CHAPTER 8

AID AND ECONOMIC STRUCTURE: A TWO-SECTOR MODEL OF THE MIRAB ECONOMY

8.1 Introduction

In this chapter, issues relating to the impact of aid on the economic structure of the recipient economy, already discussed in chapter 6 (see 6.5), are investigated further, from a theoretical standpoint. As mentioned in chapter 3, this type of impact has been a matter of increasing interest in the international literature on aid (see 3.3.5), through the so-called 'trade-theoretic approach to aid', in which aid is treated as a booming sector, with its attendant Dutch Disease effects. To some extent, this interest has been mirrored in recent studies of aid and remittances in the South Pacific, including in the MIRAB countries (see 6.5).

In an attempt to examine formally the factors affecting the emergence of Dutch Disease-like effects following an injection of aid, a theoretical, two-sector model of the formal[1] component of a MIRAB economy is built and used for comparative statics purposes. This model is based upon the Australian—or Salter—model (Salter 1959) of a small dependent economy. In this approach, two broad commodity sectors are distinguished, on the basis of their price determination mechanism. In the tradable goods sector (T), where exportables and importables are produced, domestic prices are determined in world markets. Since the modelled country is, by assumption, small, it has no power to influence the price of either good, and therefore faces given terms of trade. At these world prices, any excess supply can be exported, and any excess demand imported. The non-tradable goods sector (NT) comprises all goods and services which do not enter into world trade; as a consequence, their prices are determined solely by internal costs and demand (Salter 1959, p. 226). The distinction between T and NT goods ('tradables' and 'non-tradables'), while unavoidably arbitrary and blurred in many cases, can nevertheless provide a useful depiction of the exposure of various markets to international

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[1]This component, variously referred to as 'modern' or 'cash', includes all productive activities, except those performed for the purpose of own-consumption or subsistence (e.g. staple food production).

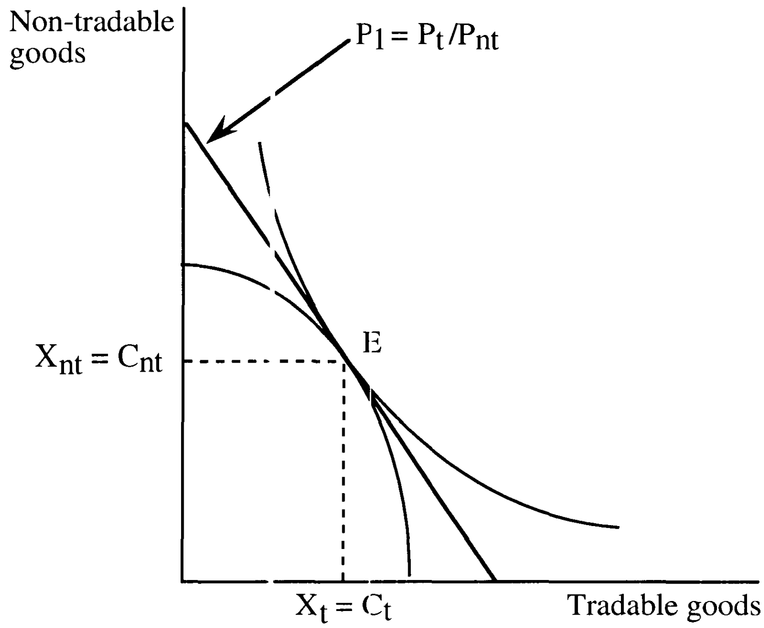
competition. Following Salter (loc. cit.), exportables and importables are treated as a single Hicksian composite commodity in the following model, a legitimate procedure as long as terms of trade are wholly exogenous and, therefore, exportables can be exchanged for importables at a constant rate. This convenient analytical device allows the examination of external balance requirements in terms of the difference between production and absorption of tradables. Since the price of tradables is exogenous, it is possible for an imbalance between supply and demand (*external* imbalance) to persist, in the absence of corrective domestic policies or exchange rate mechanisms, and in the presence of foreign capital inflows.

In the NT sector, price and resource movements prevent such lasting imbalances. If, for instance, excess demand was to develop in this sector, prices would rise, thus simultaneously reducing consumption and raising production until sectoral equilibrium (*internal* balance) was restored. In an economy with no unemployed resources, such increase in the non-tradables output can only occur at the expense of tradables output. The eventual production equilibrium (X_t, X_{nt}, where X_i = output of sector i), on the economy's production possibility frontier (PPF) is governed by the ratio of the price of tradables (P_t, converted to domestic currency if such currency exists) to the price of non-tradables (P_{nt}). This ratio, also referred to as the *real* exchange rate or *internal* terms of trade, thus plays a crucial role in determining the sectoral composition of aggregate supply in this two-sector model. A fall in P_t/P_{nt} (appreciation of the real exchange rate), for instance, would lead to the output mix being altered in favour of non-tradables.

The real exchange rate is also the principal factor, with the level of real income, affecting absorption of both goods (C_t, C_{nt}, where C_i = absorption of the commodity produced in sector i) in this economy. Should this rate alter for any reason, consumers' (taken here to mean households, governments, and investors) preferences will lead to the reallocation of expenditure on each good according to income and substitution effects.

From the fact that relative prices influence both production and consumption decisions in the model, it follows that the existence of a general equilibrium (production *and* consumption) rests upon the emergence of a real exchange rate for which production and consumption of both commodities are equal. This equilibrium, characterised by internal and external balance, is illustrated by point E in figure 8.1, using the familiar Salter (1959, p. 227) model diagram.

Figure 8.1 **General equilibrium in the Salter model**



It should be noted that a division of the economy into tradables and non-tradables sectors represents a departure from the taxonomy adopted by earlier authors when modelling MIRAB economies. In his seminal article, Bertram (1986, pp. 814-17) opted for a three-way distinction, between the subsistence (village) sector, the government sector, and the modern (capitalist) sector. The latter sector is the only one whose output is explicitly designated as tradable by Bertram. While the nature of the government sector's output is not made clear in his article, it is likely to be non-tradable in the main. No commercial agricultural or fisheries sector is postulated, from which it can be inferred that it is subsumed into the village sector. Thus, part of this sector's output must be tradable, since the bulk of MIRAB exports consists of primary commodities (see table 2.4). Bertram's choice of sectors was subsequently adopted by Poirine (1994, pp. 2000-2), in his model of MIRAB-like French overseas departments and territories.

While Bertram's model is partly inspired by the Dutch Disease approach to rent-led economies (Bertram 1986, p. 814), it does not explicitly recognise the important role that relative costs and prices can play in the advent of the disease. In particular, the inclusion of commercial agriculture into the village sector does not allow an easy delineation of the response of this type of activity to relative price movements. A second shortcoming lies in the unnecessarily restrictive definition of the government sector, whose *raison d'être* in Bertram's model is to exhaust its allocation of aid monies by hiring public servants. While this objective may represent an accurate description of the employment policy of administrative departments, it may not be as readily assigned to the large component of the public sector which is engaged in commercial or semi-commercial activities. As previously noted, the range of such activities in MIRAB economies is very large from the provision of housing, transport, and communication services, to that of utilities. The predominantly non-tradable nature of these goods and services therefore precludes their inclusion in Bertram's modern (tradables) sector. Given the extent and nature of public involvement in productive activities, therefore, it may be assumed that some state-owned enterprises respond to the same broad economic signals as their private counterparts. Thus, the current prominence enjoyed by the public sector within MIRAB economies may be as much a result of normal entrepreneurial behaviour and market signals, as the product of an aid-financed expansion in public servant numbers. Furthermore, if such behaviour exists, it can only have been reinforced by the implementation, in recent times, of corporatisation and privatisation policies by some MIRAB governments.

