Alternative Approaches to Measuring the Cost of Protection

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1. Introduction

Economists measure the economy-wide cost of protection in terms of static efficiency, growth rates and firm- or industry-level productivity. The earlier literature was devoted almost exclusively to the measurement of static welfare effects. But the recent proliferation of cross-country regressions has led some economists to focus on the effects of protection on growth rates. Equally, the increased interest in firm- and industry-level regressions has given rise to studies aimed at measuring the effect of protection on firm or industry productivity. A final, albeit less formal, strand of the literature focuses on in-depth case studies of specific countries or sectors.

The purpose of this paper is to offer a unified treatment of the literature on the cost of protection with special attention paid to the measurement of these effects. Reflecting the current state of the literature, greater attention is paid to static efficiency effects. Section 2 focuses on static effects and Section 3 on growth and productivity effects. The paper is concluded in Section 4.

2. Static Efficiency

As in most other areas of economics, measurement of costs of protection lags behind theory. There are virtually no studies that measure the *ex post* static cost of protection. Instead the available measures are *ex ante*, based on simulations whereby authors postulate a partial- or general-equilibrium model, parameterize it using values that are either taken from the literature or simply guessed, calibrate it around an initial equilibrium, and use it to calculate the change in real income from a reduction in or removal of trade barriers. Both model structure and parameter values matter so that one must take the estimates with a grain of salt.

Though theory as well as measurement of the cost of protection has had a long history, the natural starting point for our purpose is Harry Johnson (1960), which builds on the broader work of Arnold Harberger (1959) on efficient allocation of resources and also relates to an earlier contribution by Max Corden (1957).[1] Johnson's central message is that the static cost of protection as a proportion of GNP is bound to be low. This message, reinforced by more detailed calculations in Johnson (1965), has remained influential till today and resonates in many writings of more recent origin. For example, in his relative recent book, *The Age of Diminished Expectations—U.S. Policy in the 1990s*, Paul Krugman (1990) states the following:

> "Just how expensive is protectionism? The answer is a little embarrassing, because the standard estimates of protection are actually very low. America is a case in point. While much of U.S. trade takes place with few obstacles, we have several major protectionist measures, restricting imports of autos, steel and textiles in particular… From the viewpoint of the world as a whole, the negative effects of U.S. import restrictions on efficiency are…one quarter of 1 percent of the U.S. GNP."

Not all economists share the view that the cost of protection is low, however. In an early note of skepticism, Robert Mundell (1962) expressed his discomfort with the low estimates thus:

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[1] Johnson (1960) offers a careful documentation of the prior literature, noting the existence of "only two major attempts to measure the economic effects of a particular country's commercial policy" at the time. He also cites Enrico Barone (1913) and Jacob Viner (1929) as the two early theoretical analyses of the effects of tariff using the twin concepts of consumers' and producers' surplus "invented" by Marshall.

"On a more philosophical level, there have appeared in recent years studies purporting to demonstrate that…gains from trade and the welfare gains from tariff reduction are almost negligible. Unless there is thorough theoretical re-examination of the validity of the tools on which these studies are founded…someone inevitably will draw the conclusion that economics has ceased to be important!"

Jagdish Bhagwati (1968) was more directly critical and argued that the calculations by Harberger (1959) and Johnson (1965) were "strictly hypothetical." He then offered a counterexample in which an export subsidy that turned an importable into exportable halved the national income.[2]

Subsequently, attention was drawn to four sets of reasons that could make the static costs of protection larger than believed conventionally. First, Richard Harris (1984) brought economies of scale as a source of higher costs of protection by incorporating them into a general-equilibrium simulation model. He demonstrated that the presence of scale economies could give rise to much larger costs of protection. Second, Paul Romer (1994) demonstrated that if export sales are associated with fixed costs of entry, protection can lead to disappearance of some imports altogether and result in large losses of consumers' surplus. Third, Joel Bergsman (1974) and Bela Balassa (1971) went on to incorporate Harvey Leibenstein's (1966) notion of X-efficiency into the calculations and obtained estimates that were much larger than those based purely on allocative efficiency effects of protection. Finally, Anne Krueger (1974) drew attention to real resource costs of protection resulting from rent-seeking activities while Jagdish Bhagwati (1982) has broadened the concet of rent seeking and measurement of the cost of protection to include the impact of what he has

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[2] Bhagwati used a two-good, small-country, general-equilibrium model to illustrate this possibility.

christened "Directly Unproductive Profit-seeking" (DUP) activities. Simulation studies such as the one by Wafik Grais, Jaime de Melo and Shujiro Urata (1986) suggested that these costs could lead to high costs of protection as well.

In the following, I consider these and other developments beginning with Johnson's early analysis and conclude by seriously questioning the conclusion that in the traditional static setting the costs of protection are necessarily low. The main point I make is that even in this setting, high levels of protection can lead to high costs of protection.

2.1 Allocative Efficiency: Increasing Costs in a Small Country

The studies published just prior to 1960, during 1960s and early 1970s uniformly found the allocative costs of protection to be less than 1 percent of GNP. This is apparent from Table 1, which reports the estimates from the most important studies from this period.[3]

These estimates represent the usual triangular efficiency losses in consumption and production that typically result from tariffs and may be explained with the help of a simple small-country, partial-equilibrium model. In Figure 1, DD and SS, respectively, represent the demand for and supply of an importable in a small country. The world price of the good is P_W and imports are subject to an *ad valorem* tariff at rate t. The domestic price is denoted $P = P_W(1+t)$. The removal of the tariff leads to an expansion of consumption from C_t to C_W

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[3] Subsequent studies based on conventional models have produced similar results leading Harris (1984) to make the following remark: "It is well known that conventional calculations of the costs of protection give numbers which are quite small; often in the order of 0.5 to 2.0 percent of GNP. This result holds for almost all known studies based on the competitive neoclassical model, either partial or general equilibrium." Among the general-equilibrium studies cited by Harris in this context are Robin Boadway and John Treddenick (1978), Fred Brown and John Whalley (1980), A. V. Deardorff and R. M. Stern (1981) and P. Dixon et al. (1981).

and contraction of domestic output from Q_t to Q_W. In turn, we obtain the familiar efficiency gains in production and consumption represented by triangles b and d, respectively.

Table 1: Estimates of Costs of Protection

Author	Country and year	Estimated Effect as Percent of GNP	Remarks
Harberger (1959)	Chile, 1950s	< 2.5	Liberalization of all tariffs assumed to average 50 percent
J. Wemeisflder (1960)	Germany, 1956 and 1957	0.18	Tariffs ranging up to 25 percent reduced by 50 percent
Robert Stern (1964)	U.S.A., 1960	< 0.11	Efficiency gains from the removal of all U.S. tariffs in 1960 (ignoring the terms of trade effects)
Bela Balassa and Mordechai Kreinin (1967)	Several industrial countries	< 1.0	Gains from Kennedy Round tariff cuts
Stephen Magee (1972)	U.S.A.	1.0	Gains from removing all trade barriers (ignoring the terms of trade effects)

Simple manipulations allow us to show:

(1) $$\text{Cost of Protection} = \frac{V.\eta}{2}\left(\frac{t}{1+t}\right)^2$$

Here V is the value of imports at the domestic price in the presence of the tariff and η the absolute value of the arc elasticity of demand for imports as we move from protected to free-trade equilibrium. If we further assume that all importable goods are subject to a uniform tariff rate and the import-demand elasticity across them is the same, we can write

$$\text{(2)} \qquad \text{Cost of Protection as Proportion of GNP} = \frac{\alpha \cdot \eta}{2}\left(\frac{t}{1+t}\right)^2,$$

where α denotes the share of imports in GNP at the tariff-ridden equilibrium.

