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A Model of an Export-Propelled Economy: The Case of Mauritius

By

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1. SOME BASIC FEATURES OF THE MAURITIAN ECONOMY

This is not the place to launch into a description of the economy of Mauritius, but a few basic facts might help to place what follows in its context, and to relate the Mauritian situation to that of the Caribbean.

Briefly, Mauritius consists of one main pear-shaped island of 720 sq. miles, just within the Tropic of Capricorn, in the Indian Ocean. There were no original inhabitants; and, from 1810 until it became independent in March, 1968, Mauritius had been a British crown colony. The population of Mauritius, presently just over 750,000 (density over 1,000 per square mile), is of varied origin. The main group (over 60 per cent) descends from East Indian immigrants, both Hindus and Muslims who were, for the most part, indentured labourers brought in to work in the sugar plantations (very much as in Trinidad, Guyana or Fiji). The "creole" group is next in numerical importance (over 30 per cent), and comprises people of mixed and African origin, together with a few persons of European (mostly French) descent. There are also about 25,000 Chinese Mauritians. The rate of population growth has been over 3 per cent per year at times in the 1950's and early 1960's, but has declined somewhat since 1963.

The economy of Mauritius has been based on sugar for more than 100 years, and in the post-war era some 98 per cent of the exports of Mauritius have been in the form of sugar and its by-products. Total exports themselves constitute something of the order of 45 per cent of the G.N.P. at factor cost. It is difficult to detect any meaningful rate of growth of such an economy, because of fluctuations due to climatic conditions and changes in the price of sugar. G.N.P. figures for recent years are reproduced below:

	1959	1960	1961	1962	1963	1964	1965	Units
G.N.P. at factor cost	681	573	720	720	920	754	766	Rs. millions
G.N.P. per capita	1069	875	1048	1040	1290	1027	1015	Rs.

Note: 1960 saw two disastrous cyclones, and 1963 a bumper sugar crop combined with high sugar prices. Source: Mauritius Legislative Assembly, Sessional Paper No. 7 of 1966.

As a bench-mark, *per capita* G.N.P. may be said to be in the region of Rs. 1,000, or nearly U.S. \$180.

As a simplification, the ownership and management of the large units of the sugar industry may be said to be concentrated in the hands of Franco-Mauri-

tians, with British capital playing a much less important role than in the sugar industries of Guyana, Trinidad or Jamaica. The small sugar cane growers tend to be of East Indian descent. The sugar output of Mauritius has, in recent years, exceeded 600,000 metric tons but there is almost no scope for expanding the area under cane cultivation, which is already nearly 50 per cent of the total land area of Mauritius, and 90 per cent of presently arable land.

The government sector has increased spectacularly since 1950, due mainly to the expansion of social services; and government expenditure is at present of the order of 33 per cent of the G.N.P.

In spite of the lack of comprehensive employment statistics, it is clear that in recent years unemployment has increasingly become a major problem in Mauritius. The total "participating" labour force is around 180,000 - 200,000, and an official source has estimated that unemployment is increasing at the rate of 4,000 a year.¹ Thus, in early 1967, the number of *registered* unemployed was around 17,000, while an additional 20,000 were "employed" by government in "relief work". If one includes "relief workers", the rate of unemployment was certainly not far from 20 per cent of the labour force in 1967. A rough guide to employment in 1967 is presented below:

<i>Export</i>	Sugar (including small planters)	70,000
	Tea	5,000
<i>Government</i>	Including local government, but excluding relief workers	27,000
<i>Domestic</i>	Manufacturing,	7,000
	Other domestic, commerce, transport, construction, services, other agriculture	30,000 - 40,000 (?)
	Total employed	<hr/> 149,000 - 159,000 <hr/>
<i>Unemployed</i>	Relief workers	20,000
	Other unemployed (registered)	17,000