For the reasons stated above, it appears that the tradables/non-tradables dichotomy can provide a more useful framework than alternatives such as public/private, or formal/informal, with which to analyse the impact of an aid inflow. In the following section, this impact is considered initially in the context of a MIRAB country enjoying unrestricted access to the labour market of a metropolitan country.

8.2 Impact of aid in an economy with an unrestricted emigration outlet

8.2.1 Introduction

As already noted in chapter 7, the real wage in a MIRAB economy with unrestricted access to an emigration outlet is, of necessity, equated with that of the outlet, adjusted for the financial and psychological costs of emigration[2]. However, with the addition of a non-tradables sector to the model, the possibility of relative commodity price movements arises; such movements would

[2] It may also be adjusted for the probability of being unemployed in the metropolitan economy.

naturally be reflected in domestic real wages, however they are defined. For the purpose of this model, it is assumed that real wage parity between the MIRAB and metropolitan countries must occur at the 'perceived' real wage level. This real wage is a measure of the purchasing power enjoyed by MIRAB workers, equal to the ratio of the nominal wage to a 'cost-of-living' price index. Because such index normally incorporates the price of both tradables and non-tradables, the perceived real wage will usually differ from the own-product real wage faced by producers in each sector (i.e. the ratio of the nominal wage to the price of that sector's goods alone).

In order for perceived real wage parity with the metropolitan labour market to be maintained at all times in the MIRAB economy, a simple mechanism is assumed, whereby the economy-wide nominal wage rate automatically adjusts to a Laspeyres price index of both tradable and non-tradable commodities. Thus, the following equation is always satisfied:

$$\bar{w} = \frac{W_0}{\theta P_t + (1-\theta)P_{nt}} \tag{8.1}$$

where $\bar{w}$ = foreign real wage (exogenous)
W_0 = domestic nominal wage in period zero
θ = weight of tradable goods in price index $(0 < \theta < 1)$

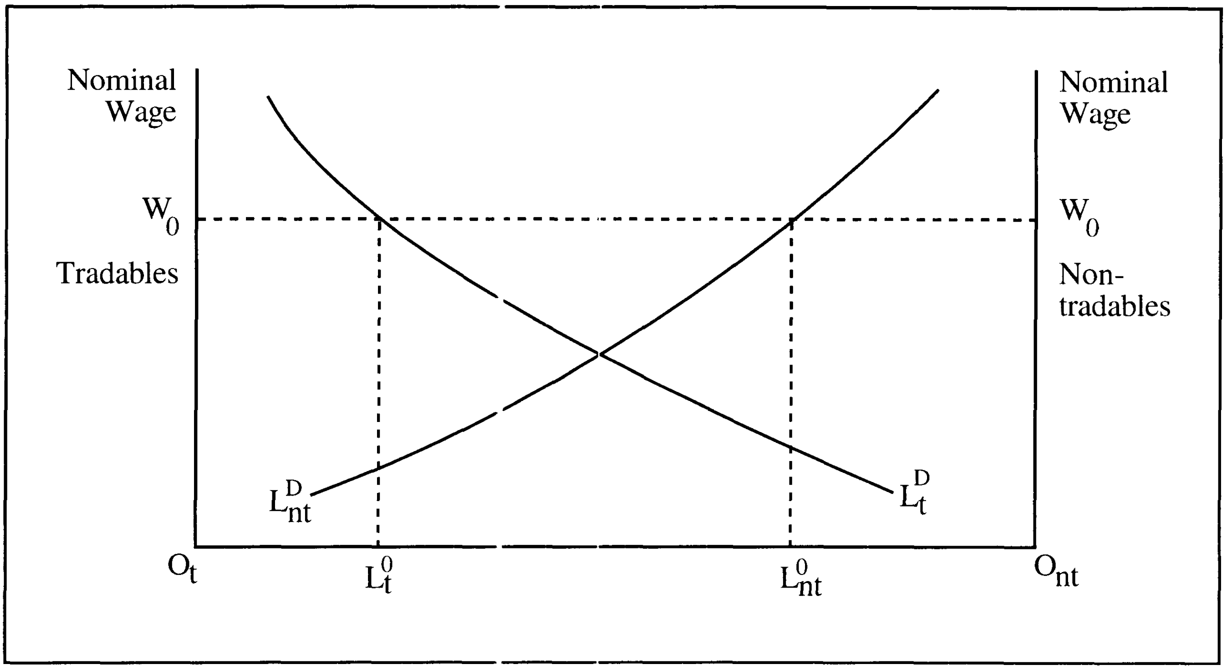
Given W_0, each sector will proceed to hire labour up to the point where its own-product real wage and the marginal product of labour are equalised. Hence, sectoral demands for labour will be:

$$L_t^0 \text{ such that } \frac{W_0}{P_t} = MP_{L_t} \tag{8.2}$$

$$L_{nt}^0 \text{ such that } \frac{W_0}{P_{nt}} = MP_{L_{nt}} \tag{8.3}$$

With $\bar{w}$ assumed to be binding throughout, the combined sectoral demands for labour do not exhaust the supply of labour at that perceived real wage rate. As a result, part of the available workforce will be employed overseas. This situation is illustrated in figure 8.2, in which sectoral employment is measured on the horizontal axis from both origins, and the money wage is measured on both vertical axes. The length of the horizontal axis measures the total supply of labour by MIRAB nationals, $\bar{L}$. The fact that this supply is finite is a reflection of

Figure 8.2 **Labour market equilibrium in the two-sector economy with an unrestricted emigration outlet**



