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The Linkage Between Domestic Taxes and Border Taxes by

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The Linkage Between Domestic Taxes and Border Taxes

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Observed patterns of tariffs across countries, and of trade policies more generally, are very puzzling given the clear policy implications of traditional optimal tariff models. These models suggest that countries with little market power should not attempt to distort trade patterns, while those countries that do have market power should attempt to restrict imports and/or exports, relative to the amount that would otherwise occur, in order to take advantage of this monopoly/monopsony power. Yet rich countries, that might plausibly have important market power, are often observed subsidizing exports in various ways. To the degree to which they restrict trade at all, it is often in sectors such as agriculture where the country clearly has no market power, or is done through nontariff barriers, where the profits arising from the difference between domestic and world prices are received by foreign firms. Poorer countries often impose tariffs, even in situations where they have no plausible market power.

The objective of this paper is to explore to what degree this pattern of border distortions may simply result from each country's attempt to offset the trade distortions created by their domestic tax structure and by other domestic policies.[1] The basic intuition is as follows. Most countries collect a sizable fraction of their tax revenue through taxation of domestic production, using a variety of tax instruments including output taxes, property taxes, and capital income taxes.[2] The corporate income tax, used heavily in most developed countries, is a good example. As a result of these taxes, more domestic taxes are paid on domestically produced goods than on foreign produced goods.

If the tax rate were the same in all sectors, then the only effect would be a readjustment in the exchange rate. However, effective tax rates vary substantially across industries, and

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tend to be much higher on manufacturing firms, presumably due to lower administrative costs in enforcing a tax on larger scale firms. If a country is a net exporter of manufacturing goods, then taxes on domestic production raise the relative prices of these goods. If the country has market power in these goods, it can thereby take advantage of this market power without the need to enact an explicit export tax. If the country has no market power, however, then it can offset the distortion created by domestic production taxes through a rebate of the production tax when goods are exported, as occurs under a V.A.T., or through an explicit export subsidy.

If a country is a net importer of manufacturing goods, then production taxes discourage the development of a domestic manufacturing industry. To offset this distortion, a country can impose a tariff at a comparable rate on manufacturing imports. In fact, GATT rules allow a country to use import tariffs or export subsidies in this way to offset taxes on the output of domestic firms, as long as the effective tax rate on imports is no higher than that faced on domestic production. GATT rules do not allow taxes on the income of domestic firms to be offset in the same way, however.[3] One alternative response is to impose nontariff barriers to imports. While nontariff barriers do not collect any revenue, unlike explicit tariffs, they still serve to protect domestic production from foreign goods which are artificially cheaper due to the distorting effects of the domestic tax structure.

Poorer countries tend to be net importers of manufacturing goods, so should be observed imposing tariffs on these imports. Richer countries tend to export manufacturing goods, explaining the pressure towards export subsidies.

Taxes are not the only policy distorting relative domestic prices. Many countries intervene actively in agricultural markets, for example; it is also common for countries to set up state-run enterprises producing tradeable goods whose output is unlikely to be sold at marginal cost. The same arguments made above with respect to tax distortions apply with equal force to other distortions.

Nothing in this argument shows that the above policies are optimal for a country. Bhagwati(1971) argued that the first–best response was to eliminate any domestic distortions; only if this failed should tariffs be used as a second–best response. Rather than taking domestic tax distortions as exogenous, however, as did Bhagwati(1971), we will explore the characteristics of a country's optimal use of domestic taxes, tariffs, and nontariff barriers. Since a production tax on a particular industry in combination with an import tariff (or export subsidy) at the same rate has identical economic effects to a tax on domestic consumption of that good, using for example a retail sales tax or a V.A.T., explaining which of these equivalent tax instruments is used leads us to focus on their relative administrative costs. If administrative costs become important, however, then they can have important effects on the characteristics of optimal policy, and on the size of any resulting trade distortions. We explore the likely pattern of these trade distortions.

This explanation for the observed use of tariffs has been discussed in a variety of papers since Bhagwati(1971). Corden(1974) explicitly noted that tariffs might well form part of an optimal tax system, once collection costs are taken into account, though he did not attempt to formally model the optimal domestic and trade tax structures. Riezman–Slemrod(1987) provided empirical support for this intuition by showing that tariffs are used most heavily by countries which likely face high administrative costs of alternative taxes. However, little attempt has been made to examine explicitly what optimal tax theory would in fact imply about the optimal use of tariffs. One exception is Aizenman(1987) who examines a particular example with one consumer in which the only available taxes are a consumption tax and a tariff. In his example, only the consumption tax has administrative costs, which are proportional to consumption tax revenues. He finds that tariffs would be part of an optimal tax system.[4] Diamond–Mirrlees(1971) showed that tariffs should not be used by a small open economy if it sets the excise tax rates on all goods optimally. However, Boadway, Maital, and Prachowny(1973) and Dixit(1985), among others, have pointed out that tariffs would almost certainly be used if they were the only source of tax revenue, and might well be used if the available set of tax instruments is more limited than assumed in Diamond–Mirrlees(1971). They do not examine the characteristics of an optimal tariff when some but not the full range of domestic taxes are used.[5]

A variety of other explanations have been proposed for the observed use of tariffs and export subsidies. In many political economy models of rent-seeking behavior, tariffs or quantitative restrictions result from the lobbying behavior of economic agents who then compete for the revenue or license premia associated with the protection.[6] This work is summarized in Bhagwati (1982.) A very different class of models have found that increasing returns to scale may give rise to welfare enhancing trade taxes or subsidies. In these models, nicely surveyed by Helpman (1984), a firm produces with increasing returns to scale. If the returns to scale are external to the individual firm, firm output may be suboptimal and trade policy can address this externality. If on the other hand the returns to scale are realized by the firm itself, the resulting market structure tends toward one of large firms with market power. This, in turn, leads to another body of research. The results here often yield welfare enhancing trade taxes or subsidies. This is the strategic trade policy literature. Here, trade taxes levied by a government act as a credible precommitment and alter the ensuing game played by firms. This literature is well surveyed in Grossman and Richardson (1985).

The objective of this paper is not to question the plausibility of these alternative explanations. Instead, our objective is to reexamine the pattern and characteristics of net trade distortions, taking into account both border taxes and the trade distortions created by internal taxes, to see to what degree the empirical regularities motivating these other papers still seem to exist once the effects of domestic taxes are taken into account.

The outline of our paper is as follows. In section 1, we develop a theoretical model of optimal tax and tariff policies in the presence of administrative costs. Numerical simulations of this model will be used to provide a clearer sense of the economic implications of the model. This model will then be used to forecast the pattern of trade distortions across countries, and to examine the implications of international agreements banning tariffs.

In section 2, we examine IMF data on government financial statistics from a variety of countries in recent years, to see to what degree the forecasts of our model are consistent with the data. In particular, we will attempt to compare average tariff rates and average production tax rates to see to what degree the resulting trade distortions are offsetting.

1. Theoretical analysis of optimal taxes and tariffs

In examining the characteristics of the optimal tax and tariff policy in a small open economy, let us start with the standard optimal tax framework used by Diamond and Mirrlees(1971), and assume that all outputs are tradeable, but inputs are not. They showed that as long as the government has use of excise taxes on all goods, then under the tax policy which minimizes efficiency costs production will occur on the production possibilities frontier. International trading opportunities are in effect another production technology, extending the production possibilities frontier.[7]

As a result, under optimal policies, the value of domestic output, based on world prices, would be maximized conditional on the supplies of all factors. A marginal increase in the output in one industry at the expense of output in any other industry, holding aggregate factor supplies constant, would not affect the value of domestic output in the world market. We will refer to this situation as one in which there are no trade distortions. Note, however, that the optimal taxes will still change trade patterns by changing the pattern of domestic consumption and factor supplies.

We rederive the Diamond–Mirrlees result to provide a formal comparison with other results we examine below. In particular, assume that a country produces two goods using two factors and constant returns to scale technologies. Assume that the government can collect revenue using excise taxes on the value of goods produced or on the value of factors supplied, and using tariffs on imports.[8]

We start by defining notation. Consumption of good i by household h is denoted by C_{hi}, the supply of factor j by the household is denoted by K_{hj}, while its endowment of this factor is K^*_{hj}. The utility of household h is denoted by $U_h(C_{h1}, C_{h2}, K^*_{h1} - K_{h1}, K^*_{h2} - K_{h2})$. Utility functions can differ among the H households. Let the price consumers pay for good i be denoted by q_i, while the amount they are paid per unit of factor j supplied is r_j. Each consumer's demand for the two goods, and supply of the two factors, depends only on these two output prices and two factor prices. By substituting these demand and factor supply functions into the direct utility function, we obtain the indirect utility function of household h, denoted by $V_h(q_1, q_2, r_1, r_2)$. In order to fix the domestic price level, we assume that the numeraire is the price of good 2, so that $q_2 = 1$.

If K_{ij} denotes the amount of the j'th factor used in the domestic production of the i'th good, then domestic output of that good, denoted X_i, satisfies $X_i = f^i(K_{i1}, K_{i2})$, where the production function has constant returns to scale. Let p_i denote the price domestic firms receive for output of good i, and let s_j be the amount they pay per unit for input j. These prices can differ from the prices individuals face because of excise taxes on production. If $c^i(s_1, s_2)$ denotes the unit cost function in industry i, then competition implies that

$$p_i = c^i(s_1, s_2). \tag{1}$$

Government revenue, denoted R, is used to buy the two goods on international markets to maximize some measure of the welfare of government expenditures. We assume that the country is a price–taker on these international markets. Let government purchases of good i be denoted by G_i. Since international prices are taken as given, we can denote the resulting welfare derived from government expenditures by $W(R)$.

