# How large is the bias against exports from import tariffs?

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**Abstract:** One goal that both developed and developing countries share is to increase their export earnings. To do this, countries sometimes resort to various export promotion schemes or request 'special and differential treatment' for their exports. However, countries have not fully embraced the notion that their own import tariffs act as a tax on their exports. That is, import protection frustrates their goal of increasing exports. This paper presents quantitative estimates of the extent to which import tariffs discourage exports. The results show that for some countries the bias imparted by tariffs is substantial. Therefore, reducing import tariffs is one way to improve export incentives.

## 1. Introduction

Developed and developing countries alike share a common goal of wanting to increase their export earnings. Developing countries frequently complain that barriers (e.g. tariffs) applied against their exports in rich-country markets make it difficult for them to achieve their goal. To overcome these barriers, developing countries sometimes resort to various export promotion schemes, such as tax concessions, which are costly, or requests for special and differential treatment for their exports. Yet, both developing and developed countries have not fully embraced the notion that their *own* pattern of import protection may be retarding their export performance. For instance, although tariff rates are generally low in developed countries, they can be quick to introduce anti-dumping duties, non-tariff barriers, or special safeguards. Also, agricultural products remain heavily protected in developed countries.

The purpose of this paper is to estimate empirically the extent to which import tariffs act as a tax on a country's export sector and thus frustrate its goal of increasing export earnings. Tariff reductions work as an 'export-promotion' strategy – a strategy that countries could pursue independently of the policy stance of other countries. That is, reducing their import restrictions is a policy option that both developing and developed countries could implement that would improve incentives to export.

A number of studies have examined the extent to which import protection taxes exports, but they used somewhat outdated information and are limited in country

coverage. The present paper assesses how import protection discourages exports for 26 developing countries using a dataset that contains the most recent information available. This paper also uses an internally consistent modeling methodology that takes into account complex interactions within an economy. In comparison, some of the previous studies did not use models that took into account all the channels through which import protection affects exports.

The next section discusses several channels through which import tariffs can discourage exports. Section 3 discusses prior literature on this issue. Section 4 presents empirical estimates of the export-tax equivalents of the structure of tariffs in 26 developing countries. Section 5 explains how export incentives would be affected by alternative tariff-cutting scenarios in the Doha Round. Section 6 concludes.

## 2. Import tariffs as a tax on exports

Tariffs on imports create a disincentive to export by directly raising the domestic price of imports relative to exports, or equivalently, by reducing the price of exports relative to imports. As shown by Lerner (1936), there exists a symmetry between the effects of an import tariff and an export tax on domestic relative prices. As an illustration, in a simple model of two goods (exports and imports), which are traded at exogenous world prices and with balanced trade, an ad-valorem tariff on imports at rate $t$ will alter domestic relative prices according to

$$\frac{P_X}{P_M} = \frac{PW_X}{PW_M(1+t)} \tag{1}$$

where $P_X$ and $P_M$ are the domestic prices of exports and imports and $PW_X$ and $PW_M$ are the corresponding world prices. Alternatively, an export tax, levied as a percent of the world price at rate $\tau$, would alter relative prices as follows

$$\frac{P_X}{P_M} = \frac{PW_X(1-\tau)}{PW_M} \tag{2}$$

because an export tax reduces the net-of-tax price received by an exporter. Domestic relative prices will be the same under an import tariff or an export tax when equation (1) equals equation (2), or when the export tax rate, $\tau$, equals[1]

$$\tau = \frac{t}{1+t} \tag{3}$$

For example, a 25% tariff on imports would have the same effect on relative prices as a 20% export tax.

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1 If the export tax is expressed as a proportion of the domestic price, instead of the world price, then $PW_X = P_X(1+\tau)$, and an export tax of rate $\tau$ would have the same effect on domestic relative prices as an import tariff of rate $t$.

Tariffs change the prices of imports, which, in turn, alter the prices of primary factor inputs: wages and rentals on capital. For example, in a simple, two-good, two-factor model, if imports are labor-intensive, then a higher tariff would raise the wage rate. Assuming labor is mobile across all sectors of the economy, the higher labor costs would be spread across all sectors in the economy, which, by itself, would raise costs of production in the export sector and reduce output. It is also true that a tariff will reduce the price of some factors of production, so the extent to which a tariff affects factor costs in a sector depends on the sector's factor intensity. When there are more than just two goods and factors, the relationship between changes in commodity prices and factor prices becomes much more complicated, still, changes in factor costs are ways in which tariffs can affect exports.

In a more complex model that includes nontraded goods, tariffs still impart a bias against exports, although the mechanism becomes more complex. In one type of model in which both the demand and supply of the nontraded good determine its price, a tariff will raise the domestic price of imports relative to exports, as in the simple, two-good model. In addition, if imports and the nontraded good are substitutes in demand, a tariff will cause consumers to substitute the nontraded good for the higher-priced import, causing the demand and the price of the non-traded good to rise, but the magnitude of this price increase will be smaller than the increase in the price of imports, as shown by Dornbusch (1974). In this type of model, a tariff on imports will raise both the prices of imports and nontraded goods relative to the price of exports. So, there is still an 'symmetry' between the effects of a tariff and an export tax, but the precise relationship depends on a number of factors, such as the degree of substitutability between imports and the nontraded good.

In another type of model, if the number of traded goods equals the number of factors of production, then the prices of the traded goods will determine the factor prices. Under this type of structure, the price of the nontraded good will be determined solely by the factor prices and cannot be affected by changes in the demand for the nontraded good. Even so, tariffs would still introduce a bias against exports, but the mechanism is different than in the model structure discussed above. Here, changes in tariffs will alter the price of the nontraded good through changes in factor prices, rather than through changes in the demand for the nontraded good.