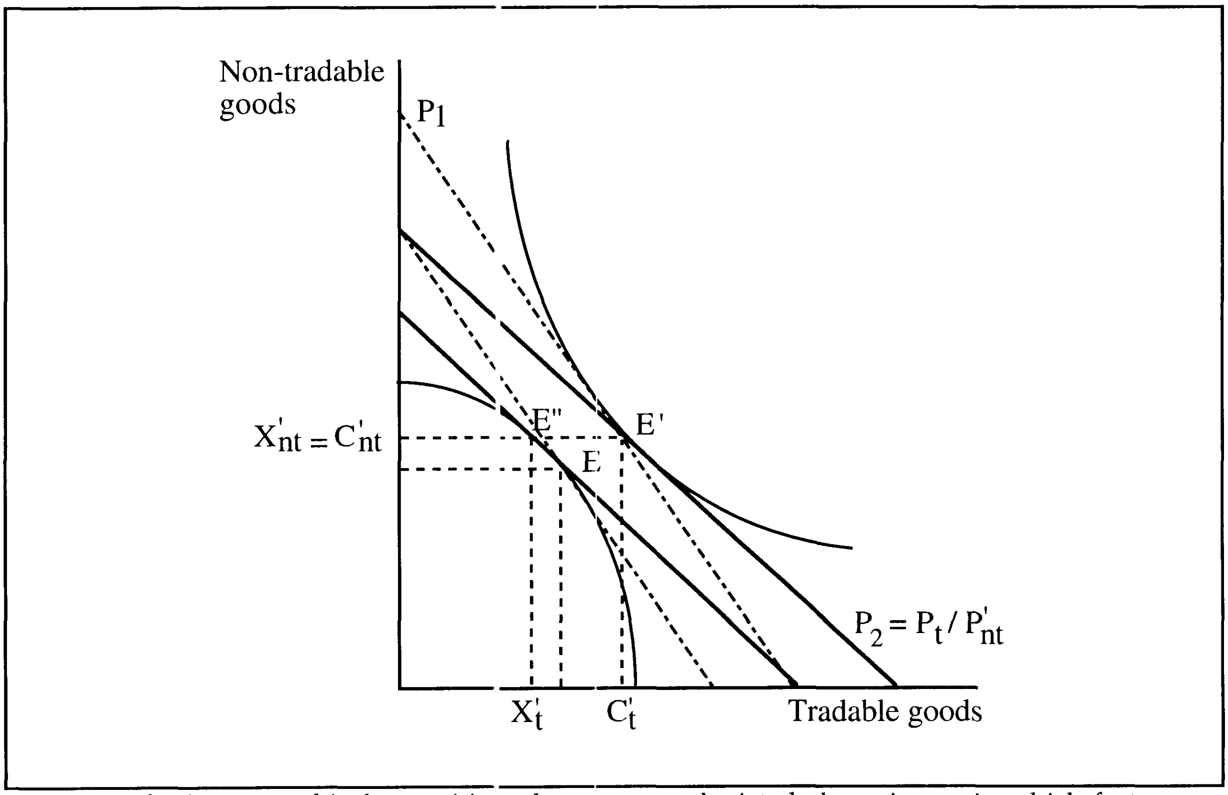
the fixity of the perceived real wage, while other factors affecting the participation rate are assumed constant. The existence of $\overline{L}$ should not, however, be interpreted as a constraint on the total amount of labour available to the two sectors. Given external labour mobility, the combined demand for labour by both sectors ($L_t + L_{nt}$) could exceed $\overline{L}$, yet be satisfied by an inflow of guest workers. Graphically, such an inflow would be represented by L_{nt} being situated to the left of L_t.

In the diagram, the sectoral demands for labour are represented by curves L^D_t and L^D_{nt}, and measured from origins O_t and O_{nt} respectively. These demands are derived from well-behaved short run production functions and from profit maximisation by producers. Given $\overline{w}$, P_t, and P_{nt}, W_0 will be automatically determined according to equation 8.1, and hence so will sectoral employment levels, L^0_t and L^0_{nt}. This, in turn, implies that $\overline{L} - (L^0_t + L^0_{nt})$ workers will be employed in the overseas sector.

8.2.2 Short run

If grant aid is provided, it will initially expand the absorption possibility frontier (APF) of the recipient economy, without a commensurate expansion of its PPF. In other words, aid will allow absorption levels in excess of those warranted by domestic production alone. Irrespective of whether aid is provided in the form of project aid, budgetary support, or household income supplements, its absorption-increasing effects are likely to be felt in relation to both tradables and non-tradables, as long as these two commodities are normal in aggregate. For instance, part of the external funds financing new infrastructure will commonly be spent on construction (non-tradable), and part on imported equipment (tradable). In the tradables sector, such an increase in absorption will simply result in the emergence of excess demand (i.e. a trade balance deficit) but, by definition, no price change. In contrast, excess demand in the non-tradables sector will provoke a price increase, which will serve to reduce consumption and increase production in that sector. These changes are illustrated in figure 8.3. With P_t fixed, and P_{nt} increasing (to P_{nt}'), the real exchange rate will appreciate (P_1 to P_2), resulting in the modification of absorption and production decisions in the whole economy. Eventually, a new equilibrium will be reached, such as (E', E"), where internal balance, but not necessarily external balance, is restored.

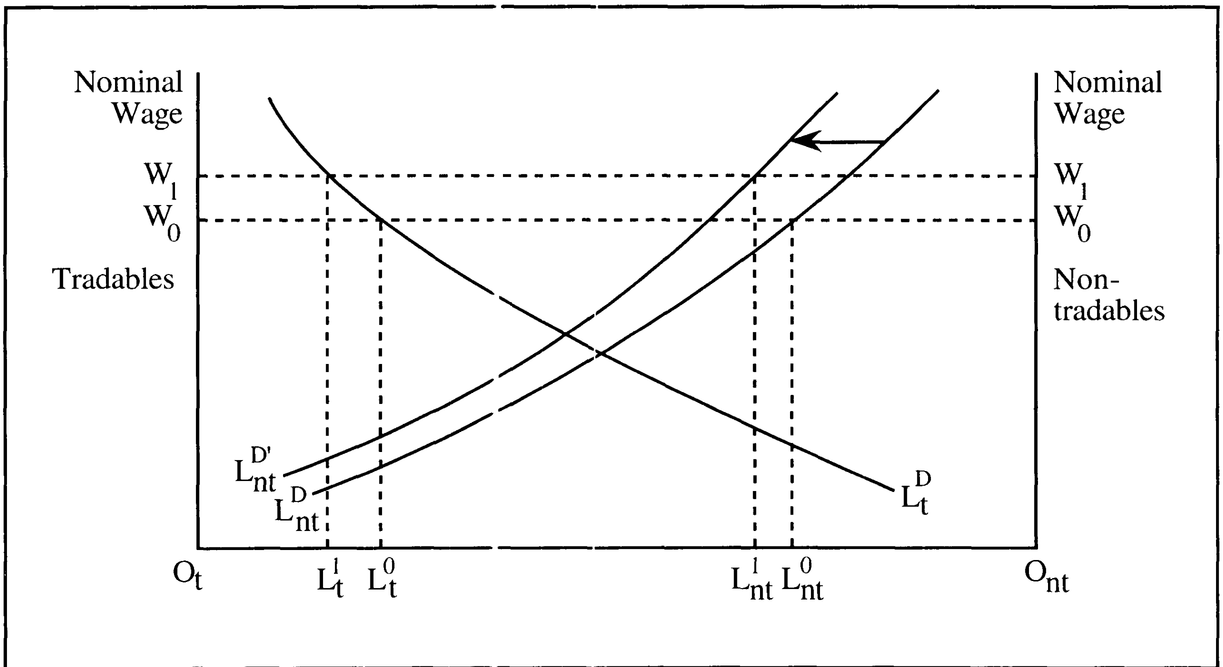
Figure 8.3 **Production, consumption, and price effects of an aid inflow in the short run**



Notes: To facilitate graphical exposition, the economy depicted above is one in which factors are fully employed domestically, as well as mobile between sectors. Accordingly, the economy is able to operate on its outermost PPF. It should be kept in mind, however, that, in the presence of overseas employment and immobility in some factors, an economy can only achieve output mixes situated within this optimal PPF. For simplicity also, the utility indifference map is assumed to be homothetic, so that points E and E′ are situated on the same ray from the origin.