If M_i denotes imports of good i, then materials balance implies that

$$\sum_h C_{hi} + G_i = f^i(K_{i1}, K_{i2}) + M_i. \tag{2}$$

By assumption, no trade takes place in factor markets,[9] so that

$$\sum_h K_{hj} = \sum_i K_{ij}. \tag{3}$$

Let the price, in units of the second good, that must be paid for good i in the international markets be denoted by p_i^*. These prices can differ from domestic consumer prices because of tariffs. Trade balance then requires that

$$\sum_i p_i^* M_i = 0. \tag{4}$$

The government's tax and tariff rates are implicit in the above prices. In particular, if we denote the tariff on good i by t_i, then $q_i = p_i^*(1 + t_i)$.[10] Similarly, if the tax rate on the value of production of good i is denoted by τ_i and the tax on supply of factor j is γ_j, then $q_i = p_i(1 + \tau_i)$ and $r_j = s_j(1 - \gamma_j)$.

In order to have a well–defined set of optimal taxes, we must restrict the set of possible taxes further. Note, for example, that tax revenue from tariffs equals $\sum_i t_i p_i^* M_i$. But, given equation (4), the revenue would be exactly the same if the tariff rates were instead $t_i - a$ for any value of a. We therefore assume that there is a nonzero tariff only on good 1. Similarly, revenue from the remaining taxes equals $\sum_i[\tau_i p_i X_i + \sum_j \gamma_j s_j K_{ij}]$. But competition and constant returns to scale imply that $\sum_i p_i X_i = \sum_i \sum_j s_j K_{ij}$, implying that lowering all the τ_i and γ_j by some constant b will have no effect on tax revenue or on incentives. Therefore, we can add or subtract a constant from all the other tax rates and again leave revenue unchanged. We normalize by assuming that $\tau_2 = 0$, implying that $p_2 = 1$.

The government is then assumed to choose the tax and tariff rates t_1, τ_1, γ_1, and γ_2, given international prices p_i^*, so as to maximize some measure of social welfare which we denote by $\sum_h V_h + W(R)$. It does so subject to equations (1-4).

In order to understand the solution to this problem, we start by solving an easier problem, and then show that the two problems have the same solution. In particular, assume that the government can control directly the consumer prices, q_1, r_1, and r_2, and all production and international trade decisions, subject to the restriction that consumer markets clear at the chosen prices. With these powers, the government can do at least as well as in the previous case since it can duplicate any solution to the previous problem. However, we will also show that it can do no better.

To begin with, the government fully determines consumer behavior through its choice of the prices q_1, r_1, and r_2. In making production and trade decisions, given its choices on consumer prices, its sole objective would be to maximize R since the consumer prices completely determine each of the V_h. But, by equations (2) and (4), $R = \sum_i p_i^* G_i = \sum_i p_i^*(X_i - C_i)$, where $C_i = \sum_h C_{hi}$. Since consumer prices determine C_i, production decisions will be made so as to maximize $\sum_i p_i^* X_i$ subject to equation (3). Resources will therefore be allocated to maximize the value of output, based on international prices, given factor supplies. Production is therefore efficient.

Note that the resulting optimal allocations are just those that would be produced by a competitive market facing $p_1 = p_1^*$, and facing those s_j that clear the factor markets, given the factor supplies implied by the consumer prices. The desired consumer prices can then be produced by setting t_1 based on the difference between the desired q_1 and p_1^*, and setting the γ_j based on the differences between the desired r_j and s_j. This solution is therefore a feasible outcome of the first optimization problem. Since it is the optimal solution to a more general problem, it is the optimal solution to the first problem.

We therefore conclude that if a country has use of all excise taxes, then it would never choose to distort trade patterns. But, given the proposed tax and tariff system, $p_1 = p_1^*$ only if $t_1 = \tau_1$. Therefore, if excise taxes on output are based on production rather than consumption, then the optimal tariff on imports is at the same rate as is assessed on domestic production of that good. This tax system is equivalent to various other tax systems, requiring care in comparing it to observed tax and tariff systems. For example, we can replace both the production tax on good 1 and the tariff on imports of good 1 with just a sales tax at the same rate on consumption of good 1 without changing the resulting allocation. We can also replace the tax on imports of good 1 with a tax at the appropriate rate on exports of good 2, e.g. choose a different value of a. This is simply the Lerner symmetry result. Similarly, we can alter the consumer taxes so that all consumer prices change proportionately, i.e. change b, without changing the resulting allocation. Sales can be taxed either directly or through a V.A.T. In addition, a proportional income tax could be introduced, with appropriate modifications in the other tax rates, without changing the allocation.

All these results describe the optimal allocation for a small country facing fixed prices on the international market. In order to describe the choice problem faced by a large country, we could replace equation (4) in the above derivation with a more complicated function describing the trading opportunities faced by a large country, and redefine the function, $W(R)$, determining the welfare produced by government revenue. Standard types of results concerning the optimal trade distortion would come out of the model. This trade distortion would show up as a difference between the optimal tariff and production tax rates.

What happens, in this model, if an international agreement were signed forbidding tariffs? Since a tariff along with an equal rate tax on domestic production is equivalent to a sales tax on domestic consumption of that good, a country could simply eliminate the tariff, reduce the tax rate on domestic production by the initial tariff rate, and increase the tax on domestic consumption by the initial tariff rate, leaving the allocation entirely unchanged. In fact, when the Common Market was set up, there was an attempt to shift domestic tax systems away from taxes such as a turnover tax which create trade distortions and towards a destination based V.A.T., which does not distort trade patterns.[11] These modifications to domestic taxes on production and consumption would be very hard to prevent by international agreement, given most countries' reluctance to accept restrictions on their choice of a domestic tax structure. But if the adjustments do occur, then the international agreements forbidding tariffs accomplish nothing.

Why then does so much attention and effort get devoted to these treaties forbidding tariffs? One possible explanation is that the adjustments in the domestic tax system which are necessary to replace tariffs are not so easy, so may not in fact happen. The equivalent domestic taxes may, for example, be much more expensive to administer. But if we introduce administrative costs, the optimal tax argument given above must be changed to take these costs into account. If these administrative costs are important enough to prevent countries from entirely replacing tariffs with suitable modifications to their domestic tax systems, then these costs should be large enough to have important effects on the characteristics of an optimal tax/tariff system.

Various approaches could be taken to model administrative costs. Aizenman(1987), for example, assumed that the administrative costs from a particular tax were proportional to the revenue raised by that tax, with the proportionality factors differing by tax. This approach does not strike us as entirely satisfactory, however, since the bureaucracy necessary to run a tax system and monitor tax returns should be approximately the same regardless of the tax rate.[12] We therefore explore an alternative approach in which there is some fixed cost to using a given tax base, regardless of the tax rate chosen, with the size of the fixed cost varying by tax base.

How does the previous analysis change if we introduce fixed costs for each tax base? To begin with, when there are alternative taxes which are exactly equivalent, then a country would consider using only that one with the cheapest fixed cost. If, in spite of the fixed costs, the country uses the same set of taxes as analyzed above, or their equivalents, then the first–order conditions characterizing the optimal tax structure remain the same, as does the conclusion that there will be no trade distortions.

If the fixed costs are high enough to force a country to restrict its set of tax instruments further, however, then results can change. To take an extreme case, if the fixed costs are too high on all taxes except a tariff on good 1, but government revenue is valuable enough to make it worth paying the fixed cost to use this tariff, then trade distortions certainly exist. In intermediate cases, when some but not all of the other taxes analyzed above are used, trade distortions may still be desired. As Diamond–Mirrlees(1971) point out, production efficiency may not be optimal if the government does not have use of a full set of excise taxes.

Consider, for example, the special case in which, because of fixed costs, a country taxes production of good 1, and taxes imports and exports, but does not tax factor incomes. This may provide a crude description of the tax system in a number of poorer countries, if we interpret good 1 to be industrial goods. Industrial production, imports, and exports, are quite easy to tax, since there are normally few industrial firms and few ports of entry. In contrast, agricultural output and retail sales are much more difficult to tax, given the large number of small firms involved. For mathematical convenience, in the formal analysis of this case we examine the equivalent system of a sales tax on good 1, denoted by σ, and a tax on domestic production of good 1, denoted by τ, ignoring any implications for administrative costs.

In this setting, will a country choose to distort trade patterns by taxing or subsidizing domestic production? If not, then the optimal production tax should be zero. To judge this, let us examine a country's optimal tax rates. Under our assumptions, the country will choose these rates so as to maximize

$$\sum_h V_h(p_1^*(1+\sigma), 1, r_1, r_2) + W(\sigma p_1^* C_1 + \tau p_1 X_1), \tag{5}$$

subject to equations (1)-(4). If we let the marginal utility of income to household h be denoted by α_h, let $\bar{\alpha}$ equal the unweighted average value of the α_h, and let ϵ_q represent the uncompensated own price elasticity of C_1, then the resulting first-order conditions can be expressed as follows:[13]

$$(W'-\bar{\alpha}) + W'\left[-\epsilon_q\left(\frac{\sigma}{1+\sigma}\right) + \left(\frac{\tau}{C_1(1+\tau)}\right)\frac{\partial X_1}{\partial \sigma}\right] - H\operatorname{cov}\left(\alpha_h, \frac{C_{h1}}{C_1}\right) = 0, \quad \text{and} \tag{6a}$$

$$(W'-\bar{\alpha})\frac{p_1 X_1}{1+\tau} + W'\left[\sigma p_1^* \frac{\partial C_1}{\partial \tau} + \tau p_1 \frac{\partial X_1}{\partial \tau}\right] + \sum_j H\operatorname{cov}(\alpha_h, K_{hj})\frac{\partial r_j}{\partial \tau} = 0. \tag{6b}$$

In each of these equations, the first term on the left–hand side measures the gain from shifting extra revenue from a representative individual, with marginal utility of income equal to $\bar{\alpha}$, to the government. The second term measures any resulting efficiency loss. This efficiency loss arises due to changes in C_1 and X_1, since in each case the marginal benefits differ from the marginal costs due to taxes.[14] The remaining terms measure the distributional gains or losses resulting from the tax change. For example, if the "deserving" individuals, who have a relatively high value of α_h, also have a relatively low value of C_{h1}, then the covariance in equation (6a) is negative, implying that a tax increase is more attractive since it is paid more heavily by those with low α's.