Tariffs on imports discourage all types of exports – not just exports from a single sector – because they tend to cause a country's real exchange rate to appreciate. By raising the prices of imports and nontraded goods relative to the price of exports, a tariff creates an incentive to shift production toward nontradeables and away from exports. Edwards (1988) argues that tariffs cause the relative price of tradeables to nontradeables – the real exchange rate – to decline, and this represents a loss in competitiveness for the home country. As such, the real exchange rate appreciation that results from higher tariffs affects all exports in an economy, and

Table 1. Effective rates of protection in four selected countries

|  | Brazil | | China | | India | | Malawi | |
|---|---|---|---|---|---|---|---|---|
|  | 1986 | 1997 | 1986 | 1997 | 1986 | 1997 | 1986 | 1997 |
| Agriculture | −43 | −5 | −28 | −15 | −14 | −5 | −9 | −7 |
| Agriculture processing | −83 | −28 | −72 | −54 | −64 | −39 | −20 | −16 |
| Resources | −45 | −6 | −14 | −7 | −9 | −3 | −6 | −5 |
| Labor-intensive manufacturing | −72 | −17 | −54 | −35 | −45 | −23 | −18 | −15 |
| Capital-intensive manufacturing | −79 | −22 | −46 | −28 | −60 | −35 | −11 | −9 |
| Services | −31 | −3 | −26 | −14 | −16 | −6 | −5 | −4 |

*Source*: World Bank, *Global Economic Prospects*, 2004, p. 77.

could cause some goods that were exported prior to a tariff increase to cease being exported.

Tariffs and other import barriers may also tax exports by raising the price of imported intermediate inputs used by exporters. For a given price of exports, higher input prices reduce the output of exportables, since tariffs result in negative effective protection – the nominal rate of protection on output adjusted for protection applied to intermediate inputs.[2] The World Bank (2004) presents estimates of effective rates of protection, or 'cost penalties' (Table 1), that apply to various export sectors in four countries (Brazil, China, India, and Malawi) for 1986 and 1997. These simple calculations take into account the effect of tariffs on the prices of imported intermediate inputs, but not interactions with other sectors of the economy, so they represent 'partial' measures of how tariffs tax exports. As Table 1 shows, although tariff reductions on imports in each of these countries has lessened the bias against exports, it still remains high in certain sectors.

In particular, in 1986, import tariffs imposed a significant tax on exports in all four countries, especially in the agricultural processing sectors. Given the large tariff reductions that occurred between 1986 and 1997, the implicit tax on exports declined in each country and sector, but remains high in agricultural processing and manufacturing.

Some countries employ duty-drawback schemes in an attempt to remove the bias against exports due to tariffs on imported intermediate inputs, but these schemes often do not eliminate the bias completely.[3] The reasons for this are:

2 Tariffs result in negative rates of effective protection for exports because the nominal rate of protection applied to their output is zero, while the protection applied to inputs (imported intermediate goods) is positive. The effective rate of protection is calculated by taking the tariff rate on final output of a given sector and subtracting the sum of tariffs applied to intermediate inputs weighted by the share of inputs in total costs.

3 Ianchovichina and Martin (2004) argue that failure to take into account a duty-drawback system could lead to a substantial overestimate of the increase in trade flows resulting from liberalization and they find this to be the case for China.

(i) they can be costly to administer; (ii) a drawback reduces government revenue when it is introduced, so other distorting taxes would have to be increased which themselves might discourage exports; and (iii) drawbacks do not reverse the decline in the relative price of exports as a result of a higher tariff.

## 3. Prior studies on the magnitude of the tax on exports

A number of studies have found that the magnitude of the anti-export bias from tariffs can be quite large. Schiff and Valdes (1992) specifically examined the bias against agricultural production and exports across a range of developing countries as a result of import protection by comparing producer prices relative to world prices. In analyzing the extent of taxation of agriculture across 18 developing countries between 1960 and 1985, the authors found that, on average, the indirect tax on agriculture from protection applied to industrial goods was about 22 % – about three times the magnitude of direct protection. Industrial protection taxed agriculture more than overvaluation of the exchange rate in these countries. On average, the direct protection of importables was 18 % (which raised the price of imports relative to the price of exports), while the direct taxation of exportables was 16 % (which lowered the price of exports relative to imports). The total increase in the relative price of importables to exportables was about 40 %.

Various authors estimated the proportion of import protection that falls on exporters and found it to be quite substantial. Using a model based on three sectors: exports, imports, and home (nontraded) goods, these studies estimated the extent to which import protection increases the price of home goods, and, therefore, the degree to which the price of exports falls relative to home goods. In general, these studies showed that between 40 % and 90 % of import protection fell on exporters. For example, Clements and Sjaastad (1984) report the proportion of protection borne by exporters in seven countries in Latin America and concluded that on average, 66 % of each country's pattern of import protection acted as a tax on exporters. Using a large-scale model of the Australian economy (the ORANI model), the same authors simulated the effect of a rise in Australian tariffs that produced a 5 % increase in the prices of imported goods and found that the output of every export-oriented industry would decline by about 2 % on average. The effects of this simulation are equivalent to a 3.2 % tax on exports. From their analysis, the authors conclude that import protection benefits import-competing producers at the expense of exporters.