II. ORIGIN AND SCOPE OF THE MODEL

The model presented here is inspired by the well-known article by Dudley Seers, where he called for a fundamental change in economic thinking, comparable to the Keynesian revolution.² Seers rightly claimed that economics as taught, for example, in current text-books, assumes, as a background, the "special case" of an advanced industrial economy in the middle of the twentieth century, and that the assumptions behind the models, and even the concepts used, were not appropriate for the understanding of the working of different types of economies. In the positive part of his article, Seers called for a new approach that would take into account the institutional background of various types of countries, of various "special cases". We

¹Mauritius Legislative Assembly, *Sessional Paper No. 7 of 1966*.

²Dudley Seers, "The Limitations of the Special Case", *Bulletin of the Oxford University Institute of Economics and Statistics*, May 1962.

could then, he argued, have a number of different models which would suit the case of various groups of countries.

Seers himself later on followed up his own suggestion by producing a model dealing with the "mechanism of an open petroleum economy".³ He claimed that this model fitted the case of Venezuela in the 1950's and suggested that it might be used for other "petroleum economies" as well. The applicability of Seers' petroleum economy model has subsequently been questioned, notably in the case of Trinidad, by Brewster.⁴

The model presented in this paper is meant to apply to a somewhat different case than Seers' petroleum economy, though there are some features that have been borrowed from Seers. In many ways an agricultural, export-oriented island economy such as Mauritius is the exact opposite of the "special case" of the U.S.A., which, as Seers has pointed out,⁵ was being assumed as background by many textbooks. If this is right, then the study of how a tiny, over-populated agricultural island functions might bear lessons not only for other similar islands, but might also be used as an extreme "special case", so that most economies might be classified somewhere between the archetype of an advanced, industrial, continental economy (USA) on the one hand, and a tiny, export-oriented, agricultural economy (say, Mauritius) on the other.

As in the Seers model the main focus of the discussion is employment, since unemployment is believed to be a very characteristic and major problem of many countries of the type envisaged here.

III. A TWO-SECTOR MODEL

The model is first presented in terms of two sectors: an *export sector* and a *domestic sector*. The export sector is very much at the centre of the model, as the export activity is really *the* essential part of the economy — the very purpose of the country's existence and the reason for its population. The domestic sector is relatively secondary and consists of co-operating activities and services; in particular those which, in the nature of things, may not be imported (e.g. construction of buildings). It corresponds broadly, I believe, to what Levitt and Best elsewhere have called the "residential sector".⁶

1. *Basic Features of the Model*

Denoting,

Q = Physical output.

P = Price (in domestic currency).

³Dudley Seers, "The Mechanism of an Open Petroleum Economy", *Social and Economic Studies*, Vol. 13, 1964, p. 233-242. This is referred to throughout this paper as the "Seers model".

⁴Havelock Brewster, "Export, Employment and Wages: Trinidad-Tobago, and Mr. Seers' Model of the Open Economy", *C.S.O. Research Papers*, Trinidad and Tobago, April, 1968.

⁵Seers, "The Limitations of the Special Case", *op. cit.*

⁶K. Levitt and L. Best, *Externally Propelled Industrialisation and Growth in the Caribbean, 1945-66*. Progress Report, McGill University Centre for Developing Area Studies, mimeo, 1967.

- X = Value added in export industry.
 π = Profit (net of taxes)
 L = Wages bill.
 k = 'profit margin' = $\frac{\pi}{L}$
 M = Value of imports (excluding inputs of the export industry).
 m = Average proportion of wages which is used to purchase imports.
 N = Employment.
 Y_D = Demand for output of the domestic sector.
 σ = Productivity $\equiv \frac{Q}{N}$
 W = Average money wage.
 i = Imported inputs for the export sector.
 E = An index of the taxes on the export sector.
 b = Average import duty.
 B = Grants or loans from abroad to government.
 r = An index of government propensity to import.