From the analysis above, it can be concluded that the short-run expenditure of an aid inflow will lead to an increase in the price of non-tradables, with the price of tradables remaining constant. This movement in relative prices has important repercussions in the kind of labour market hypothesised here. Recalling that the money wage is indexed to a basket of commodities (equation 8.1), it must be the case that the increase in W required to maintain parity with the metropolitan country's real wage will be proportionately smaller than the increase in P_{nt}. This, in turn, will impact on each sector's own-product real wage (equations 8.2 and 8.3): while the real cost of labour will decrease in the NT sector, that of the T sector will increase. In response to these changes, profit-maximising producers in each sector will alter the amount of labour they hire, with producers of NT goods increasing their workforce, while T goods producers reduce theirs. This adjustment process is illustrated in figure 8.4, using the labour market diagram previously introduced. From this diagram, it is possible to verify that the differential effects of the increase in the money wage (from W_0 to W_1) will result in an increase in the NT workforce and a reduction of the T workforce. Since these simultaneous changes in employment are of opposing sign, their combined impact on the size of the domestic, and hence, overseas

Figure 8.4 **Short run effects of an aid inflow in the labour market**



Note: The shift in L^D_{nt} is caused by the fact that, at each level of nominal wage W, a higher value of P_{nt} has reduced the real cost of labour, so that more labour can be profitably employed. In contrast, P_t has remained constant, so that the L^D_t curve does not shift.

workforce is indeterminate in terms of the diagram. This is because the magnitude of these changes is influenced not only by the shift in L^D_{nt} and the rise in W, but also by the slope of each sector's demand for labour curve over the relevant range of values of L_t and L_{nt}.

In order to identify more rigorously the factors influencing the total amount of domestic employment, it is desirable to specify the sectoral production functions. For simplicity, it is assumed that output in each sector is produced according to a Cobb-Douglas production function with constant returns to scale. Thus:

$$X_t = K_t^{\alpha} L_t^{\beta} \qquad (\alpha + \beta = 1) \tag{8.4}$$

$$X_{nt} = K_{nt}^{\gamma} L_{nt}^{\delta} \qquad (\gamma + \delta = 1) \tag{8.5}$$

where X_t = output of the tradables sector
X_{nt} = output of the non-tradables sector
K_t = capital stock[3] in the T sector
K_{nt} = capital stock in the NT sector
L_t, L_{nt} as previously defined

As is well known (e.g. Spandau 1973, p. 212; Solow 1980, p. 6), the elasticity of the demand for labour with respect to the (own-product) real wage, is equal to the reciprocal of the exponent of capital, in a Cobb-Douglas production function (see appendix 8.1). Thus, given that the real wage rate equals the marginal product of labour in each sector, it is possible to write that:

$$\frac{dL_t}{L_t} = -\frac{1}{\alpha}\frac{dMPL_t}{MPL_t} \tag{8.6}$$

$$\frac{dL_{nt}}{L_{nt}} = -\frac{1}{\gamma}\frac{dMPL_{nt}}{MPL_{nt}} \tag{8.7}$$

Given that α and γ assume values between 0 and 1, equations 8.6 and 8.7 imply that, with capital constant, labour usage is elastic with respect to the own-product real wage in each sector.

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[3] Defined, in both sectors, as a composite factor including not only physical capital, but also natural resources such as land, minerals, and fish stocks.

Changes in own-product real wages can occur as a result of changes in sectoral prices, in the money wage, or both. From equation 8.1, it is possible to write that:

$$W_0 = \overline{w}\,[\theta P_t + (1\text{-}\theta)P_{nt}] \tag{8.8}$$

hence that:

$$\frac{W_0}{P_{nt}} = \overline{w}\,\theta\,\frac{P_t}{P_{nt}} + \overline{w}\,(1\text{-}\theta) \tag{8.9}$$

Differentiating equation 8.9 totally yields (with P_t fixed):

$$d(\frac{W_0}{P_{nt}}) = -\frac{\overline{w}\,\theta P_t}{P_{nt}^2}\,dP_{nt} \tag{8.10}$$

or, in terms of elasticities (see appendix 8.2):

$$\frac{d(W_0/P_{nt})}{(W_0/P_{nt})} = -\frac{\theta\,P_t}{[\theta P_t + (1\text{-}\theta)P_{nt}]}\,\frac{dP_{nt}}{P_{nt}} \tag{8.11}$$

Similarly, from equation 8.8:

$$\frac{W_0}{P_t} = \overline{w}\,\theta + \overline{w}\,(1\text{-}\theta)\,\frac{P_{nt}}{P_t} \tag{8.12}$$

Total differentiation of $\frac{W_0}{P_t}$ yields:

$$d(\frac{W_0}{P_t}) = \frac{\overline{w}\,(1\text{-}\theta)}{P_t}\,dP_{nt} \tag{8.13}$$

and hence (see appendix 8.2):

$$\frac{d(W_0/P_t)}{(W_0/P_t)} = \frac{(1\text{-}\theta)\,P_{nt}}{[\theta P_t + (1\text{-}\theta)P_{nt}]}\,\frac{dP_{nt}}{P_{nt}} \tag{8.14}$$

Using equation 8.11 in conjunction with equation 8.7, it is possible to write:

$$\frac{dL_{nt}}{L_{nt}} = -\frac{1}{\gamma}\left\{-\frac{\theta P_t}{[\theta P_t + (1-\theta)P_{nt}]}\frac{dP_{nt}}{P_{nt}}\right\} = \frac{\theta P_t}{\gamma[\theta P_t + (1-\theta)P_{nt}]}\frac{dP_{nt}}{P_{nt}} \tag{8.15}$$

which is positive since all variables and parameters are positive. Similarly, using equation 8.14 in conjunction with equation 8.6 yields:

$$\frac{dL_t}{L_t} = -\frac{1}{\alpha}\left\{\frac{(1-\theta)P_{nt}}{[\theta P_t + (1-\theta)P_{nt}]}\frac{dP_{nt}}{P_{nt}}\right\} = -\frac{(1-\theta)P_{nt}}{\alpha[\theta P_t + (1-\theta)P_{nt}]}\frac{dP_{nt}}{P_{nt}} \tag{8.16}$$

which is negative for all positive values of the variables and parameters. Thus, the signs of expressions on the RHS of equations 8.15 and 8.16 confirm the prediction that an increase in the price of non-tradables will result in an increase in employment in that sector, and a reduction in employment in the tradables sector.

Given equations 8.15 and 8.16, and noting that, in a linearly homogeneous Cobb-Douglas production function, the partial elasticity of output with respect to each factor is given by this factor's exponent (e.g. Chiang 1984, p. 416), it is possible to derive expressions for proportional changes in output in the short run model with unrestricted emigration ('unrestricted model'). Using the following short hand notation:

$\hat{x} = \frac{dx}{x}$ = proportional change in variable x

CPI = $[\theta P_t + (1-\theta)P_{nt}]$ = Consumer Price Index

the output equations are given by:

$$\widehat{X_{nt}} = \delta\,\widehat{L_t} = \frac{\delta\theta P_t}{\gamma CPI}\widehat{P_{nt}} \tag{8.17}$$

$$\widehat{X_t} = \beta\,\widehat{L_t} = -\frac{\beta(1-\theta)P_{nt}}{\alpha CPI}\widehat{P_{nt}} \tag{8.18}$$

Terms on the right hand side of equations 8.17 and 8.18 measure the proportional changes in sectoral output. As could be expected, their signs indicate that, following an increase in P_{nt}, sectoral output levels would change in the same direction as sectoral employment. From these expressions, it is possible to identify the factors affecting the strength of sectoral responses, that is, the magnitude of employment and output elasticities with respect to P_{nt}. Given that the CPI and $\widehat{P_{nt}}$ are the same for both sectors, any differences in the strength of sectoral responses must be due to:

(i) *the weight of each commodity in the price index*: the greater the weight assigned to the non-tradables good, (1-θ), the greater the relative fall in L_t, and the smaller the relative increase in L_{nt};
(ii) *factor intensities in each sector*: the values assumed by α, β, γ, and δ will also influence the two sectors' reaction to a change in P_{nt}. The more capital-intensive a sector (α high or γ high), the less responsive its levels of employment and output; and
(iii) *relative values of P_t and P_{nt}*: a sector's response will be higher, the higher the price of the other sector's commodity (due to the indexation mechanism assumed).