In a study of Malaysia, Manzur and Subramaniam (1995) demonstrated that a country's nominal tariff structure can convey a very misleading picture of who actually bears the burden of tariffs. Using data for 1989, the authors estimated that the tariff equivalent of all import restrictions was about 18 % and the nominal assistance provided to exporters was only 1 %. Using a general equilibrium model of trade, the authors showed that this nominal structure of assistance actually resulted in a tax on exporters of about 9 %. That is, the structure of tariff

protection in Malaysia more than wiped out the 1% nominal rate of assistance they received.

Valdes (1986) reported the results from seven studies that showed a fairly high degree of substitution between imports and home goods, suggesting that import protection acts as a significant tax on the export sector in each country because protection increased both the price of imports *and* nontraded goods relative to the price of exports. For example, for the Philippines, Bautista and Valdes (1993) found that a 10% increase in the price of importables was associated with an 8% decline in the domestic price of agricultural exports relative to home goods. For Peru, Valdes (1986) found that raising the uniform tariff on manufacturing goods by 10% imposed an implicit tax of 5.6% on the production of some agricultural goods (rice) and a 6.7% tax on exports.

In a recent paper, Irwin (2006) examined the extent to which the high tariffs on manufacturing goods in the United States in the nineteenth century taxed exporters. Using the methodology set out in Clements and Sjaastad (1984), Irwin found that the 30% average tariff on imports resulted in an effective tax on exporters of 11%. Like the Irwin paper, this paper also presents estimates of the extent to which import tariffs tax exports, but it employs a methodology that takes into account several channels through which tariffs discourage exports that were left out of previous analyses. For example, this paper uses a model that captures how changes in the price of imported intermediate inputs affect exports – a channel that is not taken into account in the Clements and Sjaastad methodology.

## 4.   Quantifying the magnitude of the tax on exports from tariffs

As the previous section showed, there have been a number of studies that have quantified the extent to which tariffs tax exports, but these are somewhat dated. As well, these studies did not take advantage of the extensive datasets now available. This paper addresses these deficiencies by reporting estimates of export-tax equivalents of tariff distortions in 26 developing countries for 2001 using an economic model for each country that captures the complex interactions across sectors. Each country model contains five sectors: (1) exports of primary goods, (2) exports of manufactures, (3) imports of primary goods, (4) imports of manufactures, and (5) a nontraded sector. Primary goods are defined to include all agricultural goods and raw materials. For each country, the dissaggregated sectoral data in version 6 of the GTAP database are aggregated up so that all production activity can fit into one of these five sectors.

Individual applied general equilibrium models are used for each of the 26 countries and the structure of each model is similar to the traditional two-good, two-factor general equilibrium model that is used extensively in trade theory and explained in Jones (1965). Value added of each of the five goods (two exports, two imports, and the nontraded good) is produced using two inputs, labor, which is freely mobile across sectors, and capital, which is assumed to be sector specific.

Outputs of each good are produced using value added together with domestic and imported intermediate goods. This feature captures one of the important channels through which tariffs can tax exports by altering the prices of imported intermediate goods. National income is the sum of the income earned by all factors of production plus tariff revenue. The models assume that labor is fully employed. The appendix contains the equations of the country models and a detailed description of the methodology used.

Each of the 26 country models are parameterized using data from version 6 of the GTAP database. The export-tax equivalents are estimated based on the current levels of applied tariff rates in the countries considered. The choice of the 26 countries was based on the availability of detailed data and on the levels of per-capita GDP. Except for five countries (Argentina, Botswana, Malaysia, Singapore, and Uruguay) all countries chosen had a per-capita GDP in 2001 less than US$3000 per year and 11 had per-capita GDPs of less than US$1000 per year.

Two concepts of the export-tax equivalent are computed: one that would leave the economy as well off as it is under its current structure of tariffs, and one that keeps trade flows constant. These two concepts have been used in the literature to measure trade restrictiveness, as in Anderson and Neary (2006a). The trade-volume constant measure would be useful for trade negotiators who are interested in issues of market access, i.e. trade flows. As is well-known, the uniform export tax rate that keeps trade volume constant cannot be higher than the one that keeps real income constant.[4] Each country for which a uniform export-tax equivalent is computed is assumed to be 'small' in world markets; that is, changes in tariffs in each of these countries are assumed to have no effect on world prices of the affected products.[5]

## Estimates of export-tax equivalents

Table 2 presents two types of export-tax equivalents of import tariffs in the 26 countries: one that keeps real income or welfare constant (column 2) and one that keeps export volume constant (column 3). By either metric, Table 2 shows that import tariffs impose an implicit tax on a country's exports, and, in some cases, the magnitude is substantial. For example, using the welfare-based measure, the export-tax equivalents exceed 10% for more than half the countries considered and the simple average export-tax equivalent listed in column 2 of Table 2 is about 12.5%. These results do not, however, take into account how a duty-drawback scheme might affect the calculation of export-tax equivalents.

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4 Anderson and Neary (2006a) show that in moving to a uniform export tax rate, some rates need to be reduced, while others need to be raised. The gain in real income gain from reducing the high rate, however, exceeds the loss from raising the low rate by the same amount.

5 This assumption rules out the possibility that countries may exploit possible monopoly power in trade by enacting an optimal tariff.

