

EFFECTIVE TARIFF PROTECTION

LEE JAE - OK *

I. Basic Idea of Effective Tariff Protection

Estimates of the height of national tariff levels are designed to give expression to the restrictive effect of duties on trade flows. In a general equilibrium framework the restrictive effect of a country's tariff can be indicated by the difference between potential and actual trade, when the former refers to trade flows that would take place under *ceteris paribus* assumptions if the country in question eliminated all of its duties. Tariffs affect the pattern of production and consumption and generally reduce import and exports under full employment conditions as changes in relative prices associated with the imposition of tariffs lead to resource shifts from export industries to import-competing industries.

In empirical investigations, however, attention is focussed on imports, so that the difference between potential and actual imports in presumed to express the restrictive effect of duties.

But we face a problem that has been largely disregarded in making international tariff comparisons; the implications of duties on raw materials and intermediate product for the production of goods at a higher level of fabrication. It is easy to see that high duties on materials and intermediate products will raise the average level of tariffs on non-agricultural commodities but will reduce the degree of protection accorded to final goods by increasing the cost of inputs. Therefore, the protectiveness of national tariff cannot be indicated by comparing nominal rates of duties and averages of these duties—weighted or unweighted—when we take account of duties on material inputs. That is why, in international comparisons of the protective effects of national tariffs, one should use effective rather than nominal rates of duties.

II. The Derivation of the Effective Protective Rate and Its Implications(Under the simplifying assumptions that input coefficients are fixed and general repercussions do not exist)

* Senior Fellow, Korea Rural Economics Institute, Seoul, Korea.

The nominal tariff rate of an industry(t) is defined as $t = (P' - P) / P$ where P' and P are the unit prices of the industry's output with and without tariffs respectively, while the rate of effective protection(g) is defined as

$$(1) \quad g = \frac{(V' - V)}{V}$$

where V' and V are the value added per unit of output with and without protection, respectively.

Given the definition of effective protection, it is easy to present a formula which expresses the effective rate as a precise function of the nominal tariff on the output $j(t_j)$, the input $i(t_i)$ and coefficient of intermediate input i per unit of output $j(a_{ij} = P_{ij} / P_j)$ where P_{ij} and P_j are respectively the value of input i used per unit of industry j 's output and the unit price of output j . Free trade value added is $V'_j = 1 - a_{ij}$ and protected value added is $V'_j = (1 + t_j) - a_{ij}(1 + t_i)$ so that after substitution into(1),

$$(2) \quad g_j = \frac{t_j - a_{ij}t_i}{1 - a_{ij}}$$

and in case of more than one input

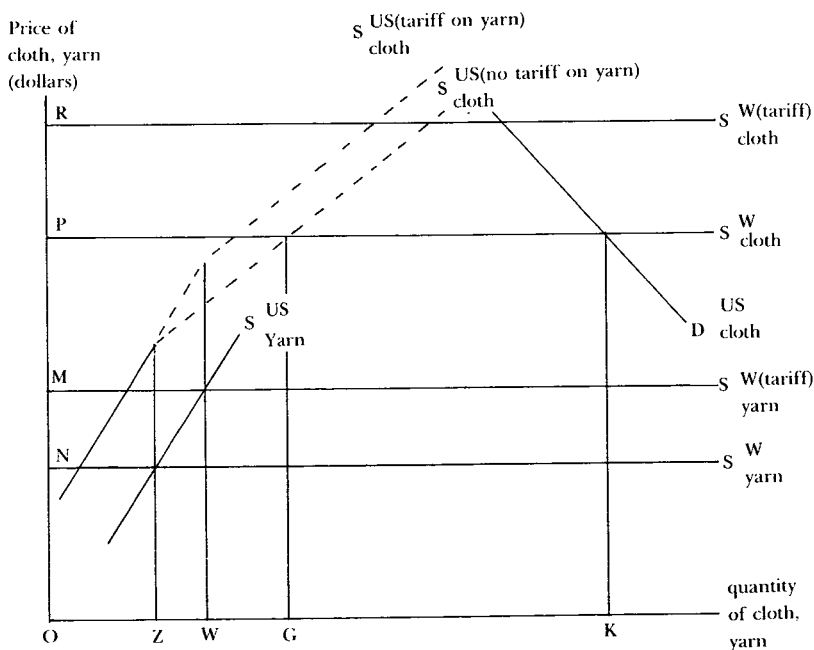


FIGURE 1

$$(2)' \quad g_j = \frac{t_j - \sum_{i=1}^n a_{ij} t_i}{1 - \sum_{i=1}^n a_{ij}}$$

Alternatively, effective protection rate could be derived by a diagram. For example, we will analyze how much protection is afforded to the U.S. cloth weaving industry, as a result of the combined tariffs on cloth and yarn. In the Figure 1 above, we show the domestic supply and demand curves for cloth and the world supply curve of cloth. In addition we show the U.S. supply curve for yarn and the world supply curve for yarn.