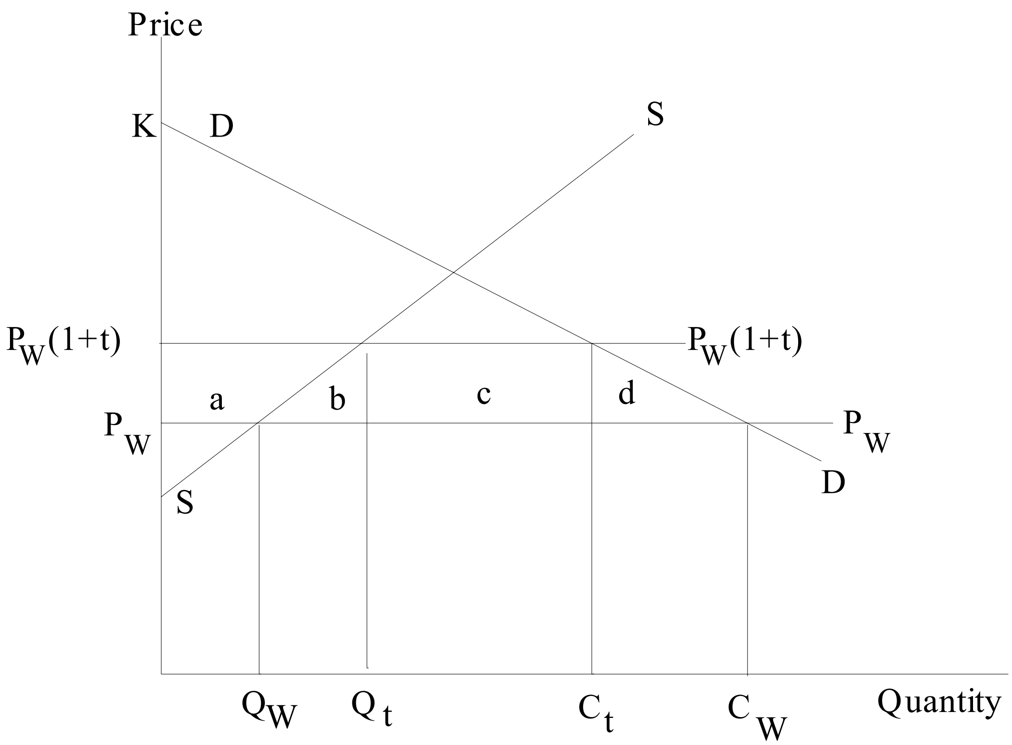

Figure 1: Cost of Protection: The Conventional Analysis

Calculations reported in Table 1 are based on either this formula or some variation of it.[4] Given that estimates of the import-demand-elasticity at the aggregate level are usually less than 2, the imports-to-GNP ratio is often less than a quarter, and $[t/(1+t)]^2$ is square of a

[4] For example, Stern (1964) and Balassa and Kreinin (1967) used a more elaborate version of this formula and calculated the cost of protection by sector.

number less than one, estimates based on these formulas can be expected to be small, especially if initial tariff rates are low. For example, if $t = 0.15$, $\alpha = .25$ and $\eta = 2$, equation (2) yields a cost of protection equal to 0.42 percent of GNP.

Even without invoking alternative model structures or sources of the costs of protection, it can be argued, however, that the calculations reported in Table 1 are misleading in so far as they convey the impression that static costs of protection in the presence of increasing opportunity costs are *always* low. This is because with the exception of Harberger (1959) whose estimate is by far the largest, all studies in Table 1 are based on initial tariffs of 15 percent or less. And in two of the five cases, only a partial removal of tariffs is considered.

To elaborate further on this point, observe that the cost of protection increases at an increasing rate with t. This suggests that high tariff rates will lead to costs that are considerably larger than those resulting from low tariffs. Not surprisingly, the estimate offered by Harberger for Chile, which assumes an initial tariff rate of 50 percent and considers its complete removal, is significantly larger than all other estimates. The large initial distortion is also behind the example provided by Bhagwati (1968) in which the export subsidy turns an importable into an exportable and cuts the GNP in half.

To give a dramatic hypothetical illustration of how the cost of high levels of protection can be very high, consider the following example comparing autarky and free trade. In Figure 2, I depict an endowment economy with 10 units of good 1 and 40 units of good 2. Denoting the consumption of good i by C_i ($i = 1, 2$), represent the preferences by the Cobb-Douglas utility function: $C_1^{1/2}C_2^{1/2}$. Under autarky, this utility function leads to a relative price of good 1 equal to 4 and an income equal to 20 in terms of good 1.