Table 2. Export-tax equivalents of tariff distortions
in selected developing countries for 2001

| Country | Export-tax equivalents of tariff barriers (rates in percent) | |
| | Real income constant | Export volume constant |
| --- | --- | --- |
| Tunisia | 33.6 | 26.6 |
| India | 31.0 | 28.5 |
| Morocco | 26.7 | 25.6 |
| Egypt | 26.2 | 15.8 |
| Romania | 18.4 | 10.1 |
| Bangladesh | 18.2 | 16.3 |
| Thailand | 16.5 | 11.5 |
| Tanzania | 14.1 | 13.2 |
| Vietnam 1/ | 12.7 | 12.6 |
| China | 12.1 | 12.0 |
| Peru | 10.9 | 10.4 |
| Mozambique | 10.8 | 9.6 |
| Sri Lanka | 10.4 | 8.1 |
| Malawi | 9.8 | 9.8 |
| Philippines | 9.7 | 5.4 |
| Albania | 9.4 | 9.3 |
| Columbia | 9.3 | 9.1 |
| Zambia | 8.6 | 8.4 |
| Brazil | 8.1 | 7.9 |
| Argentina | 8.0 | 8.0 |
| South Africa | 6.2 | 6.1 |
| Uruguay | 5.5 | 5.3 |
| Malaysia | 5.0 | 4.4 |
| Botswana | 3.7 | 3.3 |
| Madagascar | 3.6 | 3.6 |
| Singapore | 0.0 | 0.0 |

*Note*: 1 Not a member of the WTO.
*Source*: Author's calculations.

It is important to emphasize that the ranking of countries in Table 2 are based on the magnitudes of the welfare-based export-tax equivalents. The country rankings would be slightly different if the rankings were based on the export-volume export-tax equivalents. For example, Romania has the fifth highest export-tax equivalent calculated holding welfare constant, but the eleventh highest export-tax equivalent calculated holding export volume constant.

The two most important factors determining how a country's tariff structure affects export incentives are the size of the tariff distortion and the responsiveness of both consumption and production to changes in the prices of goods. It is not sufficient that the tariff rate itself be large for it to discourage exports, because a high tariff could be applied to a good for which consumers and producers are

insensitive to changes in its price. In this case, the tariff will have little effect on exports. Conversely, a low tariff could create a large export disincentive if consumers and producers are very sensitive to price changes.

### The role of non-tariff barriers in influencing export disincentives

Reducing tariffs is not the only way to promote exports. In particular, many developing countries have non-tariff barriers, such as quantitative restrictions and import licensing schemes, and face a wide range of 'informal barriers' to increasing exports, such as high levels of port charges and internal transportation costs, cumbersome customs practices, and regulation. Unfortunately, it is difficult to quantify the extent to which these factors inhibit exports due to a lack of data.

Even though evidence is difficult to obtain, available information demonstrates that informal barriers to trade can be formidable. In examining the factors that were responsible for explaining sub-Saharan Africa's slow growth of exports in the 1990s, Yeats, Azita, Reincke, and Ng (1996) showed that both high external and internal transportation costs were more important than trade barriers erected by rich countries against sub-Saharan Africa's exports. The authors concluded that export growth rates could be raised if the region adopted policies that removed the anti-export bias from tariffs and adopted structural policies that reduced transport costs. Second, using a unique survey of importers and exporters that identified the costs of doing business in Moldova, Porto (2005) was able to estimate the extent to which informal barriers taxed exports in that country. Even though Moldova had low formal barriers to trade (e.g. an average import tariff of 5.2 % in 2002), its informal barriers were equivalent to a tax on exports of around 25 %. His results showed that reducing these costs would result in a substantial reduction in poverty in Moldova.

Simulations demonstrate that taking into account the effects of non-tariff barriers (NTBs) would discourage exports to a greater extent than from just tariffs alone. Export-tax equivalents of both tariffs and NTBs were calculated using estimates of the simple average ad-valorem equivalents (AVEs) of core NTBs contained in Kee, Nicita, and Olarreaga (2004). As an illustration, export-tax equivalents of tariffs and NTBs were computed for two countries (Tunisia and Tanzania) and were compared to the export-tax equivalents of just tariffs alone. Given that information on NTBs is far from complete, a number of assumptions had to be made to conduct this exercise. In particular, it was assumed that for the two countries mentioned above, NTBs affected 5 % of total output and 1 % of total imports. Also, it was assumed that the rents from the NTBs accrued to domestic residents. Using these assumptions, the simulations demonstrate that taking into account NTBs for these two countries results in a higher estimated export-tax equivalent, holding welfare constant for both countries, compared to the export-tax equivalent for just tariffs alone. For Tunisia, including NTBs with an average AVE of 11.3 resulted in an increase in the export-tax equivalent from 33.6 to 34.3. For Tanzania, Kee *et al*. estimate the average AVE of NTBs to be

Table 3. Export-tax equivalents of tariff barriers
applied by both rich and developing countries on the
real income of developing countries

| Region | Export-tax equivalent (in percent) |
|---|---|
| Rich-country tariff barriers | 11.5 |
| Developing country tariff barriers | 16.8 |

*Source*: Author's calculations using the GTAP model and database,
Version 6.

37.6, which more than doubles the estimated export-tax equivalent from 14.1 to
38.7. Including NTBs will most likely worsen export disincentives, although the
precise magnitude depends on the size of the AVE of the NTB relative to the tariff
rates.

### *Effects of rich-country barriers against developing-country exports*

While trade barriers erected by rich countries do restrain exports from developing
countries, the anti-export bias from many developing countries' own import pro-
tection is often quantitatively more important. The extent to which rich-country
barriers discourage developing-country exports is demonstrated from simulations
using a global model of world trade – a model that includes more countries than
the 26 modeled in the previous section – that takes into account tariff barriers
applied against exports from developing countries.[6] As shown in Table 3, rich-
country tariff barriers reduce exports from developing countries and these tariff
barriers have the same effect on real income of developing countries as an $11\frac{1}{2}\%$
tax applied against all developing-country exports. On the other hand, tariff
barriers imposed by all developing countries on their own imports are equivalent
in their effects on real income of developing countries to about a 17% tax on their
own exports. Thus, tariff barriers applied by both rich and developing countries
discourage exports from developing countries, but developing countries' own
barriers have a proportionately greater effect, mostly due to the fact that their tariff
barriers are higher.