If the optimal tax policy does not distort trade, then at this optimum $\tau = 0$. If, however, the left–hand side of equation (6b) is necessarily positive when evaluated at this point, then we know that the optimal τ is positive, and conversely. In order to shed light on the sign of the left–hand side of equation (6b), when evaluated at $\tau = 0$, we need to know more about the derivative $\partial C_1/\partial\tau = \sum_h \partial C_{h1}/\partial\tau$. Increasing the tax on production affects consumption of good 1 because it affects factor prices, even though it does not change output prices. In order to simplify the story, let us assume that the utility function is additively separable between consumption and factor supplies, so that each individual's demand curve for good 1 depends only on output prices and factor income, denoted by Y_h, where factor income equals $\sum_j r_j K_{hj}$. In addition, let β_{h1} represent the fraction of extra factor income spent on good 1 by household h, and let $\bar{\beta}_1$ be the average value of β_{h1}.[15] Under these assumptions,

$$\frac{\partial C_1}{\partial\tau} = \frac{\bar{\beta}_1}{q_1}\left[-\frac{p_1 X_1}{1+\tau} + \sum_j r_j \frac{\partial K_j}{\partial\tau}\right] + H \operatorname{cov}\left(\frac{\beta_{h1}}{q_1}, \frac{\partial Y_h}{\partial\tau}\right). \tag{7}$$

Here, the first term on the right–hand side equals the average drop in C_1 per dollar drop in income times the aggregate change in income. The drop in income includes both the direct effect of the tax change plus the effects of any resulting behavioral response. The second term captures any effects arising from the income drop being concentrated in households where β_{h1} is particularly large or small.

If we substitute the value of $(W' - \bar{\alpha})$ from equation (6a) into (6b), and make use of equation (7) we find that the value of the left–hand side of equation (6b) equals

$$\frac{W'\sigma}{1+\sigma}\left[p_1^* X_1(\epsilon_q - \bar{\beta}_1) + \bar{\beta}_1 \sum_j r_j \frac{\partial K_j}{\partial \tau} + H \operatorname{cov}\left(\beta_{h1}, \frac{\partial Y_h}{\partial \tau}\right)\right] + p_1^* X_1 H \operatorname{cov}\left(\alpha_h, \frac{C_{h1}}{C_1}\right) + H \sum_j \operatorname{cov}(\alpha_h, K_{hj}) \frac{\partial r_j}{\partial \tau}. \quad (8)$$

In general, this expression can take on either sign, indicating that optimal trade distortions can be either positive or negative. However, if factor supplies are inelastic with respect to uncompensated changes in factor prices, and if the three covariances are small, then this expression is positive as long as $\epsilon_q > \bar{\beta}_1$. If the utility function were Cobb-Douglas, then $\epsilon_q = 1$, and β_1 is the fraction of total income spent on good 1 so is less than one, implying that the optimal τ is positive. In this special case, trade would be *subsidized*.

The intuition for this result is fairly straight forward. By ignoring the covariance terms, distributional effects are ignored, implying that all that matters are revenue gains and efficiency losses. The efficiency loss from raising a dollar of extra revenue by any means, starting from a situation with only a sales tax on good 1, equals the resulting drop in consumption of good 1 times the sales tax rate. When the sales tax is used to raise extra revenue, the price of good 1 rises and the resulting drop in consumption of good 1 depends on its own price elasticity, ϵ_q. In contrast, when a production tax is used, the average rate of return to factor supplies drop. If we ignore changes in factor supplies, then this drop in income leads to a drop in expenditures on all goods, where the drop in expenditures on good 1 is proportional to β_1.

If the sum of the remaining terms is sufficiently negative, however, trade may end up being discouraged rather than encouraged. If, for example, the change in factor supplies under a production tax results in a further fall in income, then consumption of good 1 will fall yet more making a production tax less attractive. Estimating the direction of change in factor supplies due to a rise in τ is complicated, however. To begin with, the uncompensated price elasticity of a factor can in general be either positive or negative. In addition, while a tax on production of good 1 must lower the return to the factor used relatively more in industry 1 vs. industry 2, it must *raise* the return to the other factor.[16]

All we can say is that if the uncompensated price elasticity of the factor used most heavily in industry 1 is large enough, and the uncompensated price elasticity of the other factor is not too high, then results could reverse. If good 1 is industrial output, and good 2 is agriculture, then an increase in τ would presumably hurt capital owners and skilled workers, while incomes of farmers would necessarily increase since the cost of other factor inputs has dropped while output prices remain unchanged. The supplies of capital and skilled labor are likely to be quite elastic, and more elastic than the supply of farmers, so this reversal could well happen.

The third term in brackets may also be negative. This would occur if capital owners and skilled workers spend a larger fraction of their incomes on industrial goods. As a result, the drop in income which arises from an increase in τ would be largest among those most likely to buy industrial goods, resulting in a larger fall in C_1.

The last two terms in equation (8) capture distributional implications of the tax change. If the tax on production of good 1 lowers the incomes of capital owners and skilled workers, and raises the incomes of farmers, this may make the tax more desirable because of its distributional effects.[17] Because of these conflicting pressures, in general the optimal trade distortion could be of either sign.

If other subsets of the initial set of tax instruments were used, the analysis is similar, but the conditions determining whether trade is encouraged or discouraged are at least as complicated. Rather than develop these cases explicitly, we provide some numerical examples below to provide some sense of the nature of the resulting optimal tax rates. Given the common use of nontariff trade distortions, however, we thought it useful to discuss the characteristics of the optimal policies when nontariff barriers to trade are used instead of tariffs or the equivalent tax barriers. The particular example we choose to focus on is one in which a country uses a tax on production of good 1 to raise revenue, but in addition has the power to restrict imports of good 1. How will the resulting policy compare with one in which explicit tariffs are used instead?

One complication that must be addressed in this situation is who receives the rents which arise from imports which cost less on the international market than they sell for on the domestic market. If the government were to sell import licenses, then the government receives these rents in the form of license fees. With market clearing license fees, quotas have identical economic effects to tariffs.[18] Similarly, if licenses were distributed in proportion to supplies of either or both factors, then the results would again be identical to those found with explicit tariffs — the subsidy to factor supplies created by the distribution rule for the licenses would, under optimal policies, be offset by a surtax which raises as much revenue as is lost through giving away the licenses. If import licenses are distributed without charge, however, then results will differ. We explore two special cases. In the first, licenses are distributed in a lump–sum fashion among domestic residents, or perhaps as a function of the exogenous K^*_{hj}. Alternatively, the import licenses could be distributed among foreign firms as, for example, with a voluntary export restraint (VER).

If the nontariff barriers to trade lead to a domestic price for good 1 equal to $q_1 > p^*_1$, rents derived from imports equal $(q_1 - p^*_1)M_1$, which we denote by π_1. Assume that the rents are given to domestic residents and that the fraction θ_h of these rents go to household h. What will be the nature of the optimal policy? Rather than describing the resulting first–order conditions in detail, we simply point out some important aspects of the problem.

Let us focus first on the policy in which the net distortion to trade is zero, so that $p^*_1 = p_1$, implying that $\tau = (q_1 - p^*_1)/p_1$. At any given tax rate τ, the outcome is the same as would occur with a sales tax on good 1 at a rate $\sigma_1 = \tau_1$ along with a lump–sum transfer to each household h equal to $\theta_h(q_1 - p^*_1)M_1 > 0$. In contrast, an explicit tariff in combination with a production tax at the same rate on good 1 is exactly equivalent to a sales tax, without any lump–sum transfers. Therefore, at each possible production tax rate, aggregate tax revenues are lower when nontariff rather than tariff barriers are used, creating pressure to raise tax rates to compensate for this loss in revenue. The marginal efficiency cost of raising tax revenue, at any initial value of τ, may not even be higher when nontariff rather than tariff barriers are present, since aggregate lump–sum transfers could well decline as q_1 rises if M_1 drops by enough in response. Another complication that arises in this situation is that distributional benefits (or costs) may result from the lump–sum transfers, making higher tax rates more (less) attractive. Optimal tax rates can therefore be either larger or smaller when nontariff barriers replace tariff barriers.

The same complications arise as previously in determining the nature of the net trade distortions. In addition, however, if we were to increase τ_1, holding q_1 fixed, lump–sum transfers now increase as long as imports increase, whereas previously tariff revenue increased. As a result, protection is more valuable than before.

If rents from the difference between foreign and domestic prices of good 1 go to foreigners, the government may still wish to impose nontariff barriers. By doing so, output of the taxed good increases, allowing government expenditures to expand. As long as these extra government expenditures are valued highly enough, trade restrictions will appear attractive.[19]

This discussion of the effects of nontariff barriers can be applied also to foreign exchange controls. Through administrative control of the exchange rate, domestic prices can differ from world prices. If the resulting controls reduce international trade, then $p_1^*/p_2^* < q_1/q_2$. As a result, while $\sum_j p_j^* M_j = 0$, under foreign exchange controls $\sum_j q_j M_j > 0$. With explicit tariffs, $\sum_j q_j M_j$ simply equals tariff revenue. If the government sells access to foreign exchange, or receives all the rents through a government monopoly controlling all international trade, then again the results would be the same as with explicit tariffs. If access to foreign exchange is given away, however, then the analysis would be the same as with nontariff barriers.