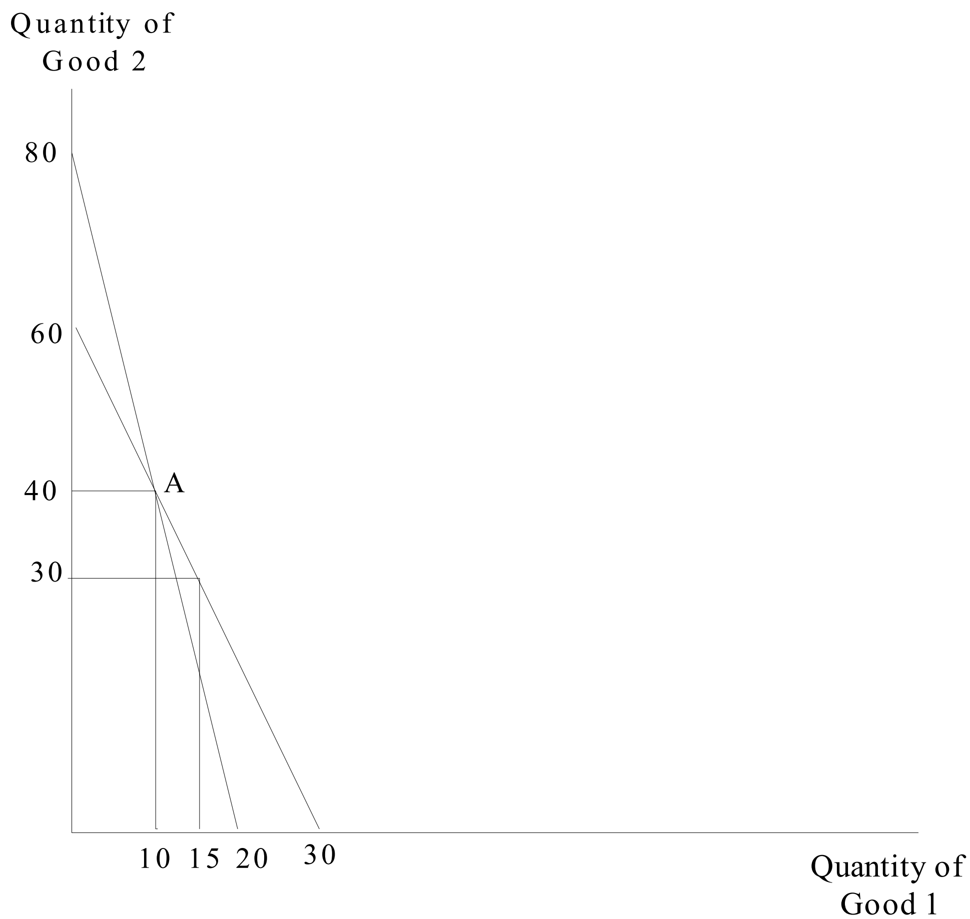

Figure 2: Cost of Autarky

Suppose next that the world price of good 1 is 2. Under free trade, this leads to a GNP equal to 30 in terms of good 1 and the country consumes 15 units of good 1 and 30 units of good 2. The move to free trade leads to a proportionate increase in real income of 6.5 percent.[5] Alternatively, if the world price of good 1 is 1, under free trade, the country consumes 25 units of each good yielding a proportionate increase in real income of 25 percent.

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[5] Since the utility function is Cobb-Douglas with equal expenditure devoted to each good, at the price of good 1 equal to 2, consumption of good 1 is 15 and that of good 2 is 30. The proportionate gain in real income from a move from autarky to free trade is then given by $[(15^{1/2}.30^{1/2}$ –

It is important to note that parameters underlying these calculations are far from biased towards yielding large estimates of protection costs. With Cobb-Douglas preferences, the elasticity of demand is unity, and with fixed endowments of goods the elasticity of supply is zero. The implicit *autarky* tariff rate and *free-trade* imports-to-GNP ratio, respectively, are 1 and 1/6 (equivalently, 100 and 16.67 percent) in the first case and 3 and 3/10 (equivalently, 300 and 30 percent) in the second case.

By way of reality check, during late 1980s, tariff rates on many products in India ranged between 300 and 400 percent. Yet imports of these products continued to be positive. The simple average of tariff rates during the same period was approximately 125 percent (complemented by strict licensing) and the imports-to-GNP ratio was still in excess of 8 percent.

The information at our disposal in the example just considered allows us to calculate the cost of autarky using the partial-equilibrium model in Figure 1. Therefore, it is useful to check whether the partial-equilibrium calculations are dramatically different from general-equilibrium calculations. The cost of autarky in Figure 1 is given by the triangle formed between the demand and supply curves above the world price. The area of this triangle is (1/2). M. (t. P_W), where M is the level of imports under free trade, t is the autarky tariff and P_W the world price. As a proportion of GNP, this cost may be written as (1/2) $t.\alpha$ where α is the imports-to-GNP ratio under free trade. In the first case considered above, we have $t = 1$ and $\alpha = 1/6$. The cost of protection as a proportion of GNP is 1/12 or 8.33 percent (compared with 6.50 percent calculated using the general equilibrium model). In the second

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$40^{1/2}.10^{1/2})/(40^{1/2}.10^{1/2})] - 1 = .065$ or 6.5 percent of the autarky income. The calculation for the following case is done analogously.

case, we have t = 3 and $\alpha = 3/10$ so that the cost of protection as a proportion of GNP is 9/20 or 45 percent (compared with 25 percent using the general equilibrium model).

Despite some differences between these partial and general-equilibrium estimates, the fundamental conclusion that the resource allocation cost of protection even under increasing opportunity costs is high when protection is high is a plausible one. The conventional wisdom that the cost of protection in terms of lost allocative efficiency is low holds only for low levels of protection. The notion that triangles must be necessarily small is fragile.[6]

Thus, recently, Douglas Irwin (2001) has estimated the cost of an embargo imposed by the United States in 1807. According to the information available in his paper, the embargo was approximately equal to 70 percent tariff on imports and led to a reduction in the imports-to-GNP ratio from 20-35 percent range to 8-10 percent range. Irwin estimates that the embargo cost the United States somewhere between 7 to 10 percent of its GNP in 1807. This estimate reinforces the above analysis, which emphasizes that once we get to high tariffs, the cost of protection can rise well beyond the traditional range of 0 to 2 percent.

One final point must be noted with respect to the formula in (2). In applying it, analysts take the estimate of the import-demand elasticity from outside, which is independent of the level of tariffs or imports. When tariffs are high, the imports-to-GNP

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[6] This point becomes particularly important when the pattern of protection is selective and calculations are done at the aggregate level. For example, suppose the value of imports of all products is the same at world prices under free trade. The cost of protection of a 100 percent tariff on half of these products is far higher than that of 50 percent tariff on all imports. Robert Feenstra (1992) also makes this point in a slightly different context.

ratio is low and we are in danger of concluding that the cost of tariff is also low.[7] To dramatize the point, suppose the initial tariff is close to the autarky level so that α is near zero. Since the tariff rate is still finite, a mechanical application of any finite import-demand elasticity to formula (2) will erroneously lead to the conclusion that the cost of near-autarkic protection is zero! In essence, formula (2) gives a reasonable approximation of the cost of protection only when the initial tariff is low. If the initial tariff is high, it is best to calculate the areas of welfare triangles directly as done above for the autarky case.

2.2 Allocative Efficiency and the Large-Country Case

Challenging the statement by Krugman quoted earlier, Robert Feenstra (1992) noted that when quotas are the instrument of protection and the country in question happens to be large, the application of the small-country framework on which many researchers rely leads to an understatement of the global cost of protection. In this case, prices are distorted in not just the country imposing the quota but also the country subject to it.

To explain Feenstra's first point, let MM in Figure 3 represent the import demand curve of HC, obtained by subtracting its supply curve from the demand curve. Free trade imports are OM_W (=Q_WC_W in Figure 1). Under the small-country assumption, a quota of OM_q (=Q_tC_t in Figure 1) leads to the efficiency cost of area SRN (= areas b plus d in Figure 1). If the country is large, however, this area understates the true cost of protection. The quota causes the FC price to deviate from the free-trade world price and, thus, causes a distortion there.