### 5. Tariff cuts in the Doha Round and the effects on export incentives

This section reports how export-tax equivalents would be affected under some
hypothetical tariff-cutting scenarios. Negotiations on tariff reductions in the Doha

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6 These simulations were performed using the GTAP (Global Trade Analysis Project) model, a general-
equilibrium model of world trade.

Round are mainly focussed on bound tariff rates[7] and for most of the 26 countries listed in Table 2, there is significant 'binding overhang', where bound rates exceed applied rates. In order to have some impact, the tariff cuts must affect applied rates. Therefore, three tariff-cutting scenarios that result in reductions to applied rates are considered. As noted above, each country model contains two import sectors, and, therefore, two import tariffs. Scenario 1 considers a situation in which the high tariff is reduced by a larger percentage than the lower one and therefore captures the spirit of a 'Swiss formula' type reduction. For purposes of illustration, it assumes that the high tariff is reduced by 20 % and the lower tariff is reduced by 10 %. Scenario 2 assumes that the high tariff is reduced by 40 %, while the low tariff is reduced by 10 %. Scenario 3 assumes that a country's higher tariff is not reduced and the lower tariff declines by 10 %. This is to approximate the case in which the high-tariff sector is classified as 'sensitive' and is exempt from a tariff reduction. In order to achieve cuts in applied rates of these magnitudes, bound rates would need to be reduced by 50–100 % depending on the country. Table 4 reports the export-tax equivalents, defined as the uniform export tax applied to all exports that would leave real income or welfare the same as in initial, tariff-distorted equilibrium, on a country basis for each of these three scenarios and compares them to the initial situation. It should be emphasized that tariff reductions that are good for welfare may not be good for market access, as noted by Anderson and Neary (2006b). Table 5 reports how the value of exports would change in each of the three scenarios described above for each of the 26 countries. In addition, Table 5 reports the change in exports that would result from the elimination of all import tariffs.

   As shown in columns three and four of Table 4, the welfare-based export-tax equivalents decline under scenarios 1 (column 3) and 2 (column 4), compared with the initial situation (column 2). In addition, the export-tax equivalents are lower under scenario 2 than under scenario 1, because the magnitude of tariff cuts are greater under scenario 2. The magnitude of the cuts in the low tariff are the same under each scenario, but the magnitude of the reduction in the high tariff is greater under scenario 2.

   The tariff-cutting scenarios demonstrate that the manner in which tariffs are reduced can affect real income in very different ways. In general, the most effective tariff-cutting formula for raising real income is the one in which import tariffs are reduced by the largest percentage and in which higher tariffs are reduced by more than lower ones. Generally speaking, exempting the sector with the higher tariff from any cuts and reducing the low tariff raises welfare and reduces the magnitude of the welfare-based export-tax equivalent, but there are seven countries for which their export-tax equivalent actually increases (column 5, Table 4), compared to the initial situation. For example, reducing the low tariff, but leaving

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   7 Exceptions to this generally include China's proposal to use 2001 applied rates and the US proposal to cut agricultural tariffs using applied rates.

Table 4. Effects of alternative tariff-cutting formulae on export disincentives

| Country | Initial level | Export-tax equivalents of tariff barriers (rates in percent) | | |
|---|---|---|---|---|
| | | Percentage change in tariff rates | | |
| | | High tariff: −20%  Low tariff: −10% | High tariff: −40%  Low tariff: −10% | High tariff: 0%  Low tariff: −20% |
| Tunisia | 33.6 | 27.5 | 21.1 | 33.9 |
| India | 31.0 | 25.7 | 21.7 | 29.2 |
| Morocco | 26.7 | 21.7 | 17.5 | 25.8 |
| Egypt | 26.2 | 20.9 | 15.2 | 27.0 |
| Romania | 18.4 | 14.8 | 11.0 | 19.0 |
| Bangladesh | 18.2 | 14.6 | 10.9 | 18.4 |
| Thailand | 16.5 | 13.5 | 10.7 | 16.5 |
| Tanzania | 14.1 | 12.2 | 10.0 | 13.2 |
| Vietnam 1/ | 12.7 | 11.1 | 10.5 | 11.1 |
| China | 12.1 | 10.6 | 10.1 | 10.3 |
| Peru | 10.9 | 9.2 | 8.2 | 10.0 |
| Mozambique | 10.8 | 8.8 | 7.0 | 10.6 |
| Sri Lanka | 10.4 | 8.4 | 6.5 | 10.6 |
| Malawi | 9.8 | 8.1 | 6.9 | 9.4 |
| Philippines | 9.7 | 7.6 | 5.5 | 10.0 |
| Albania | 9.4 | 8.0 | 7.3 | 8.5 |
| Columbia | 9.3 | 7.8 | 6.7 | 8.9 |
| Zambia | 8.6 | 7.1 | 6.1 | 8.2 |
| Brazil | 8.1 | 6.5 | 4.9 | 8.1 |
| Argentina | 8.0 | 6.5 | 5.0 | 8.0 |
| South Africa | 6.2 | 5.4 | 5.1 | 5.4 |
| Uruguay | 5.5 | 4.5 | 3.7 | 5.3 |
| Malaysia | 5.0 | 4.3 | 4.0 | 4.4 |
| Botswana | 3.7 | 3.0 | 2.3 | 3.6 |
| Madagascar | 3.6 | 2.9 | 2.4 | 3.6 |
| Singapore | 0.0 | 0.0 | 0.0 | 0.0 |

*Note*: 1 Not a member of the WTO.
*Source*: Author's calculations.

the high tariff unchanged, would actually raise the export-tax equivalent for Tunisia, Egypt, Romania, Bangladesh, Sri Lanka, the Philippines, and Brazil.[8] This occurs because the reduction in the lowest tariff rate reduces output of that sector and releases labor for employment in other sectors. Some of the labor is absorbed by the high-tariff sector, which exacerbates the cost of protection in that sector and thus, raises the export-tax equivalent.