And denoting the three sectors: export sector, domestic sector and government sector by the subscripts x , d and g respectively. We can now set out the basic features of the model in the following seven equations:

$$X + i \equiv P_x Q_x \equiv X + i \dots \dots \dots (1)$$

$$\frac{\pi_D}{L_D} = \frac{\pi_x}{L_x} = k \dots \dots \dots \text{("profit margin" equation)} (2)$$

$$M = \pi_D + \pi_x + m(L_D + L_x) \dots \dots \dots \text{(import equation)} (3)$$

$$M = X \dots \dots \dots \text{(balance of payments)} (4)$$

$$Y_D = (L_x + L_D) (1 - m) \text{ (demand for output of domestic sector)} (5)$$

$$X \equiv L_x + \pi_x \dots \dots \dots \text{(distribution of export earnings)} (6)$$

$$\sigma \equiv \frac{Q_x}{N_x} \dots \dots \dots \text{(productivity definition)} (7)$$

The discussion that now follows elaborates on each of these equations which characterize the model.

The export sector consists of one product which is sold in an international market. In the case of Mauritius this is sugar. The price accruing to producers is a weighted average of the sales in various markets, the largest of which is under the Commonwealth Sugar Agreement. The trend in average prices (P_x) of sugar for Mauritius for the years 1956-1966 is shown in Figure 1.

Except by devaluation of its currency, Mauritius has no control over the price of sugar.

$$P_x Q_x \equiv X + i \dots \dots \dots (1)$$

where X stands for the net value of export earnings i.e. the gross sales of sugar minus the value of imported inputs (i). A private estimate by the

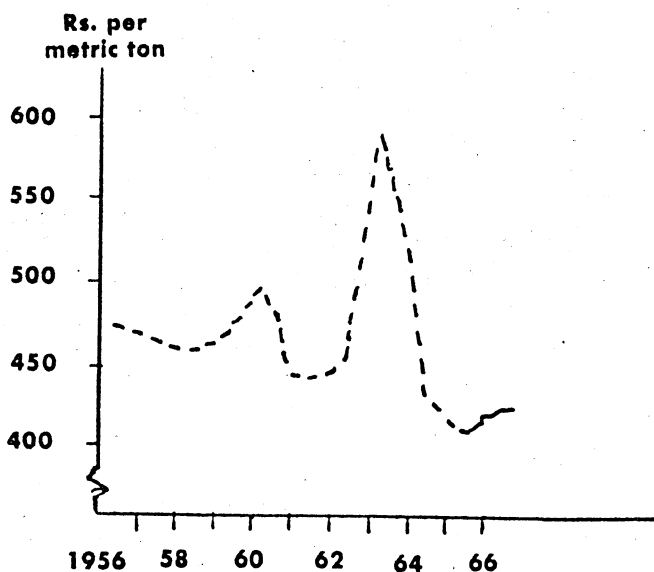
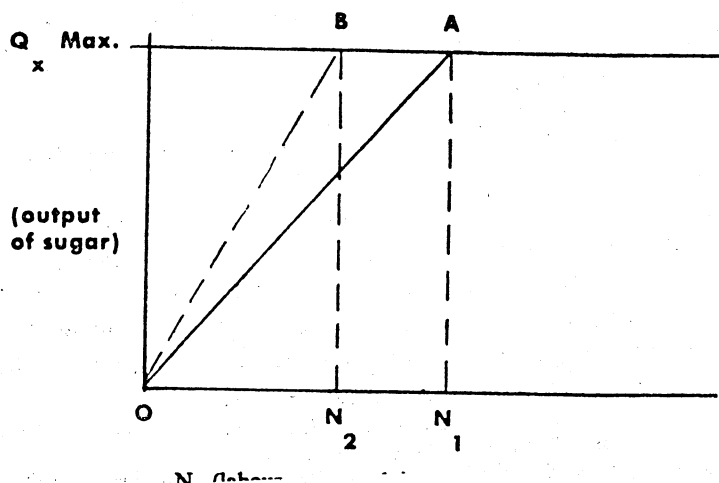