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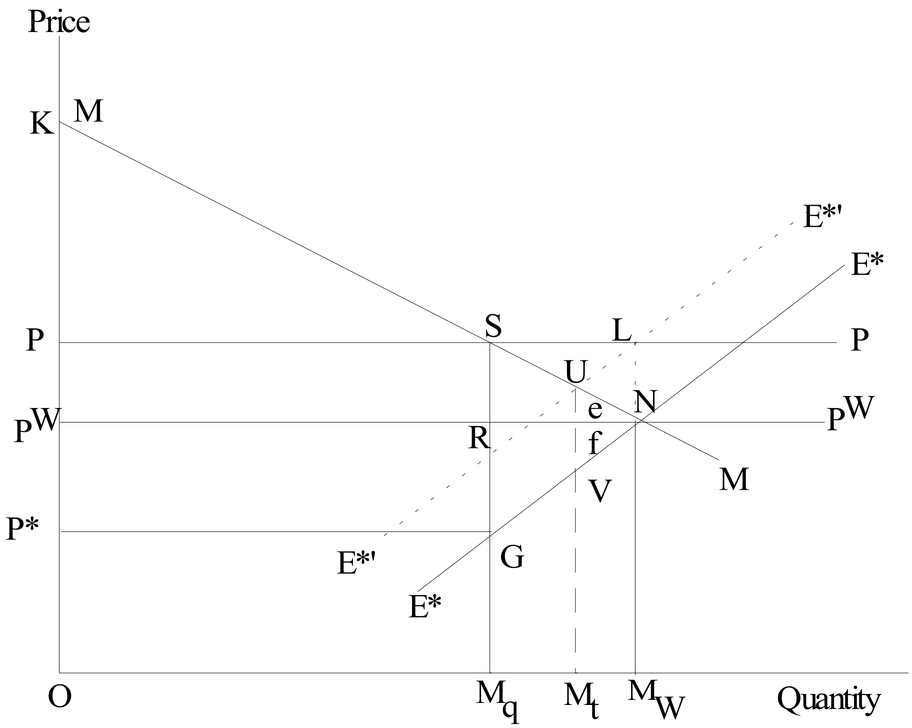
[7] Stern (1964) avoids this problem by choosing much larger import-demand elasticity for products exhibiting small ratio of imports to total demand.



SRN = b+d in Figure 1

Figure 3: .Small versus Large Country Assumption: Tariff versus Quota

Representing the export supply curve of FC by E*E* rather than P_WP_W (ignore all dotted lines for now), we continue to get P_W as the price in HC and FC under free trade. But under the quota OM_q, the price in HC rises to P as under the small-country assumption while that in FC falls to P* (unlike under the small-country assumption). The latter change leads to an additional efficiency loss measured by area RNG. Feenstra concludes that since the United States is a large country and it often uses quotas rather than tariffs, researchers who resort to the small-country assumption underestimate the global cost of its protection.

Drawing on a variety of studies, he reports annual efficiency losses from U.S. trade barriers during the years around 1985 ranging from $7.9 to 12.3 billion within the U.S. and of $4.3 to 18.8 billion in foreign countries due to the U.S. quotas. Together, these amount to three quarters of a percent of the U.S. GDP around 1985. While these are larger than those claimed by Krugman, they remain small in relation to the U.S. GDP principally because of the smallness of the implicit price distortion due to the quotas.

Before concluding this sub-section, we may note an interesting asymmetry between quotas and tariffs not recognized by Feenstra. While the small country assumption leads to an underestimation of the efficiency costs of quotas imposed by large countries, it does exactly the opposite to the estimates of costs of tariffs. Thus, we have yet another case of non-equivalence of tariffs and quotas to add to the vast literature on the subject spawned by the seminal contribution by Bhagwati (1965). A tariff of $P-P_W$ shifts the export supply curve in Figure 4 from E*E* to E*'E*', where UV = LN = $P-P_W$. The true efficiency loss is given by area e in HC plus area f in FC. But under the small country assumption, we will conclude that the cost is triangle SRN. Given RS = LN = UV, this is unambiguously larger than e+f.

2.3 Allocative Efficiency: Decreasing Costs

In the presence of scale economies, allocative costs of protection may be high even when trade barriers are low. Benefits from trade may now come from two additional sources: reduced costs of production and increased product variety due to increased market size. To introduce these effects in simple terms, suppose there are two goods, 1 and 2, and only one factor of production, labor. The two goods have identical production functions, $X_i = L_i^k$ with $\infty > k > 1$ (i = 1, 2). Scale economies are external to the firm, thus validating the average-cost-pricing equilibrium. As before, the utility function is C_1C_2.

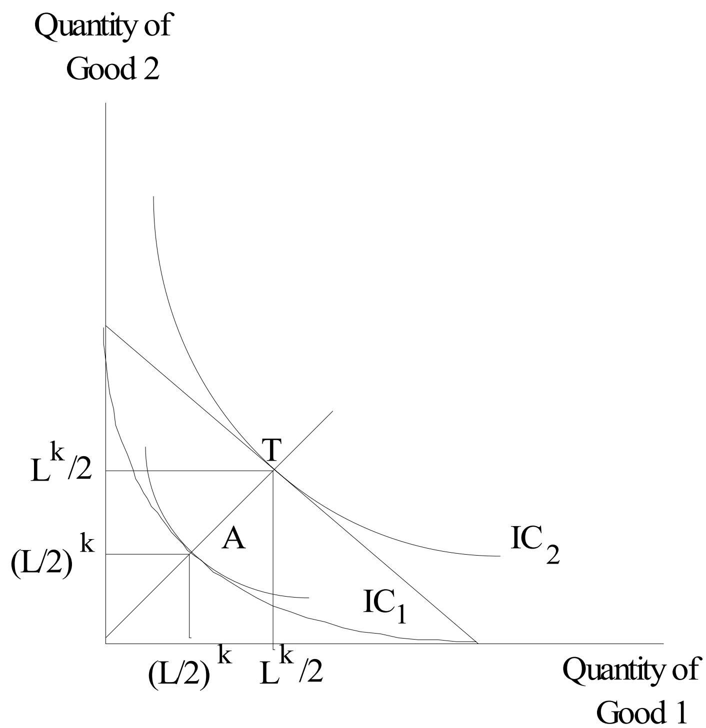


Figure 4: Economies of Scale and Specialization

As shown in Figure 4, under autarky, each sector employs half of the total labor force, L, with production and consumption of each good equaling $(L/2)^k$.[8] The opening to trade leads to specialization in one product by each country, allowing consumption of each good in each country to rise to $L^k/2$. Correspondingly, the real income rises by $(L^k/2)/ (L/2)^k - 1 = 2^{k-1} - 1$. For k = 2, this says that the move from autarky to free trade increases each country's income by 100 percent.[9]

[8] From a historical perspective, it is interesting to note that Figure 4 is identical to Figure 3.9 in Charles P. Kindleberger (1968, p. 51). While the conceptualization of the production equilibrium in terms of external economies was missing from Kindleberger discussion, he explicitly demonstrated that economies of scale could serve as a separate basis of trade between two identical countries. The caption under his Figure 3.9 reads, "Trade with identical factor endowments, identical tastes and increasing returns."

[9] For k = 1, we have constant returns and constant units costs of production. A value of k = 2 says that a one percent expansion of the industry lowers the unit cost of production by ½ percent.