Without the knowledge of specific values for these parameters, it is not possible to determine which sector will be relatively more affected by aid, in terms of employment or output. All that can be safely predicted from the general expressions derived so far, is that, other things being equal, the labour-intensive sector will be the more strongly affected by the change in its own-product real wage, which aid causes via the change in P_{nt}. In the next chapter, an attempt will be made to resolve this uncertainty, by estimating the parameters affecting the sectoral supply elasticities.

Other results, somewhat easier to interpret, point to the Dutch Disease consequences of an aid inflow in the short run. In the event of an increase in P_{nt}, these consequences would be:

(i) a rise in the real wage rate faced by the tradables sector;
(ii) a fall in P_t/P_{nt} i.e an appreciation of the real exchange rate;
(iii) a rise in the general price level; and
(iv) a decline in the tradables sector's share of output and employment.

It seems clear, therefore, that the expenditure effects of aid have the capacity to alter the economic structure of the recipient MIRAB economy in the direction predicted by booming sector theory. The extent of a Dutch Disease phenomenon would clearly be positively influenced by the magnitude of the proportional increase in P_{nt}. It is desirable, therefore, to express $\widehat{P_{nt}}$ formally in the context of the model. This requires the complete specification of the general equilibrium (GE) model of the hypothesised economy, the supply side of which is represented by equations 8.17 and 8.18. Once this has been done, it is possible to solve the model for an endogenous solution to $\widehat{P_{nt}}$ (see appendix 8.3). This solution is reported below:

$$\widehat{P_{nt}}^{*} = \frac{\sigma F}{P_t C_{nt}\left\{\frac{\delta\theta P_t}{\gamma\, CPI}\left[1-\eta(1-\lambda)\right] + \frac{\eta\lambda\beta(1-\theta)P_{nt}}{\alpha\, CPI} - \eta(1-\lambda) - \varepsilon_{nt}\right\}} \tag{8.19}$$

where F = untied grant aid inflow (current value)

σ = proportion of F spent on NT sector output

η = real income elasticity of the absorption of non-tradables

$\lambda = \frac{X_t}{Y}$ = initial T sector share of real GDP [4] $(0 \le \lambda \le 1)$

$(1-\lambda) = \frac{P_{nt}X_{nt}}{P_t Y}$ = initial NT sector share of real GDP

ε_{nt} = elasticity of the absorption of non-tradables with respect to the relative price of non-tradables.

The implications of equation 8.19 with regard to the factors influencing $\widehat{P_{nt}}^{*}$ are intuitively plausible. They are that the short run proportional change in the equilibrium price of non-tradables will be greater:

- the greater the aid-financed expenditure on NT goods relative to the initial level of absorption of those goods (i.e. $\frac{\sigma F}{P_t C_{nt}}$);
- the smaller the absolute value of ε_{nt} (assuming $\varepsilon_{nt} < 0$);
- the smaller the absolute value of the T sector's elasticity of supply with respect to P_{nt} (i.e. $-\frac{\beta(1-\theta)P_{nt}}{\alpha CPI}$); and

[4] Measured in terms of the numéraire good, T (i.e. $P_t = 1$).

- the smaller the own-price elasticity of supply in the NT sector (i.e. $\frac{\delta\theta P_t}{\gamma CPI}$).

The role of the real income elasticity of the absorption of non-tradables (η) cannot be predicted accurately from equation 8.19; this is because a large value for η means that C_{nt} will react strongly to changes in income engendered by both the contraction in one sector and the expansion in the other. Ultimately, the net effect of η on $\widehat{P_{nt}}^*$ will rest upon initial sectoral shares of real GDP (λ and 1-λ).

Finally, it may be noted that equation 8.19 allows the possibility of a fall in P_{nt}. This point may be illustrated by letting (1-λ) equal 1; in this extreme case, where real GDP consists entirely of non-tradables initially, equation 8.19 reduces to:

$$\widehat{P_{nt}}^* = \frac{\sigma F}{P_t C_{nt}\left\{\frac{\delta\theta P_t}{\gamma\, CPI}\left[1-\eta\right] - \eta - \varepsilon_{nt}\right\}} \tag{8.20}$$

This expression could be negative if η was sufficiently large and $|\varepsilon_{nt}|$ sufficiently small. This implies that the likelihood of a fall in the equilibrium value of P_{nt} is greater, the greater the non-tradables sector's initial share of GDP. Intuitively, this may be explained by the fact that, if the NT sector is very large in relation to the rest of the economy, a given proportional increase in P_{nt} may see supply outstrip demand, hence creating the need for a fall in P_{nt} ultimately.

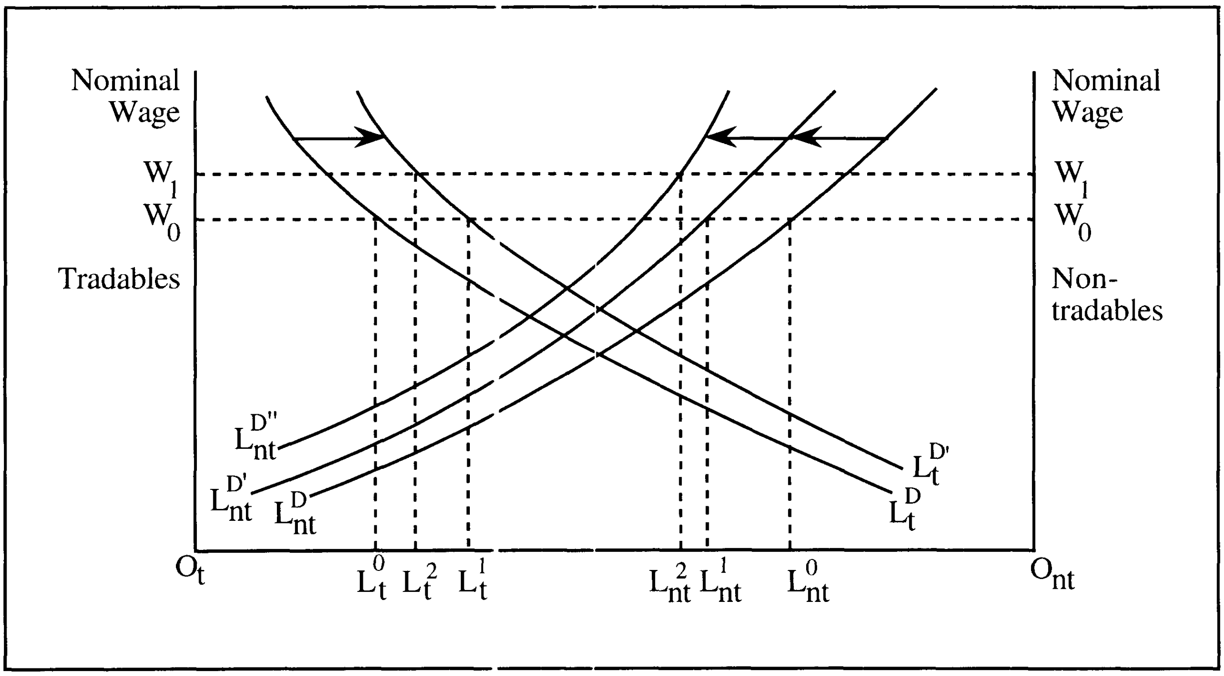
In equation 8.19, the only exogenous variable is F, the nominal value of the 'one-off' aid inflow. In the short run, the value of F determines the value of the $\frac{\sigma F}{P_t C_{nt}}$ ratio, which measures the extent to which aid contributes to the proportional increase in C_{nt} (see appendix 8.3). Once this ratio is known, $\widehat{P_{nt}}^*$ can be obtained, and then substituted into equations 8.15 to 8.18 to calculate employment and output responses in each sector.

