Effective Protection and National Content Requirement:

The Case of Iranian Automobile Industry

Basudeb Biswas*
and
Ahmad Shahrok**

Many less developed countries have pursued import-substitution policies to promote economic development. Tariffs and other trade barriers have been used to encourage domestic production of substitutes for imports. However, at the same time, they are (a) imposing tariffs on imported inputs and (b) are introducing national content requirements for the producers in the protected industries. As a result, the effective rate of protection, relevant for the analysis of resource allocation in a country, differs from the nominal rate of tariff. In this paper, our purpose is to calculate the effective rates of protection accorded to five different models of automobiles in the Iranian Automobile Industry, which account for more than 95 percent of the domestic production of passenger cars in the country.[1]

The theory of effective protection suggested by Johnson (1965) and Corden (1966) and later elaborated by Grubel (1971) in the context of a tariff structure in a country needs some reformulation and simplification for its empirical application to the case of a par-

* Professor of Economics, Utah State University.
** Assistant Professor of Economics, Free University of Iran.

1 Tariffs on inputs and national content requirements have two effects: a) they influence the effective rate of protection for the producers of the final product and, b) they protect the producers of the inputs. Our study exclusively deals with the first effect.

ticular country in the context of national content requirements. The reformulated theory of effective protection of Corden (1971) and Johnson (1972) and the content program of the Canadian Automotive Protection analyzed by Paul Wonnacott (1965) have been simplified to make them applicable to the case of the Iranian Automobile Industry. So, in the process of calculating the effective rate of protection to the Iranian Automobile Industry, we have come up with a simplified version of the theory of effective protection[2] in the context of national content requirements.

I. Theoretical Framework:

When both the final product and the material inputs are importables of a country, a tariff on the former acts as a subsidy, while a tariff on the latter is equivalent to a user tax. For this reason, the concept of effective rate of protection refers to the net effect of the entire tariff structure on the value added in a final economic activity. It is measured by the ratio of the increment in the value added due to the tariffs to the value added at c.i.f. prices.

In a partial equilibrium setting, under the assumptions of fixed input coefficients and given international prices, the effective rate of protection is measured by the following expression:[3]

$$(1) \quad e_j = \frac{t_j - \bar{t}_i \sum_{i=1}^{n} m_{ij}}{1 - \sum_{i=1}^{n} m_{ij}}$$

where e_j is the effective rate of protection to the economic activity resulting in final product, j, t_j is the rate of nominal tariff on product j, t_i is the average rate of nominal tariff on all material inputs used in the production of output j and m_{ij} is the share of input i in the unit cost of proudct j at free trade prices. The average rate of

2 The standard theory has to be simplified for two features of the protection policy of the Iranian automobile industry. First, instead of specifying the percentage of the value of a car that must be allocated to domestic inputs the Iranian government specified some mandatory components to be acquired from local sources. Secondly, the prices of locally supplied material inputs were fixed instead of having rising supply functions.

3 For derivation of the formula see Corden (1971).

nominal tariff on inputs is a weighted average of the separate individual rates t_i, where the share of an input in the unit cost of the output is used as the weight. It is given by

$$(2) \quad \bar{t}_i = \sum_{i=1}^{m} m_{ij} t_i \Big/ \sum_{i=1}^{n} m_{ij}$$

Under a national content program,[4] the domestic producers of a final product, who are protected by a tariff, are obliged to allocate a specified proportion of the unit cost of their output to domestically supplied inputs as substitutes for imports. Since the locally produced inputs cost more than the imported ones of the same quality, the local manufacturers of the final product are implicitly taxed, and this can be regarded as equivalent to a tariff on inputs. So the national content requirement in the protection policy of a country calls for the use of effective rate of protection.

For calculation of the effective rate of protection, we need to know (a) the nominal rate of tariff on the final product, t_j, (b) the average rate of tariff on material inputs, $\bar{t}_i$, and (c) m_{ij}, the share of input i in the unit cost of the final output for all i. Once we know t_i and m_{ij} for all i, we can, however, calculate $\bar{t}_i$ with the help of equation (2). But in the context of national content requirement $\bar{t}_i$ depends on two factors: (a) the nominal tariff on imported components, and (b) the excess cost of the domestically produced inputs which the domestic manufacturers of the final product are obligated to employ. So one cannot make a straightforward use of the formula given in equation (2). An effective tax equivalent of the national content requirement has to be estimated for calculation of the effective rate of protection.