We maintain the small country assumption of infinitely elastic foreign supply curves for both cloth and yarn. Also we assume that the U.S. does not specialize completely and that there is fixed amount of yarn that is used per unit of cloth woven. The latter assumption rules out possible substitution effects among inputs in the U.S. cloth weaving industry. Units in the Figure 1 are chosen so that one unit of yarn is required for each unit of cloth produced.

Initially, when there are no tariffs at all imposed, the price of cloth is PO, and the U.S. produces OG and consumes OK of cloth. The yarn price is equal to NO and the U.S. produces OZ and uses OG of yarn in the cloth production process.

The value added in the cloth weaving industry is given by the difference between the price to be paid for the yarn inputs and the value of the woven cloth, that is, PN. Now let us assume that a nominal tariff rate equal to RP / PO is imposed on cloth imports and a nominal tariff rate MN / NO yarn imports. In this case the cloth tariff increases protection to the cloth industry, but yarn tariff reduces protection. Now we can calculate the effective rate of production for the cloth weaving industry by

$$g_j = \frac{RP - MN}{PN} \left(= \frac{V' - V}{V} \right)$$

$$= \frac{\frac{RP}{PO} - \frac{MN}{NO} \cdot \frac{NO}{PO}}{\frac{PN}{PO}} = \frac{\frac{RP}{PO} - \frac{MN}{NO}}{\frac{PN}{PO}}$$

$$\text{where } \frac{RP}{PO} = t_j, \quad \frac{MN}{NO} = t_i, \quad \frac{NO}{PO} = a_{ij} \text{ and } 1 - \frac{NO}{PO} = \frac{PN}{PO} = 1 - a_{ij}.$$

The implications of equation (2) can be summarized as follows ;

- (a) If $t_j = t_i$, then $g_j = t_j = t_i$
- (b) If $t_j > t_i$, then $g_j > t_j > t_i$

(c) If $t_j < t_i$, then $g_j < t_j < t_i$

(d) If $t_j < a_{ij}t_i$, then $g_j < 0$

(e) If $t_j = 0$, then $g_j = - (t_i \frac{a_{ij}}{1-a_{ij}})$

(f) If $t_i = 0$, then $g_j = \frac{t_j}{1-a_{ij}}$

(g) And $\frac{\partial g_j}{\partial t_j} = \frac{1}{1-a_{ij}}$

(h) $\frac{\partial g_j}{\partial t_i} = \frac{-a_{ij}}{1-a_{ij}}$

(i) $\frac{\partial g_j}{\partial a_{ij}} = \frac{t_j - t_i}{(1-a_{ij})^2}$

Implication (a) tells us that if the input tariff rate is equal to the output nominal rate, then the output effective rate will also be equal to the output nominal rate; there is no divergence between the nominal and the effective rate. The equation also shows that effective rates of protection are an increasing function of output tariffs (g) and a decreasing function of input tariffs (h). Furthermore, it is possible for the effective rate to be negative (d). Such a result comes about when the tax element implicit in the tariff on the inputs, i.e., $a_{ij}t_i$ is greater than the subsidy granted through the duty on the activity's output i.e., t_j , or there is no change in the tariff levied on the output while the tariff on the direct inputs changes.

Thus, not only is the tariff on the final product decisive, but the whole tariff structure plays a role in determining the protection afforded to an industry.

It should be noted, however, that the measurement of effective protection for any given process needs to be concerned only with the tax equivalent duty on the inputs going directly into the activity and not with tariff on inputs which go into making these inputs because the prices of the part of final product are determined by their free market price plus tariffs on them.

Lastly, it is worth mentioning that subsidies on imported inputs raise and excise taxes on inputs lower effective protection rates. This point is obvious from the inspection of the formulae introduced above if it is remembered that a subsidy enters the calculation with a negative t_i and excise taxes raises the prices of inputs just like nominal tariffs.

III. Empirical Evidence

According to Bela Balassa (Table 1), the effective rate is quite different from the nominal tariff rate. Thus traditional nominal tariff rates do

not give an accurate picture of the extent of protection afforded to any given industry or of the height of the average tariff of a country.

The differences are especially pronounced—and effective rates are more than double nominal rates—in the case of textile fabrics and steel ingot. In turn, effective duties are lower than nominal tariffs in the case of ships, where the protective effect of the low duties levied on these goods is more than offsetted by duties on their inputs, so that the effective rate of tariff is negative.