In the long run, F reverts to a zero value. However, the repercussions of this inflow continue to be felt: that portion of F which was invested in the short run will translate into an increase in the capital stock of one or both sectors in the long run. It is to the analysis of these long run effects that the next section is devoted.

8.2.3 Long run

The time horizon considered in this section is that required for any portion of aid spent on investment in the short run to result in an expansion of the capital stock of each sector. The implications of such an expansion in the presence of overseas employment are examined graphically below, using the labour market diagram introduced in section 8.2.1. In the first instance, aid that increases the capital stock in each sector will cause marginal labour productivity to rise. This will in turn cause the sectoral labour demand schedules in figure 8.5 to shift upward (L_t^D to $L_t^{D'}$, L_{nt}^D to $L_{nt}^{D'}$), as more labour can be profitably employed at each level of money wage (and hence real wage since prices have remained constant so far). Assuming that the foreign real wage $\bar{w}$ continues to be binding, the increase in each sector's workforce must be such as to restore sectoral capital-labour ratios to their initial level. This has the important implication that, in each sector, the capital stock, the level of employment, and (given CRS) the level of output will all grow at the same rate. Following this first round of growth, the T sector will employ L_t^1 workers, the NT sector L_{nt}^1 workers, leaving L_t^1-L_{nt}^1 workers to find employment overseas. Up to that point, therefore, the impact on the overseas labour force is an unambiguous reduction in its size.

Figure 8.5 **Long run effects of an aid inflow in the labour market**



With both sectors employing more of each factor and producing more after this first stage (henceforth: 'first stage changes'), the economy will experience an increase in aggregate supply which, measured at constant prices, will translate into a commensurate increase in real income. As previously noted, increased absorption of both commodities should ensue, which may result in excess demand developing in the market for non-tradables. Excess demand is, however, not a certain outcome: excess supply, or market equilibrium, may exist after the first stage growth experienced by the economy. Clearly, the actual outcome will depend on such factors as the sectoral break-down of aid-financed investment, income elasticities, and capital intensities in each sector. These issues are returned to, later in this section.

Assuming, *pro tem*, that excess demand emerges in the market for non-tradables, P_{nt} will rise while P_t remains constant. In turn, this increase in P_{nt} will, through its effect on the consumer price index and the nominal wage, lead to changes (henceforth: 'second stage changes') identical to those identified for the short run. As illustrated in figure 8.5, this implies that $L^{D'}_{nt}$ will shift further up (to $L^{D''}_{nt}$), while a movement along $L^{D'}_{t}$ will occur.

From the diagram, overall changes experienced by the economy appear to be an increase in both sectoral and domestic employment levels, and a decrease in overseas employment, compared with the initial situation. These results, however, are no more than a product of the way figure 8.5 is constructed; in reality, the net employment outcome will depend upon several factors, as can be appreciated by deriving expressions measuring overall (first *and* second stage) proportional changes in sectoral employment levels. These expressions are as follows:

$$\widehat{L_t} = \widehat{K_t} - \frac{(1-\theta)\, P_{nt}}{\alpha\, CPI}\, \widehat{P_{nt}} \tag{8.21}$$

$$\widehat{L_{nt}} = \widehat{K_{nt}} + \frac{\theta\, Pt}{\gamma\, CPI}\, \widehat{P_{nt}} \tag{8.22}$$

The first term on the right hand side of equations 8.21 and 8.22 represents the first stage change in sectoral employment: given the fixity of the capital-labour ratios during that stage, the proportional increase in employment necessarily equals that in the capital stock. The second terms measure the intensity of second stage changes, which occur as a result of the variation in P_{nt}. Second stage changes are identical in nature to the short run changes already identified and are therefore measured by equations 8.15 and 8.16.

Once changes in employment are known, they can be combined with changes in capital stocks to express total sectoral changes in output (see appendix 8.4):

$$\widehat{X_t} = \widehat{K_t} - \frac{\beta\,(1-\theta)\,P_{nt}}{\alpha\,CPI}\,\widehat{P_{nt}} \qquad (8.23)$$

$$\widehat{X_{nt}} = \widehat{K_{nt}} + \frac{\delta\,\theta\,Pt}{\gamma CPI}\,\widehat{P_{nt}} \qquad (8.24)$$

An important feature of the four employment and output equations given above, is the role of factor intensity in determining the strength or the sectoral response. This point can be illustrated by letting $\widehat{K_t}$ equal $\widehat{K_{nt}}$, and θ equal $(1-\theta)$, in equations 8.21 to 8.24. For given values of the CPI and $\widehat{P_{nt}}$, the more labour intensive a sector is, the stronger its response to a change in P_{nt}. Thus, if a sector was very labour intensive, its response to a price change could conceivably outweigh its response to an increase in its capital stock. In some circumstances, this could imply a *fall* in the sectoral levels of employment and output. To illustrate this point, it may be assumed that the T sector is labour intensive, and also that P_{nt} increases. According to equation 8.23, if $\widehat{P_{nt}}$ and $\frac{\beta}{\alpha}$ were sufficiently large, $\widehat{X_t}$ would become negative. The extent of the contraction would naturally be magnified if $\widehat{K_t}$ and θ assumed small values.

The possibility of the 'price effect' (second stage change) outweighing the 'capital effect' (first stage change) underlines the importance of identifying the factors which influence the sign and value of $\widehat{P_{nt}}$. To this end, it is once again necessary to specify completely the general equilibrium model describing the long run unrestricted model, and solve it for $\widehat{P_{nt}}$ (see appendix 8.5). This exercise yields the following expression:

$$\widehat{P_{nt}}^{*} = \frac{\eta\lambda\widehat{K_t} - \left[1+\eta\lambda-\eta\right]\widehat{K_{nt}}}{\left\{\frac{\delta\theta P_t}{\gamma CPI}\left[1-\eta(1-\lambda)\right] + \frac{\eta\lambda\beta(1-\theta)P_{nt}}{\alpha CPI} - \eta(1-\lambda) - \varepsilon_{nt}\right\}} \qquad (8.25)$$

Equation 8.25 shows that, in the long run also, the proportional change in P_{nt} is subject to plausible influences Since the denominator of this expression is virtually identical to that of the short run solution (see equation 8.19), the impact of its various terms on $\widehat{P_{nt}}^*$ is as already noted in 8.2.2. Turning to the numerator, it is clear that $\widehat{P_{nt}}^*$ is unambiguously increased by larger values of $\widehat{K_t}$. This is to be expected since the more the capital stock—and hence output—in sector T is increased, the more income is generated in the economy (*ceteris paribus*). Given normal preferences in aggregate, an increase in income will lead to a rise in demand for non-tradables with no commensurate increase in supply (as K_{nt} and P_{nt} are kept constant), thus contributing to the creation of excess demand in that market.