We shall first obtain a tariff equivalent of the national content requirement and then adjust it for any nominal tariff on imported inputs to arrive at the implicit tax on all material inputs. For this purpose we lump together all components into a single element and define a unit of the lumped component to include all components used in the production of one unit of the final output. The lumped component used in the production of the final output can be divided into two parts — locally produced one which is specified in the national content requirement and the imported one. In

4 For detail analysis of the content program, see Johnson (1972) and Wonnacott (1965)

some cases the proportion of total cost (or of the total value of the product) must go to the use of local resources as specified in the national content program.[5] In some other cases (as in the case of the Iranian Automobile Industry) national content requirements specifically mention the particular material inputs that must be procured locally. In that case the proportion of the cost of the lumped component that must be allocated to domestic sources has to be estimated on the basis of some other information.

Law Pw be the free trade price of a unit of the lumped component used in the production of one unit of the final product and P_w^c the free trade price of the corresponding locally produced part in the lumped component. Also let P_d^c be the domestic price of this locally produced part of the lumped component. If P_w^i is the free trade price of the imported component and α divides the total cost of a unit of the lumped component into two parts[6] such that

$$(3) \quad P_w^c = \alpha Pw, \text{ and } P_w^i = (1-\alpha)Pw,$$

Pw becomes the sum of P_w^c and P_w^i. The ratio of the domestic price to the world price of the locally produced part of the component is defined as

$$(4) \quad t_c = P_d^c / P_w^c$$

can be used for the purpose of identifying the element of implicit tax incorporated in the national content requirements. When we know t_c and α, we can calculate the ratio of the domestic price to the world price of the lumped component as

$$(5) \quad t_a = \alpha t_c + (1-\alpha)$$

5 These cases have been analysed by Leith (1967), Munk (1967 and 1969) and Wonnacott (1965).

6 When the national content program specifies the proportion of total value to be allocated to local factors α has to be estimated in the following way. Let us set the free trade value of a car at unity. If the coefficients of value added and material inputs are v_j and m_{ij}, we have $1 = v_j + m_{ij}$. If the government specifies β as the proportion of the free trade unit value of a car to be allocated to all domestic factors, $\beta = v_j + \alpha m_{ij}$ where α is the proportion of material cost which has to be allocated to local sources. Then $\alpha = (\beta - v_j)/m_{ij}$. We cannot use this method in our case, as β is not specified by the government. Instead, the government specified the mandatory local items from which α has to be calculated.

and we can use $t_a - 1$ as the equivalent tax rate implicit in the national content requirements.

It may be noted that equation (5) assumes no nominal tariff on imported components. If there is some tariff on imported inputs the ratio of domestic price to world price of the lumped component should be defined as

$$(6) \quad t'a = \alpha tc + (1-\alpha)(1+t_i)$$

where t_i is the tariff rate on imported components.

Now the nominal tariff on imported components together with implicit user tax due to the national content requirements would lead to the following average rate of implicit tax on all material inputs:

$$(7) \quad te = t'a - 1.$$

Given the nominal tariff on the final product and the shares in unit costs, we can now replace $\bar{t}_i$ in equation (1) by te from equation (7) to obtain the following formula for the effective rate of protection:

$$(8) \quad ej = \frac{t_j - te \Sigma m_{ij}}{1 - \Sigma m_{ij}}$$

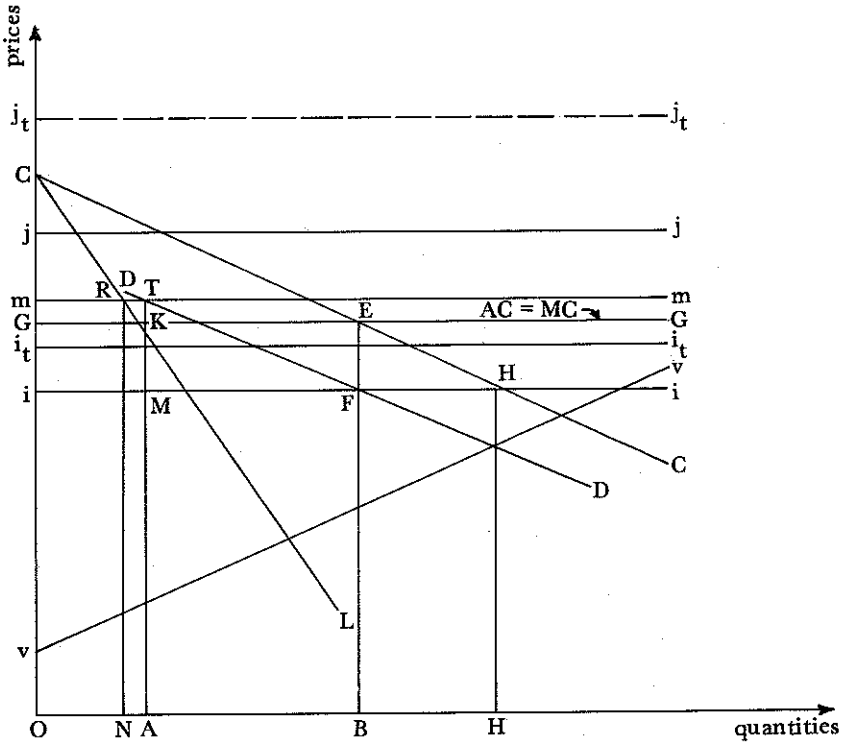
II. A Simple Diagrammatic Presentation:

