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Working Paper

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Kiel Working Papers, No. 24

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Kiel Working Papers

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THE DOMESTIC RESOURCE COST CONCEPT

- Theory and an Empirical Application to the Case of Spain -

by

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I. Introduction

The problem of how to make an optimum use of a country's limited productive resources is often a crucial one to the policy makers in less developed countries (LDCs). Not surprisingly, therefore, the various methods of cost-benefit analysis have attracted much attention among professional economists and are finding a wide spread application in evaluating the social profitability of investment projects and in the planning decision-making process as well. Relatively less attention has been paid to yet another criterion of project appraisal in a developing country that has been developed independently of social cost benefit analysis - the so called domestic resource cost (DRC) approach to project appraisals. This approach is properly regarded as the application of the propositions of allocation theory when the project, or the industry in question, produces (or saves) foreign exchange.[1)]

The DRC concept compares the opportunity costs of domestic resources (primary factors such as labour, capital, land) committed

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Remark: We wish to express thanks to our colleagues Ulrich Hiemenz and James Riedel for very helpful discussions during the preparation of this paper. The usual disclaimer applies.

1) See, for instance, M. Bruno, Interdependence, Resource Use and Structural Change in Israel (Jerusalem: Bank of Israel, 1962), pp. 104 sqq. - A.O. Krueger, "Some Economic Costs of Exchange Control: The Turkish Case", The Journal of Political Economy, Vol. 74 (1966), pp. 466-480. - M. Bruno, "The Optimal Selection of Export-Promoting and Import-Substituting Projects", Planning the External Sector - Techniques, Problems and Policies (New York: United Nations, 1967), pp. 88-135. - B. Balassa and D.M. Schydlowsky, "Effective Tariffs, Domestic Cost of Foreign Exchange, and the Equilibrium Exchange Rate", The Journal of Political Economy, Vol. 76 (1968), pp. 348-360. - M. Bruno, "Domestic Resource Costs and Effective Protection: Clarification and Synthesis", The Journal of Political Economy, Vol. 80 (1972), pp. 16-33. - A.O. Krueger, "Evaluating Restrictionist Trade Regimes: Theory and Measurement", ibid., pp. 48-62. - B. Balassa and D.M. Schydlowsky, " Domestic Resource Costs and Effective Protection Once Again", ibid., pp. 63-69.

to the production of final goods with prices at which these goods can be exported or imported - the latter prices (the foreign exchange gained or saved) being considered as the ensuing benefits from production. The rationale for using the foreign exchange gained (through exports) or saved (through imports) as a standard of reference is that foreign exchange is relatively, and often critically, scarce in many developing countries.

A simple numerical example may serve to illustrate the basic idea of the DRC concept. Consider an economy which faces the question of whether it should locally assemble the imported parts and components to a passenger car, or whether it should directly import the car. The equilibrium exchange rate is assumed to be 1 $ = 10 P (P. being the currency of the country in question). Now suppose that the car, if imported, costs the country $ 1,000 (P. 10,000 when converted at the equilibrium exchange rate); in the alternative case of assembling the car at home, the country has to import parts and components for, say, $ 850 (P. 8,500), while using domestic labour and capital which cost, say, P. 1,000. This means that a domestic value added of P. 1,000 ($ 100) is generated through assembling, which is lower than the international value added embodied in the (imported) car ($ 150 or P. 1,500). Obviously, the assembling of the car would be efficient from a social point of view. Had the same amount of labour and capital cost the country, say, P. 2,000 (instead of P. 1,000), which could be employed elsewhere, it would have been profitable for our country to import the whole car and to shift the domestic resources to other activities in which it is a relatively more efficient producer vis-à-vis the rest of the world.

It should be clear from the above example that the DRC criterion is closely related to the familiar concept of comparative advantage in international trade. A country has a comparative advantage in a particular activity if its domestic resource cost of foreign exchange is lower than the equilibrium exchange rate (units of domestic currency per dollar). The lower the domestic resource cost, the more worthwhile is the activity for the economy as a whole. This ex ante applicability apart, the DRC criterion can also serve ex post purposes in the sense that it shows the costs that the current industrialization and trade policies, which deviate from the norm of comparative advantage, impose on the society as a whole. It is in this ex post notion that the DRC criterion bears some relationship to the well known theory of effective protection (ERP). High and differential domestic resource costs are then an indicator of welfare losses resulting from the impact of trade-restricting or trade-promoting measures on relative prices.

The recent debate on the DRC concept, which has been concerned mainly with its relationship to the ERP criterion, has thrown up a number of interesting issues. It seems, however, that the discussion has also given rise to some confusion not only as to how to measure domestic resource costs of alternative activities but also as to what the measure is really all about. This paper represents an attempt to clarify the basic theoretical concept of the domestic resource cost, providing at the same time a brief survey of the contemporary state of discussion surrounding this subject. Moreover, it is intended to apply the DRC criterion to data for one particular semi-industrialized country - Spain - with the view to examining the feasibility of this approach in quantifying, in terms of domestic resource costs, the aggregate impact of pursuing policies of import substitution and export promotion.

II. A Two Commodity, Two-Factor Model

The ideas underlying domestic resource costs can perhaps best be illustrated with the help of the standard neo-classical model of international trade. Consider an economy with the following production functions and resource endowments:

$$X = X(K_x, L_x) \tag{1}$$

$$Y = Y(K_y, L_y) \tag{2}$$

$$L_x + L_y = \bar{L} \tag{3}$$

$$K_x + K_y = \bar{K} \tag{4}$$

X and Y are the physical outputs of two commodities; $\bar{L}$ and $\bar{K}$ are the economy's total endowments of labour and capital respectively, where Kx, Lx and Ky, Ly are the labour and capital employed in the two industries; (1) and (2) are the production functions for X and Y respectively. Assume perfect competition, no transportation costs, absence of non-traded goods, constant returns to scale, a given international price ratio (Py/Px) implying that price elasticities of both the export demand and the import supply are infinite within the relevant range, and optimal trade policies (if any). The economy's production possibilities curve, F (X, Y) = 0, is assumed to be concave to the origin, showing increasing opportunity costs of producing X and Y. Assume further (this assumption will soon be dropped) that the production of X and Y use no intermediate inputs so that the unit final product prices equal their respective unit value added.

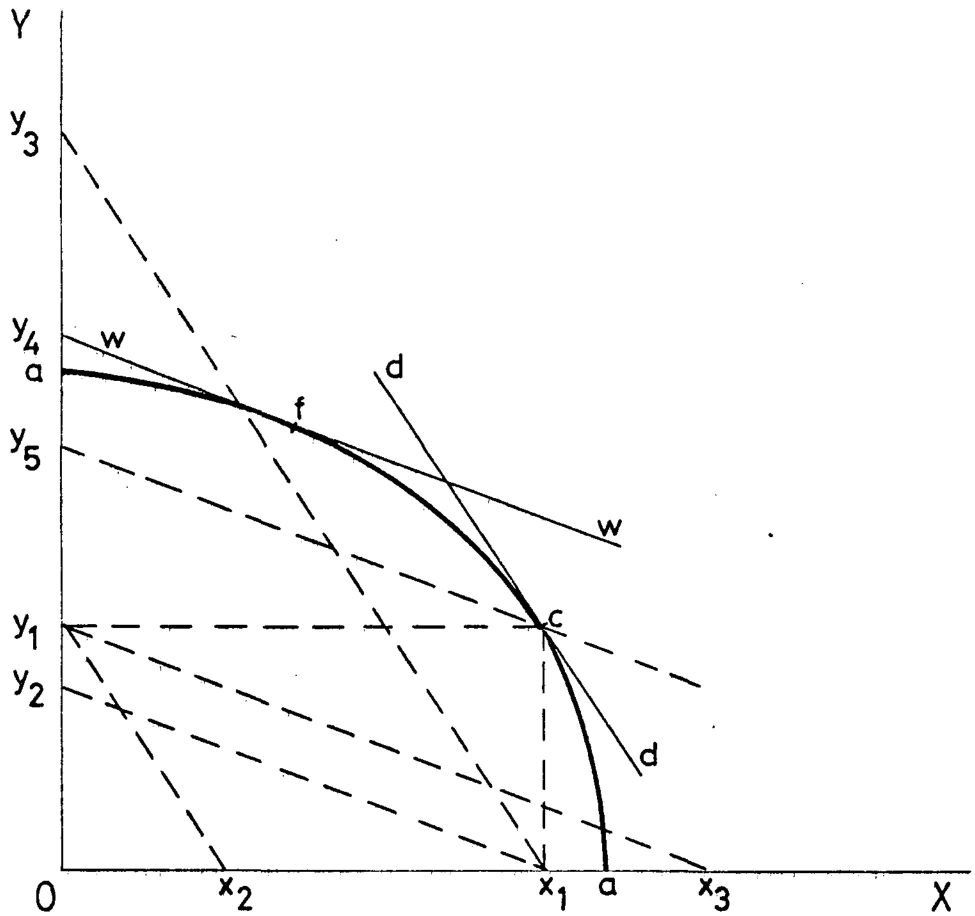
Now recall that domestic resource cost is an expression for net benefit to be derived from producing a commodity where its benefit is the world price at which the product can be sold or imported (foreign exchange earned or saved) whereas cost is the opportunity cost of production (i.e. its value added, the primary factors being priced at their opportunity costs). We can write, in a general form,