Although aggregate exports would expand regardless of the magnitude and the composition of the tariff reductions, countries are not necessarily better off,

8 Although not shown due to rounding, Brazil's export-tax equivalent rises slightly in scenario 3.

Table 5. Effects of alternative tariff-cutting formulae on export values by country

| Country | Percentage change in the value of exports (relative to 2001 base) | | | |
| --- | --- | --- | --- | --- |
| | High tariff: −20% Low tariff: −10% | High tariff: −40% Low tariff: −10% | High tariff: 0% Low tariff: −20% | High tariff: −100% Low tariff: −100% |
| Tunisia | 2.3 | 4.6 | 0.7 | 17.7 |
| India | 5.8 | 10.0 | 4.0 | 45.1 |
| Morocco | 4.7 | 8.7 | 1.7 | 29.0 |
| Egypt | 1.8 | 3.4 | 0.5 | 10.8 |
| Romania | 0.8 | 1.4 | 0.3 | 4.6 |
| Bangladesh | 8.1 | 16.2 | 1.1 | 46.0 |
| Thailand | 0.3 | 0.5 | 0.2 | 2.1 |
| Tanzania | 4.0 | 6.6 | 2.9 | 28.1 |
| Vietnam 1/ | 0.7 | 0.9 | 0.8 | 5.5 |
| China | 2.3 | 3.2 | 3.0 | 19.5 |
| Peru | 1.7 | 2.7 | 1.7 | 13.3 |
| Mozambique | 1.4 | 2.5 | 0.6 | 8.7 |
| Sri Lanka | 1.0 | 1.6 | 0.6 | 6.4 |
| Malawi | 1.6 | 2.8 | 0.6 | 9.3 |
| Philippines | 0.2 | 0.4 | 0.1 | 1.1 |
| Albania | 2.5 | 4.1 | 1.8 | 17.4 |
| Columbia | 2.3 | 3.9 | 1.4 | 15.2 |
| Zambia | 1.7 | 3.1 | 0.9 | 10.1 |
| Brazil | 2.5 | 5.0 | 0.1 | 12.7 |
| Argentina | 1.8 | 3.6 | 0.1 | 9.4 |
| South Africa | 0.9 | 1.2 | 1.2 | 7.5 |
| Uruguay | 1.1 | 2.0 | 0.4 | 6.6 |
| Malaysia | 0.2 | 0.2 | 0.3 | 1.8 |
| Botswana | 0.5 | 1.0 | 0.1 | 2.9 |
| Madagascar | 1.2 | 2.3 | 0.2 | 6.7 |
| Singapore | 0.0 | 0.0 | 0.0 | 0.0 |

*Note*: 1 Not a WTO member.
*Source*: Author's calculations.

in a welfare sense, in all cases. The simulations reported in Table 5 reveal that a reduction in import tariffs increases exports under all scenarios for all countries. This is because tariff reductions raise the price of exports relative to both imports and nontraded goods. However, there are seven countries, mentioned above, that would experience a decline in real income as a result of tariff cuts under scenario 3, even though exports increase, because the tariff cuts cause resources to move into the sector that is exempt from a tariff reduction, which increases inefficiency. These results demonstrate that an increase in exports is not synonymous with an increase in real income.

The results also show that an important factor that determines how exports respond to tariff reductions is the extent to which a country's export sectors use imported intermediate inputs. Table 6 reports the ratio of expenditures on

Table 6. *Importance of imported intermediate input costs for each sector*

| Country | Ratio of imported intermediate input costs to the value of output (at producer prices) | | Elimination of all tariffs | |
|---|---|---|---|---|
| | Exports of primary products | Exports of manufactured products | Percentage change in imported intermediate input costs in the primary export sector | Percentage change in imported intermediate input costs in the manufactured export sector |
| Tunisia | 0.10 | 0.29 | −18.0 | −10.7 |
| India | 0.13 | 0.20 | −23.3 | −15.8 |
| Morocco | 0.26 | 0.20 | −16.8 | −9.2 |
| Egypt | 0.25 | 0.10 | −14.8 | −11.6 |
| Romania | 0.22 | 0.34 | −11.4 | −2.7 |
| Bangladesh | 0.55 | 0.31 | −13.0 | 3.2 |
| Thailand | 0.21 | 0.35 | −14.0 | −7.2 |
| Tanzania | 0.23 | 0.36 | −8.7 | −5.3 |
| Vietnam 1/ | 0.42 | 0.41 | −11.2 | −10.0 |
| China | 0.19 | 0.30 | −8.9 | −3.7 |
| Peru | 0.23 | 0.29 | −9.9 | −6.8 |
| Mozambique | 0.32 | 0.30 | −5.8 | −1.1 |
| Sri Lanka | 0.14 | 0.40 | −6.0 | −0.9 |
| Malawi | 0.24 | 0.22 | −6.9 | −5.3 |
| Philippines | 0.23 | 0.54 | −4.5 | −1.6 |
| Albania | 0.34 | 0.27 | −6.9 | −6.6 |
| Columbia | 0.20 | 0.27 | −6.8 | −3.1 |
| Zambia | 0.28 | 0.50 | −4.7 | −1.2 |
| Brazil | 0.37 | 0.35 | −5.9 | −0.7 |
| Argentina | 0.31 | 0.23 | −5.6 | −4.1 |
| South Africa | 0.14 | 0.12 | −5.4 | −2.8 |
| Uruguay | 0.22 | 0.20 | −4.7 | −4.6 |
| Malaysia | 0.15 | 0.16 | −5.7 | −3.4 |
| Botswana | 0.24 | 0.47 | −1.6 | −0.4 |
| Madagascar | 0.16 | 0.52 | −2.4 | −0.3 |