Numerical Example

In order to shed further light on the nature of optimal policies, we decided to explore a simple numerical example. Specifically, we assumed that both the production functions and the utility functions were Cobb–Douglas. Let the share of revenue in industry i used to purchase inputs of factor 1 be denoted by λ_{i1}; the rest of the revenue is used to purchase the second factor. Assume that there are two types of households. The first type supplies only the first factor, and the second type supplies only the second factor. The utility function of the h'th type is denoted by $U_h = \sum_i \beta_{hi} \ln C_{hi} + \beta_{h3} \ln(K_h^* - K_h) + \beta_{h4} \ln R$, where $\sum_{i=1}^3 \beta_{hi} = 1$. The government chooses its policy so as to maximize $\sum_i \omega_i U_i$. In interpreting these results, we assume that factor 1 is capital, factor 2 is labor, good 1 is industrial output, and good 2 is agricultural output. Type 1 households are therefore capital owners, while type 2 households are workers. We assume that $\lambda_{11} = .7$ and $\lambda_{21} = .3$, so that industrial production is relatively capital–intensive. In addition, we assume that $\beta_{11} = .65$ and $\beta_{21} = .5$, so that capital–owners spend relatively more of their income on industrial goods. The compensated own price elasticities of factor supplies are initially set equal to 0.15, and factor endowments are each initially set equal to 1.0. Finally, we set $p_1^* = 0.9$ and $\beta_{h4} = .2$. These parameters imply that good 1 will be imported, except under extreme policies.

Several idiosyncratic characteristics of this model should be pointed out. To begin with, uncompensated factor supply elasticities are zero, eliminating this consideration from the analysis. In addition, some care is needed when interpreting distributional effects. We did not build in diminishing marginal utility of income. As a result, the marginal social utility of income to household h equals simply $\omega_h V_h / r_h$, so that a higher utility level in itself implies a higher marginal utility of income. In deciding what value of $\omega \equiv \omega_1/\omega_2$ is reasonable, keep in mind that we report the aggregate, not the per capita, income and consumption levels of each group. To the degree that there are fewer capital owners than workers, then the relative income of individual capital vs. labor owners exceeds their relative share of aggregate income, implying that a utilitarian objective would likely assign capital owners less weight. In addition, even if each group faced the same factor price, the resulting utility level of the capitalists would differ because of the differing weight they place on consumption of good 1. If the prices of the two consumption goods were the same, the capitalists would have higher reported utility, given the characteristics of a Cobb–Douglas utility function with differing combinations of weights on different goods. To compensate for this, the social welfare weight on their utility would need to be lower. We therefore focus on utility functions with $\omega \leq 1$.

The resulting optimal tax rates are reported in Table 1. The first two rows in the Table report the optimal tariff rate for two different values of the relative weight, ω, on the utility of the capitalists. When the tariff rate increases, capitalists gain relative to workers because output of the capital intensive industry expands, bidding up the rental price of capital relative to the wage rate. However, a higher tariff rate also raises the consumer price of industrial goods, on which capitalists spend a larger share of their income. Given our parameters, the first effect is more important, and the tariff rate rises as capitalists are given more weight in the welfare function.

The next two rows describe the optimal tax rates when both a tariff and a tax on production of good 1 are available. Notice first that the tax rates, and the fraction of

GDP used for public goods, are much higher than when only a tariff is used — raising revenue is far easier with a somewhat broader tax base. (Seen from a different perspective, the fixed costs associated with domestic taxes must be quite large before it is not worth incurring such costs.) As a result, utility levels are also higher, particularly for workers who consume relatively less of the first good. The optimal tax rates are very sensitive to the distributional weight, ω, however. When $\omega = .5$, so that capitalists get less weight, trade is subsidized, implying that imports occur in spite of the fact that the world price of good 1 exceeds the domestic producer price of good 1. The net tariff rate can be measured by $(p_1 - p_1^*)/p_1^* = (t_1 - \tau_1)/(1 + \tau_1)$, which in this case equals -12.7%. When $\omega = 1.0$, however, trade is slightly discouraged.[20] As in the previous case when only a tariff was used, trade distortions have conflicting distributional effects, but tariffs on net aid capitalists by increasing demand for the capital intensive good. When $\omega = 1.0$, aiding capitalists is desired because the marginal social utility of income to capitalists exceeds that for workers, given the algebraic properties of the Cobb–Douglas utility functions being used.

The following two rows describe the optimal tax rates when a tariff, a tax on domestic production of good 1, and a tax on domestic sales of good 2 are used.[21] Again, we find that either trade taxes or subsidies are possible, depending on the distributional weights used. Note, however, that social welfare, and the relative size of the government, increase only slightly when we add a sales tax on good 2 to the available tax instruments, implying that only minor fixed costs would lead a country to use a simpler tax system. Since workers buy relatively more of good 2, their welfare falls when this extra tax is introduced, while the welfare of capitalists increases.

In addition, we examined the effects of eliminating tariffs as a possible tax instrument, as might occur under GATT or IMF pressure. If this left the country with only a tax on domestic production of good 1, social welfare and government expenditures would drop substantially. In spite of the loss of tariff revenue, the production tax rate falls dramatically, in order to keep the trade distortion from becoming too large. The loss is large enough to justify large administrative costs of adding further tax instruments. If the country were left with both a tax on domestic production of good 1 and a tax on domestic sales of good 2, then there would be a major shift towards use of the sales tax — the trade distortions created by the production tax are too large to make its use attractive. Given these readjustments in domestic tax rates, eliminating tariffs does not necessarily reduce trade distortions, though trade subsidies become more likely than trade taxes.

We tried a variety of sensitivity tests to see to what degree these results changed as various parameter values were changed. Changing any of the parameters except for the distributional weights had only minor effects on the size of the optimal trade distortions.

In Table 2, we explore how nontariff barriers would be used if tariffs are not available and only domestic production of good 1 is taxable. For each value of ω there are three sets of results, describing how the optimal policies vary, depending on who receives the profits from the import licenses. There are several striking characteristics of these results. To begin with, the optimal nontariff barriers are very high. For example, when the licenses are given to capital owners and $\omega = .5$, the nontariff barrier leads to a domestic price of good 1 which is 53.8% above its price in the world market. The optimal nontariff barriers are more restrictive than the optimal tariff barriers. In fact, when the licenses must be given to foreigners, the optimal nontariff barriers are prohibitive, leading to autarky. These high barriers result in increased tax revenue from domestic production of good 1, which helps offset the lost tariff revenue. This increase in production of good 1, which is capital intensive, also helps capital owners to the point where they would normally prefer nontariff to tariff barriers. In contrast, workers would normally prefer tariff barriers. While social welfare is always higher with tariff than with nontariff barriers, the difference is often very small, implying that a country would not put up much resistance to international pressure to drop tariffs. One other surprising result is that capital owners would rather have foreigners receive the import licenses rather than receiving the licenses themselves. When foreigners get the licenses, the government responds by prohibiting imports, leading to a large enough increase in demand for the capital intensive good that the resulting rise in the rental price of capital more than offsets the loss in license revenue.

Table 2 also illustrates a general contribution to the literature on tariff–quota (non)equivalence. This literature has adopted a partial equilibrium focus and has concentrated on the existence of uncertainty, dynamics, or imperfect competition to generate tariff quota nonequivalence. By explicitly modeling quotas in a general equilibrium setting, we have shown that the presence of distorting taxes in a perfectly certain and static competitive economy gives rise to tariff–quota nonequivalence. A formal and more general treatment of this phenomenon is the subject of forthcoming work by the authors.

Implications for Observed Tax Policies

The above derivations characterize the optimal tax/tariff policies conditional on the set of tax and tariff instruments used. The choice of a set of policies depends on the pattern of fixed costs for different combinations of tax instruments. While theory alone cannot tell us the pattern of these fixed costs, we propose the following simple story. Under any tax system, each taxpayer is monitored to some degree and audited with some probability. To do this requires a certain amount of skilled manpower, which due to pressures towards factor price equalization costs roughly the same in all countries. The average monitoring cost per taxpayer may vary across categories of taxpayers, however, depending for example on the complexity of the transactions involved.[22] While the average monitoring cost for a given category of taxpayer should be roughly the same across countries, however, the tax revenue collected per taxpayer will vary substantially, depending primarily on the income level of the country.

Within a country, the relative importance of monitoring costs, compared with revenue raised, is likely to vary substantially across categories of tax. It seems plausible to presume that border taxes collect a lot of revenue relative to monitoring costs, since in most countries relatively few people are sufficient to man the border. Taxation of industrial firms is also likely to collect a lot of revenue compared with monitoring costs, due to the large size of most industrial firms. In contrast, taxation of retail outlets should be significantly more expensive, while a graduated personal income tax should be even more difficult to administer.

In deciding on the optimal choice of tax bases, a country would compare social welfare under each possible system, since the choices are nonmarginal. The per capita efficiency and equity gains from shifting to a more flexible tax system are basically proportional to the GDP per capita of a country, while the per capital increase in monitoring costs should be roughly similar across countries. Therefore, richer countries would be expected to choose more flexible tax systems than poorer countries. Since tariffs plausibly have the lowest monitoring costs relative to revenue raised, this story leads us to expect that the poorest countries would rely primarily on tariffs, somewhat less poor countries would use production taxes as well, while richer countries should use a variety of other tax instruments, such as retail sales taxes and personal income taxes.[23]

Therefore, the poorest countries should be observed discouraging trade, due to their reliance on tariffs to raise revenue. As seen in Table 1, however, the cost of using such a narrow tax base can be very high, implying that government revenue will be a small fraction of GNP. Somewhat less poor countries may either encourage or discourage trade on net. The figures in Table 1 suggest that any distortion is likely to be small, however, in spite of the observed use of tariffs. These countries are likely to have a much larger government sector than the poorest countries. The gain from further broadening of the tax base seems to be quite modest according to the figures in Table 1. The richest countries, which use the full complement of tax instruments, have no reason to use tariffs unless they have market power, and they can in principle make use of this market power without relying on tariffs. While other more detailed forecasts can be obtained from the theory, the data at this point are inadequate to test them.