$$(5) \qquad B_j = P^w_j \cdot r_e - \left[\sum_i a_{ij} P^d_i + \sum_h f_{hj} g^d_h\right]$$

where B_j is the net benefit from j (j = X, Y); P^w_j is the world price of j and r_e is the equilibrium rate of exchange (domestic currency per unit of foreign currency); a_{ij} is the amount of input i (i = X, Y) required per unit of producing j; P_i is the price of this input, f_h is the amount of primary factor h (h = K, L) required for producing a unit of j, and g_h is the per unit price (equal to opportunity cost) of h, the superscript d referring to domestic prices. In equilibrium, commodity prices will equal their average costs of production and since by our assumption a_{ij} are equal to zero, the world price P^W_j is the per unit direct value added measured in world prices, which, when compared with the per unit direct value added measured in domestic prices (the opportunity cost of domestic resources), provides the sign of net benefit, B_j. In the absence of trade restricting measures such as tariff and quotas, the two value addeds for a product may differ, because an economy's resource endowments may be different from that of the rest of the world, thus conferring it with comparative cost advantages on one or other product depending on the nature of production technology (i.e. factor intensity requirements, which we assume to be stable and non-reversible within the relevant range of prices for a product).

Under conditions of increasing opportunity costs, the product transformation curve is shown in Figure I by the curve aa; the slope of the straight lines dd and ww are the domestic and world prices of commodity X and Y in terms of each other. As the price of Y in terms of X is assumed to be higher abroad than at home, the economy's comparative cost advantage lies in the production of Y. At point c, where the domestic price ratio is tangent to the transformation curve, the domestic resource cost of producing OX_1 of X exceed the benefit to be derived from international exchange (the world price of X) whereas the net benefit is positive for producing OY_1 of Y. Hence, it will pay the country to shift resources out of X and into Y, moving production from c (the optimal production and consumption point before trade) towards f (the optimal production point after entering into trade). In Fig. I the domestic value added (which is also the value of total output since intermediate inputs are absent) of OX_1 of output, measured in terms of Y_1 is equal to OY_3, whereas the same amount of output measured in world prices has a much lower value added, equal to OY_2 (note that the lines Y_2X_1 and Y_3X_1 are parallel to the price ratios ww and dd, respectively). On the other hand, the international value added of OY_1 amount of output, measured in terms of X, is equal to OX_3, which is much larger than the corresponding

FIGURE I.



value added measured in domestic prices, OX_1, indicating that the production of Y involves a positive net benefit to the economy. The production combination at f represents a welfare increase since the price line ww will be tangent to a higher indifference curve (assuming a map of such curves which do not intersect). That the international value of the product mix is greater at f than at c (implying a potential welfare increase) is seen clearly by letting the international price line pass through c and observing that through resource reallocation the economy extracts an extra Y_4Y_5 amount of Y (or an equivalent amount measured in terms of X).

III. Introducing Intermediate Inputs

The argument developed above remains essentially unchanged when intermediate inputs are introduced into the production functions but all the other assumptions are retained. Introduction of intermediate input means that a distinction now has to be drawn between the gross and net production possibility (or transformation) curves and the corresponding gross and net outputs at a given commodity price ratio. We consider, first, the simplest case of two goods where each good is required in the production of the other but not in its own production; the input coefficients are, moreover, assumed to be constant.[1] All goods are tradable but domestically produced, and no intermediate inputs are imported. In terms of notations already used we can write

$$(6) \qquad x = X(Lx, Kx) - a_{xy} \cdot Y(Ly, Ky)$$

$$(7) \qquad y = Y(Ly, Ky) - a_{yx} \cdot X(Lx, Kx)$$

where x and y are the net (or final) outputs of X and Y and a_{xy} and a_{yx} are the fixed input coefficients. The derivation of the net production possibility curve â la Vanek[2] and the meaning of domestic resource costs in situation of intermediate inputs are

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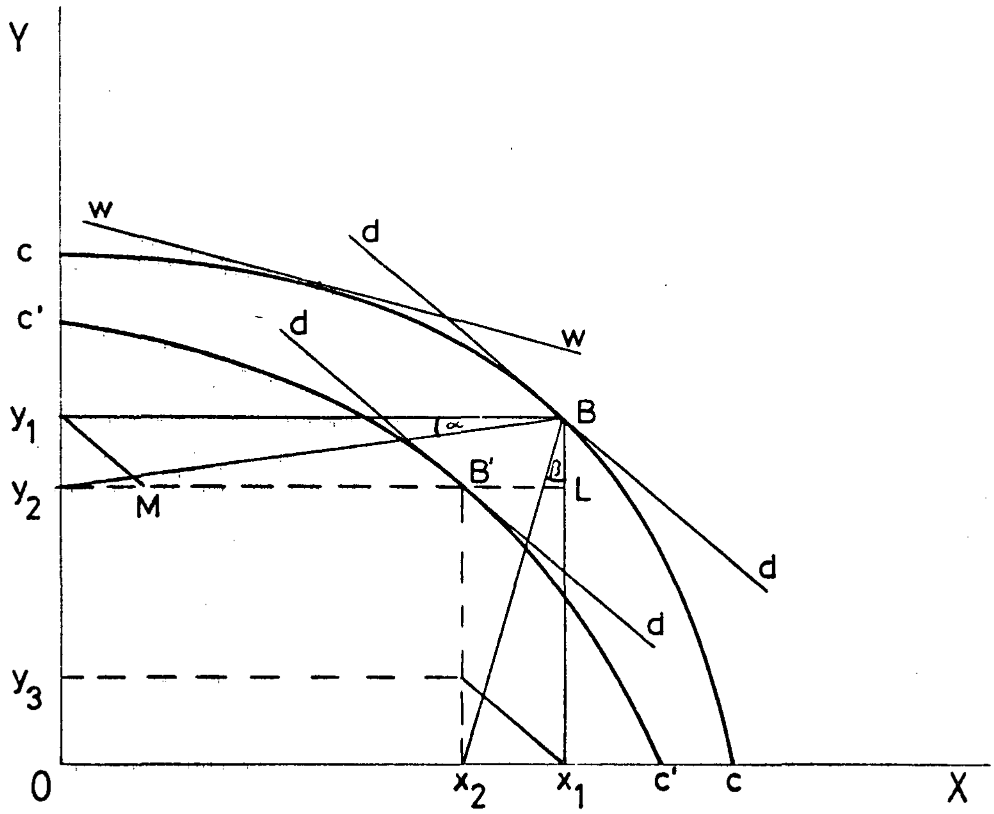
1) If, instead, variable input coefficients are assumed, this will change the shape of the net production possibility curve without basically altering any of the arguments concerning domestic resource costs.

2) J. Vanek, "Variable Factor Proportions and Inter-Industry Flows in the Theory of International Trade", The Quarterly Journal of Economics, Vol. 77 (1963), pp. 129 sqq.

FIGURE II.



shown in Figure II.

The curve cc is the economy's gross transformation curve between X and Y. At the domestic price ratio dd[1], the economy produces the commodity combination B i.e. OY_1 of Y and OX_1 of X, requiring as intermediate inputs $X_1 X_2$ of X (in the production of Y) and $Y_1 Y_2$ of Y (in the production of X).[2] OY_2 of Y and OX_2 of X are then available for final demand

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1) Note that we are still assuming that the domestic price ratio is different from the world price ratio because of the differences in comparative cost advantages and not because of trade restricting measures like tariff and quota. The measurement of domestic resource cost, however, needs to be modified to take account of such trade restricting measures, as will be shown below.

2) The tangents of angle α and β are the required input coefficients, a_{yx} and a_{xy} .

(either for home consumption or for exports) and the point B' is obtained (on the net production possibility curve) as the meeting point of the two straight lines dropped from Y_2 and X_2. By allowing the price line to vary, the economy's "net" transformation curve c'c' is derived by joining the locus of all such "meeting points"; any one point on this curve shows the commodity combination which is available for final demand at that price ratio and the corresponding point on the curve cc (the gross production possibility curve) then shows the total output combination.

According to equation (5), the total domestic resource cost of producing a commodity is its direct plus indirect value added, the latter being the value added of domestic primary factors of production embodied in the domestically produced intermediate input used up in its production (which is the same as the total value of intermediate inputs used, since no imported inputs are involved). In figure II, the direct domestic value added of producing Y_2L (= OX_1) of total output of X is ML, Y_2M being the value of intermediate input Y_1Y_2 but measured in domestic prices in terms of X (note that the line Y_1M is drawn parallel to the domestic price ratio).[1)] By definition, Y_2M is identical with the indirect value added in the production of X and therefore the total (direct plus indirect) domestic value added is the domestic value of total output Y_2L - a familiar result when commodities and primary factors are measured at their real opportunity costs. By similar reasoning, the value of total output OY_1 (= X_1B) is also the total value added of producing that amount of Y. Analogous to Figure I, by drawing appropriate lines (i.e. by converting the domestic values of output into world prices) at the world price ratio shown, the net benefit of producing

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1) See St. Guisinger, "Negative Value Added and the Theory of Effective Protection", The Quarterly Journal of Economics, Vol. 83 (1969), pp. 416 sqq.