*Note*: 1 Not a member of the WTO.
*Source*: Data for all countries except Egypt were taken from the GTAP database, version 6.

imported and domestic intermediate inputs to the value of output in each sector (at producer prices). These ratios provide some sense of how price changes affect intermediate input costs, since a tariff directly affects the price of imported and domestically produced intermediates. The last two columns of table 6 show that the elimination of all tariffs would reduce the cost of imported intermediate inputs for both export sectors in each country with one exception.[9]

9 Eliminating all tariffs would raise imported intermediate input costs in the manufactured export sector in Bangladesh because it increases production of exports, which raises the demand for imported

Table 7. Effects of tariff elimination by both rich and developing countries on developing-country exports

|  | Percentage change in the value of developing-country exports | Percentage change in the volume of developing-country exports |
|---|---|---|
| *Rich-country liberalization* |  |  |
| Eliminate tariffs against exports from developing countries | 4.0 | 2.6 |
| Eliminate tariffs against exports from both rich and developing countries | 2.0 | 2.6 |
| *Developing-country liberalization* |  |  |
| Eliminate tariffs against exports from rich countries | 9.9 | 12.9 |
| Eliminate tariffs against exports from developing countries | 14.1 | 12.9 |
| Eliminate tariffs against exports from both rich and developing countries | 20.1 | 22.4 |

*Source*: Author's calculations using the GTAP model and database, Version 6.

Developing-country exports would expand proportionately more if they were to eliminate their own tariffs compared with tariff elimination by rich countries. As shown in Table 7, elimination of all tariffs by developing countries would increase the value of their exports by about 20% and about 70% of this increase would come from eliminating tariffs against exports from other developing countries. Exports from developing countries would increase by only 4% if they were to forego liberalization themselves and rely exclusively on tariff reductions by rich countries. From a policy point of view, developing countries could expand their exports by a much larger percentage by eliminating their own tariff barriers, rather than waiting for tariff reductions by rich countries.

## 6. Conclusions

A central message of this paper is that a consequence of import protection is to create disincentives that diminish a country's ability to export. The anti-export bias from tariffs arises because they: (1) lower the domestic relative price of exports; (2) alter wages and rental rates which must be absorbed by the export sector; and (3) raise the cost of imported intermediate inputs used by export sectors. Also, tariffs can raise the price and output of nontraded goods, which draw resources away from exports. The simulations reported in this paper demonstrate that the export-tax equivalents of import tariffs, measured by holding

intermediate inputs. The increase in the quantity of imported intermediate inputs used outweighs the reduction in the price of imported inputs, so total costs rise in this case.

either welfare or trade volume constant, can be quite large for some developing countries.

From a policy point of view, reducing import barriers (e.g. tariffs) would serve as an export promotion strategy by ameliorating the implicit tax they introduce on exports. It is not possible for a country to simultaneously protect their import-competing sectors *and* promote their export sectors – these policies work at cross purposes with each other. Countries can partially reduce the burden imposed by tariffs – the part due to increased costs of imported intermediate inputs – but these schemes can be difficult to administer and are ripe for corruption.

While developing countries frequently look for ways to increase their exports, tariff reductions represent one way to achieve this. The extent to which exports increase following a reduction in import tariffs will depend on how easily relative prices can adjust. There are, however, reasons why countries would not want to undertake unilateral tariff reductions, based on political economy considerations, which have not been taken into account in the analysis. Still, countries could reduce tariff peaks.

The manner in which countries choose to reduce tariffs has important implications for the effects on export incentives and well being. Generally speaking, reducing import tariffs will raise real income, but tariff-reduction schemes that exempt high-tariff or sensitive sectors could actually leave countries worse off. Thus, a strategy whereby all tariffs are reduced, and high tariffs are cut more than low ones, would do the most to improve real income in developing countries. This prescription, however, may not be the one that increases market access, i.e. raises trade flows, the most.

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## Appendix: Details of the model used to compute export-tax equivalents

The export-tax equivalents were produced by using a full general-equilibrium model of an economy that includes the following features: (i) consumers maximize their real income subject to a budget constraint; (ii) producers minimize the cost of producing a given level of output; (iii) there are traded goods (imports and exports) as well as nontraded goods; and (iv) markets for goods and factors of production (labor and capital) clear.[10]

### *Structure of the applied general equilibrium model*

This paper uses an applied general equilibrium model for each of the 26 developing countries listed in table 2. Each country model consists of five sectors (two import sectors, two export sectors, and a nontraded sector) and six factors of production (labor which is mobile across all sectors and capital which is specific to each sector). The import sectors can be thought of as primary products (e.g. agriculture) and manufactured goods. A representative household receives all factor income, as well as all revenue collected from taxation. Each country is assumed to be small in world markets, so the terms of trade are exogenous and the price of exports is taken to be the numeraire. The price of nontraded goods adjusts to bring about equilibrium in the goods market.