This simple model can also be modified to show how trade may bring benefits by increasing the number of products available. Thus, retaining the symmetry across products, replace the form of the utility function by CES and assume the elasticity of substitution is larger than unity. In this case, indifference curves intersect the quantity axes at finite values and the autarky equilibrium itself may be characterized by complete specialization in one of the two products. When the countries move to free trade, each country still produces only one product but consumes both of them. The gains from trade result from increased variety of products.

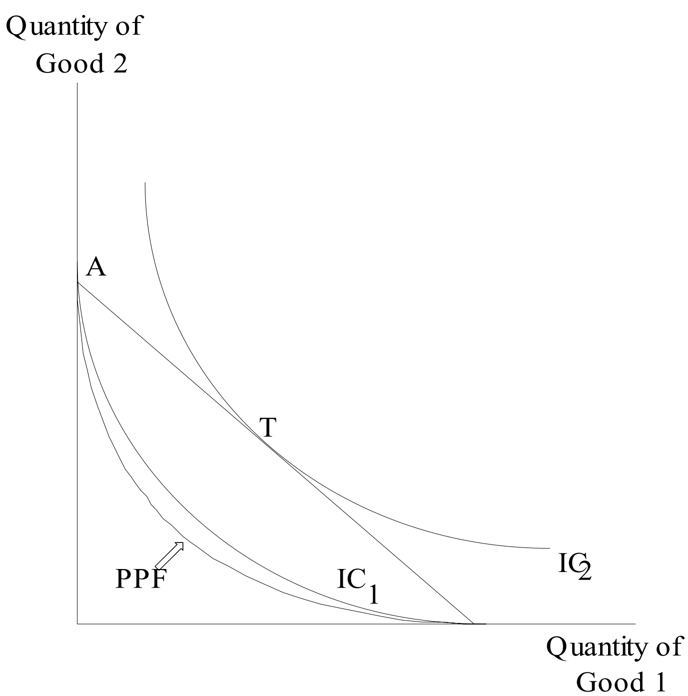


Figure 5: Trade Leading to Increased Variety of Products

Figure 5 illustrates this possibility. The highest indifference curve reachable under autarky, IC_1, meets the production possibilities frontier (PPF) at either of the two axes. Continuing to assume average-cost pricing, the economy produces only one of the two goods.[10] Under free trade, each country can produce one product and consume both of them. For the CES utility function with an elasticity of substitution equal to σ, each country's income rises by the proportion $2^{(\sigma-1)/\sigma}-1$. For $\sigma = 2$, this implies a gain of approximately 42 percent for each country.

The examples in Figure 4 and 5 are based on external economies of scale, which rule out increasing returns at the firm level. But taking advantage of the pioneering work of Krugman (1979, 1980), we can readily apply them to the context of firm-level economies of scale and product differentiation. Thus, we can imagine that consumer likes product variety, there are many potential varieties and each variety is produced under firm-level increasing returns. Marginal-cost pricing and free entry with the latter determining the number of varieties produced in equilibrium characterize the equilibrium. It is then intuitive that a larger market (resulting from freer trade) will allow firms to operate on a larger scale in the spirit of Figure 4 and also admit larger variety in the spirit of Figure 5.

Harris (1984) estimates the cost of protection in Canada in a general-equilibrium model with sectors that are subject to firm-level scale economies and imperfect competition. He experiments with two types of firm behavior: at one extreme, firms act as Nash-Cournot competitors and at the other extreme they set price collusively at an appropriate focal point. In the latter case, he follows H.C. Eastman and S. Skykolt (1966) in choosing the world price plus tariff as the focal point. Free entry, resulting in the equality of price and average

[10] Strictly speaking, we can also find an equilibrium (not shown in Figure 5 to avoid clutter) involving incomplete specialization. At this equilibrium, an indifference curve is tangent to the PPF and lies inside the latter (except at the point of tangency). But this equilibrium is unstable (Panagariya 1986).

cost of production, determines the number of firms. Reduced protection reduces the number of firms and thus allows greater exploitation of scale economies.[11]

Harris makes the so-called "almost small country assumption" whereby Canada is a price taker in importable goods but price maker in exportable goods.[12] He takes into account tariffs imposed by Canada as well as those faced by Canadian firms abroad. In 1976, the year for which the model is calibrated, Canadian tariffs range between 0 to 33 percent with simple average being 11 percent. The simple average of tariffs faced by Canadian goods abroad is 16 percent. Under the assumption of perfect competition, Harris finds that the removal of Canadian tariffs generates no welfare gain. This is because the efficiency gains are (coincidentally) exactly offset by the losses from the deterioration of the terms of trade. In contrast, under economies of scale and imperfect competition, the gain is 4.1 percent of GNP assuming that focal point pricing and Cournot pricing are assigned equal weights. The gain is larger if focal point pricing is given a larger weight. Multilateral trade liberalization leads to a much larger gain to Canada: 8.6 percent of the Canadian GNP if weights on the two pricing rules are equal and 16.3 percent of GNP if focal point pricing is given a weight of 0.8. Again, it is important to remember that these effects relate to Canada and therefore include the terms of trade effects. Liberalization by the rest of the world

[11] Harris considers two versions of the model, one with product differentiation and the other without it. But this distinction is not central to his conclusions. The discussion in the text is based on the version without product differentiation.

[12] While this assumption has the ring of plausibility, a moment's reflection should make clear that an economy is either small or large in general equilibrium but not both. To dramatize the point, in a two-good model, the offer curve of the foreign country is either a straight line or it is curved. In the multi-good model, one can artificially fix the world prices of importable goods relative to one another but any reductions in the tariff rates of the almost small open economy that increase its imports also increase exports through the trade balance condition and worsen its terms of trade.

improves Canada's terms of trade, making the gains from multilateral liberalization larger than from Canada's own liberalization.[13]

2.4 Protection Leading to Disappearance of Products

Paul Romer (1994) suggests a different channel through which scale economies can give rise to high costs even when the level of protection is low. Romer's essential point, which he generously attributes to a 150 years old contribution by Jules Dupuit [reprinted as Dupuit (1969)], is that if there are fixed costs associated with the introduction of a product in a market and it is sold there in positive quantities under free trade, a small tariff can lead to its withdrawal and the loss of the entire consumers' surplus.

Romer's point is most easily made with the help of Figure 6, which depicts the market for a product that a foreign supplier is able to produce at a constant marginal cost. But because he must incur the fixed cost of introducing the product in the market (for example, the cost of advertising or establishment of a service and parts supply network), the average cost curve is downward sloped. As drawn, the supplier just breaks even under free trade.[14] The introduction of even a tiny tariff in this setting leads to complete withdrawal of the product from the market and the loss of the entire consumers' surplus shown by triangle APE. The argument remains valid, of course, in the presence of positive profits as long as the tariff is sufficiently high to wipe out profits at all positive quantities.

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[13] Since the work of Harris, many investigators have incorporated increasing returns and imperfect competition into simulation models and obtained similarly large gains from the liberalization of even relatively small tariffs.