Fig. 1. Average Sugar Prices, Mauritius, 1956-1966

Chamber of Agriculture places the 1964 value of imported inputs (current and capital) at about Rs. 50 million, or about one-seventh of gross earnings from sugar. Q_x , the physical output of sugar, depends on a variety of complex climatic factors, but even under the most favourable conditions, the output of sugar is limited by a severe natural resource constraint, — there is practically no more land available in Mauritius for sugar cane cultivation. With technical progress, resulting in better yields per acre, however, the value of Q_x may be expected to continue to increase gradually over time.

The following diagram may be used to illustrate the relation between employment and sugar output:



Given all other factors (area under cultivation, cane varieties, climate) it would appear that an output of Q_x max. may be obtained if, say, N_1 man hours are expended. The marginal product at the point A is zero, i.e. no more sugar is produced if more man-hours are used. On the other hand, assuming homogeneous man-hours, the marginal product of a man-hour is constant from 0 to A. Of course, in practice, this number of man-hours have to be expended during a certain optimum period, for example for cutting cane, so that a minimum number of *men* may be required; otherwise output will not reach Q_x max. Now, if for some reason productivity is increased, the same output Q_x max. will require fewer man-hours to produce, say N_2 man hours, but there is no reason to believe that output will itself be increased.

Profit Margins: Equation (2) is a behavioural relationship

$$\frac{\pi_D}{L_D} = \frac{\pi_x}{L_x} = k \dots\dots\dots (2)$$

This states that "profit margins" are equalized in the domestic and export sectors. The expression "profit margin" for the ratio of profits (after tax) to the wages bill is derived from Seers, who claims⁷ that the ratio (k) has remained constant in the 1950's in Venezuela's domestic sector. This concept is probably akin to what Marx called the "rate of exploitation".⁸

Statistics do not permit verification of this assumption for Mauritius, mainly because of a large "unincorporated enterprises" sector, where no distinction is made between labour incomes and property income.

The rationale behind equation (2) is that, in an area with good communications, where businessmen are involved in activities both in the domestic and export sectors, rates of profits in the two sectors cannot remain too far from each other. A further assumption appears to be necessary: it is that, given a uniform wage rate, capital per worker is the same in both sectors. Equation (2) may also be justified by an analysis in terms of a fixed "mark-up" over the wages bill.

Imports: The model assumes that *all* profits, as well as a proportion (m) of wages and salaries in the economy are spent on imports. This is expressed formally in equation (3).

$$M = \pi_D + \pi_x + m (L_D + L_x) \dots\dots\dots (3)$$

It will be noted that M stands for all imports except the inputs of the export industry.

The statement that all profits are spent on imports is difficult to "prove" It is of the same type as the so-called "extreme classical assumption" found in recent growth models and which states that all profits are re-invested and all wages are consumed.⁹ However, it can be argued that, given a situation such as that prevailing in Mauritius, profits tend to accrue to a better-off

⁷Seers, "The Mechanism of an Open Petroleum Economy" *op. cit.*

⁸This, at any rate, is the interpretation given by Joan Robinson in her *Collected Economic Papers*, Vol. I, Oxford, Basil Blackwell, 1951, p. 147.

⁹See, for example, N. Kaldor and J. A. Mirlees, "A New Model of Economic Growth", *Review of Economic Studies*, June 1962, pp. 174-192.

type of people whose pattern of consumption reflects a strong taste for imported goods and services, whereas poorer workers have to make do largely with what is produced locally. As far as investment is concerned, all equipment and machinery, steel etc., have to be imported from abroad.

If one considers that the overall propensity to import of Mauritius is of the order of 45 per cent (Rs 367 million imports for a GNP of Rs 766 million in 1965), the assumption that the propensity to import out of (after tax) profits is unity cannot be very far removed from reality.

