Economics Division Working Papers

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Research School of Pacific Studies ANU

Enquiries

The Editor, Working Papers
Economics Division
Research School of Pacific Studies
Australian National University
GPO Box 4
Canberra ACT 2601
Australia

Tel: (61-6) 249 4700
Fax: (61-6) 257 2886

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Berhanu Woldekidan completed his PhD dissertation,'Mauritius: An export-led economic success', at the National Centre for Development Studies, Australian National University in June, 1992.

Islands/Australia Program

National Centre for Development Studies

This paper originates in the Islands/Australia Program at the National Centre for Development Studies. The size, geographic isolation and histories of the Pacific island states create special development problems. Australia plays an important role in the region, both as an aid donor and trading partner. The National Centre for Development Studies has given priority to research on the islands since 1975. The Islands/Australia Program provides policy insights, primarily for Australia in its relations with its Pacific neighbours, but also for the island governments and international agencies. This stream of the Economics Division Working Papers widens the former Islands/Australia Working Paper series. Research on the area is being undertaken by other scholars in the Division. The National Centre for Development Studies continues to disseminate analysis of the island economies through its *Pacific Policy Papers, Pacific Research Monographs* and the *Pacific Economic Bulletin*.

The Economics Division acknowledges the contribution made by the Australian International Development Assistance Bureau towards the publication of this working paper series.

Published by the National Centre for Development Studies
Printed in Australia by Better Printing Service Queanbeyan

ISBN 0 7315 0988 9
ISSN 1038-412X

Key to symbols used in tables

n.a.	**Not applicable**
..	**Not available**
-	**Zero**
.	**Insignificant**

abstract

The results of the analysis indicate that industries producing for export and industries producing for domestic markets differ substantially in terms of protection. Industries producing for the domestic market are protected from external competition through tariffs and they are also provided with other forms of domestic assistance. The incentives provided have made investment profitable for entrepreneurs but the performance of import substituting industries has been inadequate both in terms of production and employment creation.The tariff structure also raises cost of production by increasing the price of inputs to industries which use inputs from tariff protected producers.

In contrast, export industries function in a competitive international environment. Export processing enterprises have to compete against other well established free trade areas such as Hong Kong and Singapore. To do so successfully they have to operate under conditions no less favourable than those of their rivals. For these reasons, it is perceived that they generally get higher domestic assistance than import substitution enterprises. However, the findings of this study suggest that export processing enterprises get less domestic assistance per unit of output than do their non-export processing counterparts. In this aspect export processing enterprises are more efficient than non-export processing enterprises in Mauritius.

industries assistance and resource misallocation:
an assessment for Mauritius

Trade protection and assistance, including tariffs, import quotas and subsidies, influence a country's industrial characteristics by providing advantages to some industries at a cost to others. This paper develops an analytical framework which is then applied to measure the level of government intervention on Mauritian industries. Nominal and effective protection analysis is applied to measure border interventions. The measurement of protection is then extended to the measurement of forms of assistance that include non-border intervention.

Manufacturing enterprises in Mauritius fall into two major groups: export promoting and import substituting. Export promoting (export processing) enterprises function in a competitive international environment whereas import substituting (non-export processing) enterprises enjoy a protected domestic environment. Protection also affects other economic activities by creating biases against them.

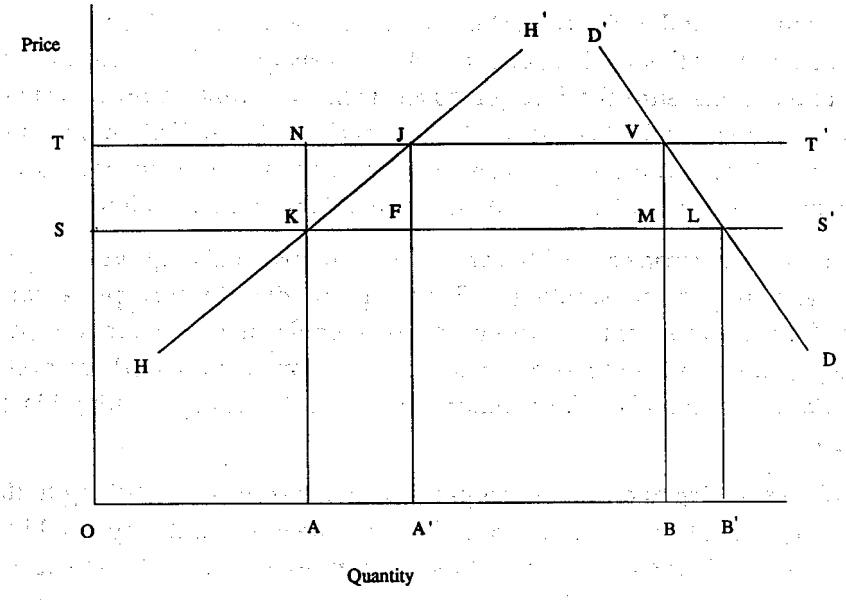
As export processing and non-export processing enterprises may belong to the same industry, estimation of the assistance level for the whole industry would be an average for the industry. To show the disparities in the protection levels between export processing and non-export processing enterprises within an industry, the two sets of enterprises are treated separately in the estimation procedure.

The theory of protection

The theory of protection explains the relationships between protection and consumption, production, international trade and income transfers (Figure 1). The domestic aggregate demand and domestic supply curves are represented by DD' and HH', respectively. SS' represents a perfectly elastic world supply curve. The price of imports is not affected by domestic demand, but determined by

world prices at the level OS. If free trade prevails OB' is demanded, OA is supplied from domestic sources and AB' from imports. The effect of an ad valorem tariff (ST) is to raise the price of an imported commodity from OS to OT. Assuming imported and domestically produced commodities are perfect substitutes for each other, the tariff also raises the price received by domestic producers and paid by domestic consumers by the rate ST/OS. The increase in price encourages producers to raise output by AA', and consumers to reduce consumption by B'B. The tariff also restricts imports from AB' to A'B.