What does this model imply would happen if a country were to agree to eliminate any explicit tariffs? Some countries may not have had tariffs to begin with. Even if a country did have tariffs, in principle it can eliminate the tariff yet duplicate its effects, for example by cutting the production tax on each good by the original size of the tariff on that good and by raising the sales tax rate on the good by the same amount. However, these changes may create extra administrative costs, which may not be worth the price. For example, if a country initially has a tax on production of good 1 and a tariff on imports of good 1, but no sales tax on good 1, what happens if the tariff is eliminated? Tariff revenue is lost, and in addition production of good 1 will fall since imports are now cheaper, implying a drop in government revenue. This increase in imports can be offset with nontariff barriers, though the revenue from tariffs is still lost. Alternatively, the government can pay the fixed costs to expand its tax system. The net effect of eliminating tariffs on trade distortions will vary, depending on the set of taxes used after tariffs are eliminated. The results in our numerical example suggest that trade distortions are not likely to be reduced significantly as a result of eliminating tariffs, and may well get worse.[24]

2. Estimates of Actual Trade Distortions

Rather than developing a formal test of the above theory, our intent in this section is to shed light on the actual pattern of trade distortions, taking account of both tariffs and the trade distortions created by the domestic tax systems in various countries. We begin by describing the data and their limitations. We then explain how the data are used to investigate linkages between domestic taxes and border taxes. We conclude with the presentation and discussion of the results.

The Data and its Limitations

Our primary data source is the International Monetary Fund's (IMF's) Government Financial Statistics, which reports total tax and nontax revenue collected by the central government in all major countries from 1970 to 1987. Several components of total tax revenue are reported. We use data on revenue from corporate taxes, payroll or manpower taxes, individual income taxes, domestic sales and value added taxes on goods and services, import duties, and export duties. These variables give a rough breakdown of the share of government revenue from different sources, but say nothing about the corresponding tax rates.[25]

In order to obtain an estimate of the tax rate associated with each tax, some estimate of the relevant tax base is necessary. We use the data from the IMF's International Finance Statistics (IFS), which provides national data on the levels of imports and exports, private consumption, and GDP (all in the domestic currency). We also obtain data on population, the exchange rate (domestic currency to U.S. dollar), and a GDP deflator from the IFS. Finally, data on the 1980 share of GDP that is industrial output is obtained from the World Development Report (1980).

Tax rates are formed for each of the 33 countries in our sample as follows.[26] The import tariff rate is given by import tariff revenue divided by value of imports. The export tax rate is analogously defined.[27] Construction of other tax rates is less straightforward.

The production tax rate is intended to measure the degree to which relative domestic output prices are distorted by the domestic tax system, resulting in a trade distortion. Which of the reported taxes distort relative output prices? Presumably, corporate taxes do so because effective rates vary by sector, and because parts of the economy are noncorporate. While in some circumstances, sales taxes may further distort the relative prices of domestic output, we do not have enough information to judge when this is the case.[28] Similarly, personal income tax rates and property tax rates may differ by industry. For example, it is much easier to tax the labor income, capital income, or capital value in the industrial sector than to tax the income or capital of farmers and other self-employed individuals.[29] Since any trade distortions created by sales, personal income, and property taxes likely vary greatly be country, and in ways that are unknown given the available data, we chose to ignore any trade distortions created by these taxes. A further question concerns how to treat nontax revenue. This revenue can come from a variety of sources. Our presumption was that a primary source of this revenue was profits from state enterprises in the industrial sector. We therefore chose to define revenue from production taxes to equal corporate tax revenue plus nontax revenue. To the extent that nontax revenue comes from other sources, our results may be misleading.[30] The tax base for the production tax is taken to be industrial output. The resulting figure for the production tax rate, which equals production tax revenue divided by industrial output, is therefore an average tax rate on industrial output.[31]

Industrial output is itself a constructed variable for years other than 1980. We first regress the 1980 industrial share of GDP on real per capita GDP (denoted in 1980 US$) and its square.[32] Using the actual 1980 value for the industrial share (I_{80}) as a seed value, we create a time series of I for each country according to the relation:

$$I_t = I_{80} + \alpha_1(GPD_t - GDP_{80}) + \alpha_2(GDP_t^2 - GDP_{80}^2)$$

where the α's are from the estimated regression. The production tax rate is then set equal to reported production tax revenue divided by the product of GDP and our estimate of the industrial share of GDP.

Given the various strong assumptions that must be made to construct a production tax *rate* from the available data, we also construct two alternative measures of the production tax rate. In one alternative measure, we exclude nontax revenue. Since nontax revenue can come from a variety of sources, we want to check on the role of nontax revenue in our results. We also compute production tax rates using GDP instead of the industrial share of GDP as the tax base. For richer countries, this may yield more accurate rates.

Finally, we compute sales tax rates and individual income tax rates. In each case we use GDP as the tax base. Revenues from sales taxes are reported on the GFS tape. We take revenues from payroll taxes as well as revenues collected from individuals as the revenue of our income tax. These very gross approximations are presented only to give some feel for the structure of tax rates other than trade or production tax rates.

We made no attempt to measure nontariff barriers (NTBs). Nogues, Olechowski, and Winters(1986) report the percent of trade affected by NTB's in sixteen industrial countries, but say nothing about the implicit tariff rates associated with these NTB's. Leamer(1988) presents a thorough and amusing account of the problems associated with attempting to carefully construct a more satisfactory NTB data base. Countries may differ in their reliance on tariff vs. nontariff barriers to trade. As a result, observed differences in the use of tariffs across countries at a given date, or across time for a given country, may provide a very misleading indication of the differences in tariff plus nontariff barriers. Similarly, we know virtually nothing about nontax distortions within the domestic economy. Many countries, for example, have regulations causing agricultural prices to differ systematically from marginal costs, yet we would not know this given the available data.

In addition, from these data alone, we know nothing about which goods are subject to tariffs and production taxes. Based on the theory, what we want to measure is the difference between the tariff rate and the production tax rate for each good. Aggregate revenue figures from production taxes and tariffs shed no light on these differences. For example, if production of only industrial goods is taxed, and imports of agricultural goods are taxed, the implied distortions are very different than if both taxes and tariffs apply only to industrial goods, yet we cannot tell these two scenarios apart in the data.

Application of the Data to the Model

Even if we knew everything about the domestic tax system, there is a further conceptual question concerning how to measure the size of any trade distortion. All we have claimed so far is that there are no trade distortions if a marginal increase in the output in one industry at the expense of output in any other industry, holding aggregate factor supplies constant, does not affect the value of domestic output in the world market. To the extent that this is not the case, trade patterns are distorted.

There are a variety of ways of measuring the extent to which marginal reallocations of resources can lead to a change in the value of total output, measured at world prices. For example, in a two good setting, extra output in one industry can be produced with many different combinations of factor movements from the other industry. If production had been efficient, any marginal change has no effect on the value of total output. If production were not efficient, however, then the resulting change in the value of total output would depend on the composition of the factors that are shifted between industries. The approach we adopt is to measure the change in the value of total output if industry 1 produces one more unit, using its *existing* technology, with industry 2 then using whatever factors are left. We will use this change in the value of total output as an estimate of the size of any trade distortions.

These trade distortions arise from domestic taxes and tariffs in our model. In order to simplify the interpretation of the resulting measure, we use the same normalizations of the tax law described in section 1. In particular, we set the tax rate on the output of industry 2 and the tariff on imports of good 2 at zero, making the required adjustments in the other tax and tariff rates. In addition, we now allow for factor taxes at the firm level, with rates varying by firm, in addition to the factor taxes faced by individuals. However, we define the individual tax on each factor to equal the combined firm and individual factor tax rates in industry 2, thereby by construction setting the firms' factor tax rates in industry 2 equal to zero. This normalization then defines the factor tax rates in industry 1. Let the resulting tax rate on inputs of factor j in industry i equal γ_{ij}, and let the resulting required before tax rate of return on factor j in industry i equal s_{ij}.

If industry 1 expands output by one unit, using its existing technology, and industry 2 loses these inputs, then the change in the value of total output, denoted Δ, equals

$$\Delta \doteq \sum_j (p_1^* f_j^1 - p_2^* f_j^2) \left(\frac{K_{1j}}{X_1} \right). \tag{8a}$$

But competitive behavior implies that $p_i \partial f^i / \partial K_{ij} = r_j/(1-\gamma_{ij})$, while competitive pricing implies that $p_i^* = p_i(1+\tau_i)/(1+t_i)$. Using these expressions to simplify equation (8a), given the above normalizations, we find that Δ equals

$$\Delta = \tau p_1 - t p_1^* + \sum_j \gamma_{1j} s_{1j} (K_{1j}/X_1). \tag{8b}$$

But this expression simply equals the sum of all the extra taxes due if output of the first good increases by a unit, and imports of this good decrease by a unit, with output and imports of good 2 changing as required. Equation (8b) then describes our measure of the extent of any trade distortions. We will need to be careful in using it, however, because of the various normalizations of the tax and tariff rates.

In making use of the available data to estimate the extent of any trade distortions, we make the following assumptions. First, we assume that each economy consists of two sectors, an urban industrial sector and an agricultural sector. We assume that production tax revenue is collected entirely from firms in the industrial sector.[33] To the extent that other sectors are subject to production taxes, our results will be misleading. For example, at least in the richer countries, services and other primarily nontraded goods may well form an important part of the production tax base. A production tax on nontraded goods is equivalent to a consumption tax on these goods, and does not distort the efficiency with which the existing output is produced. Therefore, to the extent to which services are subject to the production tax, this part of the revenue should not in principle be included in our measure of the trade distortion created by the production tax.