Equation (4)

$$X = M \dots\dots\dots (4)$$

is the "balance of payments" equation, both X and M being net of the inputs of the export sector.

Demand for output of domestic sector: Equation (5) does not contain any new assumption. It follows from the previous assumption that no part of the profits is spent domestically.

$$Y_D = (L_x + L_D) (1 - m) \dots\dots\dots (5)$$

Only a fraction, $1 - m$, of labour incomes is spent on domestically produced goods and services.

Distribution of export earnings: This is given by the identity

$$X \equiv L_x + \pi_x \dots\dots\dots (6)$$

since X is net of the imported inputs and there is no taxation in this two-sector model.

Productivity definition: Equation (7) is the usual definition of productivity - output per man hour

$$\sigma \equiv \frac{Q_x}{N_x} \dots\dots\dots (7)$$

Discussion of productivity is confined, in this paper, to the export sector.

2. The Two-Sector Model in Operation

Using the simple assumptions and definitions contained in equations (1) to (7), it is possible to obtain a picture of how the economy works.

Output of the domestic sector: By combining equations (2), (3), (4) and (5) the following expression is obtained for demand for domestic output.

$$Y_D = X \frac{(1 - m)}{k + m} \dots\dots\dots (8)$$

This illustrates well the export-propelled nature of the economy. Y_D , output for the domestic market, is directly dependent on the net export earnings, X, over which there is little local control. By taking the derivatives of equation (8), it is apparent, on the other hand, that increases in profit margins (k) and the propensity to import out of labour incomes (m) have a negative effect on domestic output.

Employment and productivity in the export sector: Letting W be the average wage throughout the economy, so that

$$L_x \equiv W \cdot N_x \dots\dots\dots (9)$$

We may combine equations (1), (2), (6), (7) and (9) thus:

$$P_x \cdot \sigma = W(1 + k) + \frac{i}{N_x} \dots \dots \dots (10A)$$

If, as an approximation, we treat the ratio $\frac{i}{N_x}$ as a constant (i.e. we regard each man-hour as combining with a fixed value of imported inputs) equation (10A) may provide interesting insights in the working of the export sector.

Suppose P_x suddenly increases,¹⁰ then one of three things must happen:
 productivity (σ) will go down.
 wages rates (W) will increase.

or the "profit margin" ($k = \frac{\pi_x}{L_x}$) will increase

Now, a permanent increase in k is not regarded as a practical possibility for a country like Mauritius in the late 1950's and 1960's. There are strong social and political pressures that would develop to frustrate this, so that it is much more likely that wage rates would rise and even that productivity might fall. In fact, during 1963 the high price of sugar (P_x) led both to an increase in the wage rate in the sugar industry (by 25-30 per cent) and to a lowering of productivity. Productivity was lowered by the passing of legislation forcing the sugar industry to retain in the out-of-crop season (about seven months) all the workers who had worked regularly during the crop (about five months). This meant that, over the whole year, the same output of sugar was produced by many more man-hours than would otherwise have been needed.

Conversely, when P_x falls (as has been the case since 1963) there are pressures to squeeze profit-margins (K) and wages (W), and to increase productivity (σ). Again, it is postulated that profit-margins may not be squeezed below the level considered as "normal" by entrepreneurs. As for wages, the Keynesian assumption of downward inflexibility is considered realistic, so that the bulk of the adjustment has to be made by productivity. In Mauritius, there are no clear signs that productivity has increased in recent years, but the experience of both the Trinidad and Jamaican sugar industries illustrates well the great pressures from the employers' side to increase productivity, e.g. by mechanization, in the face of declining sugar prices.

Turning now to the employment aspect, equation (10A) may be rewritten thus:-

$$N_x = \frac{X}{W(1 + K)} \dots \dots \dots (10B)$$

giving an expression for employment in the export sector.