[14] This can be the result, for example, of a monopolistically competitive market with free entry as in Krugman (1980). We can think of the product in Figure 6 as representing one of the many varieties of the Krugman differentiated good.

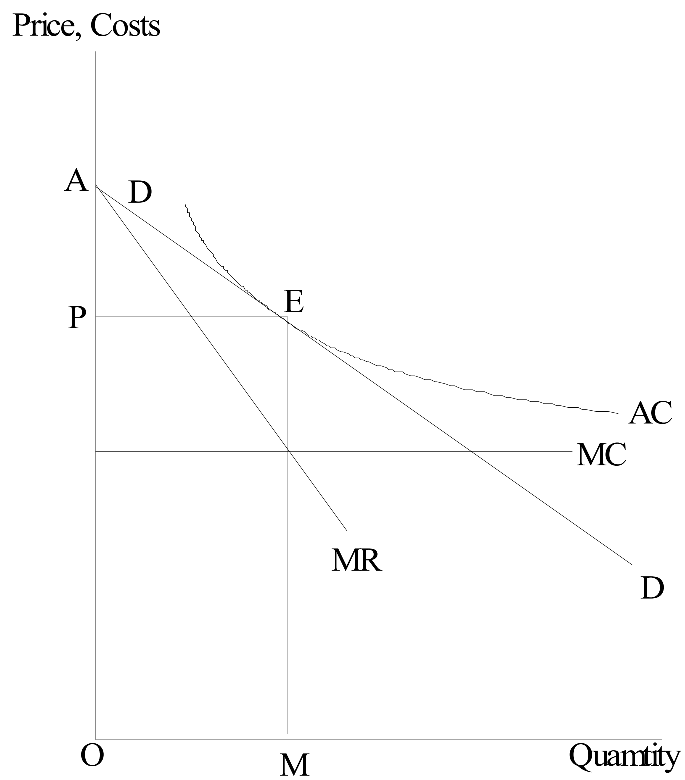

Figure 6: Protection Leading to Disappearance of Products

Romer sets up a simple model in which a country consumes a single good, which is produced using labor and a large number of inputs that are differentiated and imported from abroad. The larger the number of available inputs, the lower the cost of production. Each is produced at a fixed per-unit cost but is subject to fixed costs as in Figure 6. Fixed costs vary across inputs and the latter are indexed according to rising costs. The supplier of each input acts as a monopolist but entry is free. The number of inputs supplies is then determined by setting the profit of the marginal input supplier equal to zero. An increase in tariff reduces the number of inputs supplies and increases the cost of production.

Assuming equal shares of labor and input costs, Romer simulates this model under two alternative scenarios. Under the first scenario, he freezes the number of inputs at the free trade level and calculates the decline in welfare accompanying the introduction of a tariff. Under the second scenario, he allows the number of inputs to adjust. He finds that an 11.11 percent tariff [t/(1+t) = .10] lowers real income by 1 percent under the first scenario and by 19.81 percent under the second scenario! Disappearance of some inputs leads to very large adverse effects on welfare for even small tariffs.[15]

2.5 X-efficiency

Reacting to the low estimates of the cost of distortions resulting solely from allocative inefficiency, Leibenstein (1966) offers the idea that distortions may result in larger costs if they reduced efficiency within the firm thereby shifting the production function downward. As proposed, the idea is *ad hoc*, leading Corden (1970, 1974) to attempt a more rigorous conceptualization of it. Corden begins by noting that if (i) output responds positively to managerial effort, (ii) income elasticity of leisure in the manager's utility function is positive, and (iii) protection distributes income in favor of producers of import-competing goods, it may reduce X-efficiency by inducing managers to reduce their effort. He hastened to add, however, that redistribution in favor of producers of import-competing goods must also increase managers' effort in exportable products and, thus, increase X-efficiency in those goods. Therefore, on balance, the economy-wide X-efficiency may rise or fall with protection.[16]

Corden goes on to suggest, however, that the idea could be resurrected under at least two circumstances. First, if protection raises the degree of monopoly in general and thus shifts income in favor of profits and against workers, managers might reduce effort in

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[15] The specific model employed by Romer is highly simplified and it will be interesting to calculate how powerful his effect is in the more conventional models.
[16] John Martin (1978) offers a formal analysis of this set of ideas.

general. Second, if imports are capital intensive, protection may redistribute income in favor of capital everywhere and reduce effort in all industries. But even in these cases, we must assume that workers cannot increase effort in response to their reduced incomes.

It follows that the theoretical foundations of the conclusion that protection lowers X-efficiency in general are shaky.[17] Nevertheless, Balassa (1971) and Joel Bergsman (1974) have gone on to build the losses due to X-efficiency in their estimates and arrived at costs of protection much larger than those obtained under the conventional methodology.[18]

Applying a partial-equilibrium framework and assuming constant production costs, Bergman (1974) and Balassa (1971) divide the import-competing sectors into two categories: conventional sectors such as textiles and clothing that will survive the freeing of trade and modern sectors such as consumer durables that will be forced out of existence by increased competition. High domestic costs in the former case are identified with X-inefficiency and in the latter with allocative inefficiency.

Following Bergsman (1974), the essential idea can be explained with the help of Figure 7. In this figure, DD represents the demand for an import-competing product, P_W its world price, t the ad valorem tariff and $P_W(1+t)$ the domestic price. In the presence of protection, domestic marginal cost of production is assumed to be constant at $P_W(1+t)$. If the product belongs to the first category, upon removal of protection, X-efficiency is assumed to improve by the full amount of initial protection per unit, yielding a net gain of tP_WC_t in production and triangle d in consumption. If the product belongs to the second category, no improvement in X-efficiency takes place, the industry disappears and resources

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[17] Besides, if our ultimate interest is in welfare, our calculations must also take into account the changes in utility due to changes in effort.

[18] Balassa also uses the term "dynamic" effects to refer to these costs.

are allocated to other sectors. The gain in production, which is once again tP_WC_t, is classified as resource allocation effect. The key to larger X-efficiency effects is the presence of higher protection and larger value of output of goods in the first category of sectors.