The role played by $\widehat{K_{nt}}$ in relation to excess demand for NT goods, and hence an increase in P_{nt}, is somewhat less clear-cut. If the term which multiplies it is positive[5], then $\widehat{K_{nt}}$ is inversely related to $\widehat{P_{nt}}^*$. Thus, if $\widehat{K_{nt}}$ was sufficiently large relative to $\widehat{K_t}$, $\widehat{P_{nt}}^*$ would fall and could even become negative. This might have been expected since, intuitively, the greater the capital stock expansion in sector NT, the more output will be supplied, thus diminishing the likelihood of excess demand developing, and hence diminishing the need for a large price rise to quell it. However, this sector also generates income in the economy, which is then partly expended on NT goods. Therefore, if this sector's share of initial real GDP is large (i.e. λ is small), and demand for its output is highly income-elastic (η is high), the $[1+\eta\lambda-\eta)]$ term will be negative. This would imply that, in the NT sector, capital and output expansion effectively contribute to the creation of excess demand, and hence to the need for a price increase.

In summary, the endogenous solution for $\widehat{P_{nt}}^*$ clearly allows the possibility of either a rise or a fall in P_{nt}, following an aid-financed expansion in sectoral capital stocks. Ultimately, the direction and magnitude of the change in P_{nt} is dependent on four categories of factors:

(i) the sectoral breakdown of the aid inflow which, in combination with initial sectoral capital stocks, determines the values of $\widehat{K_{nt}}$ and $\widehat{K_t}$;
(ii) the sectoral elasticities of supply with respect to changes in the price of non-tradables;

5 Which will be the case if the inequality $\frac{1}{(1-\lambda)} > \eta$ is satisfied.

(iii) the real income and relative prices elasticities of the absorption of non-tradables; and
(iv) the initial sectoral shares of real GDP.

If the combination of these factors led to an increase in P_{nt}, price effects would favour the growth of the NT sector and hinder that of the T sector. Depending on the values of $\widehat{K_{nt}}$ and $\widehat{K_t}$, this could then translate into a relative or absolute decline in the T sector, hence to a Dutch Disease-type change in economic structure. However, the probability of this outcome cannot be predicted from the algebra alone. This uncertainty notwithstanding, the comparative static analysis of the long run unrestricted model, performed above, is not entirely without benefits, since it allows the identification of conditions favourable to the disease. The existence of these conditions will be ascertained in chapter 9, to the extent allowed by the availability of data.

8.3 Impact of aid in an economy with limited emigration possibilities

8.3.1 Introduction

In this section, an attempt is made to model the impact of an aid inflow on the economic structure of the recipient, in the absence of an unrestricted emigration outlet. As mentioned previously, the lack of such an outlet is a feature of two MIRAB economies, Kiribati and Tuvalu. While a sizeable number of their nationals is employed overseas, it is likely that the domestic labour market in each country operates mostly independently from metropolitan ones. Thus, the link between domestic and overseas real wage rates is likely to be weaker than in the unrestricted emigration case. This is not to say, however, that no such link exists, and that the real wage rate in the MIRAB economy is completely free of external influences. To quote Bertram:

> [In Kiribati and Tuvalu,] labour migration to the Nauru phosphate diggings, and to work for international shipping lines, does provide some external reference point for local wage rates. (1986, p. 811)

Accordingly, it is probable that the real wage in the formal sector of these MIRAB economies will be a reflection of both domestic and overseas factors. In the public sector, for instance, the salary scale may be set with at least partial reference to overseas earnings possibilities, especially those of skilled workers (Kiribati 1992, p. 15, p. 49), thus creating a benchmark for the rest of the formal sector. Reports of significant open unemployment[6] in Kiribati and Tuvalu (Kiribati 1992, p. 48; Tuvalu 1992, p. 20) suggest that, at this benchmark wage rate, the labour market is not able to clear. In Kiribati for instance, the formal sector unemployment rate stood at 8.2 per cent in 1990 (ibid., p. 46). The existence of excess labour supply in that country is also confirmed by reports that only one in ten school leavers succeeded in finding formal employment between 1985 and 1990 (loc. cit.). In Tuvalu, the equivalent statistic is one in five (AIDAB 1993, p. 33).

Based on evidence of unemployment, and on evidence of minimum wage-setting in Kiribati and Tuvalu (Douglas and Douglas 1989, pp. 287, 578), an institutionally determined, binding real wage rate is assumed in the analysis below. Specifically, the wage-setting procedure postulated is one which consists of the enforcement of a minimum nominal wage rate in the non-tradables sector such that the perceived real wage[7] in that sector equals the external reference (e.g. seamen's earnings). Therefore, for perceived wage parity to be maintained over time, it is necessary for the money wage to be indexed to the cost-of-living index. Thus, it must be the case that:

$$\bar{w} = \frac{W_{nt}}{\theta P_t + (1-\theta)P_{nt}} \tag{8.26}$$

where $\bar{w}$ = external reference real wage (exogenous)
W_{nt} = nominal wage in the NT sector
θ = weight of tradable goods in price index ($0 < \theta < 1$)

In essence, therefore, the relationship linking the overseas real wage and the domestic nominal wage (in sector NT) is the same as that of section 8.2. However, the money wage is now institutionally determined rather than forced into adjustment by unrestricted emigration. While full and explicit wage indexation is not found in Kiribati or Tuvalu, there are indications that partial and informal indexation is taking place. For instance, annual wage increases have been granted in most years, in the public sector of these two countries (AIDAB 1993, p. 9; Sinclair 1993, p. 86). Such increases, it is safe to assume, have been based on some measure of the cost of living, and have had a flow-on effect on the private component of the formal sector.

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[6] Defined as unemployed workers actively looking for a job in the formal sector. National development plans (Kiribati 1992; Tuvalu 1992) also note the existence of considerable under-employment.

[7] As defined in section 8.2.

The assumption of an institutionally determined minimum wage in the non-tradables sector, allows a Harris-Todaro sectoral wage differential to be incorporated into the analysis. As is well known since these authors' influential article (Harris and Todaro 1970), such a differential can arise between the agricultural/rural sector and the manufacturing/urban sector under certain circumstances, and can be used to explain internal migration in developing countries. In the South Pacific, the Harris-Todaro migration model has been used by Elek (1978) in the context of rural-urban migration in Papua New Guinea. In the present model, the rural/urban dichotomy is assumed to correspond to the tradable/non-tradable one. While the overlap between the two classifications cannot be perfect, it may be sufficiently large to justify the use of this simplifying assumption. A strong degree of convergence is especially likely between the non-tradable and urban sectors, as the vast majority of government services and state enterprises are commonly found in the capital of a country. As regards the tradables sector, its geographical location is dependent upon the exact nature of the activities considered. As table 8.1 illustrates, most of Kiribati's exports are produced in the outer islands, and are therefore of rural origin. In contrast, a few import-competing goods are manufactured in the capital, Tarawa: their contribution to exports, employment and GDP is, however, very small. On balance, therefore, the identification of the tradable with the rural sector appears warranted.

Table 8.1 **Geographical origin of Kiribati's main exports**

	Copra	Fish[a]	Seaweed
Outer islands	97.3	51	99.8
Tarawa	2.7	49	0.2
Year	*1985*	*1988*	*1991*

[a] Caught by private fishermen only.
Sources: SPD; Kiribati 1988, 1992.