We measured the average tax rate on imports and the average tax rate on exports as discussed above. Let e denote the export tax rate, so that $(1+e)p_i = p_i^*$ on whatever good i is exported, and let t' denote the tariff rate on imports. Then when we renormalize the tariff rates to set the export tax rate to zero, the resulting tariff rate, t, equals $t = t' + e(1+t')$. We made no attempt to capture the presence of nontariff barriers.

Whether of not tariffs offset the trade distortion created by the production tax depends on whether or not the country exports or imports industrial goods. If it imports these goods, then the production tax encourages trade, whereas if it exports these goods then the production tax discourages trade. In contrast, when tariffs collect positive revenue they serve to discourage trade. Therefore, the two distortions offset if industrial goods are imported and reinforce if industrial goods are exported. Unfortunately, we have no data on the composition of each country's exports and imports. We therefore made the crude assumption that the countries in the richest two quintiles export industrial goods to countries in the poorest three quintiles.[34] Given our assumption that industrial goods are imported in the countries in the poorest three quintiles, production taxes in these countries encourage international trade, offsetting the effects of any tariffs. Therefore, the net distortion to trade, as shown in equation (8b), is the tariff rate minus the production tax rate. In the countries in the richest two quintiles, however, we assume that industrial goods are exported in which case the production tax discourages international trade, reinforcing the effects of any tariff. Therefore, the net distortion to trade in these countries equals the tariff rate *plus* the production tax rate.[35]

Data Analysis and Results

In this paper, we simply report our estimates of various average tax rates, and the implied net trade distortions, and do not attempt a more formal statistical test of the above theory. Given the many weaknesses of the available data, any more ambitious use of the data seemed inappropriate.[36]

Table 3 illustrates the structure of tax rates in 1980, reporting results for five groups of countries divided according to their per capita GDP.[37] The Table reports the mean tax rate (and its standard deviation) within each group of countries for each tax, as well as the implied trade distortion. The cell for the first row and first column, for example, tells us that the countries in our sample that fall into the bottom quintile of per capita income have on average a tariff rate of 21.4 percent. The same tax rate for countries falling in the top quintile of per capita income is only 1.6 percent.

The first row of Table 3 gives the import tax rate, t'. The second row gives the export tax rate, e, while the third row corresponds to the net border distortion, $t' + e(1 + t')$. The fourth row of Table 3 give the production tax rate as described above. The fifth row then provides a summary measure of the net trade distortion, based on our assumption that only industrial goods are subject to the production tax, and that these goods are imported by countries in the poorest three quintiles and exported by countries in the richest two quintiles. A positive value for the net trade distortion implies that on average the combination of trade and domestic production taxes act to discourage trade.

The sixth and seventh rows report alternative measures of the production tax rate. The production tax rate reported in the sixth row excludes nontax revenue from the tax revenues, while the rate reported in the seventh row used GDP instead of just industrial GDP as the tax base. The eighth row gives a rough estimate of sales tax rates.[38] The ninth row provides an equally rough estimate of income tax rates. The tenth row gives government revenue as a share of GDP. The bottom row gives the average per capita GDP of the countries in each of the quintiles.

The results tend to support several of the predictions of the theory developed in Section 1. In particular, we find that:

1. *As countries become richer, import tariff rates in particular and net border distortions in general decline.* This is illustrated in the first and third rows of the Table 3. Import tax rates monotonically decline from a high of 21.4 percent in the poorest quintile of countries to a low of 1.6 percent in the richest quintile. Net border distortions similarly decline (although not quite monotonically) from 26.9 percent to only 1.7 percent. The nonmonotonicity in the decline of net border distortions is due to an unusually high export tax rate in the third quintile, but this value has a very high standard deviation associated with it. This is consistent with the notion that poorer countries tend to rely more heavily on border taxes to fund public expenditure. Without other sources of revenue, as illustrated for example in Table 1, tariff rates are fairly high. When countries are richer and as a result use a broader range of domestic taxes, border tax rates fall appreciably.

2. *Poorer countries seem to have much higher net border distortions than net trade distortions.* Net border distortions in the poorest three quintiles of countries appear fairly high (26.9, 20.8, and 23.1 percent respectively), yet our estimates of the net trade distortions are significantly lower (7.3, 5.8, and 10.5 percent respectively). Tariffs are to a large extent simply offsetting the distortions of domestic production taxes (and visa versa). Net border distortions cannot be viewed to be a good approximation to net trade distortions.

3. *The richer countries have virtually no border distortions, yet still have significant production taxes and so have significant net trade distortions.* Since richer countries impose very low border taxes, their taxes on domestic production serve to distort trade patterns. Given our assumption that richer countries export industrial goods, which are subject to

the production tax, this production tax discourages international trade, serving the same role as a tariff.

To the degree to which production taxes are assessed on nonindustrial goods, our estimates of the net trade distortion are biased upwards. However, our figures also ignore nontariff barriers to trade, and to that degree underestimate net trade distortions.

4. *Richer countries levy a broader range of taxes and collect more tax revenues as a percentage of GDP.* Rows eight and nine indicate that effective sales tax and income tax rates generally rise with a country's income. The income tax rate rises from 1.5 percent in the poorest quintile to 7 percent in the richest quintile, while the sales tax rate rises from 2.6 percent to 5.4 percent. Due to the construction of these tax rate variables, this result is probably due more to the larger tax bases in the richer countries than to their higher tax rates. It is no surprise, then, that government revenue as a share of GDP rises from 21.3 percent in the poorest quintile to 28.1 percent in the richest quintile.

5. *Nontax revenues are an important source of revenue for rich and poor countries.* We have assumed that nontax revenues are derived from state owned industrial firms. Without very detailed country specific information on government fiscal structure, this assumption is difficult to substantiate. Insofar as the assumption is valid, nontax revenue is a quantitatively important part of production tax revenues for countries in every income quintile. Exclusion of nontax revenues from the calculation of the production tax, shown in row six, reduces the production tax rate by about half for each quintile.

6. *Except for the countries in the richest and poorest quintiles, there is much intra-quintile variance of net trade distortions.* Only in the fifth quintile is the standard deviation of the net trade distortion even as small as half of the mean value of this distortion. While the above comments 1 – 5 illustrate some broad trends, one should refrain from assuming too much homogeneity of tax structures within quintiles.

Table 4 gives country specific information about net border distortions, production tax rates, and the resulting net trade distortion. Each entry in the Table is the time series average for a variable across those years in which enough data were available to calculate the net trade distortion.

In some cases, there are obvious explanations for why a country's tax patterns differ from those of other countries in the same income quintile. For example, much of the production tax revenue in Venezuela likely comes from the taxation of oil exports, explaining the high calculated value for this production tax. Malaysia is another oil exporting country with a high production tax rate. Here the production tax revenue is presumably mainly from a tax on exported rather than imported goods, contrary to our assumptions. It is interesting to note that Brazil, which has a reputation for restrictive policies, has no estimated net trade distortion.[39]

Countries that are members of the EEC have uniformly very small net border distortions.[40] These countries generally have sizable production taxes, however, giving rise to important net trade distortions.

Even for data within a country, there are often high standard deviations, implying significant changes in policy over the period of observation. In future work, we hope to investigate the degree to which changes in net border distortions and changes in net production taxes were coordinated so as to leave net trade distortions relatively unaffected.

3. Conclusions

What can optimal tax theory tell us about the optimal trade policy of a country? Diamond–Mirrlees(1971) showed that if all excise taxes are available, then production will be efficient under an optimal tax system. This implies in a small open economy that there should be no trade distortions if all excise taxes are available. While there may be no net trade distortions, however, tariffs could well be used to offset the trade distortions created by various domestic taxes.

Administrative costs may restrict the set of tax instruments which a country would consider using. If fewer tax instruments are used, however, then trade distortions may well exist under an optimal tax system. We find that the optimal trade distortions in small open economies can be of either sign. Richer small countries would likely use a broader set of tax instruments, however, implying that trade distortions are more likely in poorer small countries, as well as in countries with market power in international markets.

We used the IMF financial statistics for 30 countries during the period 1970–1987 to examine the size and pattern of net trade distortions. These data suggest that net border distortions are much larger than net trade distortions in countries in the poorer three quintiles. Countries in the richest two quintiles, however, have very small border distortions yet still have significant trade distortions created by their domestic taxes. It is likely that these distortions discourage trade. Our numbers suggest roughly comparable net trade distortions across countries at all income levels, even though border distortions are important in only the poorest countries. The data therefore suggest that the GATT restrictions on border taxes have been relatively ineffective in eliminating trade distortions in richer countries.

It is possible, however, that the net trade distortions in richer countries may not necessarily arise from the exercise of market power, and may not result in important reallocations of resources. Our theory forecasts that tax competition between countries with no market power should drive production taxes to zero, assuming that GATT agreements have eliminated border taxes. However, the optimal tax framework examines the Nash equilibrium in which each country chooses its optimal tax policy, taking as given the tax policies elsewhere. As discussed in Gordon(1983), coordination of tax policies across countries would lead to higher welfare. For example, if all countries agreed to impose production taxes at the same rate, then the location of production remains undistorted by taxes, and yet countries may find the resulting tax system more attractive on equity or efficiency grounds. Certainly no explicit agreement exists coordinating production taxes across countries. Recent experience in the E.E.C. shows how difficult it is to convince countries to restrict by international agreement their flexibility in setting domestic tax rates. Yet game theory shows that cooperative outcomes could arise without explicit agreements. Certainly the observed simultaneous reduction in corporate taxes in many developed countries, around the time of the 1986 tax reform in the U.S., suggests such an informal coordination of tax policies. In addition, the characteristics of international tax treaties suggest a concern for world efficiency. It is premature to conclude that these countries are using tariffs to exercise market power.