Y is seen to be positive and that of X negative, implying that potential Pareto improvement is possible by transferring resources to the production of Y.

IV. Considering Imported Intermediate Inputs

We now assume, more realistically, that production of commodities involves the use of not only domestically produced inputs but also imported inputs. In other words, production has a foreign exchange cost which must now also be deducted from the benefit (foreign exchange earned or saved) in order to arrive at a more accurate measurement of the net benefit. For the sake of simplicity we assume that the domestically produced inputs do not use any imported inputs in their own production and that they are used in a fixed proportion with imported inputs in the production of final goods. The formula (5) can now be rewritten after Bruno[1)] as:

$$(8) \qquad B'_j = [P^w_j - m_j]\, r_e - [\sum_{i=1}^{n} a_{ij} P^d_i + \sum_h f_{hj} g_h]$$

where m_j is the foreign exchange cost (i.e. the cost of imported inputs) of producing one unit of j, and the other notations retain their former meaning. The first term on the right hand side of the above expression is the per unit net foreign exchange earned or saved measured in domestic currency and the second term is the corresponding total domestic resource cost (direct and indirect value added) of producing one unit of j. As before, any activity whose net benefit, B'_j, is positive will indicate a comparative cost advantage in production, either for export promotion or for import substitution depending on the relationship between the world price and domestic price ratios. By writing the expression for

1) M. Bruno, "Domestic Resource Costs and Effective Protection: Clarification and Synthesis", op. cit.

total value added in the numerator and that for net foreign exchange earned or saved in the denominator, Bruno[1] derives an expression for the total domestic resource costs of earning or saving a unit of foreign exchange, d_j , which, when compared with the real equilibrium rate of exchange, r_e , provides an alternative way of estimating an economy's comparative advantage or disadvantage, in the production of j:[2]

$$(8a) \qquad d_j = \frac{\sum_i a_{ij} P_i^d + \sum_h f_{hj} g_h}{P_j^w - m_j}$$

It should be clear that $d_j > r_e$ implies that the net benefit of producing j is negative and activities which are socially profitable are only those for which $d_j < r_e$.[3]

Now consider the situation where production of final goods requires, apart from imported (direct) inputs, also domestically produced inputs which themselves use imported inputs in their own production. The final

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1) M. Bruno, "Domestic Resource Costs and Effective Protection: Clarification and Synthesis", op. cit.

2) If all intermediate inputs are traded (i.e. in the present case imported), so that $m_j = \sum_i a_{ij} P_j^W$, we obtain

$$(8b) \qquad d_j = \frac{\sum_h f_{hj} g_h}{P_j^w - \sum_i a_{ij} P_j^w}$$

DRC is then the ratio of unit value added measured in domestic prices to unit value added measured at world prices. Although it looks suspiciously akin to the familiar ERP formula, the similarity is deceiving. In the ERP the numerator is measured at tariff-distorted prices, whereas in the case of DRC it is measured at the opportunity costs of domestic primary factors.

3) If the world price is affected by a country's exports (i.e. when the small country assumption no longer holds), then the marginal revenue from exports (or the marginal import cost) is the relevant measure of gross foreign exchange earned or saved. Infinite elasticities of export demand and import supply is not an essential assumption for measuring domestic resource costs.

production, in other words, involves direct and indirect foreign exchange costs, the sum of which must be substracted from the total foreign exchange earned or saved (in the denominator of (8a)). To clarify what is involved consider, as a very simple example, the production of machine tools which uses, as direct intermediate inputs, imported machinery and steel which is domestically produced. Assume further that the production of steel requires two intermediate inputs, coal which is imported and the domestically produced iron ore. Under these simplifying assumptions, in calculating the unit domestic resource cost, the numerator of (8a) will consist of the direct value added of domestic primary factors in producing one unit of machine tool, plus the domestic value added of producing the required steel input plus the domestic value added of producing the amount of iron ore required for the production of steel,[1] the primary factors at all stages being priced at their real opportunity costs. In the denominator, the sum of the foreign exchange costs of the imported machinery and that of coal has to be substracted from the unit world price of machine tool.

It has been assumed thus far that imported inputs are used in the production of domestic inputs as well as directly in the production of final output. It may be the case, however, that an intermediate input, such as steel in our previous example, is partly domestically produced and partly imported.[2] In that case, the foreign exchange cost of the imported part will be included in the denominator of d_j, together with other direct and indirect foreign exchange costs. The

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1) The calculations will stop at this stage only if iron ore production does not in itself use any domestically produced intermediate input. If it does, then all the further backward linkages will have to be taken into account in computing the total value added of producing the machine tool. If iron ore production uses imported machinery, this will be considered as indirect foreign exchange costs of producing one unit of machine tool and has to be entired into the denominator of (8a).

2) The theoretical implication of this possibility for the standard factor proportions theorem in international trade has been examined by J. Riedel, "Intermediate Products and the Pure Theory of International Trade: A Generalization of the Pure Intermediate Good Case", mimeo draft, Kiel Institute of World Economics, September 1974.

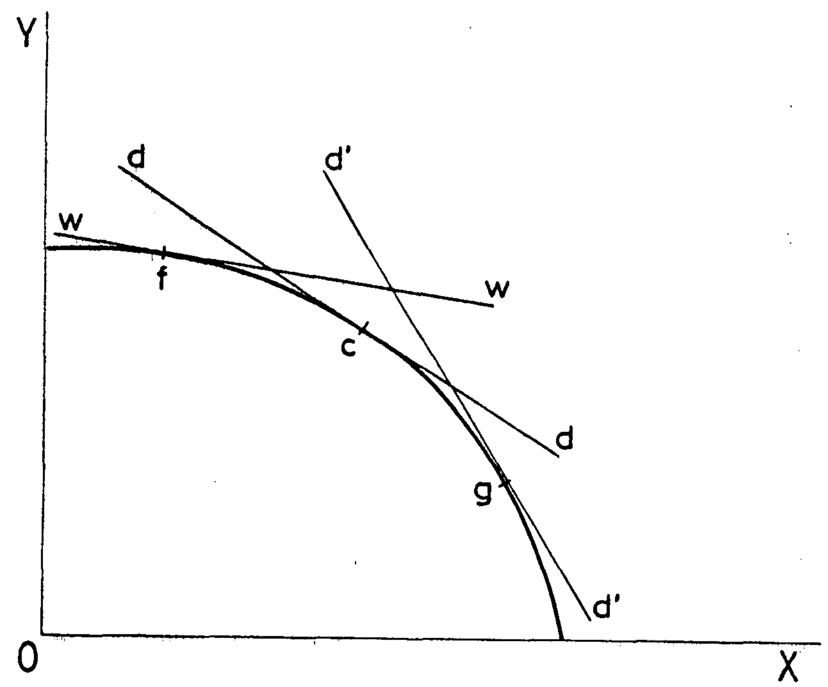
numerator of d_j will then include, apart from the direct value added in the final stage of production, the indirect domestic value added of that part of intermediate inputs which is domestically produced. It is also important for the purpose of DRC computation to draw a distinction between the imported and the domestically owned (or produced) primary factors. If management, for instance, is partly recruited from abroad and partly indigeneous, then the "imported" part is included in the denominator as foreign exchange costs, whereas the price of using local management, measured at its opportunity cost, is included in the numerator as direct value added; other primary inputs are handled in a similar way.

V. Domestic Resource Cost and the Effective Rate of Protection

To recapitulate, in its ex ante interpretation the domestic resource cost is a measure of a country's comparative cost advantage in alternative activities. It compares the international free trade value added per unit of output in an economic activity with the per unit value added measured in domestic prices, where the domestic primary factors are priced at their real opportunity costs. If the former exceeds the latter, i.e., if the activity's net benefit is positive, potential welfare can be increased by diverting resources from the uses in which the net benefit is negative (or lower) to this activity. The DRC criterion thus provides a norm which indicates the direction in which resources ought to be allocated. It is in this sense that the DRC concept bears a close relationship to the familiar theory of effective protection. The effective protective rate shows the degree by which the value added in any particular economic activity exceeds, thanks to restrictionist trade regimes, what this value added would be if the same activity were fully exposed to international competition. The standard formula for effective protection, EP, in the j-th activity is given as:

$$(9) \qquad EP_j = \frac{VAD_j - VAF_j}{VAF_j} = \frac{VAD_j}{VAF_j} - 1$$

FIGURE III.



where VAD_j is the activity's per unit value added at tariff-inclusive domestic prices and VAF_j is the per unit value added at the world (or free trade) price. One of the various possible uses of the ERP is the assessment of the relative incentives which protection provides to particular industries, i.e., the appraisal of the resource allocative effects. This is done by comparing an actual post-tariff situation of resource allocation with the one which would prevail in the free trade, given the set of domestic and world prices. The domestic resource cost, on the other hand, compares the situation of pre-trade resource allocation in the absence of tariff and other trade restricting measures (this is the rationale for measuring the price of inputs and domestic primary factors at their opportunity costs) with that of resource allocation under the free trade, again under the given set of world and domestic prices. The difference between the two concepts is perhaps best understood in terms of the standard neo-classical model of trade (Figure III).