Figure 1 Production, consumption, international trade and income transfer effects of a tariff



Source: W. Corden, The Theory of Protection, Oxford University Press, London, 1971:6.

In addition, tariffs redistribute income from consumers to government and producers. Because of the tariff there is a consumer surplus loss of STVL. Part of the loss, FJVM, is transferred to government in the form of tariff revenue while, STJK, goes to producers in the form of higher revenue. The rest is a net loss to the economy (welfare loss). There is an efficiency loss in production (KJF) due to a misallocation of resources through de-specialization, and a welfare loss in consumption (MVL) due to the higher domestic price charged for the commodity and corresponding reduced consumption.

Since the price to domestic producers has risen at the expense of consumers (either final consumers or industrial users) the consumer is subsidizing the output of domestic product. This is the subsidy equivalent of the tariffs (STJF). If the purpose of the tariff is to assist production, a direct government subsidy of the amount STJF would have resulted in the same level of protection. But, unlike the tariff, the subsidy would not raise the price faced by consumers and would not have an effect on consumption.

Quotas and import licences also have a tariff equivalent. By restricting the quantity supplied they raise prices and have all the subsequent effects of a price rise that apply for tariffs.

The structure of assistance in Mauritius

Tariff protection is the only form of border protection currently operating in Mauritius. Quotas and import licensing were removed in 1985. Some non-border assistance measures are provided to import substituting enterprises holding a Development Certificate, as well as to export processing enterprises. These assistance measures include corporate income tax exemptions, credit subsidies and electricity price reductions.

Import tariffs are composed of a variety of border taxes.

Fiscal duty. Fiscal duty varies among commodities, ranging from 0 to 600 per cent. The highest import duty is paid on imports which are close substitutes to domestically produced goods, and luxury goods. The level of the duty rises as the level of processing increases.

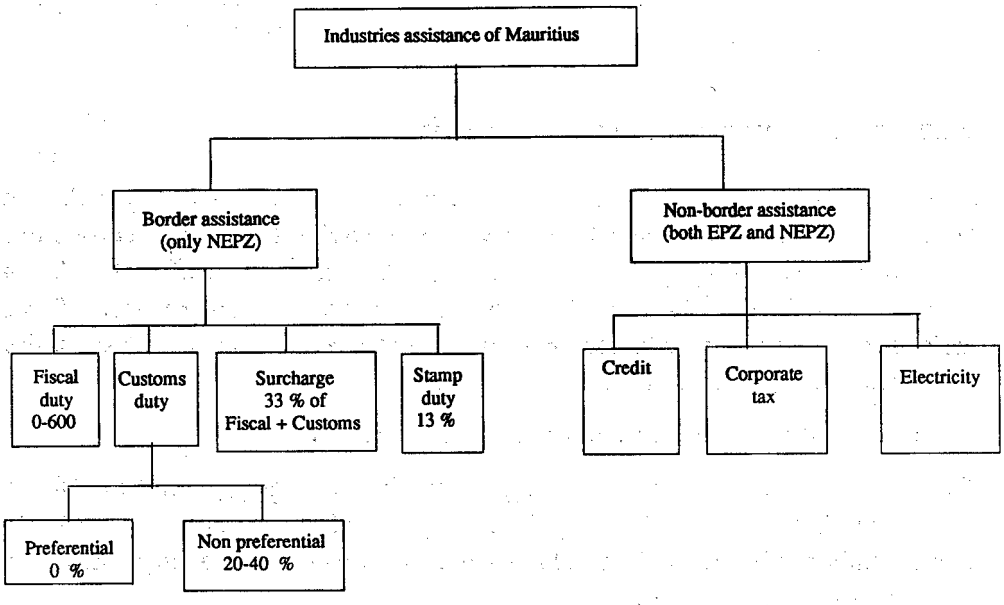
Customs duty. This duty is levied on goods that are imported from non-preferential tariff countries at rates ranging from 20-40 per cent of the fiscal duty. Mauritius has signed a treaty for customs tariff exemptions with most of its major trading partners, but Japan, Taiwan and the Republic of Korea are non-preferential treatment countries. The major exports from non-preferential countries to Mauritius are electronics equipment and vehicles. Almost all other imports are from preferential countries including European Community member countries, India and South Africa.

Stamp duty. A stamp duty of 13 per cent is charged on almost all imports. Government imports are exempted.

Surcharge. In addition a surcharge equal to 33 per cent of fiscal and customs duties is levied on virtually all imported goods.

In estimating the average tariff rate applicable to a commodity group, all types of duties were taken into account except the customs duties. Customs duties data were not available at the level of disaggregation required. The protection effect of these price changes was then estimated. That is, nominal and effective protection to manufacturing industries at the three digit ISIC level and to eight economy-wide sectors were estimated.

Figure 2 Structure of assistance: Mauritius, 1987



Data sources and manipulation

To estimate protection rates, tariff rates, values of imports, outputs and inputs are required. Fiscal tariff rates by item were obtained from the Customs Tariff Act. The corresponding cost, insurance and freight (c.i.f.) values of imports, assumed to be perfect substitutes for the outputs of domestic industries, were obtained from the Chamber of Commerce (1988) for 1987. These imports were further sub-divided between imported inputs brought in by export processing enterprises and non-export processing enterprises. Average fiscal tariff rates were estimated at a certain level of aggregation by weighting the rates of the detailed items by the corresponding value of imports.