With the use of a distribution identity for the domestic sector

$$Y_D \equiv \pi_D + L_D \dots \dots \dots (11)$$

¹⁰As happened in 1963. See Figure 1.

as well as equations (2) and (5), an expression is obtained for employment in the domestic Sector (N_D):

$$N_D = \frac{X(1-m)}{W(k+m)(1+k)} \dots\dots\dots (12)$$

From (10B) and (12), total employment (N) in the economy may be expressed as

$$\begin{aligned} N &= N_x + N_D \\ &= \frac{X}{W(k+m)} \dots\dots\dots (13) \end{aligned}$$

Equation (13) is an extremely simple statement of the determinants of employment in the whole economy.

It illustrates very well the positive effect of export earnings (X) on employment. The negative effect of wage rates (W) is also apparent, so that a sort of "wages fund" may be said to operate. Increase in k and m also have a negative effect on employment. The effects of X , W , k and m on employment may be obtained formally by taking the derivatives of equation (13).

IV. A THREE-SECTOR MODEL

The model presented in the previous section may be modified by introducing a third sector, the government sector. In doing so, the model loses its great simplicity but gains, it is hoped, in realism.

Government Revenue

As a simplification, four sources of revenue are dealt with:

(i) *An export tax.* In Mauritius, there has been a 5 per cent *ad valorem* tax on sugar exports since 1961. Letting this rate of taxation be a , revenue from this source is $a(X + i)$ which we may write as aX , as an approximation.

(ii) *Import duties.* This is a major source of revenue in Mauritius, amounting normally to about 30 per cent of total government revenue. We assume that the imported inputs of the export sector are not taxed; so that, with an average import duty of b , revenue from this source is bM .

(iii) *Tax on profits of the export industry.* Government revenue from this source may be expressed in terms of after-tax profits as $c\pi_x$, where the rate of taxation out of pre-tax profits is $\frac{c}{1+c}$.¹¹ The tax take from non-sugar industries is ignored, since in Mauritius, it is fairly easy for most industries other than sugar, to obtain a tax holiday.

(iv) *Finance from abroad.* This may be in the form of grants or loans received by government, and is denoted by B . The value of B has not been large for Mauritius, in the past. However, this "variable" is included as it is

¹¹Gross profits = $c\pi_x + \pi_x$

$$\text{Therefore rate of taxation} = \frac{c\pi_x}{c\pi_x + \pi_x} = \frac{c}{1+c}$$

possible that for a tiny, strategically placed island aid might become an important part of the government budget. The model assumes that there are no net transfers abroad to or from the private sector.

Government revenue is therefore

$$aX + bM + c\pi_x + B$$

The arithmetic may be simplified to some extent by combining the taxes on the export sector $[aX + c\pi_x]$ by using equation (2), so that government revenue may be written

$$bM + EX + B$$

where $E = a + \frac{c(1-a)}{1+c+1/k}$

Government Expenditure

Seers, in his model, assumed that all government expenditure was on wages and salaries. In the case of Mauritius or other countries with very high propensities to import, it is more realistic to divide government expenditure into two parts, allowing for the fact that government has a propensity to import ($= m_2$).

Total government expenditure (TGE) = Imports + Wages & Salaries

$$TGE = m_2 TGE + (1 - m_2) TGE$$

$$TGE = \frac{m_2}{1-m_2} L_G + L_G$$

$$= L_G (1 + r), \text{ where } r = \frac{m_2}{1 - m_2}$$

A rough estimate for Mauritius is that $m_2 = 1/3$.

so that $r = 1/2$.