The calculation of effective duties also influences the country's ranking of tariffs in regard to individual industries. In terms of effective tariffs, the U.S. appears to be more protective than nominal duties in case of ingot. These changes in rankings find their origin in the relatively low duties on material in the U.S. that raise the protective effect of a given nominal duty.

Among countries under consideration, a broad similarity exists with respect to the ranking of industries according to their effective rates. In most of the countries, effective rates are high on textile fabrics and clothing. As a possible explanation, it may be suggested that in the case of these commodities cost differences are relatively small among the industrial countries, while the possibilities of substituting foreign commodities for domestic merchandise are considerable and protectionist pressures are also strong.

TABLE 1 Nominal and Effective Tariff Rates, 1962

Commodity	United States		United Kingdom		Common Market		Japan	
	Nominal	Effective	Nominal	Effective	Nominal	Effective	Nominal	Effective
Thread and Yarn	11.7	31.8	10.5	27.9	2.9	3.6	2.7	1.4
Textile Fabrics	24.1	50.6	20.7	42.2	17.6	44.4	19.7	48.8
Clothing	25.1	35.9	25.5	40.5	18.5	25.1	25.2	42.4
Ingot	10.6	106.7	11.1	98.9	6.4	28.9	13.0	58.9
Rolling Mill Products	7.1	- 2.2	9.5	7.4	7.2	10.5	15.4	29.5
Metal Manufactures	14.4	28.5	19.0	35.9	14.0	25.6	18.1	27.7
Ships	5.5	2.1	2.9	-10.2	0.4	-13.2	13.1	12.1
Automobiles	6.8	5.1	23.1	41.4	19.5	36.8	35.9	75.7
Airplanes	9.2	8.8	15.6	16.7	10.5	10.8	15.0	15.9

Source : Bela Balassa, "Tariff Protection in Industrial Countries : An Evaluation," *Journal of Political Economy* (The University of Chicago Press, December 1965), p.580.

IV. Policy Implications of the Effective Tariff Protection

The concept of effective protection as just discussed has many important implications for policy formulation and the analysis of the efficiency of protection. The most important of these implications are as follows.

(i) The theory of effective protection formalizes calculations

which national tariff setting agencies employ informally whenever they confront applications for tariff protection from an industry.

(ii) By translating a set of nominal rates into a set of effective rates, one can understand more clearly the general characteristics of a tariff structure and changes in it. For example, a widely noted characteristic of the tariff structure of many countries is that nominal rates tend to be low or even zero for raw materials and to rise or escalate with the degree of processing. It is then correct to say that the escalated structures of the advanced countries encourage underdeveloped countries to export raw materials rather than to export processed products.

(iii) The theory of effective protection has some implications for international bargaining about tariff reduction. First, instead of bargaining for equivalent reductions in nominal tariff rates of groups of industries, agreement should be sought for equivalent reductions in effective rates of protection. Second, a country which reduces tariffs more on intermediate than final products can actually end up with greater protection for the final production processes than it enjoyed before. However, according to the equation (1), equi-proportionate reductions in all nominal rates cut all effective rates of protection by an equal proportion. Third, all relative price distorting actions by government, quotas, taxation, restrictive practices, and discrimination affect effective protection patterns. For purposes of nominal tariff rate setting, it is therefore desirable that effective protection rates be analyzed and calculated reflecting the net effects on these price distorting influences from all important sources.

(iv) The welfare losses by consumers induced by tariffs and measured by the dead weight loss of consumer surplus are not affected by the structure of tariffs and rates of effective protection for industrial processes. Nominal tariff rates continue to serve as the basis for measuring the welfare losses from protection since consumers are guided by relative prices of final goods which change directly with nominal tariffs.

(v) The levels of the effective rates reveal the degree to which the country has to provide artificial support to individual industries. The higher the needed support, the lower is the country's comparative advantage in the industry or process. From this it follows that ranking processes by their levels of effective protection is equivalent to ranking them by the degree of their current competitiveness in world markets.

(vi) Theorizing about the causes of observed differences in nominal tariffs among industries has led economists to hypothesize that tariff rates should be an increasing function of the labor content of the U.S. produced goods. The theory is that the relative scarcity of labor in the U.S. results in a comparative disadvantage in the production of

labor-intensive goods which require protection for their existence. However, the theory of effective protection suggest that the proper focus of analysis of labor intensity are not the final product and the nominal tariff rate but the process and the effective rate. Tests showed that the rates of effective protection are not an increasing function of the labor intensity of a process, casting doubt on the validity of the hypothesis that tariffs are designed to protect U.S. labor against the competition from foreign trade.