Singapore's 1975 manufacturing intermediate input to output coefficients were used as a proxy to disaggregate the intermediate inputs for Mauritius by commodity. The adoption of the input-output coefficient for Singapore assumes that Singapore's production technology in 1975 was not significantly different from Mauritian production technology in 1987. The total intermediate input to output ratio of each of the Mauritian manufacturing industries in 1987 was not markedly different from those observed in Singapore's 1975 intermediate input to output ratio in corresponding industries. As the overall intermediate input and value added were taken from Mauritian data, the use of Singapore's matrix to disaggregate the intermediate inputs was unlikely to introduce a significant bias to the data set.

The intermediate input-output matrix of Mauritian manufacturing industries was calculated by multiplying the input-output coefficient of manufacturing industries adopted from Singapore by the value of Mauritian output of the respective industries. These estimates were made for export processing enterprises, non-export processing enterprises and all enterprises together.

To estimate assistance rates, additional information on major domestic credit assistance, corporate tax and electric power rate concessions by industry was required. Data on credit concessions was obtained in the Bank of Mauritius (1989). Corporate tax concessions were calculated using unpublished data from the Ministry of Industry. Power concessions were calculated from power consumption and power rates data obtained from unpublished data in the Ministry of Industry.

In estimating the effective rate of assistance, the study uses an input-output method which is believed to be better than the value added method. Although the input-output method and the value added method can be proved to be equivalent algebraically, they differ in application. Unlike the input-output method, in practice the value added method does not allow for explicit estimation of assistance. Assistance to value added is calculated by taking the difference between the observed value added and the free trade value added. It relies on the assumption that the difference in value added is due to assistance which might not always be true. The use of the value added method can therefore yield biased results.

Methodology

Assumptions made in measuring protection

Input-output coefficients are assumed fixed. This precludes any material input substitution effects resulting from relative price changes that follow from protection. However, there is substitution among primary inputs of labour and capital.

Traded goods are assumed to be homogeneous, that is, there is perfect substitution between imports and domestically produced importable goods.

The small country assumption implies infinite elasticity of supply of imports. Under this assumption the prices of imports and import substitutes are not affected by domestic demand, but determined by world prices plus the price raising effect of protective measures.

The protective measures are not prohibitive; trade continues after protection.

Nominal protection

The nominal rate of protection (NRP) is the percentage change in gross returns per unit of output relative to the free trade situation.

$$t_j = (P'_j - P_j) * 100 / P_j \qquad j = 1....m \qquad 1$$

where:

t_j = the nominal rate of protection on output j;

P'_j = value of output of commodity j after protection;

P_j = value of output of commodity j before protection.

The nominal rate of protection is sometimes referred to as the price raising effect of the tariff, because it measures the proportional price increase due to a tariff. The nominal rate of protection indicates the potential distortion in consumption arising from the tariff, but not the potential distortion in production.

The nominal rate of protection does not indicate the production effects of the tariff because production decisions are influenced by both the price of the final product and the cost of production. The revenue increase for an industry's output due to a tariff, could be offset by higher costs of production if the industry uses

inputs facing high tariffs. While tariffs assist the local manufacturers of an import-competing commodity, by enabling them to raise the price of the commodity, it is a form of tax to the users of the commodity. Therefore tariffs on inputs constitute an implicit production tax on the using industries.

As the nominal rate of protection does not take into account the taxing effect of tariffs on inputs, it is not a good indicator of the degree of protection enjoyed by an industry. To measure the full effect of tariff protection on industries, changes in input costs due to tariffs have to be included.

The tax effect of the tariff on an industry's inputs is derived in the same manner as the nominal rate of protection on output. The nominal rate of tax on inputs to industry j (t'j) is the percentage change in the average value of inputs:

$$t'_j = \sum (P'_{ij} - P_{ij}) * 100 / \sum_i P_{ij} \qquad i = 1....m;\ j = 1....m \qquad 2$$

where:

t'_j = the nominal rate of input protection;

P'_{ij} = value of input i used in producing output j after protection;

P_{ij} = value of input i used in the production of output j before protection.

Effective protection

Effective protection considers the effect of tariffs on both output and inputs. The theory of the effective rate of protection (ERP) deals with measurement of protection on value added. Pioneering work has been done in this area by Barber (1955), Humphrey (1962), Johnson (1965), Balassa (1965) and Corden (1966a, 1966b). Since then, an extensive literature regarding the theory and empirical estimation of effective protection has developed; Corden (1969, 1971), Finger (1969), Johnson (1969), Balassa (1971), Grubel and Lloyd (1971), Jones (1971), Gamir (1971), Ray (1973), Hamilton (1984), Greenaway (1988) and Greenaway and Milner (1989). Many countries calculate effective protection and assistance for their industries. The Australian Industry Commission produces estimates of effective rates of protection and assistance for most Australian industries (Australian Industries Assistance Commission 1987, 1988).

Effective protection measures the net protection to value added in production, including the cost of protection on inputs in production as well as outputs. It is this impact of the protection structure on value added which affects the allocation

of resources in production. The calculation of the effective rate of protection takes into account the nominal rate of protection on output, the nominal rate of protection on the various inputs, and the share of each input in the cost of producing the final product.

The effective rates of protection standard formula is:

$$H_j = \frac{t_j - \sum_i a_{ij} t'_j}{1 - \sum_i a_{ij}} \qquad 3$$

where:

H_j = effective rate of protection;

a_{ij} = share of commodity i in total cost of producing commodity j;

t_j = tariff rate on commodity j;

t'_j = average tariff rate on the various inputs used in producing commodity j.