We can therefore write a simple budget equation

$$bM + EX + B = L_G (1 + r) \dots\dots\dots (14)$$

(government revenue) (government expenditure)

It is now necessary to modify the equations of the two-sector model, in order to accommodate the government sector; thus the following new equations:

Balance of payments: Equation (4) modified

$$M = B + X \dots\dots\dots (15)$$

Import equation: equation (3) modified

$$M(1+b) = \pi_D + \pi_x + m(L_D + L_x + L_G) + rL_G \dots\dots\dots (16)$$

Distributions of export earnings: equation (6) modified

$$X = EX + \pi_x + L_x \dots\dots\dots (17)$$

Demand for output of domestic sector: equation (5) modified

$$Y_D = (L_x + L_G + L_D) (1 - m) \dots\dots\dots (18)$$

From these modified equations, it is possible to derive the following expression for the output of the domestic sector:

$$Y_D = \frac{1-m}{k+m} \left[(B+X)(1+b) + \left\{ k-r \right\} \left\{ \frac{B+b(B+X) + EX}{1+r} \right\} \right] \quad (19)$$

Employment in the Three-Sector Model.

Denoting the average wage throughout the economy by W , employment in each of the three sectors is given by the following expressions: from equations (17) and (2):

$$\text{Export sector } N_x = \frac{X(1-E)}{W(1+k)} \dots \dots \dots (20)$$

From equations (14) and (15):

$$\text{Government sector } N_g = \frac{L_g}{W} + \frac{B+b(B+X)+EX}{W(1+r)} \dots \dots \dots (21)$$

From equations (11) and (2):

$$\text{Domestic sector } N_D = \frac{Y_D}{W(1+K)} \dots \dots \dots (22)$$

So that total employment (N) is

$$N = N_x + N_g + N_D$$

$$N = \frac{X(1-E)}{W(1+k)} + \frac{B + b(B + X) + EX}{W(1+r)} + \frac{1-m}{W(k+m)(1+k)} \left[(B+X)(1+b) + \left\{ k-r \right\} \left\{ \frac{B+b(B+X)+EX}{(1+r)} \right\} \right] \dots \dots \dots (23)$$

Equation (23) is a rather unwieldy expression for employment in the whole economy and the effect on employment of changes in $X, E, W, k, B, b, r,$ and m may be ascertained by working out the derivatives of equation (23).

V. SOME CONCLUSIONS

Nothing that comes out as a 'result' of this model is either surprising or original. What we have described (in a formal fashion, with certain institutional assumptions) is basically an economy with a supply bottleneck in the export sector, which in turn "creates" a demand deficiency in the domestic sector.

If one is seeking solutions for unemployment, equation (13),

$$N = \frac{X}{W(k+m)},$$

as well as equation (23) provide the following:

- (i) that efforts should be made at increasing exports (X). This might include shifting to more profitable lines as prices of the basic export falls. This last step is particularly difficult in plantation societies whose *raison d'etre* was precisely to provide this one export. Sweden, incidentally,

seems to be a good example of an export-oriented economy constantly looking for more profitable export activities.

(ii) that wages (W) should be diminished. This may be obtained, in real terms, by a devaluation of the local currency, thus increasing the ratio of X to W , and increasing employment (N). This lowering of wage rates is clearly neither a very palatable nor, often, a politically acceptable solution.

(iii) that a lowering of import propensities (m and r) as well as profit margins (k) is desirable. Import substitution has, however, very definite limits in Mauritius-type islands, without natural resources; whereas we have argued that profit margins (k) are not subject to manipulation.

(iv) that increases in import duties (b) and net incoming foreign transfers (B) are beneficial. Increases in b however would be equivalent to a diminution of real wages.

(v) that an increase in E (the index of taxes on the export sector) has a negative effect on employment, if $k < r$ ¹². In Mauritius, k is probably of the order of $1/3$ and r around $1/2$. An increase in E would also tend to diminish the output of the export sector, so that even if k exceeded r , it is doubtful whether increases in E would have, on balance, a positive effect on employment.

One further solution would be to plan a diminution of population so that full employment may be maintained without lowering real wages.

¹²This follows from the result of the partial derivative $\frac{\partial N}{\partial E}$.