The line ww is, as before, the world price ratio, dd is the pre-trade domestic price ratio in the absence of tariff and other trade restricting measures and d'd' is the domestic price when a tariff is imposed on the good X. The DRC measure compares the international value of the commodity combination at c, with that at f, whereas the conventional ERP measure compares the latter situation with the international value of the commodity combination at g (namely the point at which the economy has actually settled down after the imposition of tariff). Although the final message of both the DRC and the ERP measures is the same, namely that potential welfare can be increased by moving towards the point f, it is important, nevertheless, for the purpose of actual interpretation, to keep the conceptual distinction between the two clearly in mind.

Once, however, the possibility is ignored that the domestic price of a commodity (with factors measured at opportunity costs) in the absence of tariffs and other trade restrictions (but before trade) need not necessarily be identical with the international free trade price but may lie anywhere between the free trade price and the tariff-inclusive price, the distinction between the ERP and the DRC is blurred and attempts have indeed been made in the literature to relate one measure to the other. Thus under the assumptions that all goods are traded, transportation costs are nil, factors of production are internally perfectly mobile but internationally perfectly immobile, and domestic markets are perfectly competitive, Anne Krueger[1] defines the domestic resource cost of a unit of foreign exchange in the activity as:

$$(10) \quad d_j = \frac{P_j^w (1 + t_j) - \sum_i a_{ij} P_i^w (1 + t_i)}{P_j^w - \sum_i a_{ij}} = \frac{VAD_j}{VAF_j} = EP_j + 1$$

1) A.O. Krueger, "Evaluating Restrictionist Trade Regimes...", op. cit., p. 54.

where a_{ij} is the amount of the i-th input required per unit of output of j, t_j and t_i are the nominal tariffs on output and inputs respectively, VAD is the domestic and VAF the foreign value added per unit of output of j. The numerator of (10) is the unit direct value added of domestic primary factors, measured in tariff-inclusive domestic prices (the indirect value added need not concern us here because all intermediate inputs are, by definition, imported), whereas the denominator is the net foreign exchange earned (or saved). From this definitional identity, Krueger concludes that if and only if the above cited assumptions hold that the ranking of industries by their ERP and their DRC, and thus the resource-pull and the resource-push developments indicated by both measures, will be identical.[1)]

Bela Balassa and Daniel Schydlowsky[2)], reach just the opposite conclusion from the way they look at the relationship of DRC to ERP. Their definition parallels our formula (8a), but expresses it as percentage excess of direct and indirect value added in producing domestically commodity j over the corresponding total value added in world prices. In symbols:

$$(11) \qquad d_j = \frac{\sum_i VAD_i \cdot r_{ij}}{\sum_i VAF_i \cdot r_{ij}}$$

where r_{ij} are the elements of the inverted Leontief-matrix.[3)] After using the formula for the effective protection (10) to define

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1) A.O. Krueger, "Evaluating Restrictionist Trade Regimes...", op. cit., pp. 54-55.

2) B. Balassa and D.M. Schydlowsky, "Effective Tariffs, Domestic Cost of Foreign Exchange and the Equilibrium Exchange Rate", op.cit., pp.350-351.

3) In the Balassa-Schydlowsky formulation, it is not clear at all whether they are using the total or the domestic input coefficients. It should be emphasized, that it is only the latter which matters. This point has also been stressed, though in a somewhat different context, by J. Riedel in his "Factor Proportions, Linkages and the Open Developing Economy", Kiel Working Paper, No. 20, July 1974.

$VAD_i = VAF_i\ (1 + EP_i)$ and by substituting this expression into (11), one obtains

$$\text{(11a)} \qquad d_j = 1 + \sum_i EP_i \frac{VAF_i \cdot r_{ij}}{\sum_i VAF_i \cdot r_{ij}}$$

This formula by Balassa and Schydlowsky shows that if industries differ from each other in their contribution of total value added to final output produced under free trade conditions, domestic resource cost and effective rates of protection will provide a different ranking of these industries.

Is it meaningful to attempt to establish a formal relationship between the ERP and DRC in the way different authors have done? It seems not. As has been repeatedly stressed in this paper, the proper measure of domestic resource cost of a commodity is the one in which the domestic primary factors are measured at their real opportunity costs, i.e. after correcting for the distortionary effect of tariffs (and other trade restricting measures) on domestic price relations. The domestic value of marginal product of primary factors in a protected industry will normally be higher than the international value of their marginal products, because the domestic price of a unit of this industry's output will be higher than the unit world price. The value added measured at domestic prices in situation of tariff will then not reflect the real opportunity costs of the primary factors in the protected industry. Yet Krueger, in defining the numerator of equation (10) as the per unit domestic resource cost of an activity, apparently makes an ad hoc departure from the implications of the true DRC concept without explicitly recognizing it or even defending the necessity for such a departure.[1)] This ad hoc departure from the accepted definition of

1) This is all the more surprising since Krueger does, in fact, state explicitly in the earlier part of her above mentioned article that the numerator of the DRC formula should be the domestic opportunity cost of domestic resources employed.

DRC is also apparent in Balassa and Schydlowsky's work cited above. Thus, it would seem quite illegitimate to substitute (as they have done) the per unit domestic value added term from the formula of effective protection into that of the DRC formula, when it is recognized that the per unit value added in the ERP formula is measured in situation of tariff while in the DRC it is (and should be) measured at the domestic opportunity costs of domestic primary factors.

VI. Assessing the Allocative Costs of Foreign Trade Regimes

Our last remarks imply that the DRC and the ERP, although closely related (in that both are based on the principles of allocation theory), are separate concepts in a formal sense.[1)] This formal distinction between the two may tend to disappear, however, if the DRC concept is used for ex post purposes. Most developing countries are known to employ a variety of trade restrictive devices such as quotas, tariffs, domestic input-content requirements, import predeposits and so on. Apart from balance of payments reasons, such regulations are mainly aimed at initiating and then promoting domestic industrial growth through import substitution. As the process of import substitution moves forward, these countries sooner or later face the need to spill over into manufactured export expansion at a significant scale. Responding to this need frequently requires the introduction of export incentives of various kinds.

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1) It should also be noted, that the DRC approach involves consideration of all stages in the production process, whereas the ERP concept involves only the first stage. In the ex ante application, the ERP method is a partial equilibrium form of analysis while the DRC concept is closer to a general equilibrium form of analysis.

The question then is whether or not the protection from imports and/or subsidies to exports were in excess of those actually needed to get particular activities started. While it is now widely agreed that much of import-substituting industrialization in developing countries has been excessive and wasteful, it is not certain that the more outward-oriented developing countries of today are always aware of the costs of their export policies. Where protection in favour of import substituting industries is high, export incentives have to be equally high in order to make exports feasible in spite of high domestic costs. In extreme cases, the level of export incentives will deprive the country of the net gains from exporting and will simply subsidize the foreign importers. The ex post DRC measures tend to indicate the opportunity cost incurred by an economy in pursuing policies of import substitution or export promotion and may provide guidelines for rational policy actions. It would, for instance, be rational for a country to alter or discontinue policies which are found to sustain activities with high resource costs of a unit of foreign exchange but which neglect those with low-resource costs ("high" or "low" in relation to some accounting rate of foreign exchange).

In assessing ex post DRC, the existing input-output structure of the economy is taken as given and the direct and indirect value added of primary factors in an activity is measured at domestic market prices (net of indirect taxes and subsidies) and compared with the actual net foreign exchange earned or saved by the economic activity. Since the factor prices are usually distorted in a developing economy (neither the wage rates nor the interest rates reflect the real opportunity costs of labour and capital), one can try to measure the ex post DRC after correcting for the factor market distortions in order to see whether the ranking of the industries according to their ex post DRC at uncorrected prices is changed after the corrections are introduced. It is important to note that since the ex post DRC approach is oriented towards quantifying the actual rather than a hypothetical (as would be the case with ex ante DRC) domestic resource cost of a unit of foreign exchange, the official rate of exchange (which may be different from the equilibrium rate) can be used in the calculation of the net foreign exchange saved (through import substitution) or earned (through exports).

As long as the existing input-output structure is taken as given, the DRC approach in the ex post sense may fail to make a straightforward distinction between the efficient and inefficient industries of the country in question. An industry may show a high resource cost of a unit of foreign exchange not because it is inefficient as such but simply because it is dependent for its supply of inputs on an industry which itself is inefficient. The textile industry may be socially profitable in a less developed country but only if the textile machinery is imported. If the domestic production of textile machinery is inefficient and has a high foreign exchange cost, and if domestic producers of textile are required to use only domestically produced textile machines, the resource costs of a unit of producing textile will conceivably be very high. However, there is, as Bruno has suggested, a way of overcoming this problem and thus locating the source of inefficiency. It consists of running two sets of DRC estimates: one using the existing structure of production in an activity and the other assuming the major tradable inputs for the activity are imported. If the source of inefficiency lies indeed in the domestic sector, the latter estimate of DRC of a unit of foreign exchange will then be substantially lower than the former estimate.