The effective rate of protection calculation in equation 3 uses input-output data. Alternatively effective rate of protection can be estimated using value added as in equation 4.

$$H_j = V'_j - V_j / V_j \qquad 4$$

where:

V'_j = value added after protection and

V_j = value added before protection, also defined as

$$V'_j = P'_j - \sum_i P_{ij} \qquad 5$$

$$V_j = P_j - \sum_i P_{ij} \qquad 6$$

Equations 5 and 6 can be written per unit of output:

$$V'_j = (1 + t_j) - \sum_i a_{ij} (1+t'_j) \qquad 7$$

$$V_j = (1-\sum_i a_{ij}) \qquad 8$$

Substituting equations 7 and 8 in equation 4 will give equation 3.

The effective rate of protection indicates the incentive for resources to relocate in the industries where they obtain the highest return. High levels of effective protection encourage movement of resources into an industry even if the resources could have been utilized more efficiently in less protected industries.

The effective rate of protection is only a relative measure. It indicates that if industry A has a higher effective rate of protection than industry B, resources tend to shift to industry A. For this reason the effective rate of protection is considered a measure of 'resource pull' (Corden 1971).

Effective assistance

The concept of protection can be extended to include the effects of other governmental non-border interventions such as taxes and subsidies. The effective rate of non-tariff assistance can be derived in the same way as the effective rate of tariff protection:

$$K_j = \frac{S_j - \sum_i a_{ij} S'_j + r_j}{1 - \sum_i a_{ij}} \qquad 9$$

where:

K_j = effective rate of non-tariff assistance on output j;

S_j = average rate of subsidies less taxes on output j;

S'_j = average rate of taxes less subsidies on the various inputs, in producing output j;

r_j = direct assistance to value adding factors as a proportion of unassisted value of output j.

The combined effect of tariff protection (equation 3) and non-tariff assistance (equation 9) gives the total assistance accorded to an activity. The proportionate

change in returns per unit of output to an activity's value adding factors due to the entire assistance structure is given as:

$$G_j = \frac{t_j + S_j + r_j - \sum_i a_{ij} (t_j' + S_j')}{1 - \sum_i a_{ij}} \qquad 10$$

where:

G_j is the effective rate of overall assistance.

The discussion so far assumes there are only importable commodities. Theoretical problems arise in dealing with non-traded goods and exportables.

Non-traded goods

A theoretical problem arises when non-traded goods are intermediate inputs into tradable inputs. As no protection is levied directly on non-traded inputs, protection would not have direct effects on the cost of non-tradables. However, protection can indirectly increase non-tradable prices in two ways. First, this increase comes through the use of protected tradable inputs in the production of the non-tradable inputs. The effect of protection on non-tradable inputs through indirect traded material inputs in producing commodity j is:

$$\sum_k \sum_i a_{kj} a_{ik} (1 + t_k) \qquad 11$$

where:

a_{kj} = input coefficient of non-traded inputs k, which are used in industry j;

a_{ik} = input coefficients of traded material inputs in the production of the non-traded input k;

t_k = the tariff rate on indirect traded material inputs.

Second, if protection is given to a commodity it increases the demand for the commodity's inputs (both traded and non-traded). The increase in demand for tradable inputs is satisfied from external supplies and therefore does not affect prices because of the small country assumption. But a rise in demand for non-tradable inputs may or may not increase their prices depending on the assumption of the elasticity of supply of non-tradable inputs.

Balassa's method (1965) assumes that the supply curve of non-traded inputs is perfectly elastic so they can be treated like traded inputs. A perfectly elastic supply implies that, when demand for these inputs increases in the production of a protected commodity, the price of the non-traded inputs remains unchanged. Hence, protection of a traded commodity would not have indirect effects on the price of non-traded inputs.

The value added per unit of output of commodity j for Balassa's method before and after protection are given in equations 12 and 13, respectively:

$$V_j^B = 1 - (\sum_i a_{ij} + \sum_k a_{kj}) \qquad 12$$

$$V_j^{'B} = (1 + t_j) - [\sum_i a_{ij} (1 + t_j') + \sum_k \sum_i a_{kj} a_{ik} (1 + t_k) + \sum_k \sum_r a_{kj} a_{rk}] \qquad 13$$

where: a_{rk} is value added coefficient in the production of the non-traded input k.

Therefore, Balassa calculates the value added of the protected industry by subtracting both the tradable and non-tradable inputs from output.

Corden's method assumes a less than perfectly elastic supply of non-tradable inputs (Corden 1971). Under this assumption, the increase in demand for non-tradable inputs raises their prices. Therefore, protection of a commodity indirectly protects industries producing non-tradable inputs used in the protected industry. Accordingly, Corden estimates value added of the protected industry by subtracting the tradable input and the indirect tradable input component of the non-tradable inputs. Corden's value added before and after protection are presented in equations 14 and 15, respectively:

$$V_j^C = 1 - (\sum_i a_{ij} + \sum_k \sum_i a_{kj} a_{ik}) \qquad 14$$

$$V_j^{'C} = (1 + t_j) - [(\sum_i a_{ij} (1+t_j') + \sum_k \sum_i a_{kj} a_{ik} (1+t_k)] \qquad 15$$

By doing so, Corden lumps together the value added of the protected industry and that of the non-traded input:

$$V_j^C = V_j^B + \sum_k \sum_r a_{kj} a_{rk} \qquad 16$$

where the non-traded input coefficient can be split into material input and value added coefficients:

$$\sum_k a_{kj} = \sum_k \sum_i a_{kj} a_{ik} + \sum_k \sum_r a_{kj} a_{rk} \qquad 17$$

As Corden's method takes into account changes in value added of both tradable and non-tradable goods, it may be regarded as measuring the overall 'domestic resource cost'.