10 For a description of the modeling framework used, see Cassing and Tokarick (2007).

## Production structure

Value added in each sector $VA_j$ is produced by combining a labor input $L_j$, with capital $K_j$ according to a constant elasticity of substitution (CES) production function

$$X_j = A_j[\alpha_j L_j^{-\rho_j} + (1-\alpha)_j K_j^{-\rho_j}]^{(-1/\rho_j)} \tag{1}$$

where $A_j$, and $\alpha_j$, are constants, and $\rho_j = \frac{(1-\sigma_j)}{\sigma_j}$ where $\sigma_j$ is the elasticity of substitution between factors in sector $j$. The allocation of labor across sectors is determined by equating the value of the marginal product of labor with the wage

$$w = \frac{\partial X_j}{\partial L_j} PD_j \tag{2}$$

where $PD_j$ is the consumption price of the $j$th good and $w$ is the wage rate. Since capital is sector specific, its return, $r_j$ is determined as a residual

$$PVA_j VA_j = wL_j + r_j K_j \tag{3}$$

where $PVA_j$ is the value-added price in sector $j$, $VA_j$ is value added in sector $j$, and $L_j$ is the amount of labor employed in sector $j$. Since labor is fully employed

$$\sum_j L_j = \bar{L} \tag{4}$$

where $\bar{L}$ is the endowment of labor. Capital stocks are fixed by sector

$$K_j = \bar{K}_j \tag{5}$$

## Intermediate demand

One channel through which tariffs affect export incentives is by altering the cost of intermediate inputs used by export sectors. In each sector, the value of output at producer prices $PX_j$ must equal the total costs of production

$$PX_j X_j = wL_j + r_j K_j + \sum_i PD_i DI_{ij} + \sum_i PM_i MI_{ij} \tag{6}$$

where $\sum_i PD_i DI_{ij}$ represents the cost of domestic intermediate inputs, $DI_{ij}$ is the amount of good $i$ used in a unit of good $j$, and $\sum_i PM_i MI_{ij}$ is the cost of imported intermediate inputs, where $MI_{ij}$ is the amount of imports of good $i$ used in a unit of good $j$. Changes in tariffs therefore affect the costs facing the export industry through changes in $PD_i$ and $PM_i$, the prices of domestic and imported intermediates respectively.

## Aggregate income and demand

Aggregate income available for spending by the representative consumer ($Y$) equals the sum of factor income, government revenue, and foreign borrowing,

$B$, which is assumed to be fixed in terms of the numeraire

$$Y = w\bar{L} + \sum_j r_j K_j + GR + B \tag{7}$$

Government revenue equals tariff revenue

$$GR = \sum_j tm_j PW_j (MD_j + MI_j) \tag{8}$$

where $tm_j$ is the tariff rate on good $j$, $PW_j$ is the international price of good $j$, $MD_j$ are imports of good $j$, and $MI_j$ is the amount of imported intermediate inputs of good $j$. As imports are treated as perfect substitutes for domestically produced goods, imports equal the difference between domestic demand and production.

### Aggregate demand

Absent information on elasticities of demand, we assume that a representative consumer maximizes a Cobb–Douglas utility function defined over the six goods. The resulting demand functions are

$$DD_j = \frac{s_j Y}{PD_j} \tag{9}$$

where $PD_j$ is the consumer price (inclusive of tariffs), $DD_j$ is the demand for good $j$, and $s_j$ is the budget share of good $j$. Of course, with this demand structure, the own-price elasticity of demand is $-1$, the cross-price elasticities are zero, and the income elasticity of demand is 1.

The prices of traded goods paid by the consumer differ from the prices received by the producer, due to import tariffs. For imported goods

$$PS_j = PW_j(1 + tm_j) \tag{10}$$

while for exported goods, the producer price equals the world price, since there are no export taxes or subsidies

$$PS_j = PW_j \tag{11}$$

### Equilibrium

Equilibrium in the model is achieved when a set of factor prices is found that generates zero profits in each sector and is consistent with full employment of each factor. In this model, the terms of trade are given exogenously, so the price of the nontraded good adjusts to achieve equilibrium. In the nontraded sector, demand must equal supply

$$DD_N = X_N \tag{12}$$

For the imported good

$$DD_M = X_M + MD_M \tag{13}$$

while for the exported good

$$DD_X + E_X = X_X \qquad (14)$$

where $E_j$ are exports of good $j$.

### Data, elasticities, and parameter values

The simulation results presented in tables 2 and 3 were generated using data from version 6 of the GTAP database. Parameter values were determined by the technique of calibration, described in Mansur and Whalley (1984). Calibration entails using data on exogenous and endogenous variables in the base year to 'solve for' unknown parameter values. Because of this technique, the model will replicate the base year data exactly, that is, the model will produce values for all the endogenous variables that match the observed values.

As noted in the text, each country model contains five sectors: exports of primary products, exports of manufactures, imports of primary products, imports of manufactures, and nontraded goods. Each one of the 57 sectors contained in the GTAP database are mapped into one of the five sectors, depending on the actual structure of trade for a particular country.

The simulations in Table 4 were generated using the GTAP model and version 6 of the database. A detailed description of the model and the database can be found in Dimaranan and McDougall (2002). Briefly, the GTAP model is a global model of production and trade. It consists of a number of individual country models linked together through trade flows.