VII. An Example of the Application of the DRC as an ex-post Measure: The Case of Spain

The evidence available up to now on the domestic resource cost of foreign exchange incurred by the various economic activities in developing countries is rather limited. There are estimates for Israel where, according to Bruno, the use of the DRC criterion, ex-ante and ex-post, has a long tradition.[1] Estimates are also available for Turkey,[2] Chile[3] and India.[4] It seems that the difficulty in getting the required data has been limiting a wider application of the DRC criterion in the past. This may now be changing, however, as more suitable input-output tables are becoming available and as an increasing amount of field research is being devoted to gathering price and cost information from individual producers.[5]

Spain is a case in point. Among the semi-industrialized countries of today, Spain provides an outstanding example of economic isolation and autarchy for a long period (until the late 1950s), followed by a more outward looking strategy involving a greater integration of domestic industries into the world economy. During the last decade, this country has experienced a more rapid pace of industrial development than at any time before in this country. The average annual rate

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1) See, M. Bruno,"Interdependence, Resource Use and Structural Change in Israel", pp. 104 sqq.

2) See, A.O. Krueger, "Some Economic Costs of Exchange Control", op. cit., pp. 470 sqq.

3) See, L. Taylor and E. Bacha, "Growth and Trade Distortions in Chile and Their Implications in Calculating the Shadow of Foreign Exchange", in: R.S. Eckaus and P.N. Rosenstein-Rodan (eds.), Analysis of Development Problems - Studies of the Chilean Economy. (Amsterdam, London, New York: North Holland and American Elsevier Publishing, 1973), pp. 130 sqq.

4) See, Ch.P. Staelin, "The Cost and Composition of Indian Exports", University of Michigan, Centre for Research on Economic Development, Discussion Paper No. 22, May 1972.

5) Estimates of DRC are reportedly under preparation for a number of countries in the context of the project on "Foreign Trade Regimes and Economic Development" sponsored by the National Bureau of Economic Research, Washington D.C. See also in this connection, as an outgrowth of the Kiel Institute of World Economics' project on "Import Substitution and Export Diversification in Selected Developing Countries", the recent study by M. Girgis, "Industrialization and Trade Pattern in Egypt", mimeo draft (Kiel 1974).

of growth, over 10 percent in real terms, was among the highest both in the developing world and in the industrial countries. The same holds for the expansion of both imports and exports. Economic planning (of an indicative nature for the private sector), on which the Spanish government embarked in 1964, as well as its trade policy, which involves a number of regulatory measures aimed at protecting home industries against import competition and at promoting domestic production for exports, have been playing a major role in determining the economic progress in the recent past.[1)]

It would seem worth while, therefore, to examine these policies in terms of domestic resource costs in order to form an idea about their economic efficiency. If the policies pursued by the Government have been optimal, we will expect the DRCs of the import substituting and export activities to be lower than the (equilibrium) exchange rate. To the extent that the resource costs of some industries are found to be higher than the exchange rate, economic policies have failed in achieving an optimal resource allocation. The country would have been better off had the Government encouraged the high DRC industries to redeploy their factors of production in enterprises with lower DRCs, i.e. those having greater comparative advantage.

Our brief analysis will be addressed to the following questions:

- Do domestic resource costs of a unit of foreign exchange differ from activity to activity and, if so, to what extent?

- To what extent does inefficient domestic production of major material inputs generate high domestic resource cost in producing the final output?

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1) For a detailed analysis see, J.B. Donges, "From an Autarchic Towards a Cautiously Outward-Looking Industrialization Policy: The Case of Spain", Weltwirtschaftliches Archiv, Vol. 107 (1971), pp. 48 sqq. - Idem, "Shaping Spain's Export Industry", World Development, Vol. 1, September 1973, pp. 19 sqq.

- Is there any significant relationship between the DRCs and various performance indicators such as the growth of output, of domestic supply, of exports and of competitive imports?

- How does the ranking of activities according to the DRCs compare with the ranking provided by the effective rates of protection?

Two sets of DRC estimates for Spain have been attempted. The first set refers to particular manufactured products, which are either pure import substitutes or are goods also sold abroad. The major source of data on domestic and world market prices as well as on cost structures are interviews conducted in 1971 and 1972 with individual manufacturers and producers' associations. The selection of products is not based on a random sample; rather, it only reflects our "success" in extracting information from Spanish entrepreneurs. Domestic prices are ex factory and net of indirect taxes; world market prices are the prices of competitive products in the European Common Market as reported by the interviewees themselves. The second set of estimates is sector-wise. It is based on the Spanish input-output tables for 1962 and 1968 containing 86 productive sectors, of which 56 belong to the manufacturing industry. Domestic prices are producer's prices; world market prices have been obtained by deflating the domestic prices of output and material inputs with the corresponding nominal tariffs.

The product-DRCs have been derived, in accordance with (8a), using the following formula:

$$(12) \qquad d_j = C_D : X_F$$

where C_D (expressed in pesetas) is the domestic price of the product minus the foreign exchange component, and X_F (expressed in US-$) is the EEC price for the same product minus the import component of the Spanish firm's output.

The results for 100 products, referring to the late 1960s, are shown in Table 1. It should be emphasized that the estimates are rather crude for a number of reasons. We took only the direct imported inputs into account because we did not get any information on the import component of domestically supplied material inputs. This might have biased the results and also affected the ranking of products according to DRCs. Additional imperfections in our measurements are due to the fact that for lack of information we had to disregard non-traded inputs and could not adjust the cost item for inter-firm differences in both the degree of capacity utilization and external economies. Nontheless, the numerical results obtained are rather instructive in indicating the degree of allocative inefficiency of Spain's industrial and trade policies. The unweighted average DRC for the sample as a whole is 73.82 pesetas per dollar, as compared to the exchange rate of 70 pesetas to a dollar which prevailed (in the late 1960s). In addition, there is an appreciable variation in DRCs among products, ranging from 11.74 (cigarettes), to 171.11 (radio sets), the standard deviation being 26.91. This seems to imply that governmental policy has been rather indiscriminate in promoting industries.

Of the 100 products under consideration, it appears that 56 are rather efficiently manufactured from a general economic point of view, involving domestic resource costs which are lower than the exchange rate. Most of these products are those in which Spain undisputedly has a significant, although not yet fully realized, export potential. This is particularly true of canned vegetables and fish, woolen textiles, shoes, household furniture, engine-generator sets, small-sized passenger cars, busses, medium-sized vessels, and firearms. It should be noted, however, that since our sample happens to consist of relatively successful firms, these DRC estimates do not necessarily reflect the typical situation of the industries concerned, as will be shown below. The evidence is quite different on the import-substitution side, where most of the products have domestic resource

Table 1 - Estimates of Domestic Resource Costs by Products in Spain*

(Pesetas per US-$)

Sector / Item	DRC
Processed food, beverages, tobacco	
Cigarettes	11.74
Chocolate	39.27
Canned vegetables	46.79
Rice products	49.63
Canned fish	51.72
Beer	64.87
Preserved fish	69.74
Pasteurized milk	75.69
Whisky	80.30
Textiles and clothing	
Underwear	50.57
Mattresses	53.25
Thread	55.97
Woolen textiles	59.11
Suits (synthetic fibres)	65.08
Cotton yarn	70.65
Jackets	72.95
Pillow cases	80.08
Pullovers	96.12
Shirts	96.64
Table cloths	107.94
Footwear	
Rubber boots	39.10
Men shoes	66.93
Children shoes	68.21
Women shoes	69.05
Wood & cork manufactures incl. furniture	
Household furniture (of wood)	54.04
Wooden building materials	69.19
Veneer boards	69.25
Frames of cork	69.96
Paper products	
Bookbinding	40.66
Kraft paper	46.17
Printing paper	66.34
Manufacture of printed cards	75.16
Ordinary offset paper	112.46
Rubber products	
Tires for passenger cars	67.10
Tires for trucks	68.12
Chemical industry	
Fertilizers	32.17
Oxygen	34.49
Aspirins	40.71
Sulphuris acid	46.82
Detergents	51.80
Plastic components for insulation	53.98
Sodium hydroxide	61.15
Cellulosic man-made fibres	65.75
Plastic bags	65.82
Liquid ammonia	68.14
Plastic materials	69.49
Sodium carbonate	69.64
Hydrogen	74.20
Perfumes	74.39
Polyramillin chloride	75.32
Calcium superphosphate	78.07
Chlorine	84.13
Soaps	89.48
Polyethilene (low density)	129.03
PVC floor coverings	144.90
Non-metallic mineral industry	
Portland cement	63.65
Window glass	65.99
Tubes	67.42
Glassware	74.17
Iron and steel industry	
Ingots of steel	57.91
Billets	62.29
Slabs	66.00
Wire rods	69.70
Cold plates	70.13
Hot-rolled coils	76.41
Copper wire	78.39
Cold-rolled sheets	79.99
Special steels	112.89
Machinery, parts and appliances	
Engine-generator sets	40.32
Milling machines	41.44
Gramophone records (33 rev.)	42.44
Sewing machines (automatic)	51.68
Sewing machines (non-automatic)	61.92
Large ship diesel engines	67.00
Hydraulic excavators	73.04
Electric coffee-mills	81.48
Steam boilers	85.28
Textile machines	85.28
Stoves and other space heaters	86.12
Electrical transformers	86.51
Electric irons	88.52
Bulbs (40 w)	92.37
Refrigerators (large size)	93.83
Shavers	105.84
Television receiver (61 cm)	121.39
Washing machines (large size)	129.39
Universal turning lathes	146.32
Vacuum cleaner plus 7 accessories (750 w)	169.92
Radio sets (medium size)	171.11
Transport equipment	
Passenger cars (up to 1.500 cc)	56.83
Busses (large size)	53.32
Medium-sized vessels (up to 30.000 grt)	58.90
Diesel locomotives	75.88
Passenger cars (over 1.500 cc)	82.14
Freight-cars (3.500 TRW)	86.81
Lorries (38.000 TRW)	91.84
Miscellaneous manufactures	
Firearms	56.46
Typewriters	69.67
Wrist-watches	80.12
Photocameras	114.60

* Data refer to different years in the late 1960s.