The implication of the national content requirements on the effective rate of protection can be shown with the help of a simple diagram. We use Figure 1 to show how the tax equivalent of the national content requirement can be obtained. The horizontal axis measures the quantities of the final product, the material inputs and the value added by primary factors. Their respective prices, both before and after tariff, are shown along the vertical axis. The units of material inputs and value added are chosen in such a way that one unit of each of them corresponds to one unit of the final product.[7]

7 This enables us to measure all quantities along the horizontal axis in the same scale.

Figure 1

EFFECT OF NCR ON THE LEVEL OF ERP WITH $0 < \alpha < 1$



Under the small country assumption, the free trade supply curves of the final product and material inputs are the horizontal lines jj and ii respectively, with Oj and Oi international prices. The domestic supply curve of value added (vv) is drawn with finite elasticity, while domestic supply curve of material inputs (mm) has been drawn with infinite elasticity to capture the fact that the Iranian Automobile Industry could purchase local components at fixed and controlled prices. Imposition of a nominal tariff, t_j, on the import of automobile results in a shift of the supply curve of foreign cars from jj to j_tj_t. Given the supply curve of primary factors (vv), we can use the concept of derived demand[8] to generate the demand curve for material inputs. Vertical subtraction of the

domestic supply curve of value added (vv) from the post-tariff supply curve of foreign cars ($j_t j_t$) gives us the derived demand curve CC for components (both domestic and imported taken together). Once we know the value of α from given national content requirements,[9] we can divide the horizontal distance between the CC curve and the vertical axis into two parts in the proportion of $\alpha:1-\alpha$ to indicate the division of the lumped component into domestic and imported parts. Assuming $\alpha = 1/3$, we have drawn the CL curve in the diagram; the horizontal distance between the vertical axis and the CL curve is one-third of that between the vertical axis and the CC curve. So the CL curve may be treated as the demand curve for domestic component.

Oi and Om are the prices of foreign and domestic components. Now the supply price of the lumped component is equal to α OM + (1-α)Oi. In the diagram it is OG = 1/3 Om + 2/3 Oi. E, the intersection point of the supply and demand curves for the lumped component represents the total equilibrium demand for components from both sources. Also point K on the demand curve for local components (CL) is the equilibrium point for domestically produced material inputs. OB is the total components demand and OA is obtained locally at Om price and AB is imported at Oi price.[10]

Now it can be seen from the diagram that without any explicit tariff on the imported components, there is an implicit user tax equal to iG/Oi on inputs, paid by car producers. If there is a nominal tariff (t_i) on imported material inputs in addition to the national content requirements, the result is modified by shifting the supply curve of foreign components from ii to $i_t i_t$, assuming that $t_i = ii_t/Oi$. Now the supply curve of the lumped component has to be drawn at αOm + (1-α)Oi_t. It means that the supply curve of the lumped component will shift somewhere above G, say at G' (not shown in the diagram). Then the implicit user tax will be

8 We have employed the diagrammatic simplification suggested in Friedman (1976), ch. 7.

9 The procedure followed in getting an estimate of α has been explained in the empirical part of the study.

10 Note that given the curve CL for local components and the price Om, instead of demanding ON, the car producers demand OA of domestic inputs, and, as a result, get a point like T, which is on the supply curve of local inputs (mm). Connecting this point to the point F, which is on the supply curve of foreign inputs, the DD curve is obtained This curve may be called the joint implicit demand curve for local and imported components.

given by iG'/Oi. Now we can follow the standard method of vertically adding the supply curves of material inputs and of value added to obtain the domestic supply curve of cars and then we can calculate the effective rate of protection accorded to the domestic value added in car production.[11]