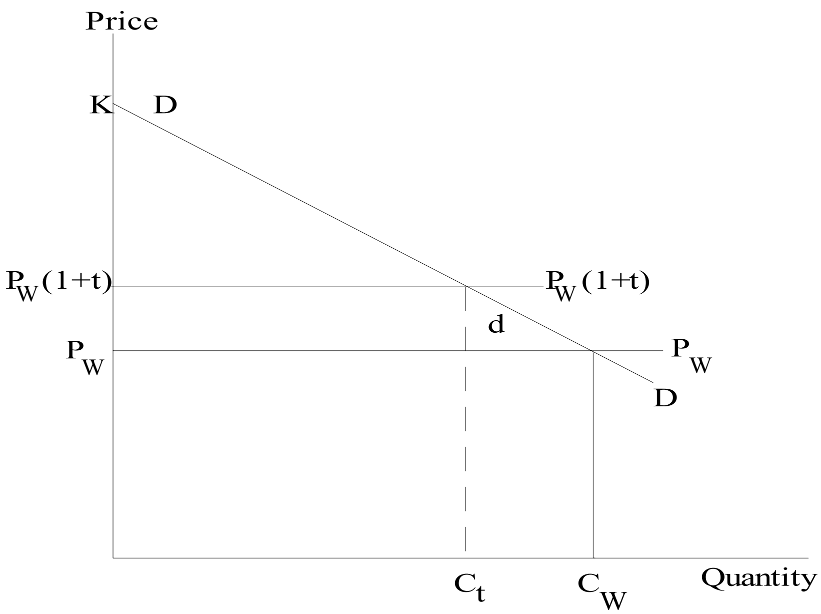

Figure 7: Cost of Protection: X-inefficiency

Table 2 offers a summary of the results reported in Balassa (1971), who follows the Bergsman (1974) methodology. Observe that X-efficiency costs of protection are uniformly much larger than the traditional costs. Brazil provides a particularly striking example: the X-efficiency cost for this country is 9.5 percent of GNP while the net conventional cost is zero! The conventional benefits of liberalization are exactly offset by the losses arising from the deterioration of the terms of trade (see the last row of Table 2). For Malaya and Chile, which export primary products that are subject to low elasticity of demand, the terms of trade effect is sufficiently large to turn the net conventional cost of protection actually negative.

Before concluding this section, it may be noted that the effect identified with X-efficiency by Bergsman (1974) and Balassa (1971) can be readily interpreted as the allocative effect resulting from trade liberalization in the presence of scale economies. Thus, if we assume that unit costs decline with the scale of production and producers price the product at the world price plus tariff as in Harris (1984), the removal of tariff lowers the cost of production precisely in the manner assumed by Bergsman (1974) and Balassa (1971) for sectors that survive trade liberalization.

Table 2: Cost of Protection as Percent of GNP

	Brazil 1966	Chile 1961	Malaya 1965	Pakistan 1963-64	Mexico 1960	Norway 1954	Philippines 1965
Allocative Cost*	0	-3.4	-0.8	0.8	0.3	-0.2	1.1
X-efficiency Cost	9.5	9.6	0.4	5.4	2.2	2.0	2.6
Total Cost	9.5	6.2	-0.4	6.2	2.5	1.8	3.7
Memo (TOT Effect)	-0.5	-3.5	-1.4	-0.6	-0.3	-0.7	-0.6

*Includes the terms of trade effect shown in the last row.

Source: Balassa (1971, Table 4.1; p. 82)

2.6. *Directly Unproductive Profit-seeking (DUP) Activities*

Anne Krueger (1974) observes that in the presence of import quotas, firms may compete for quota rents using real resources. Under free entry, such rent seeking will result in the waste of real resources equal in value to the entire quota rent. She estimates quota rents to be 7.3 percent of GNP in 1964 for India and 15 percent in 1968 for Turkey and surmises that these may represent extra costs of protection.

In turn, Bhagwati (1982) has broadened the concept of rent seeking and measurement of the cost of protection to include the impact of what he has christened as Directly Unproductive Profit-seeking (DUP) activities. In Bhagwati (1989), he distinguishes between *downstream* DUP activities such as rent and revenue seeking and tariff and quota evasion that take place in response to an existing distortion and *upstream* DUP activities such as tariff and quota seeking that create distortions in the first place. He correctly notes that only downstream DUP activities should be considered in the measurement of the cost of protection since upstream DUP activities are the cause, not effect, of protection.

Bhagwati (1989) argues that even downstream DUP costs may be smaller than the entire quota rent or tariff revenue for two reasons: DUP activities may not be perfectly competitive because the brother-in-law has a better chance of getting the license and in the presence of a distortion, the shadow price of the resources themselves is likely to be below the market prices. He concludes, however, that despite these caveats, the DUP literature strengthens the anti-protectionist hand.

Grais, de Melo and Urata (1986) incorporate rent-seeking costs accompanying import quotas into a general-equilibrium simulation of Turkey. They find that the removal of quotas alone results in a 6.3 percent increase in the real GDP in the year 1978. This is a much larger than the 1 to 2 percent figure produced by conventional calculations. Again, bears noting, however, that the presence of rent seeking is simply assumed in the study rather than actually measured.

3 Growth and Productivity Effects

The relationship between growth and openness at the theoretical as well as empirical level has been systematically discussed recently by T. N. Srinivasan and Bhagwati (2001).

As they note, within the growth accounting framework, growth depends on inputs, efficiency with which inputs are deployed and innovation that can give rise to new products, new uses of the existing products or increased productivity of inputs. Reduction in trade barriers can potentially contribute to each of these factors.

Rather than discuss various theoretical nuances, in the rest of this paper, I restrict my attention to empirical literature and even then only selectively. Two approaches have been applied to assessing the empirical relationship between openness and growth: case studies and cross-country regression studies. For policy judgments, the importance of the former can hardly be overemphasized. But for the present purpose, it is the latter on which I will focus.

Table 3, taken from Harrison (1996), summarizes the findings of the main studies published during or prior to early 1990s. The studies in panel I employ some measure of trade shares or changes in them to proxy openness. Most studies find a positive and statistically significant relationship between this measure and growth. A problem with trade shares is that they are themselves endogenous. To avoid this problem, Edwards (1992) uses Leamer's (1988) index. Leamer's index is based on the deviations of observed trade flows from what they would have been had the economy been trading freely. The latter calculation itself is based on an empirical model. Edwards finds a positive and significant relationship between this index and growth. Oddly, however, Pritchett (1996) shows that Leamer's (1988) measure bears an inverse relationship to other measures of openness such as import penetration, quotas and tariffs.