Exchange rate: 70 Ptas = 1 US-$

Source: Data provided by Spanish firms and producer's associations.

cost of above 70 pesetas, in particular a number of durable consumber goods, chemicals and steel products. The existence of these high-cost products is perfectly consistent with the general view among observers of the Spanish economic scenario that it is here where import substitution has been pushed excessively far, leading to a number of structural weaknesses which inhibit many firms in these industries from becoming internationally competitive. In the case of steel products, the problem of high DRCs is particularly serious because of their cost-raising impact on other manufactured goods for which steel is a major input. In sum, the DRC estimates seem to indicate that a more selective industrialization policy placing more emphasis on activities with comparative advantage would have increased the net foreign exchange earnings and/or savings from the available resources.

Let us now consider Spain's sectoral DRCs. Using the familiar input-output technique, formula (8a) can be rewritten as follows:

$$(13) \qquad d_j = \frac{\sum_i v_i^d \cdot s_{ij}}{P_j^W - \sum_i m_i \cdot s_{ij}} \qquad j = 1 \ldots, n$$

where s_{ij} stands for the elements of the inverted Leontief matrix of domestic material inputs, $(I-D)^{-1}$, required by the j-th sector; v_i is the unit value added in the i-th activity (measured in domestic prices), m_i is the import requirements (measured in foreign prices) for the unit production of the commodity i and P_j^W is the world price (or the free trade price) of the commodity j. The numerator of d_j is the direct and indirect domestic resource costs of producing one unit of j for final demand; the denominator is the net foreign exchange earned or saved (depending on whether it is an export or import substituting activity), the second term in the denominator being the direct and indirect foreign-exchange cost of producing one unit of final demand in j. The main problem of applying the above formula is that of measuring the denominator in world prices. As there is no methodologically satisfactory way of solving this problem, we have made some crude estimates assuming that world prices of the traded commodities, converted at the current exchange rate, equal domestic prices deflated by the sectoral nominal tariff or tariff equivalent. After normalizing world prices at unity, formula (13) then becomes

$$(13a) \qquad d_j = \frac{\sum_i v_i^d \cdot s_{ij}}{\left(\frac{1}{1 + t_j} - \sum_i \frac{m_i}{1 + t_i} \cdot s_{ij}\right)}$$

where t_j and t_i represent the customs tariffs on the finished product and its material inputs (we obtained them by dividing tariff revenues by the value of imports at c.i.f. prices, as provided by the Spanish input-output tables).

The results of the calculations, given in index number form,[1)] are presented in Tables 2 and 3. In interpreting and comparing them with the product-wise estimates, one has to keep in mind that the sectoral data conceal, as was suggested by Table 1, a great deal of differences among the firms within a sector. What is more, the input-output matrices automatically take into account the great number of small firms which are typical of virtually every single sector in Spain, including those sectors (like the chemical industry, iron and steel industry, and transport equipment) in which the minimum efficient size requirements are, for technical reasons, quite high. That might explain to some extent why the sectoral DRC estimates tend to be higher than the product-wise ones. Keeping in mind these facts, our estimates lend support to the following inferences:

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1) The index numbers facilitate inter-temporal comparisons of DRCs, since the exchange rate in Spain changed from 60 pesetas to a dollar in 1962 to 70 pesetas to a dollar in 1968.

Tabelle 2 - Actual Domestic Resource Costs by Major Economic Sectors in Spain

Sektor	Number of branches	1962 Average (unweighted)	1962 Standard Deviation	1962 Coefficient of Variation	1968 Average (unweighted)	1968 Standard Deviation	1968 Coefficient of Variation
d_j							
Primary sector	10	1.0620	9.11	8.58	1.0801	7.00	6.47
Manufacturing industry	56	1.2323	23.53	19.10	1.2009	47.03	39.17
- Consumer goods	29	1.2340	28.44	23.04	1.0747	16.51	15.36
- Intermediate products	21	1.2375	17.78	14.36	1.2225	13.73	11.23
- Capital goods	6	1.2063	12.10	10.03	1.8356	146.85	80.00
Construction & services	20	0.9683	7.01	7.24	1.0133	14.17	13.98
Total economy	86	1.1511	22.62	19.65	1.1432	39.48	34.53
d_j^*							
Primary sector	10	1.0864	15.10	13.90	1.0771	8.44	7.84
Manufacturing industry	56	1.2813	37.68	29.41	1.2152	57.87	47.63
- Consumer goods	29	1.3031	44.66	34.27	1.0457	21.90	20.94
- Intermediate products	21	1.2845	28.25	21.99	1.2719	24.06	18.92
- Capital goods	6	1.1647	25.68	22.04	1.7348	122.61	70.68
Construction & services	20	0.9670	8.62	8.91	0.9898	8.25	8.34
Total economy	86	1.1855	33.92	28.61	1.1467	47.94	41.81
d_j^{**}							
Primary sector	10	1.1166	24.17	21.65	1.1112	22.08	19.87
Manufacturing industry	56	1.4318	102.56	71.63	1.2102	64.39	53.21
- Consumer goods	29	1.5159	136.56	90.09	1.0536	31.32	29.73
- Intermediate products	21	1.3754	44.18	32.12	1.2295	26.91	21.89
- Capital goods	6	1.2222	17.46	14.29	1.8997	159.58	84.00
Construction & services	20	0.9667	9.97	10.31	0.9937	34.93	35.15
Total economy	86	1.2870	85.72	66.61	1.1367	57.10	50.23

Source: See Table 3.

Table 3 - Actual Domestic Resource Costs by Manufacturing Industries in Spain[a)]