Measurement of effective rate of protection: the Balassa and Corden methods

The effective rate of protection for Balassa's method is obtained by substituting equations 12 and 13 into equation 4.

$$H_j^B = \frac{(1+t_j) - [\sum_i a_{ij}(1+t'_j) + \sum_k \sum_i a_{kj} a_{ik}(1+t_k) + \sum_k \sum_r a_{kj} a_{rk}] - (1-(\sum_i a_{ij} + \sum_k a_{kj}))}{1-(\sum_i a_{ij} + \sum_k a_{kj})} \qquad 18$$

$$= \frac{t_j - (\sum_i a_{ij} t'_j + \sum_k \sum_i a_{kj} a_{ik} t_k)}{1-(\sum_i a_{ij} + \sum_k a_{kj})} \qquad 19$$

Similarly, substituting equations 14 and 15 into equation 4 gives Corden's effective rate of protection (H^C_j).

$$H_j^C = \frac{(1+t_j) - [\sum_i a_{ij}(1+t'_j) + \sum_k \sum_i a_{kj} a_{ik}(1+t_k)] - (1-(\sum_i a_{ij} + \sum_k \sum_i a_{kj} a_{ik}))}{1-(\sum_i a_{ij} + \sum_k \sum_i a_{kj} a_{ik})} \qquad 20$$

$$= \frac{t_j - (\sum_i a_{ij} t'_j + \sum_k \sum_i a_{kj} a_{ik} t_k)}{1-(\sum_i a_{ij} + \sum_k \sum_i a_{kj} a_{ik})} \qquad 21$$

The numerators in both methods are identical, but they differ in the denominator by the value added component of the non-tradable inputs, included in the Corden method. Balassa's method, having a smaller denominator, leads to a higher measure of effective rates of protection.

Balassa's assumption that non-tradable inputs prices are unaffected by protection has been criticised. Corden's method raises problems of interpretation, however, when the effective rate is to be assigned to a particular activity. This occurs because the effective rate calculated for a particular activity will also include the value added of non-traded inputs coming from a separate activity.

A third, alternative approach to Balassa's and Corden's method is to treat non-traded inputs in the same way as primary factors as in equation 3. In this case the value added in the protected industry implicitly includes the total value of non-tradables in addition to the primary factors. This third approach is likely to understate the effective rate since value added is overstated compared with either Balassa's or Corden's method. Suppose the production cost of a non-tradable (electricity) consists of 60 per cent value added and 40 per cent tradables. If the clothing industry (tradable) spends 10,000 rupees on electricity, the Balassa method adds the cost of the electricity to the clothing industry input costs. Corden's method adds 4,000 rupees to the clothing industry input costs, and 6,000 rupees to the clothing industry value added. The third method adds it all to the value added of the industry.

From a practical point of view the choice among these methods is generally determined by data availibility. Limited data favours the general method, ease of interpretation favours Balassa's method and the strength of the conceptual framework favours Corden's method.

Exportables

The effective rate of protection in equation 3 assumes that protection raises the price of all products. This is true only if all output is sold on the domestic market. However, if some of the output is exported, protection has no effect on the export price if the export price is determined internationally. Hence, protection can raise the price of only that part of the output that is sold domestically. To estimate the price increase of the commodity, the nominal rate of protection on the commodity has to be multiplied by the share of domestic sales to total sales of the output. The effective rate of protection which excludes export sales is then specified as:

$$H_j = \frac{d_j t_j - \sum_i a_{ij} t'_j}{1 - \sum_i a_{ij}} \qquad 22$$

where d_j refers to the ratio of domestic to total sales. The average price of commodity j is raised by $d_j t_j$ with a tariff rate t_j.

Using the analytical framework set out in equations 1 to 22, estimation methods of nominal rates of protection, effective rates of protection, nominal rates of assistance, and effective rates of assistance are developed.

Estimation to Mauritian industries: approach and results

In all estimations, enterprises are grouped into export processing, non-export processing and all enterprises. This grouping was made to indicate the scale of assistance on import substituting and export promoting enterprises separately. The separate estimation of assistance for the export processing enterprises and the non-export processing enterprises was particularly important to the analysis of the assistance given to export-oriented industries received. The estimation of assistance for all enterprises indicates the average scale of assistance to industry.

All manufacturing industries are regarded as producers of tradables. Among the aggregate sub-sectors only construction and services are considered non-tradables. By including assistance measures other than tariffs, the effective protection rates are extended to assistance rates.

Effective protection and assistance apply the input-output method. The effective rate of assistance was determined by the nominal rates of assistance on an industry's output ($t_j + s_j$), inputs ($t'_j + s'_j$), concessions to value adding factors, r_j (credit and tax concessions), and the industry's input to output ratio ($Sa_{ij} + Sa_{kj}$), measured in terms of unassisted prices. As observed data were inclusive of the tariff, they were deflated by the average tariff rate to obtain the unassisted values. For instance, the unassisted value of output was estimated as:

$$P_j = P'_j / (1 + t_j) \qquad 23$$

The estimation method treated non-traded inputs as they are treated in the Balassa method for ease of interpretation. Estimations also took into account the distinction between exports and domestic sales for non-export processing enterprises.