Table 3

Summary evidence on openness and growth

Openness measure	Countries	Period	Impact	Source
I. Measures based on trade shares				
			Coefficient on openness	
Deviation from predicted trade	45	1973–78	Significant, > 0	Balassa (1985)
Deviation from predicted trade (Leamer, 1988)		1982	Significant, > 0	Edwards (1992)
Changes in trade shares	19	1960–85	Significant, > 0	Helliwell and Chung (1991)
Trade shares	81 LDCs	1960–85	Weakly significant, > 0	Quah and Rauch (1990)
II. Price-based and administrative measures				
Bhalla and Lau (1992), using the relative price of tradables to international prices	60	1960–87	Raises GDP growth	Bhalla and Lau (1992)
Relative domestic price of investment goods to international prices	98	1960–65	Raises GDP growth per capita	Barro (1991)
Relative price of traded goods	95	1960–85	Raises GDP growth per capita	Dollar (1991)
Effective rate of protection in manufacturing	47	1950–80	Lower protection raises GDP growth	Heitger (1986)
Trade liberalization index from Thomas et al. (1991)	35	1975–85	Export incentives positively affect GDP per capita growth, insignificant impact of import restrictiveness	Lopez (1990)
Trade liberalization index from Thomas et al. (1991)		1978–88	Trade reform positively affects GDP growth.	Thomas and Nash (1992)
III. Micro and productivity studies				
Deviation from predicted export share	108	1960–82	Positive	Syrquin and Chenery (1989)
Export growth	4	1955–78	Positive	Nishimizu and Robinson (1984)
Export growth	17	1950–80	Positive	Nishimizu and Page (1990)
Export growth	4	1976–88	Positive	Tybout (1992)
Import penetration	17	1950–73	Ambiguous	Nishimizu and Page (1990)
		1973–85	Negative	
Import substitution (IS) (1 − Import penetration)	4	1955–78	IS negatively affects TFP	Nishimizu and Robinson (1984)
Import substitution	4	1976–88	IS positively affects TFP	Tybout (1992)
Effective rates of protection and domestic resource costs	Turkey	1963–76	Ambiguous	Krueger and Tuncer (1982)
Change in import shares	UK	1976–79	Ambiguous	Geroski (1989)
Tariffs and import penetration	Ivory Coast	1975–87	Positive	Harrison (1994)
IV. Causality tests				
Methodology			*Exports cause growth?*	
Granger tests	37	1950–81	For only 4 countries	Jung and Marshall (1985)
White specification test	73	1960–77	Yes	Ram (1985)
Granger, Sims tests	4 (Asian NICs)		Sometimes	Hsiao (1987)
Granger tests	Austria	1965	No, but productivity growth causes exports	Kunst and Marin (1989)

Source: Harrison (1996)

Panel II of Table 3 lists studies that use policy instruments as measures of openness. These include average tariff rates and quantitative restrictions. The advantage of these measures is that they are less likely to be endogenous than trade shares. The disadvantage is that they are difficult to measure. For example, it matters how tariff rates are averaged and very high tariff rates are likely to have water in them. Quantitative restrictions are even harder to measure. They generally represent the proportion of imports subject to non-tariff barriers. This procedure gives the least weight to goods whose imports are restricted the most. An alternative measure relies on the proportion of product lines subject to import restrictions. This measure has the disadvantage that it gives no consideration to the severity of various restrictions. These problems notwithstanding, the studies based on the policy variables do show a generally positive relationship between openness and growth.

Panel III of Table 3 lists micro studies that quantify the relationship between productivity growth and trade. These studies find a positive association between productivity growth and exports. But the relationship between productivity growth and import penetration is often negative. Finally, the studies applying causality tests and listed in panel IV of Table 3 lend some support to the hypothesis that causation flows from openness to growth rather than the other way around.

Harrison (1996) herself carries out a detailed investigation of the link between openness and growth using a pooled cross-country, time-series data. She experiments with as many as seven different indexes of openness with country samples that vary from 17 to 51 and time periods 1960-86 and 1978-88. Harrison's results are mixed. When observations are averaged over the entire sample period so that regression data are purely of a cross-country nature, only one of the seven measures of openness reveals a positive association with growth. When averages are taken over five-year periods so that the sample has both cross-section and time series elements, three measures of openness are statistically significant. Finally, when annual data are employed, six out of seven measures of openness become statistically significant.

Some of the recent studies have tried to study the link between openness and growth by exploring the presence of convergence in incomes. The idea is that in a world in which everyone has access to the same technology and capital is mobile, poorer countries must grow faster so as to eventually catch up with the rich countries. In their ambitious study, Sachs and Warner (1995) find no such tendency when they do a regression of growth from 1970 to 1989 on the initial income in 1970 in 117 countries. Convergence implies a negative coefficient of the initial level of per-capita income: the poorer the country, the faster it should grow to catch up with the rich countries. In fact, the coefficient turns out to be positive and statistically insignificant. Sachs and Warner argue that this absence of evidence supporting convergence is due to protectionist policies pursued by the large majority of the developing countries until at least the end of 1970s.

But once Sachs and Warner control for trade policy and other relevant explanatory variables, the coefficient of the initial per-capita income becomes negative and statistically significant at 5% level. All variables with statistically significant sign, including that representing openness, have the expected sign. Since convergence is shown controlling for openness and other variables, it may be viewed to be the result of technological catch up.[19] Moreover, the positive coefficient of the openness variable implies that increased openness leads to an increased rate of growth of the GDP.

The tendency towards convergence among economies that are open is also shown to exist by Ben-David (1996). He forms groups of countries, which trade intensively with one another. He then compares the tendency towards convergence among countries within these

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[19]But this is not necessary since convergence may be the result of convergence in capital-labor ratios as well.

groups with that among countries within randomly selected groups. He finds that the probability of observing in random groups a convergence coefficient as high as that estimated for the groups within which countries trade intensively with each other is very low.

4 Concluding Remarks

In this paper, I have reviewed the current state of our knowledge on how costly is protection in the sense of static efficiency and selectively briefly considered cross-country regression studies of the relationship between growth and openness. With respect to static costs of protection, the paper arrives at three main conclusions.

First, if we rely on the traditional assumption of increasing opportunity costs, the deadweight loss due to allocative inefficiency generated by average tariffs of 15 percent or less are unlikely to exceed 1 percent of GNP.

Second, one cannot conclude from this, however, that under increasing opportunity costs, static costs of protection are always low. High levels of protection can readily lead to losses nearing 10 percent of GNP. Irwin (2001) estimates that the Jeffersonian trade embargo that resulted in protection equivalent to 70 percent tariff on the average reduced the U.S. incomes by 7 to 10 percent of GNP. Average tariffs of 100 percent or more, prevailing in India until 1991, can be shown to result in even larger deadweight losses. Hypothetical examples provided in this paper have generated costs of autarky that may be as high as 50 percent of GNP.

Finally, if we modify the standard model to allow for scale economies in production, fixed costs of introducing products into a market, X-efficiency, and directly unproductive profit-seeking (DUP) activities, even low levels of protection can result in large deadweight losses. Harris (1984) finds that in the presence of scale economies in production, average protection of 11 percent cost Canada 4 percent of its GNP in 1976. In the presence of fixed costs of introducing new products into a market, Romer (1994) provides a hypothetical example in which a 10 percent tariff leads to a loss of one fifth of GNP. Allowing for X-efficiency effects, Balassa (1971) finds protection cost Brazil 9.5 percent of GNP in 1966. Allowing for DUP activities, Grais, de Melo and Urata (1986) find the cost of quotas in Turkey was 6.3 percent of its GNP in 1978.

I have also reviewed briefly the literature evaluating the link between openness and growth using cross-country regressions. While the findings of this literature remain subject to dispute as evidenced by its critique by Francisco Rodriguez (1999) and counter-critique by Bhagwati and T. N. Srinivasan (1999), from the policy perspective, the link between openness and growth is difficult to dismiss. Bhagwati and Srinivasan (1999) argue this persuasively on the basis of country case studies. Countries such as Hong Kong, Singapore, Republic of Korea and Taiwan, which opened their economies early on grew rapidly. On the other hand, countries such as India and China, which remained highly protectionist, paid a high price in terms of low growth. In the following decades, both countries began to open up and saw their economies grow rapidly.

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