There is certainly much room for further research on the linkages between domestic and international taxes. We are currently looking more closely at the optimal use of nontariff barriers in the presence of distorting domestic taxes. We also hope to collect much better information about the pattern of net trade distortions, using detailed information on tariff rates vs. production tax rates by good in various countries. In addition, we hope to examine what readjustments occurred in domestic taxes in countries that have made major changes in tariff and nontariff barriers to trade. Finally, we hope to learn more about the degree to which production taxes are coordinated among countries in order to minimize trade distortions while still allowing use of this source of tax revenue.

Appendix

The objective of this appendix is to derive equations (6)-(7). This derivation is very similar to those appearing elsewhere in the optimal tax literature.

Equations (6a) and (6b) characterize the values of σ and τ which maximize the expression in equation (5). Differentiating equation (5) with respect to σ, we find that

$$\sum_h p_1^* \frac{\partial V_h}{\partial q_1} + W'\left[p_1^* C_1 + \sigma p_1^* \frac{\partial C_1}{\partial q_1}\frac{\partial q_1}{\partial \sigma} + \tau p_1 \frac{\partial X_1}{\partial \sigma}\right] = 0. \quad (A1)$$

Note that factor prices and the firms' output price, p_1, do not change when σ changes. By Roy's identity, $\partial V_h/\partial q_1 = -\alpha_h C_{h1}$, where α_h is the marginal utility of income of the h'th household. Let $\bar{\alpha} = \sum_h \alpha_h/H$. If we then substitute the expression $-(\bar{\alpha} + (\alpha_h - \bar{\alpha}))C_{h1}$ for $\partial V_h/\partial q_1$ in equation (A1) and simplify, we then get

$$-\bar{\alpha} p_1^* \sum_h C_{h1} - \sum_h (\alpha_h - \bar{\alpha}) p_1^* C_{h1} + W' p_1^* C_1 \left[1 + \left(\frac{\sigma}{1+\sigma}\right)\left(\frac{\partial C_1}{\partial q_1}\frac{q_1}{C_1}\right) + \left(\frac{\tau}{C_1(1+\tau)}\right)\frac{\partial X_1}{\partial \sigma}\right] = 0. \quad (A2)$$

But by the definition of a covariance, $\sum_h (\alpha_h - \bar{\alpha})C_{h1} = H\mathrm{cov}(\alpha_h, C_{h1})$. Using this result, equation (6a) follows from equation (A2) by simply dividing through by $p_1^* C_1$ and making use of the definition of ϵ_q.

Differentiating equation (5) with respect to τ, we find that

$$\sum_h \sum_j \frac{\partial V_h}{\partial r_j}\frac{\partial r_j}{\partial \tau} + W'\left[\sigma p_1^* \frac{\partial C_1}{\partial \tau} + \left(\frac{p_1}{1+\tau}\right) X_1 + \tau p_1 \frac{\partial X_1}{\partial \tau}\right] = 0. \quad (A3)$$

By Roy's identity, $\partial V_h/\partial r_j = \alpha_h K_{hj}$. In addition, however, if we differentiate each of the two cost functions described in equation (1) with respect to τ and sum the total derivatives, we find that

$$\sum_j K_j \partial r_j/\partial \tau = X_1 \partial p_1/\partial \tau. \quad (A4)$$

Proceeding as above, and making use of this additional result, we quickly get equation (6b).

In order to derive equation (7), note that the assumption that utility is additively separable between consumption and factor supplies implies that

$$\frac{\partial C_1}{\partial \tau} = \sum_h \frac{\partial C_{h1}}{\partial Y_h}\frac{\partial Y_h}{\partial \tau}. \quad (A5)$$

But by the definition of β_{h1}, $\partial C_{h1}/\partial Y_h = \beta_{h1}/q_1 = (\bar{\beta}_1 + (\beta_{h1} - \bar{\beta}_1))/q_1$. After substituting this expression, we find that

$$\frac{\partial C_1}{\partial \tau} = \frac{\bar{\beta}_1}{q_1} \sum_h \frac{\partial Y_h}{\partial \tau} + H \operatorname{cov}\left(\frac{\beta_{h1}}{q_1}, \frac{\partial Y_h}{\partial \tau}\right). \tag{A6}$$

Using equation (A4) and the definition that $Y_h = \sum_j r_j K_{hj}$, equation (7) follows quickly.

Footnotes

1. This basic idea is not new, having been discussed in the literature at least since Bhagwati(1971).

2. Even labor income taxes can distort relative prices of domestic products to the extent that the effective tax rates vary by industry.

3. For a discussion of GATT rules, see Dam(1970).

4. Yitzhaki(1979), Wilson(1988), Panagariya(1988) also explore the optimal size of the tax base, when a broader base implies higher administrative costs, though in a closed economy setting.

5. Mitra(1987) and Heady–Mitra(1987) also examined some aspects of the linkage between domestic and border taxes.

6. These models try to explain which groups will be favored by government policy, unlike optimal tax models which simply assume an objective for the government. Conditional on the resulting distributional preferences, the two types of models are likely to make very similar policy forecasts. The optimal tax models simply describe the Pareto efficient policies, given the desired distribution.

7. Trade theorists will recognize this as the notion that international trade extends the consumption possibility frontier.

8. We ignore taxes on consumption since a tax on the consumption of a good can be duplicated with a production tax and a tariff at the same rate on imports of this good.

9. With trade in both goods and one of the factors, and factors mobile between industries, a country would almost always specialize production to only one of the two goods, eliminating various effects we wish to focus on.

10. If good i is exported rather than imported, and exports are taxed, then it would be more natural to define an export tax rate, e_i, such that $q_i(1+e_i) = p^*$. Then, $t_i \equiv -e_i/(1+e_i)$.

11. Article 3 under GATT allows a rebate of indirect taxes, such as a V.A.T., when a good is exported, thereby eliminating any trade distortions from the tax. Doing the same for a turnover tax is very difficult, since the appropriate size of the rebate depends on the degree to which intermediate inputs in a product are transferred between firms in the course of production.

12. To the degree that tax payers are more aggressive at evading taxes when there is more money at stake, monitoring may become more expensive as rates rise, though higher penalties could substitute imperfectly for extra monitoring.

13. See the Appendix for a derivation of equations (6a), (6b), and (7).

14. The efficiency loss measure therefore takes the form of a tax rate, which measures the difference between marginal benefits and costs for the good, times the change in quantity of the good.

15. In general, the value of β_{h1} will depend on consumer prices and income.

16. Firms in industry 2 must continue to break even. Output prices are unchanged, the cost of one input has fallen so the cost of the other input must have risen in equilibrium. This is simply a manifestation of the Stolper–Samuelson Theorem of International Trade Theory.

17. Distributional objectives may differ across countries, however.

18. This equivalence assumes perfect competition, no uncertainty, and a static economic environment. Relaxation of any of these assumptions may result in tariff - quota nonequivalence. The models used in the rent–seeking literature can also lead to this result. For example, if money is used to bribe officials to obtain licenses, then the equilibrium bribe should be the market clearing price for a license, and the official wage rate of officials would in principle adjust to clear the labor market.

19. In fact, we have been able to show in this situation that a prohibitive nontariff barrier is at least a local optimum under plausible assumptions. Reducing the trade barrier slightly

from this point reduces tax revenue from domestic production, yet does not result in any savings on goods previously purchased from abroad, since there were none.

20. When $\omega = 1.5$, the optimal net tariff rate is so high that good 1 is exported rather than imported.

21. The incentive effects of these taxes can be duplicated using a sales tax on each good, at separate rates, along with either a tariff or a production tax on good 1.

22. We have assumed that the cost does not depend on the chosen tax *rate*.

23. See Tanzi(1987) and Riezman–Slemrod(1987) for empirical results consistent with these hypotheses.

24. Judging whether or not world efficiency improves is very complicated in this second–best setting, given the presence of many tax distortions.

25. A cross sectional regression analysis relating the share of revenue from each source (relative to GDP and relative to total tax revenue) to a measure of national income is provided in Tanzi(1987).

26. We selected a cross section of countries. The 33 countries initially in our sample were Argentina, Brazil, Cameroon, Canada, Chile, Columbia, Egypt, France, Germany, Ghana, Greece, India, Indonesia, Italy, Japan, Kenya, Korea, Malaysia, Mexico, Netherlands, Nicaragua, Pakistan, Peru, Philippines, Portugal, Senegal, Spain, Sri Lanka, Tunisia, Turkey, the U.K., Uruguay, and the U.S. Due to lack of data on imports and exports we dropped Chile, Indonesia, and Uruguay from the sample. The countries were selected as follows. We first included a handful of countries that underwent trade liberalization. These countries are important for future work with the data set. We then randomly selected countries from the list of countries in the World Development Report.

27. For several industrial countries, there were no data on export tax duties. The GFS do not allow us to determine whether this is simply a missing observation or whether zero revenue was collected. Rather than exclude all industrial countries except the U.K. from the analysis, we set these missing values to zero.

28. A sales tax would distort relative output prices if it is assessed based on domestic output rather than domestic consumption, if the rate differs by industry, and if no compensating adjustment takes place at the border. In addition, sales of domestic producers and sales of importers might be taxed differently. The European V.A.T. does include compensating border adjustments, so does not distort trade patterns.

29. See Ahmad–Stern(1987) for a discussion of how sales and income taxes can distort relative producer prices.

30. For example, nontax revenue may come from agricultural marketing boards. If the revenue from these boards results from higher prices charged for domestic agricultural output, then this change in relative prices offsets rather than reinforces the distortion created by the corporate income tax. If the revenue comes solely from higher prices on exports of agricultural goods, then this revenue reflects a higher effective tariff rate rather than a higher effective production tax rate.