Price effect of the tariff

A tariff raises the price of imported inputs to import substituting industries (non-export processing enterprises) by the size of the average tariff rate. However, tariffs have no price or cost effects on imports to exporting (export processing) enterprises as these enterprises obtain their inputs duty free. The price effect on total imports would be the weighted average increase in prices of duty free (export processing enterprises) imports and dutiable (non-export processing enterprises) imports. It is derived by dividing the duty paid by non-export processing enterprises by the (c.i.f.) value of total imports.

Nominal assistance

Assistance to outputs. Producers of import competing goods are able to mark up the price of products sold in the domestic market by the amount of the tariff. Accordingly, where all production is for the domestic market, the nominal rate of protection equals the tariff rate (NRP = t_j). This is the case for non-export processing enterprises, as almost all their produce is for domestic consumption. The nominal rate of protection to export processing enterprises is nil. In estimating the nominal rate of protection to the whole industry the price increase to only that part of output consumed domestically is considered. As exports are sold at international prices, tariffs do not raise their prices. The nominal rate of protection to the whole industry is then calculated by multiplying the tariff rate for the whole industry, t_j, by the ratio of domestic to total sales at free trade prices, d_j, that is $d_j t_j$.

$$O_j = t_j + s_j \qquad 24$$

In equation 24, O_j refers to the rate of assistance to outputs. This increases the gross receipts to producers. Tariffs, import quotas, export incentives and production subsidies fall into this category. Tariffs on competing imports are the only form of output assistance to Mauritian industries. Hence, $S_j = 0$; $O_j = t_j$. That is, the total rate of assistance to output equals the rate of protection to output.

Assistance to inputs. This can be written as

$$M_i = t'_j + s^1_j \qquad 25$$

where M_i consists of the additional rate paid by industrial users for domestically produced and imported goods as a result of overall assistance to inputs. A tariff on imported inputs (t'_j) represents tax on the user industry. To obtain the overall assistance or tax on inputs, M_i, t'_j is added to the rate of taxes less subsidies on inputs (s'_j). Electricity concessions are the only assistance (subsidy) to inputs.

Therefore, M_i constitutes tariff rates on inputs, t'_j and electricity concession rates, s'_j.

To calculate the average tax effect of a tariff on an industry's inputs, data on inputs and tariff rates on each input are required. For the summary industries, input data are obtained from the input-output data of Mauritius. For the detailed manufacturing industries the modified input-output coefficient matrices for export processing enterprises, non-export processing enterprises, and all enterprises are used separately.

The gross tax equivalents (negative assistance) on inputs are obtained by multiplying the intermedate inputs of each industry by their respective tariff rates. These effects are then aggregated by industry to reflect the tax equivalent faced by each industry. The average nominal rates of tax on inputs are estimated by dividing the gross tax equivalents on inputs by the unassisted value of inputs. This is done for non-export processing industries in the manufacturing sector and for all industries in the sector. For export processing enterprises the gross tax equivalents and the average nominal rate of tax on inputs are zero, as imported inputs for these industries enter duty free.

In addition to assistance to outputs and inputs other forms of government intervention provide assistance directly to value adding factors. This includes income tax and credit concessions. This direct assistance to value adding factors needs to be included in estimating net assistance to industries.

Effective protection and assistance

The effective rate of protection and the effective rate of assistance are estimated according to the methodology discused above. The estimation of the effective rate of protection and the effective rate of assistance are specified as in equations 26 and 27, respectively.

$$H_j = \frac{d_j t_j - (\sum_i a_{ij} t'_j + \sum_k \sum_i a_{kj} a_{ik} t_k}{1 - (\sum_i a_{ij} + \sum_k a_{kj})} \qquad 26$$

$$G_j = \frac{d_j O_j + r_j - (\sum_i a_{ij} M_i + \sum_k \sum_i a_{kj} a_{ik} t_k)}{1 - (\sum_i a_{ij} + \sum_k a_{kj})} \qquad 27$$

Equations 26 and 27 are modified forms of equations 3 and 10, respectively. They are modified by accounting for non-tradable inputs as in equation 19 and

exportables as in equation 22. The analytical framework established in equations 26 and 27 is used to estimate the effective rate of protection and effective rate of assistance, respectively.

Nominal and effective protection for sub-sectors of the economy

Of all eight sectors the largest beneficiary of the protective structure is non-export processing manufacturing (Table 1). The second largest beneficiary, other agriculture, receives only one-third of the rate of protection received by non-export processing manufacturing. Though the tariff rate on sugar is 109 per cent, sugar producers are able to raise the price for only 10 per cent of their produce, that is on the proportion that is domestically consumed. The average price increase on the total output is then 10.9 per cent (tariff rate times share of domestic sales in total output). This average price increase on the total output of the sugar industry is the average nominal protection on sugar production.

Table 1 Protection rates by major sector, Mauritius, 1987

	Nominal rate of protection	Effective[a] rate of protection	Effective[a] rate of assistance
Sugar	11	15	16
Other agriculture	29	21	25
Non-export processing manufactures	89	115	134
Export processing (textiles and clothing)	-	-	8
Other export processing manufactures	-	-	7
Mining (salt)	21	21	21
Tourism	-	-27	-25
Other services	-	-12	-12

[a] Measured using the Balassa method.

The negative effective rate of protection for services indicates that the sector loses because of protection. Services do not gain anything from the protective structure, with zero nominal rate of protection, but they incur higher costs on their inputs because of protection, resulting in a negative effective rate of protection. The effective rate of protection for non-traded industries such as other services has been estimated to examine the extent to which such industries are penalized by the existing assistance structure.

