it reduces output in a sector which is already facing heavy domestic indirect taxation. Second, in the Cameroon model, workers in the same skill category may face different wages depending on the sector in which they are employed. This specification is necessitated by the data, where such wage differentials are observed. Typically, wages are higher in manufacturing than in agriculture. When there is trade liberalization, workers move from the protected manufacturing sectors to the unprotected agricultural sectors, that is, they move from the high-wage sector to the low-wage sector. The result is a decline in welfare which dampens the efficiency gains in eliminating tariff distortions. We should stress that these two features of the Cameroon model affect the level of welfare gains from trade liberalization; they do not directly alter the rate at which these gains change with increases in the Armington elasticity.

Our final remark about the Cameroon model is how it is "closed" in the experiments we are about to describe. This is important because the model contains savings and investment

accounts. Furthermore, as it is based on historical data (the base year is 1983) trade is not balanced in the model, unlike in the small model of section I. It is now well-appreciated that the manner in which these savings/investment and foreign capital accounts are "closed" can have a strong bearing on the simulation results (see, for example, Robinson [1989]). As we are concerned with welfare calculations, we do not want our results to be driven by adjustments in the macroeconomic balances. Consequently, we have chosen a closure which keeps the levels of total investment and the current account balance fixed in real terms. In addition, the level of current government expenditure is fixed in real terms. Since trade liberalization will result in a reduction of tariff revenue to the government (and hence a reduction in public savings), a lump-sum tax is levied on consumers to generate sufficient revenue to meet the desired level of public savings. This desired level, in turn, is the fixed level of investment, less foreign savings (also fixed) and private savings (which is endogenous in the model). Thus, in the tradition of other tax analysis, the welfare effects of tariff reform are measured by assuming that the tariff is replaced by an equivalent lump-sum tax which enables the economy to generate the same level of investment and current account balance as before.

We turn now to the results of simulations with the Cameroon model. Recall that Clarete and Whalley [1988] obtained the result that a complete elimination of tariffs in the Philippines would increase welfare by 3.3 percent[2]. The corresponding experiment with the Cameroon model, using the base levels of Armington elasticities, yielded a welfare gain of only 0.05

[2]Their definition of welfare is the equivalent variation of consumer surplus. Although this is different from our definition (which is the direct measurement of the single consumer's utility), the *percentage* increase in welfare from the two measures are comparable

percent. The two percentage changes are different by two orders of magnitude. The reasons are a combination of those mentioned earlier -- the absence of the Armington assumption in the Philippines case, the presence of second-best conditions in the Cameroon case -- as well as the fact that the Philippines and Cameroon are different countries with different initial conditions. It should be noted, however, that on one dimension, the two countries are quite similar: the average rate of tariffs in the Philippines is 27 percent, that in Cameroon is 26 percent. The question of interest, then, is the extent to which the difference can be attributed to Clarete and Whalley's assumption of perfect substitutability between imports and domestic goods. To answer the latter question, we repeat the previous experiment with the Cameroon model, only this time the Armington elasticities have been scaled by a factor of ten. That is, the pattern of elasticities remains unaltered, but each elasticity is ten times its base value (this leads to the elasticies' ranging from three to 30). In this scaled version of the model, the welfare gain from trade liberalization is 0.5 percent -- still lower than Clarete and Whalley's figure, but significantly larger than the gain associated with the base case. Finally, when the elasticities are multiplied by 100 times their base values, the welfare gain from eliminating tariffs is 1.3 percent, which comes close to the Clarete and Whalley figure. Thus, while the welfare gains increase with the Armington elasticities, it takes a hundredfold increase in the elasticities to approach the order of magnitude gain obtained by Clarete and Whalley.