Industrial branch[b)]	1 9 6 2			1 9 6 8		
	d_j	d_j^*	d_j^{**}	d_j	d_j^*	d_j^{**}
A Slaughtering	1.0005	0.3070	0.0712	0.9853	0.6466	0.5997
A Preparations of meat	1.1733	1.9373	2.2064	0.9597	0.9123	0.9060
X Canning and preserving of fruit and vegetables	1.2360	1.4569	1.5273	1.1136	1.1018	1.0871
M Sugar factories and refineries	1.0397	1.0493	1.0255	0.9961	0.8305	0.8009
A Cocoa, chocolate and sugar confectionery	1.4872	1.6220	1.8598	1.0056	1.0073	0.9983
A Dairy products	1.4788	2.2240	2.9040	1.0445	1.0758	1.0986
A Grain mill products	1.3333	1.0916	1.0306	1.0664	0.8731	0.8315
A Bakery products	1.4760	1.7564	1.8585	0.9639	0.8495	0.8408
X Canning and preserving of fish	1.0613	0.9791	0.9743	1.0002	0.9070	0.8626
A Miscellaneous food preparations	1.4179	1.6009	1.7552	1.1587	1.1649	1.1965
X Wine industries	1.0992	1.2051	1.2591	1.1393	1.1649	1.1906
A Distilling, rectifying and blending of spirits	0.7777	0.6766	0.5840	0.9797	0.9248	0.9125
A Other beverage industries	1.4560	1.7030	1.8019	1.1692	1.2089	1.2432
A Vegetable and animal oils and fats	1.0184	1.0030	0.9767	1.0661	0.9984	0.9742
A Tobacco manufactures	0.4669	0.3895	0.3478	0.5257	0.4716	0.4339
M Yarn industry	1.2407	1.2409	1.3349	1.0731	1.0731	1.0386
A Cloth industry	1.5918	2.2441	0.9147	1.4525	1.9673	0.5200
X Knitting mills	1.5399	1.8485	0.3617	1.2864	1.4133	1.4564
A Wearing apparel	1.6344	1.6818	1.1029	1.1464	1.0150	1.0211
A Other textiles	1.5137	1.4461	1.6783	1.2571	1.1414	1.1771
X Footwear	1.5396	1.7287	1.0304	1.3255	1.4547	1.5197
M Preparations and sawing of lumber	1.0541	1.0403	1.8571	1.0398	0.9979	0.9976
A Wood manufactures (incl. furniture)	1.3050	1.3051	1.3110	1.2129	1.2632	1.2763
X Cork industry	1.3123	1.3939	1.4433	1.2670	1.3138	1.3640
M Paper and pulp industry	1.1040	1.1040	1.1255	1.2503	1.2506	1.2751
M Manufactures of paper and cardboard	1.3379	1.3377	1.4512	1.5236	1.8152	2.0000
X Printed matter	0.9862	0.9463	0.9097	1.1446	1.1112	1.1119
A Tanning industry	1.1191	1.2167	1.3217	1.0508	1.2769	1.9330
X Leather products	1.2907	1.3853	1.4056	1.2152	1.2579	1.2765
M Rubber and asbestos products	0.9802	0.9194	0.8934	1.0880	1.0640	1.0677
A Plastic articles	1.6260	1.6491	1.7166	1.1879	1.1567	1.1529
M Synthetic materials	1.4532	0.5298	1.7053	1.3772	1.5412	1.5468
M Basic chemical industry (incl. fertilizers)	1.2155	1.2156	2.9827	1.1591	1.1590	1.1809
A Soap, detergent and perfume industry	1.1934	1.2377	1.2952	1.0956	1.0891	1.1061
A Other chemical products	1.1545	1.1492	1.1436	1.1848	1.2153	1.2137
A Petroleum refineries	0.9480	0.9453	0.9452	0.9092	0.9092	0.8968
A Non-metallic mineral industry	1.2309	1.2415	1.2689	1.2151	1.2229	1.2452
A Cement industry	1.0090	1.0192	0.9930	1.1251	1.1415	1.1528
M Glass manufactures	1.2328	1.2439	1.2467	1.3687	1.3687	1.4033
M Iron and steel industry	1.1871	1.1871	1.1994	1.2841	1.2848	1.3365
A Non-ferrous metal industry	1.0937	1.0938	1.1503	1.1540	1.1539	1.2344
A Metal castings industry	1.1987	1.2022	1.2235	1.2320	1.2499	1.2994
M Finished metal products	1.3136	1.3467	1.3658	1.2799	1.2789	1.3061
M Metal industry for construction	1.4118	1.4862	1.5159	1.2867	1.2877	1.3111
M Agricultural machinery	1.3008	1.3230	1.3843	1.1485	1.1267	1.1276
M Other non-electrical machinery	1.2043	1.2088	1.2095	1.2135	1.2028	1.2110
M Electrical machinery	1.3150	1.3686	1.3856	1.2066	1.2171	1.2295
X Shipbuilding	1.2502	1.2615	1.2628	1.3211	1.3257	1.3403
M Railroad equipment	1.2160	1.2224	1.2270	4.4703	5.1130	5.4616
M Automobile industry	1.4588	1.4591	1.6209	0.8824	0.8825	0.8218
- Repair of automobiles	0.9394	0.9253	0.9257	0.9137	0.9131	0.4466
X Motor cycle and bicycle industry	1.8115	1.8113	2.0833	1.4588	1.4588	1.5470
M Aircraft industry	0.9513	0.6041	0.8642	1.0487	1.0284	1.0283
M Precision instruments	1.1299	1.1262	1.1395	1.1448	1.1433	1.1485
M Jewellery, sport goods and toys	1.1550	1.1529	1.1390	1.1325	1.1267	1.1207
- Repair of metal products	0.9380	0.9032	0.8603	0.9415	0.8968	0.8903

a) For method see text.

b) Primarily export-oriented industries (X) are those in which the export-production ratio is higher than 10 percent and than the import-total supply ratio. Primarily import-competing industries (M) are those in which the import-total supply ratio is higher than 10 percent and than the export production ratio. In the remaining industries (A) both ratios are lower than 10 percent.

Source: Calculated from Organización Sindical Española, Tablas input-output de la economía española, 1962, 1968.

- First, as before there is a wide variation in the domestic resource costs by activities. This is especially true for the manufacturing sector.

- Second, manufacturing production is, on average, more expensive in terms of domestic resource costs than production in the primary and tertiary sector, particularly so in 1962 (Table 2). In that year, the average domestic resource cost for the manufacturing sector, being 1.2323 times the current exchange rate, exceeded the average DRCs in the primary sector by 16 percent and that in the tertiary sector (including construction) by 27.3 percent. By 1968, the picture has changed somewhat. The manufacturing sector was still relatively more costly than the other two although the difference had narrowed down to 11.2 and 18.5 percent, respectively. One is tempted to associate these findings, to an important extent, with the shift in the industrialization strategy aiming at the gradual opening up of the Spanish economy initiated in 1959 and which probably did correct, during the 1960's, some of the significant misallocation of resources introduced in the previous period of exclusively inward-looking industrialization.

- Third, on average, production for manufactured exports do not appear to be the cheapest means of earning foreign exchange. The average domestic resource cost of industries classified as export-oriented was, in 1968, 1.2271 times the current exchange rate, while the corresponding DRC for import-competing industries was 1.3486 (or 1.1844 excluding the extreme value found for railroad equipment) and that for autarchic industries (called "autarchic" for lack of a better term), 1.0895 (Table 3).

- Fourth, Table 3 shows also that 7 out of 10 primarily export-oriented industries experienced a reduction of domestic resource cost between 1962 and 1968 as compared to 11 primarily import-competing industries (out of 20) and 17 autarchic industries (out of 24). It should be noted, in addition, that the two industries which are commonly regarded as particularly successful exporters - footwear and shipbuilding - have, contrary to the product-related findings, relatively high domestic resource cost. This implies that an indiscriminate promotion of exports does not necessarily result in production which is profitable in terms of net foreign exchange earnings. Indeed, a close look at these two industries in Spain reveals much evidence suggesting the co-existence of efficient and inefficient firms within each sector. This is consistent with the supposition that industrialization and trade policies have not been as selective as is desirable from a resource allocation point of view; rather they have allowed inefficient producers to stay in the market.

Another point, which is also important to look at, is whether all industries with high domestic resource costs are inefficient in themselves or whether their DRCs reflect the use of high cost inputs from other domestic industries. One way to deal with this issue is, as we said above, through the assumption that the main inputs are available at world market prices instead of being procured domestically. For the purpose of measurement, the total domestic and the international value added of the input(s) which is now assumed to be imported must be substracted from the values added corresponding to the final production in question. In algebraic terms, formula (13) then needs to be rewritten as follows:

$$(14) \qquad d^{*}_{j} = \frac{\sum_{i} v^{d}_{i} \; s_{ij} - (\sum_{x}\sum_{i} a_{xj} \cdot v^{d}_{i} \; s_{ix})}{P^{w}_{j} - \sum_{i} m_{i} \; s_{ij} - [(\sum_{x}\sum_{i} a_{xj} \cdot m_{i} \; s_{ix}) + (\sum_{x} a_{xj} \cdot P^{w}_{x})]}$$

where a_{xj} is the value of input(s) x (which is assumed to be imported) used per unit of j and P^{W}_{X} represents the world price of the final product(s) x.

We performed two sets of calculations. In the first one, after adjusting the DRCs for the one most important input, we arrive at d^{*}_{j} estimates as presented in Tables 2 and 3. In the second set, adjustments for the three most important inputs were made, obtaining the estimates for d^{++}_{j}. If we look at Spain's major economic sectors (Table 2) we find that, in 1962, the adjusted domestic resource costs were appreciably higher than the original ones (with the exception of the sector construction and services). By 1968, these differences became rather small, implying an overall reduction in allocative inefficiency. The more disaggregated estimates for Spanish manufacturing industries (Table 3) indicate that in a number of cases the high cost domestic supply industries apparently prevent the final production from being more efficient in terms of domestic resource costs, i.e. $d_{j} > d^{+}_{j} > d^{++}_{j}$. Examples are: slaughtering, grain mill products, canning and preserving of fish, oils and fats, wearing apparel, printed matter, and aircraft industry. On the other hand, there are many instances in which high-cost industries are inefficient in themselves, i.e. $d_{j} < d^{*}_{j} < d^{**}_{j}$. Examples are wood manufactures, paper and pulp industry, non-metallic mineral industry, iron and steel, electrical machinery,and railroad equipment, apart from some of the primarily export-oriented industries, such as wine, cork, leather products, and shipbuilding. Once again, it turns out that manufactured exports expansion during the 1960's was not costless to the economy.

This last conclusion leads us to the question of whether or not there is an association between the rank order of industries according to DRCs and the rank order according to their export performance and other selected characteristics. For this purpose, we performed a rank correlation analysis between the DRCs and eleven variables which, on a priori grounds, could be expected to have some association with the domestic resource cost. The results, summarized in Table 4, suggest that domestic resource costs are not strongly associated with any of the eleven factors except, to some extent, with effective protection rates. This last correlation may lend support to the views of those

Table 4 - Spearman's Rank Correlation between DRCs and Selected Variables Concerning Spain's Manufacturing Industry[a]

Variable correlated with domestic resource cost	1962-68	1962	1968
1. Growth of industrial production	0.001*		
2. Growth of domestic supply	0.183*		
3. Growth of exports	0.299		
4. Shares of intermediate inputs in total output		- 0.215*	0.171*
5. Shares of imported inputs in total inputs		- 0.177*	- 0.032*
6. Shares of imports in domestic supply		- 0.269	0.110*
7. Shares in exports in output		- 0.109*	0.307
8. Shares of sectoral exports in total exports		0.007*	0.229*
9. Effective rates of protection[b]		0.892	0.707
10. Capital intensity[c]		n.a.	- 0.178*
11. Degree of concentration of industries (Gini-coefficient)[d]		n.a.	- 0.165*

[a]The sample consists, if not otherwise specified, of 56 industries. Both the DRCs and the selected variables have been ranked in descending order. Coefficients with an asterisk are not statistically significant at the 5 percent level.