31. This type of average tax rate is often used to measure tax distortions. See, for example, Fullerton, King, Shoven, and Whalley(1981). However, as emphasized by Auerbach(1983), it has a variety of problems. For example, the size of the tax distortion created by a corporate tax depends on the present value of depreciation deductions and tax credits that result when an investment is undertaken. But the observed use of depreciation deductions and tax credits in a given year depends heavily on the particular timing of investments that occurred in the economy.

32. The resulting regression is $IND\ SHARE = .2925 + 3.160E - 5 * GDP - 2.136E - 9 * GDP * *2$. Each coefficient is significantly different from zero at the 95 percent level. These coefficients imply that the industrial share of GDP rises with GDP until real (1980) per capita income reaches about US$7400 and then falls.

33. Our derivation of the measure of trade distortions implies that we need to know only the revenue collected from this tax, relative to output, and not the extent to which it is a tax on output, capital income, or some other tax base, as long as it is not a tax on pure profits.

34. Of course, this crude assumption will be violated in a variety of cases. For example, poorer countries which export petroleum and minerals often impose taxes on these exported goods. In fact, optimal tax theory would support taxation of these goods, even without market power in international markets, since a tax at a constant rate on this output acts as a land tax and to that extent has no efficiency cost and perhaps an equity gain.

35. Since the tariff and the production tax apply to different goods, we implicitly renormalize the production tax rates by setting the renormalized tax rate in the industrial sector to zero and setting the tax in the remaining sector equal to minus the measured production tax rate.

36. We adopt a descriptive approach for two interrelated reasons. First, as Section 1 demonstrates, there are few truly exogenous and observable variables in our analysis. Given this, simple single equation regression analysis will provide biased and inconsistent estimates. Second, the severe measurement problems with our data make any interpretation of regression results highly problematic.

37. When data needed to calculate the net trade distortion were not available in 1980, which was the case for three countries, we report the data from the latest available year instead.

38. If data were not available in 1980 for one of the following variables, we use data from the latest year available. For four countries, no data were ever available for sales tax revenues. The reported sales tax rate is therefore the average over those countries with available data.

39. The inclusion of NTB's may alter this conclusion.

40. The lack of any border distortion is mildly surprising since while intra-EEC trade is free, trade between EEC countries and the rest of the world need not be.

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TABLE 1
Optimal Tax and Tariff Rates

	Tariff on good 1	Prod'n tax on good 1	Net tariff	Sales tax on good 2	Revenue/ GDP	V_K	V_L
			Tariff only				
$\omega = .5$	.105	——	.105	——	.017	.107	.097
$\omega = 1.0$	.117	——	.117	——	.017	.108	.096
			Tariff and Prod'n Tax				
$\omega = .5$	.333	.527	-.127	——	.182	.105	.161
$\omega = 1.0$	.375	.331	.033	——	.170	.131	.142
			Tariff, Prod'n Tax, Sales Tax				
$\omega = .5$	.246	.437	-.133	.154	.194	.107	.161
$\omega = 1.0$	.252	.184	.057	.291	.186	.140	.136
			Prod'n Tax				
$\omega = .5$	——	.127	-.113	——	.020	.083	.118
$\omega = 1.0$	——	.114	-.102	——	.020	.085	.117
			Prod'n Tax, Sales Tax				
$\omega = .5$	——	.153	-.133	.559	.145	.109	.152
$\omega = 1.0$	——	.019	-.019	.692	.144	.130	.138

TABLE 2
Optimal Prod'n Tax and Nontariff Barriers

	Implicit tariff good 1	Prod'n tax on good 1	Net implicit tariff	Revenue/ GDP	V_K	V_L
			Licenses to K			
$\omega = .5$	.538	.510	.019	.169	.135	.136
$\omega = 1.0$	.482	.398	.060	.161	.138	.134
			Licenses to L			
$\omega = .5$	.620	.776	-.088	.148	.097	.164
$\omega = 1.0$	.486	.355	.097	.169	.137	.134
			Licenses to Foreigners			
$\omega = .5$	.578	.453	.086	.211	.136	.134
$\omega = 1.0$	.495	.342	.114	.172	.141	.131

Table 3
The Structure of Tax Rates

		RANK FOR VARIABLE GDPREAL				
		1	2	3	4	5
IMPORT TARIFF RATE	MEAN	0.214	0.153	0.083	0.039	0.016
	STD	0.103	0.053	0.027	0.035	0.018
EXPORT TAX RATE	MEAN	0.049	0.047	0.134	0.000	0.002
	STD	0.084	0.046	0.156	0.001	0.004
NET BORDER DISTORTION	MEAN	0.269	0.208	0.231	0.039	0.017
	STD	0.083	0.097	0.198	0.035	0.022
PRODN TAX RATE	MEAN	0.196	0.150	0.126	0.171	0.127
	STD	0.106	0.062	0.086	0.147	0.059
NET TRADE DISTORTION	MEAN	0.073	0.058	0.105	0.211	0.145
	STD	0.147	0.117	0.225	0.169	0.066
...	...	.	.	.	.	.
PRODN TAX RATE EXCLUDING NON-TAX REVENUE	MEAN	0.087	0.061	0.075	0.089	0.068
	STD	0.059	0.029	0.073	0.137	0.024
PRODN TAX RATE W/ GDP AS BASE	MEAN	0.054	0.050	0.046	0.070	0.047
	STD	0.036	0.024	0.033	0.072	0.020
SALES TAX RATE	MEAN	0.026	0.021	0.021	0.035	0.054
	STD	0.022	0.018	0.019	0.022	0.032
"INCOME" TAX RATE	MEAN	0.015	0.029	0.019	0.048	0.070
	STD	0.009	0.030	0.008	0.044	0.030
GOV'T REVENUE SHARE OF GDP	MEAN	0.213	0.187	0.193	0.275	0.281
	STD	0.077	0.070	0.078	0.065	0.144
GDP/POP IN 1980 US$	MEAN	370.133	976.392	1905.625	5862.011	11288.507
	STD	122.401	256.489	505.030	2338.675	751.764

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Table 4
The Composition Of the Net Trade Distortion

	1980 GDP QUINTILE ------- QUINTILE NO.	NET BORDER DISTORTION		PRODN TAX RATE		NET TRADE DISTORTION		GOV'T REVENUE SHARE OF GDP	
		MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD
COUNTRY									
ARGENTINA	4	0.[illegible]51	0.075	0.107	0.076	0.158	0.090	0.151	0.025
BRAZIL	3	0.132	0.034	0.142	0.081	-0.010	0.100	0.214	0.027
CAMEROON	2	0.312	0.048	0.227	0.216	0.085	0.235	0.179	0.035
CANADA	5	0.060	0.018	0.148	0.013	0.208	0.029	0.190	0.011
COLUMBIA	2	0.197	0.033	0.103	0.025	0.094	0.054	0.116	0.010
EGYPT	1	0.351	0.076	0.456	0.119	-0.105	0.187	0.394	0.039
FRANCE	5	0.002	0.002	0.103	0.009	0.105	0.008	0.377	0.030
GERMANY	5	0.004	0.008	0.050	0.010	0.054	0.009	0.275	0.018
GHANA	3	0.396	0.121	0.114	0.054	0.282	0.136	0.096	0.036
GREECE	4	0.051	0.027	0.134	0.022	0.185	0.014	0.305	0.042
INDIA	1	0.374	0.074	0.131	0.016	0.243	0.067	0.125	0.007
ITALY	4	0.002	0.003	0.074	0.014	0.076	0.014	0.325	0.033
JAPAN	5	0.030	0.013	0.095	0.011	0.125	0.014	0.113	0.010
KENYA	1	0.122	0.022	0.365	0.071	-0.243	0.056	0.198	0.022
KOREA	3	0.074	0.016	0.093	0.016	-0.019	0.016	0.165	0.020
MALAYSIA	3	0.168	0.025	0.288	0.060	-0.120	0.080	0.240	0.029
MEXICO	3	0.263	0.156	0.099	0.016	0.164	0.155	0.140	0.027
NETHERLAN	5	0.001	0.002	0.218	0.046	0.218	0.045	0.491	0.027
PAKISTAN	1	0.282	0.026	0.123	0.033	0.159	0.058	0.148	0.015
PERU	2	0.275	0.051	0.088	0.020	0.187	0.047	0.162	0.014

(CONTINUED)

Table 4
The Composition Of the Net Trade Distortion

	1980 GDP QUINTILE / QUINTILE NO.	NET BORDER DISTORTION		PRODN TAX RATE		NET TRADE DISTORTION		GOV'T REVENUE SHARE OF GDP	
		MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD
COUNTRY									
PHILLIPIN	2	0.167	0.044	0.074	0.012	0.093	0.040	0.118	0.016
PORTUGAL	3	0.096	0.003	0.057	0.011	0.039	0.014	0.269	0.015
SENEGAL	1	0.249	0.060	0.106	0.029	0.143	0.080	0.189	0.020
SPAIN	4	0.116	0.046	0.106	0.011	0.222	0.047	0.223	0.026
SRI LANKA	1	0.263	0.087	0.131	0.029	0.131	0.101	0.198	0.026
TUNISIA	2	0.227	0.030	0.228	0.064	-0.001	0.065	0.295	0.042
TURKEY	2	0.219	0.127	0.137	0.051	0.082	0.142	0.202	0.025
U.K.	4	0.010	0.011	0.203	0.028	0.213	0.025	0.354	0.021
U.S.	5	0.037	0.008	0.111	0.008	0.148	0.009	0.193	0.011
VENEZUELA	4	0.081	0.018	0.156	0.120	0.537	0.119	0.270	0.055

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