In addition to the two data points presented above (welfare gains of 0.05 percent and 0.5 percent), it may be interesting to see how the welfare gains vary with a range of substitution elasticities. We now present such a set of results, although instead of considering the case of

complete trade liberalization, we examine the welfare gains from a partial reduction in tariffs. Specifically, we examine the gains from lowering tariffs so that tariff revenues fall by two percentage points of GDP (initially, tariff revenue was about six percent of GDP). The pattern of tariffs remains unchanged. Also, as before, a lump-sum tax is levied to maintain the level of investment. Calculations of this type are useful not just because partial tariff reform is easlier to contemplate than full-scale trade liberalization. They are also valuable in assessing the welfare costs of using different instruments. For example, if it can be shown that the welfare gains from lowering tariffs by two percent of GDP are greater than the gains from lowering indirect taxes by the same amount, the government should contemplate such a revenue-neutral tax reform which replaces tariffs with indirect taxes. Finally, this calculation is very close to the standard definition of the marginal welfare costs of taxation, and hence we will refer to it as such.

The results of the simulations are given in Table 1. We have included one simulation where the Armington elasticities were *lowered* (to half their base levels) for comparison purposes. Overall, the marginal welfare gain does rise with the Armington elasticity. However, the rise is not rapid. Only when the elasticities are a *thousand* times their base values does the marginal welfare gain of a two percent reduction in tariffs approach the order of maginitude of the Clarete-Whalley figures.

Table 1

Marginal Welfare Gain from Reducing Tariffs by 2% of GDP
(as percentage of base welfare)

Base Case	0.06
0.5*elasticity	0.04
10*elasticity	0.3
100*elasticity	0.9
1000*elasticity	1.2

Source: Model Simulations

III. Conclusion

The purpose of this paper has been to examine the role of imperfect substitutability between imports and domestic goods in determining the welfare gains from trade liberalization. Using a simple analytical model, and simulations with a more elaborate, empirical model, we showed that this imperfect substitutability -- expressed in terms of the Armington elasticity -- can play a substantial role in determining the magnitude of the welfare gains. We noted that the single CGE model simulation which obtained high welfare gains from trade liberalization -- that of Clarete and Whalley [1988] -- assumed that imports and domestic goods were perfect

substitutes. Once this assumption is relaxed, the welfare gains could fall quite dramatically. In the case of Cameroon, for reasonable values of the Armington elasticities, the gains from complete trade liberalization are almost negligible (less than one-tenth of one percent). Finally, the marginal welfare cost of tariffs is equally small, and -- unlike the total welfare cost -- does not rise significantly with the Armington elasticity.

What are the implications of these results for policy? This paper should not be construed as either an attack on, or a defense of, trade liberalization in developing countries in general. Our aim has been to clarify one of the arguments for trade liberalization, namely, the efficiency gains from removing tariff distortions. If the case for trade liberalization in a particular country is being made exclusively on the grounds of static efficiency gains, then our results do have an important policy message. To the extent that in most developing countries imports and domestic goods are imperfect substitutes, these static efficiency gains are likely to be quite small. The intuition is quite simple. A tariff is both a consumer tax and a producer subsidy; both will have distortionary effects. But the consumer tax, especially in a country with heavy domestic indirect taxes, comes close to duplicating a lump-sum tax (Diamond and Mirrlees [1974]). Thus, the residual efficiency loss from a tariff is the producer subsidy, which distorts production decisions. However, if the domestic and imported goods are imperfect substitutes, the subsidy enjoyed by domestic producers is that much less. Hence, removing the tariff does not eliminate a major distortion.

Our results also have implications for modelling trade liberalization. As noted earlier,

both the Armington assumption and the assumption of sector-specific capital stocks avoid the unrealistic outcomes of full-specialization in CGE models with perfect competition and constant returns to scale. In this paper, we have shown that while either of the two assumptions is sufficient to prevent full-specialization, adopting one without the other can generate misleading quantitative results. It should be noted that others have dropped the assumptions of perfect competition and constant returns to scale (Harris [1984], Gunasekara and Tyers [1990], Devarajan and Rodrik [1991]), and obtained a range of estimates for the welfare gains from trade liberalization. Unfortunately, many of these models are based on rather weak empirical evidence about the underlying market structure or degree of returns to scale. The overall lesson is that, while the pure Walrasian framework does not appear to be the best tool for analyzing trade liberalization, the direction in which the model needs to be amended is by no means clear, and should ideally be based on the empirical evidence in the country being modelled.

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