III. An Empirical Study of Iranian Automobile Industry:

The theoretical framework that we have suggested earlier is now applied to the Iranian Automobile Industry to compare the nominal and effective rates of protection. In this study we calculate the effective rates of protection due to tariff restrictions on imports through a content requirement scheme for five different models of automobiles. They accounted for more than 95 percent of the domestic production of passenger cars which were made by three major automobile manufacturing companies in the early 1970s.[12] When the Iranian government imposed nominal tariffs on the imported cars, it also specified some mandatory components, as the national content requirements, to be acquired from local suppliers. The mandatory components included tires, batteries, radiators and parts, mufflers and exhaust pipes and parts, electrical wirings, spark plugs, bumpers, seats, windshields, side windows and rear glasses, floor carpets, fuel tanks, springs, shock absorbers, wheels, radios and a few other minor items. The prices of domestically produced components were fixed regardless of the amount purchased. This was based on the agreement between the government and the domestic component producers. According to the agreement, the component producers, as a condition to be protected by the government, were obliged to supply any number of components required by the automobile industry at fixed prices.[13]

For our empirical study we need to calculate (a) the nominal tariff rates on imported automobiles (t_j), (b) the rate of implicit user tax on components due to the national content requirements and the nominal tariff on imported inputs (t_e) and (c) the shares of local and imported inputs in the unit cost of a car (m_{ij}).

11 For this manipulation of the diagram, see Corden (1971).

12 See Amuzegar (1977).

13 A large part of the information has been obtained from Ministry of Commerce, Ministry of Industries and Mines, Iran, and Iranian automobile manufacturers on the basis of personal interviews and confidential documents written in Farsi.

In the case of the Iranian Automobile Industry, the consumption tax rate on imported automobiles was 10 percent of the c.i.f. price plus nominal tariff, while the consumption tax on similar domestic cars was 5 percent. So there was an implicit subsidy of 5 percent to the domestic manufacturers. For this reason the net nominal tariff rate on the automobiles incorporates this indirect subsidy in the form of additional consumption tax of 5 percent. Column 6 of Table 3 shows the nominal tariff rates estimated on the basis of c.i.f. values of cars and Iranian custom duties and commercial benefit tax for different types of passenger cars including the 5 percent additional consumption tax. It so happens that the nominal rates of protection are the same and are equal to

Table 1

AVERAGE NOMINAL TARIFF RATE ON IMPORTED COMPONENTS IN IRANIAN AUTOMOBILE INDUSTRY, 1971

Automobile	Duties paid on imported components (in rials)	C.I.F. Value of imported components (P_w^i) (in rials)	Average Nominal Tariff Rate on imported components (t_i)
(1)	(2)	(3)	(4) = (2)/(3)
1. Peykan Deluxe (Hunter Deluxe)	29,388	73,470	0.400
2. Peykan GT	32,730	81,659	0.401
3. Jiyan (Citroen "AY")	14,000	60,000	0.233
4. Jeep CJ-5 Hardtop	25,000	140,000	0.179
5. Shaheen (Rambler 220)	23,000	130,000	0.177

Source: U.N. Industrial Development Organization, Metro Group, *A Study of Automotive Market and Industry in Iran*, October, 1972.

Table 2

PROPORTION OF NATIONAL CONTENT REQUIREMENT IN THE TOTAL COMPONENTS USED IN THE IRANIAN AUTOMOBILE INDUSTRY, 1971

Automobile	Value of local components at domestic prices (P_d^c) (in rials)	Estimated value of local components at free trade world price ($P_w^c = P_d^c/tc$ with $t_c = 1.5$) (in rials)	Value of imported components (P_w^i) (in rials)	Free Trade price of all components ($pw = P_w^c + P_w^i$) (in rials)	Proportion of national content requirement ($= P_w^c/Pw$)
(1)	(2)	(3)	(4)	(5)	(6)
1. Peykan Deluxe (Hunter Deluxe)	30,000	20,000	73,470	93,470	0.21
2. Peykan GT (Hunter Super)	35,000	23,333	81,659	104,992	0.22
3. Jiyan (Citoren "AY")	18,000	12,000	60,000	72,000	0.17
4. Jeep CJ-5 Hardtop	30,000	20,000	140,000	160,000	0.13
5. Shaheen (Rambler 220)	35,000	23,333	130,000	153,000	0.15

Source: U.N. Industrial Development Organization, Metro Group, *A Study of Automotive Market and Industry in Iran*, October, 1972.