(VII) In empirical studies, quite a significant number of process have been found to have negative rates of effective protection which may reflect a specific tariff structure. Considering equation (2) it is apparent that the effective rate can be negative when either the numerator is negative while the denominator is positive; or *vice versa*. In the first case the tariff structure is such that the weighted average of input tariffs exceeds the nominal tariff of the output (i.e., $t_j < a_{ij}t_i$) as a stated above in Section II. This event occurs when the industry is unaware of the taxation imposed on its process by the input tariffs or it is unable to persuade tariff setting authorities of the need for offsetting protection. Ignorance of the total effect of a country's protective structure on specific industries may not be uncommon in countries which tariffs, quotas, exchange restrictions, and other government regulations result in a most complex set of cost distortions. In the second case, the value of tradable inputs exceeds the value of the output, both measured at unprotected prices (i.e., $\sum_{i=1}^n a_{ij} > 1$). This means that the finished good could be purchased abroad more cheaply than the sum of the importable inputs used up in its production. It is hard to believe that such a fact could escape economic policy makers in the long run, but given the complexity of protective structures, especially in developing countries, it may go unnoticed for some time.

V. Conclusion and Summary

Throughout the discussion of this paper, the validity of effective protection depends upon several assumptions. The first one is that the general equilibrium repercussions of tariffs are zero. The second one is that factor input proportions are fixed. The relaxation of both these assumptions is necessary for the analysis of production and welfare effects of massive changes in tariffs.

The conclusions of general equilibrium models will be less general but more useful for researchers interested in the application of the concept of effective protection to real world problems. The problem with genuine general equilibrium analysis is that the most explored theoretical models contain only two inputs and two outputs so that their empir-

ical usefulness is nil. The most promising approach appears to lie in the imposition of some a prior constraints on the mathematical forms of production and consumption functions and the sign and size of elasticities of substitution, demand, and supply.

With the assumption of fixed input proportion, effective rates of protection are inadequate as measures. They are greatly affected not only by the classification scheme but even more critically by the unknown degree of substitutability among factors in the industry whose protection is being examined. Some theoretical research has been devoted to relaxing the assumption of fixed factor inputs while retaining the partial equilibrium nature of the analysis. This combination of assumptions appears to be an improvement over that used in the original formulation of the theory of effective protection for two reasons. First, elasticities of substitution in production functions are well understood theoretically and empirical evidence on their magnitude is accumulating rapidly. Second, most of the problems faced by tariff-making authorities involve relatively small changes in tariff structure, as when they are asked to pass judgement on the merit of new applications for protection or of old tariff under periodic review. In these instances general equilibrium repercussions of tariff changes may be disregarded safely as they are likely to be exceedingly small.

However, we should point out that, even if serious problems in effective protective rate calculation arise because of its restrictive assumption, the theory of effective protection contributes substantially to the understanding of how the structure of nominal tariffs affects the production pattern of a country by specifying what effects tariffs have on the value added, or process, of an industry rather than on the price of the protected industry's output.

REFERENCES

- Balassa, B. (1965), "Tariff Protection in Industrial Countries: An Evaluation," *Journal of Political Economy*, vol. LXXIII (December), pp.573 - 594.
- Bhagwati, J.N., and T.N. Srinivasan(1973), "The General Equilibrium Theory of Effective Protection and Resource Allocation," *Journal of International Economics*, vol.3, no.3(August), pp.259 - 281.
- Basevi, G.(1966), "The United States Tariff Structure: Estimates of Effective Rates of Protection of the United States Industries and Industrial Labor," *Review of Economics and Statistics*, May.
- Corden, W.M.(1966), "The Structure of a Tariff System and the Effective Protective Rate," *Journal of Political Economy*, vol. LXXIV, no.3, (June), pp.221 - 237.
- Guisinger, S.E.(1969), "Negative Value Added and the Theory of Effective Pro-

- tection," *Quarterly Journal of Economics*, vol. 83, no.3(August), pp.415 — 433.
- Humphrey, D.B.(1969), "Measuring the Effective Rate of Protection : Direct and Indirect Effects," *Journal of Political Economy*, vol. 77, no.5(September), pp.834 — 844.
- Kreinin, M.E., J.B. Ramsey, and J. Kmenta(1971), "Factor Substitution and Effective Protection Reconsidered," *American Economic Review*, vol.LXI, no.5(December), pp.891 — 900.
- Leith, J.C.(1968), "Substitution and Supply Elasticities in Calculating the Effective Protective Rate," *Quarterly Journal of Economics*, pp.588 — 601.
- Lloyd, P.J.(1970), "Effective Protection : A Different View," *Economic Record*, vol. 46, no.115(September), pp.329 — 340.
- Massell, B.F.(1968), "The Resource-Allocative Effects of a Tariff and the Effective Protection of Individual Inputs," *Economic Record*, vol. 44, no.107(September), pp.369 — 376.

빈

면