Nominal protection for manufacturing outputs

These estimates were expected to be lower than the Greenaway and Milner (1989) findings because following policy reviews in the early 1980s by the United Nations Industrial Development Organization (UNIDO) and the World Bank trade barriers have been liberalized. Despite this expectation, the nominal rate of protection has increased in 7 of the 21 industries. One explanation is that although import licensing and quantitative restrictions have been reduced, tariff barriers remain high. In fact tariff barriers have increased in some cases to compensate for the loss of protection resulting from the removal of quantitative restrictions. Within the manufacturing sector, protection is high for tobacco and beverages where tariffs are levied mainly for revenue reasons rather than for protection (Table 2). Other industries which have large nominal protection include leather products, transport equipment and furniture. Since these commodities, with the exception of leather products, are mainly or exclusively produced by non-export processing enterprises, their nominal rate reflects the total industry rates of nominal protection.

The nominal rates of protection for non-export processing enterprises with the exception of the few mentioned above are higher than the corresponding rates for overall industry. The lower total industry rates can be explained in two ways. First, substantial amounts of imports entered duty free outside the non-export processing category, but within the same industry, making the average tariff rate on the industry lower than the non-export processing. For instance, the nominal rate of protection for all output is much lower than that for non-export processing manufactures in textiles as a large proportion (75 per cent) of the total imports was imported free of duty by export processing enterprises. Because of the large proportion of imports entering duty free, the average tariff rate on imports competing with the industry's output becomes small. Second, for the same tariff rate, a large proportion of exports leads to lower nominal rate of protection. A much lower nominal rate of protection is observed for wearing apparel, watches and lenses in the whole industry than in non-export processing enterprises because a substantial proportion of the output of these industries is exported. For instance, 98 per cent of the total output of wearing apparel is exported.

As tariffs cannot raise the world price of exports, the average price increase on the overall output would be 2 per cent (the share of domestic sales in output) of the tariff rate. The weighted mean of nominal rate of protection for total manufactures is only one-fifth of the non-export processing manufactures. This occurs because the share of export processing manufactures output, with zero tariff rate, in manufacturing output is large. A wider variation in nominal protection is also observed in the estimates for whole industries than for non-

export processing enterprises. This can be observed from the higher values of the coefficients of variation for the whole industry than for non-export processing enterprises.

Table 2 Nominal and effective tariffs by manufacturing industry, Mauritius, 1987

	Nominal tariff		Effective tariff	
	Non-export processing enterprises	Total manufactures	Non-export processing enterprises	Total manufactures
Beverages[a]	307	307	382	382
Tobacco[a]	311	311	359	359
Textiles[b]	53	2	76	3
Wearing apparel[c]	80	1	103	2
Leather products[b]	146	3	228	5
Footwear[c]	81	38	71	31
Wood products	58	31	75	34
Furniture[a]	99	99	242	242
Paper products	63	47	90	62
Printing	40	35	15	28
Basic chemicals	21	19	17	21
Other chemicals	60	46	108	79
Rubber	93	52	93	54
Plastic	53	27	38	17
Glass	64	51	77	75
Base metal	26	23	20	23
Fabricated metal	62	56	134	103
Non-electrical machinery	66	41	76	35
Electrical machinery	79	67	79	67
Transport equipment[a]	146	146	157	157
Watches and lenses	45	3	56	4
Arithmetic mean	93	67	89	57
Standard deviation	77	85	100	108
Weighted mean	91	18	112	23
Coefficient of variation	0.8	1.2	0.84	1.3
Range	21-311	1-311	15-382	2-382

a Produced only for domestic market by non-export processing enterprises.
b Commodities which are imported in large quantity by export processing enterprises.
c Commodities which are exported in large quantity by export processing enterprises.

Effective rates of protection and assistance for manufacturing industries

As in the case of the nominal rate of protection, the effective rate of protection for textiles, wearing apparel and leather products is small when estimated for the whole industry.

The present estimates for non-export processing manufactures resulted in higher coefficients of variation of effective rates than did Greenaway and Milner (1989), suggesting that the dispersion in assistance among industries has increased since 1980. As larger variations in protection tend to worsen distortions in resource allocation, the results imply that resources were used more efficiently in non-export processing enterprises in 1980 than in 1987. However, this must be treated with caution because of the different estimating approaches of the two studies.

The estimates of effective rates of assistance (Table 3) tell a similar story to those of effective rate of protection (Table 2), except that export processing enterprises also obtain some assistance.

Table 3 Effective rates of assistance for non-export processing and export processing enterprises, 1987

	Effective rates of assistance	
	Non-export processing enterprises	Export processing enterprises
Beverages	395	n.a.
Tobacco	369	n.a.
Textiles	83	17
Wearing apparel	107	7
Leather products	246	5
Footwear	95	13
Wood products	84	8
Furniture	253	n.a.
Paper products	98	1
Printing	21	6
Basic chemicals	19	4
Other chemicals	112	12
Rubber	107	4
Plastic	46	8
Glass	90	12
Base metal	24	5
Fabricated metal	142	8
Non-electrical machinery	83	7
Electrical machinery	91	8
Transport equipment	172	n.a.
Watches and lenses	58	9
Arithmetic mean	98	7
Weighted mean	121	8.7
Standard deviation	102	4
Coefficient of variation	0.80	0.6
Range	19-395	1-17

The assistance takes the form of concessions given for both import substituting and export processing enterprises. The nominal rate of interest appears to have been a market rate but import substitution enterprises and export processing enterprises were given discounted loans from commercial banks. In 1987 the discounts were 3.5 per cent and 3.75 per cent less than the market interest rate respectively (Bank of Mauritius 1989).