215 percent for all the five types of cars.[14]

The nominal tariff rates on imported components have been estimated on the basis of the duties paid on imported components and their c.i.f. values.[15] These are shown explicitly in Table 1.

Table 2 shows the procedure we have adopted and the estimates we have arrived at for values of α for different types of cars. α could be obtained directly on the basis of equation (3) if P_w^c, P_w^i and Pw were known. But Pw is the estimated free trade price of the lumped component and so it is not a directly observed datum. The domestic price of the local component (P_d^c) is known directly. Based on interviews with dealers of automobiles and auto parts in the USA and in Iran, we have come up with a value between 1.5 and 1.75 for the ratio of domestic price to world price of the locally produced components (viz., tc.). Since $P_d^c/P_w^c = t_c$ in equation (4) we obtain the estimate of P_w^c we get P_w. Finally, the ratio P_w^c/P_w gives us the value of α.[16]

For estimation of the shares of domestic and imported inputs in the unit cost, we have used in input-output coefficients derived from the study made by the U.N. (1972) for the Iranian automobile industry. Combining the results from Table 1 and 2 we finally arrive at the estimated effective rates of protection as presented in Column 9 of Table 3.

IV. Conclusion

One interesting conclusion from our empirical study is that the same nominal rate of protection to different types of cars (as implied by the customs duties, commercial benefit tax and additional consumption tax) yields widely different effective rates of protection consequent upon the national content requirements and nominal tariffs on imported inputs. From Columns 2, 3 and 9 of Table 3 it may be noted that e_j is a falling function of both t_i and α for given t_j. Though the government apparently accorded the same rate of nominal protection to all car manufacturers, the

14 For calculation of t_j we have used the tariff rate structure given in annually published *General Regulations of Exports and Imports*, 1967-78, Ministry of Commerce, Iran.

15 See the source quoted in Table 1.

16 In estimating α we have used $t_c = 1.5$.

Table 3

IMPLICIT USER TAX ON COMPONENTS DUE TO NATIONAL CONTENT REQUIREMENT AND EFFECTIVE RATES OF PROTECTION IN IRANIAN AUTOMOBILE INDUSTRY, 1971

Automobile	Average nominal tariff on imported components (t_i)	Proportion of national content requirements (α)	Ratio of effective domestic price to face value price of all components tc = 1.5 ($t'a$)	Rate of implicit user tax on components (te)	Rate of nominal tariff on automobile inclusion of additional consumption tax (t_j)	Share of imported components in unit cost (m_{1j})	Share of domestic components in unit cost (m_{2j})	Effective rate of protection (e_j) $\frac{t_j - te \sum_{i=1} m_{ij}}{1 - \sum_{i=1}^{2} m_{ij}}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Peykan Deluxe (Hunter Deluxe)	0.400	0.2	1.421	0.421	2.15	0.511	0.139	5.36
2. Peykan CT (Hunter Super)	0.401	0.22	1.423	0.423	2.15	0.522	0.149	5.67
3. Jiyan (Citroen "AY")	0.233	0.17	1.278	0.278	2.15	0.715	0.143	13.46
4. Jeep CJ-5 Hardtop	0.179	0.13	1.221	0.221	2.15	0.760	0.109	14.95
5. Shaheen (Rambler 220)	0.177	0.15	1.225	0.225	2.15	0.783	0.141	25.55

Source: Computed from data supplied in (1) Ministry of Commerce, *General Regulations of Export and Import* (Tehran, Iran, March, 1968), and (2) U.N. Industrial Development Organization, Metro Group, *A Study of Automotive Market and Industry in Iran,* October, 1972.

economically relevant rate of protection which need to be used in any analysis of resource allocation is significantly different from it.

Three major automobile manufacturers in Iran are Iran National Industrial Manufacturing Company (producer of Peykan Deluxe and Peykan GT), Saipac Company (producer of Jiyan) and General Motors of Iran Limited (producer of Jeep and Shaheen). All the big three automobile manufacturers have started their production, more or less, at the same time in the early 1960s. Consequently, one expects them to be at the same stage of production and be protected equally by the government. But according to the results of our study, Iran National received the lowest rate of effective protection (at 536 percent for Peykan Deluxe and 567 percent for Peykan GT), while General Motors was at the top (with 2555 percent for Shaheen and 1495 percent for Jeep), Saipac Company coming in between (with 1346 percent for Jiyan). If relative effective rates of protection are any indicator of the relative productive inefficiency of domestic manufacturers, the estimates of the effective rate of protection suggest serious welfare implications in terms of resource misallocation.

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