[b]38 industries; [c]31 industries (1966); [d]22 industries.

Source: Basic data for rows (1) - (8) are from the Spanish Input-Output-Tables for 1962 and 1968. Effective protection rates are from L. Gâmir, "El proteccionismo arancelario en la España actual", <u>Información Comercial Española</u>, March 1972, p. 99 , and J.B. Donges, "Shaping Spain's Export Industry", op. cit., p. 35. Capital-intensity figures are also from this latter paper (p. 30). The Gini coefficients were taken from J.B. Donges, "From an Autarchic Towards a Cautiously Outward-Looking Industrialization Policy", op. cit., pp. 46-49.

who argue that ex post resource allocation effects of trade policies can be judged as well by looking at the ranking of industries according to their effective tariffs. Besides, it should be noted that there is a statistically significant (though weak) association between DRCs and the growth of manufactured exports as well as export-to-output ratios (in 1968). These observations again tend to cast some doubt upon the overall social profitability of the export pattern of the Spanish industries which existed in the period under observation.

VIII. Concluding Remarks

Two interpretations of the domestic resource cost of a unit of foreign exchange were outlined above - an ex ante definition and an ex post definition. The ex post DRC estimates are, as we have tried to show by a concrete case study, indicative of the economic costs to an economy of pursuing unduly restrictive trade policies. The ex ante DRCs are useful in evaluating the social profitability of economic activities and investment projects, with a view to determining the relative priorities of investments in accordance with the most efficient use of the resources available (now and in the future). The DRC approach to project appraisal is, however, legitimate only if the output of the investment directly leads to earnings or savings in foreign exchange (i.e. only in case of export promoting or import substituting projects). Moreover, the investment in question has to be sufficiently small in relation to the country's national income so that its effect on relative product prices in the economy can be assumed to be negligible. As was pointed out in the text, the social profitability of economic activities or projects can be estimated either by comparing the unit cost of production directly with the benefit to be imputed to the activity (or project) in the form of foreign exchange earned or saved, or by comparing the direct and indirect resource cost of a unit of foreign exchange with the equilibrium rate of exchange. The two methods will lead to the same conclusion with regard to the acceptance or the rejection of an activity only if all intermediate inputs and primary factors (including foreign exchange) are priced at their real opportunity costs.

In a less developed country, in which the markets are generally distorted, the relevant opportunity costs ought to be imputed by appropriately shadow pricing the inputs and primary factors. The shadow pricing, however, poses the real difficulty in determining ex ante, the structure of comparative advantage (or disadvantage) because of the limitations of the data base in most less developed countries.[1)] Some of the problems associated with shadow pricing will be dealt with tangentially in this concluding section without, however, going into the details, which can be found in the literature.[2)] Of crucial importance is the shadow pricing of foreign exchange, of domestic labour (skilled and unskilled) and of capital. In addition, if the net benefit approach to project appraisal is desired, one has also to price at their opportunity costs all those commodities that enter as intermediate inputs into the project. The imported intermediate inputs will then be priced at the opportunity cost of foreign exchange. The domestically produced non-tradable intermediate inputs should be priced at the opportunity cost of the domestic primary factors used in their production, after adjusting for the foreign exchange cost (again at its accounting price), if any, of these inputs. How to price the tradeable inputs that are domestically produced? In one method of social

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1) If enough data were available for a country one could make use of an optimising linear programming model and by fitting in the relevant constraints into the model, could derive the shadow prices from the solution of the dual problem. See H. Chenery, "Comparative Advantage and Development Policy", The American Economic Review, Vol. 51 (1961), pp. 221-237.

2) See, for instance, I.M.D. Little and J.A. Mirrlees, Project Appraisal and Planning For Developing Countries (London: Heinemann Educational Books, 1974) - UNIDO, Guidelines for Project Evaluation (New York: United Nations, 1972).

cost-benefit analysis the use of the relevant world prices has been advocated as the appropriate procedure to adopt.[1] Yet, in the context of the domestic resource cost measurements this pricing technique would seem to be quite inappropriate to use because the domestic price of a unit of tradable domestic input, like that of a unit of non-tradable input, should be equated to the opportunity cost of the domestic factors used in producing it (again after adjusting for any foreign exchange cost) and the world price of this commodity is no index of the domestic opportunity cost.[2] As was pointed out already, a separate DRC estimate can, however, be made at world priced intermediate inputs and compared with the DRC estimate based on domestic priced (at opportunity cost) inputs in order to locate the inefficient sectors in the existing input-output structure of a commodity. When the list of domestic input in the production structure is rather long, the work of imputing the domestic price at opportunity cost to each and every input becomes quite involved. If, however, through input-output table the information is available on the amount of direct and indirect primary factors required per unit of a commodity's output produced, then the DRC estimates can more easily be made by appropriately shadow pricing the primary factors only.

It is well known that the practice of exchange control existing practically in all developing countries tends to make the nominal price of foreign currency - a scarce factor - depart from its opportunity cost. The demand for foreign currency is physically controlled rather than discouraged by devaluating the home currency presumably because the authorities do not wish to raise the price of imported goods like food and machinery. Keeping the price of

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1) I.M.D. Little and J. Mirrlees, "Project Appraisal ...", op.cit.

2) See, E.J. Mishan, "Cost-Benefit Rules for Poorer Countries", The Canadian Journal of Economics, Vol. 4 (1971), pp. 86-98.

foreign exchange artificially low, however, entails a social cost to an economy in terms of output lost since in place of highly productive uses into which the foreign exchange would have been put had its price been higher, it is encouraged to be used in relatively low productive uses. In appraising investment projects it is therefore necessary to correct the nominal value of foreign exchange to allow it to reflect its true opportunity cost. Various measures have been proposed to estimate the correct price of foreign exchange, an excellent summary of which can be found in a recent survey by Edmar Bacha and Lance Taylor.[1)] These two authors themselves recommend the use of a shadow price that takes free trade as a reference point - an equilibrium exchange rate which is calculated in terms of volume indexes of exports and imports.

It is widely recognized that the market price of labour in less developed countries having overt and disguised unemployment is not its true opportunity cost - there is substantial overpricing of labour. It is often too hastily concluded from this that in appraising investment project, labour should be assigned a zero shadow price since it is withdrawn either from the pool of unemployed or from agriculture where its marginal productivity may be zero and therefore there is no loss of output to the economy resulting from an additional employment. This view may be erroneous for a number of reasons. First, agriculture is seasonal in nature and during the periods of intense activity (sowing and harvesting, for example), nearly all available farm hands may be busy. It is necessary to study the seasonal pattern of demand in agriculture before it can be concluded that no loss in output will result from the transfer of labour from agriculture into a non-agricultural

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1) E. Bacha and L. Taylor, "Foreign Exchange Shadow Prices: A Critical Review of Current Theories", The Quarterly Journal of Economics, Vol. 85 (1971), pp. 197-224. See also B. Balassa, "Estimating the Shadow Price of Foreign Exchange in Project Appraisal", IBRD Economic Staff Working Paper, No. 142, February 1973.

activity. Secondly, the opportunity cost of labour is positive if there is a cost of transferring labour from one place to another which the society has to bear. Third, the employment of a previously unemployed or underemployed labour may have a resource cost to the society in the form of extra consumption of the labourer resulting from the employment. Fourth, no unemployment may exist for particular types of skilled labour which a project may demand. Its market price is then perhaps the appropriate opportunity cost. Hence, imputing a zero price to labour will not be appropriate in all situations.

Just as labour is overpriced so is capital underpriced in most less developed countries. Capital is subsidized in various forms - not least because the exchange rate is overvalued. Cheap development credit and various investment allowances artificially reduce the price of capital, leading frequently to substitution of labour by capital. It is therefore necessary to impute an accounting price to capital, which, in the absence of better information, is often taken as the marginal cost of foreign borrowing.

In our attempt to test briefly the appropriateness of DRC estimates in the context of the Spanish economy, we did not make use of shadow pricing, although there is reason enough for assuming that factor prices are distorted in the directions described above. As there are no capital stock and labour data broken down according to the industry classification of the input-output table (the interviewed firms did not provide us with such data either), the differences between private and social costs have been ignored by us. Hence, the numerical results offered should be regarded as approximations rather than definite estimates. Instead of doing "intelligent guess works" today, which may be subject to all kinds of errors and may provoke a great deal of criticism, we feel that our own resources are perhaps better allocated by waiting until such time as more accurate information on Spain's primary factors of production become available (hopefully with the first industrial census which is now, reportedly, under preparation).