Import substituting and export processing enterprises received the same concession in electric power consumption and corporate income tax. In 1987 both import substituting and export processing enterprises paid corporate income tax of 15 per cent whereas other industries were taxed at 35 per cent.

The difference between the estimates in Table 3 and 2 shows the effect of non-border concessions. The concessions fall into two assistance categories. Concessions of income tax and credit are direct assistance to value adding factors. Concessions on electric power rates are assistance to inputs.Given the large size of export processing enterprises (Table 4) it is neither practical due to budget constraints nor necessary to subsidize exports. Further, as a substantial proportion of export processing enterprises are foreign owned, export processing enterprises may obtain their capital requirements from international sources.

Table 4 The importance of export processing and non-export processing in total manufacturing sector, 1987

	Employment		Output		Establish-ment[a]	Value added		
	Number ('000)	Per cent	Million rupee	Per cent	(number)	Million rupee	Per cent	Growth
Export processing	83	80	7960	45	591	2585	53	30[b]
Non-export processing	18	17	4390	25	372	1335	28	7[b]

a Number of firms.
b Between 1984-88.
Source: Mauritius Central Statistical Office, *Digest of Industrial Statistics, 1988*, Government Printer, Port Louis.

The estimates in Table 3 include these measures as well as the impacts of tariffs. Non-export processing enterprises benefit more than export processing enterprises from these concessions. The rates of direct assistance to value adding factors are estimated as a ratio of dollar value of concession to output. For a certain level of concession the higher the value of output the lower the rate of

assistance. Although concessions for export processing enterprises are higher than or equal to those for import-substituting industries, export processing industries appear to obtain lower assistance per unit of output because of the higher output of the export processing enterprises. As export processing enterprises obtain a lower level of assistance per unit of output, they benefit less from the concessions than their non-export processing counterparts.

Given the large size of export processing enterprises (Table 4) it is neither practical due to budget constraints nor necessary to subsidize exports. Further, as a substantial proportion of export processing enterprises are foreign owned, export processing enterprises may obtain their capital requirements from international sources.

Effective rates of assistance and resource allocation

Subsidies and tax exemptions are a cost to the government in terms of increased expenditure or foregone revenue. They may distort allocation of resources away from where they are efficiently used. The potential misallocation of resources is estimated in Tables 2 and 3 using effective rates of protection and effective rates of assistance, respectively. The effective rate of protection measures potential misallocation of resources because of tariff protection. The effective rate of assistance measures similar resource misallocation due to overall assistance (tariff and non-tariff) to industries.

Table 5 Indicators of protection effects on export processing and non-export processing enterprises, 1987

	Clothing and textiles			Total industry		
	Non-export processing	Export processing	Total	Non-export processing	Export processing	Total
Labour cost per worker ('000 rupee)	17.7	14.7	14.9	21.9	15.5	16.9
Value added per output ('000 rupee)	34.7	32.7	32.9	38.5	32.5	32.9
Value added per worker ('000 rupee)	36.8	29.4	30.4	68.5	31.5	43.8
Ratio of operating surplus to total cost	0.21	0.19	0.20	0.25	0.20	0.21

Source: Mauritius Central Statistical Office, *Digest of Industrial Statistics, 1988*, Government Printer, Port Louis, 1988.

Such a movement of resources is influenced by the rents (excess profit) accruing to protected industries. Greater protection implies less competition. Other things remaining unchanged, with less competition there is a tendency for a greater potential for higher rent. To examine the proposition that highly protected industries obtain a higher rent, gross operating surplus as a ratio of production costs was taken as a proxy for rent as in Greenaway and Milner (1989).

Rent is generally higher for non-export processing enterprises than for export processing enterprises (see Table 5). Within the non-export processing enterprises those with higher effective rates of assistance also have above average rents. Part of this rent is passed on to factors of production in the form of higher wages. This possibility is examined by comparing earnings per worker among industries of varying levels of assistance. Labour costs per worker for non-export processing enterprises are greater than for export processing enterprises (Table 5). Comparing earnings per worker between export processing and non-export processing firms of the same industry is even more appropriate. Firms of the same industry are likely to employ labour of similar skill and gender. Therefore the difference in earnings could be largely associated with protection and assistance. The available data support the proposition that highly protected industries pay higher wages. For instance, the average annual wage rate in textiles and clothing industries is 17,700 rupees in non-export processing firms, where as it is only 14,700 rupees in export processing firms.

Mauritius, a densely populated country, is a labour rich nation. Therefore, it would be expected to have a comparative advantage in labour-intensive industries. Under free trade, investment would flow into labour-intensive industries to minimize the costs of production. The higher value added per worker of 68,500 rupees for non-export processing enterprises as compared with 31,500 rupees for export processing enterprises indicates that industries with a high effective rate of assistance tend to be capital intensive. These figures are consistent with officially published figures by the Statistics Office. For example, value added per worker in non-export processing and export processing enterprises is 75,000 rupees and 31,000 rupees respectively (Central Statistical Office 1988). Value added is taken here as a proxy of overall capital (physical capital and human capital) as in Lary (1970).

Given the distorting effect of tariff protection on resource use, removing or reducing the level of tariffs is expected to improve the efficiency of resource use. Additional benefits would also be expected from increased resource utilization.

As noted earlier, the effective rate of assistance measure indicates only the net benefit in value added terms and the likely effect of the distortion measures on

resource allocation. Being a partial measure, it does not indicate the impact on output, employment and other factors. However, general equilibrium model simulation results (Woldekidan 1992) indicate that tariff reform gives incentives for tourism and other services industries to expand substantially, with marginal expansion in other agricultural, sugar and export processing enterprise. There is an overall gain in the economy with reduced inflation and expanding overall output.

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