The nature of exports is somewhat different in Tuvalu, where value exports of stamps and garments have surpassed those of copra in recent years (no fish is currently exported). These manufactured exports, combined with the existence of a few import-competing industries, suggest that a sizeable portion of the tradables sector is urban-based. However, export statistics present a biased picture of the importance of the agricultural tradables sector. This is due to this sector's close links with the subsistence sector: depending on expected returns, village producers can readily switch between the production of copra for exports and that of other products (e.g. foodcrops, livestock, poultry) for commercial sale on the domestic market. Thus, even in times of low agricultural exports, there may exist a significant agricultural output. Since such output is normally in competition with imported foodstuffs, it is probably tradable in the main. Thus, the assumption of a predominantly rural tradables sector cannot be rejected in the case of Tuvalu.

Data on sectoral earnings in MIRAB countries are scarce, and the existence of a wage differential between the tradables (i.e. rural) and non-tradables (i.e. urban) sectors can only be documented in relation to the Cook Islands (SPD). Nevertheless, continued internal migration from the outer islands to the capitals of Kiribati and Tuvalu (Munro 1990, p. 39; Kiribati 1992, p. 78; Tonganibeia 1993, p. 298) may be interpreted as indirect evidence of such a differential. According to Connell (1990, p. 3), 'migration [in the South Pacific] is primarily a response to real and perceived inequalities in socio-economic opportunities'. While the economic motive may be assigned primarily to workers transferring from the subsistence to the formal sector, it is also likely to apply to those seeking higher pay within the formal sector, for instance by abandoning cash cropping in rural areas for a white collar job in the capital.

Thus, the labour market of the urban sector can exert a strong influence on that of the rural sector, a possibility which Bertram recognised in relation to Kiribati and Tuvalu (1986, pp. 821-22: footnote 10). According to that author, the link between the two markets can be explained readily in terms of the general MIRAB model (see 4.2.6), by redefining the 'world wage' as that on offer in the 'dominant island'. Thus, any worker who is unable to find employment at that wage in the outer island can automatically find work in the capital.

A more realistic approach given the existence of unemployment already mentioned, should incorporate the probability of remaining unemployed after migrating to the city. In their model, Harris and Todaro (1970) postulated that workers in the rural sector (tradables or T henceforth) would be willing to migrate to the urban sector (non-tradables or NT henceforth) in search of a higher real wage, as long as the urban real wage, discounted for the probability of not finding an urban job, remained above the rural real wage. Other things being equal, continued migration would ensure that, eventually, the probability of urban unemployment became sufficiently high that the incentive to migrate would be cancelled. Thus, a static equilibrium would be reached when the rural real wage became equal to the *expected value* of the urban real wage. Or, in terms of tradables and non-tradables, when:

$$\frac{W_t}{\theta P_t + (1-\theta)P_{nt}} = \frac{L_{nt}}{L_u} \frac{W_{nt}}{\theta P_t + (1-\theta)P_{nt}} \tag{8.27}$$

which is equivalent to:

$$W_t = \frac{L_{nt}}{L_u} W_{nt} \tag{8.28}$$

where W_t = nominal wage in the T sector
L_u = urban labour force (L_{nt} + unemployed)
L_{nt} = employment in the NT sector

with:

$$L_t + L_u = \bar{L} \tag{8.29}$$

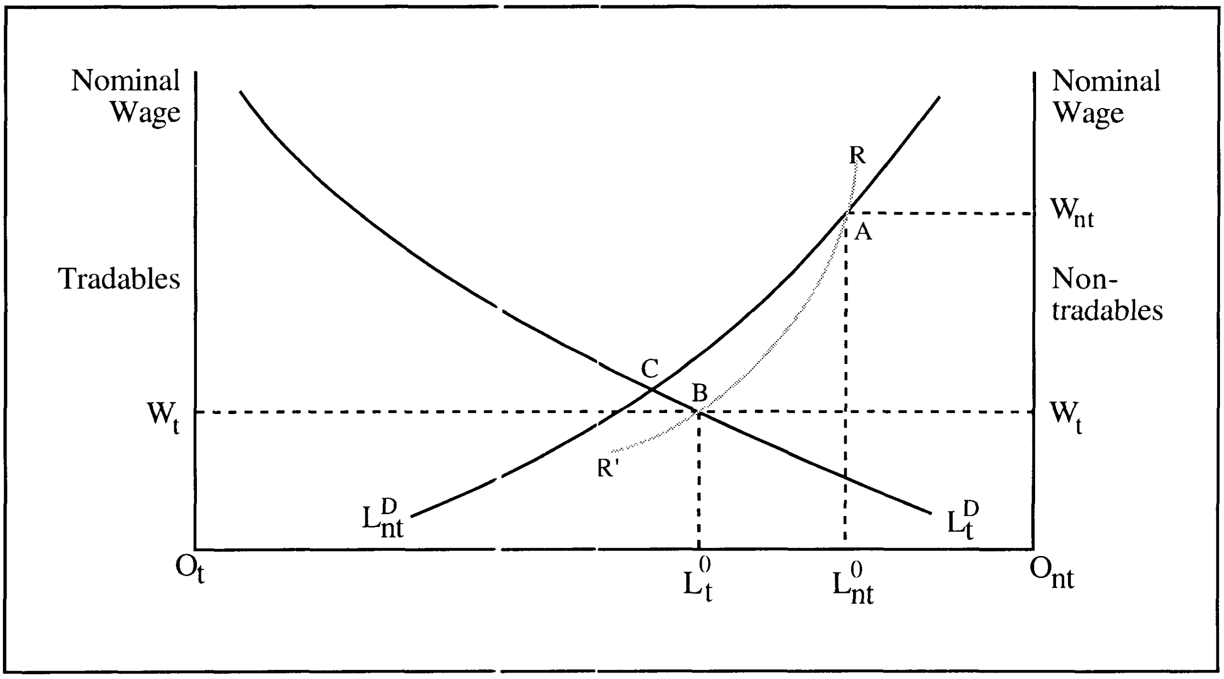
As pointed out by Corden and Findlay (1975, p. 61), the equilibrating mechanism embodied in equation 8.28 is equivalent to assuming:

(i) a random turnover in the NT sector's workforce, so that each member of the total urban labour force has an equal chance of being employed on any given day;
(ii) that no premium is attached to the risk of settling into the urban unemployment pool, even when migration to the city is justified by the expectation of a higher real wage; and
(iii) the availability of a subsistence income for the unemployed.

These simplifying assumptions are adopted in the model developed below, in order to restrict its complexity.

Given the Harris-Todaro migration process posited, and its attendant wage equalisation mechanism, the nature of equilibrium in the labour market can be illustrated in terms of figure 8.6, adapted from Corden and Findlay (1975, p. 61). In the diagram, the money wage in the NT sector is set at W_{nt}, a level such that real wage parity with the external reference is satisfied for given commodity prices P_t and P_{nt}. At W_{nt}, the NT sector employs L^0_{nt} workers, with the remainder of the workforce being divided between urban unemployment and employment

Figure 8.6 **Labour market equilibrium with a Harris-Todaro migration process**



in the T sector (L_t^0). It must be noted that, as no international worker immigration is assumed, $\overline{L}$ represents the maximum number of workers employable in the economy; in other words, L_{nt} can be situated on the same vertical plane as L_t (i.e. there is no unemployment) but never to the left of it.

Given that, from equation 8.29, $L_u = \overline{L} - L_t$, equilibrium condition 8.28 may be re-written as:

$$W_t\,(\overline{L} - L_t) = W_{nt}\,L_{nt} \tag{8.30}$$

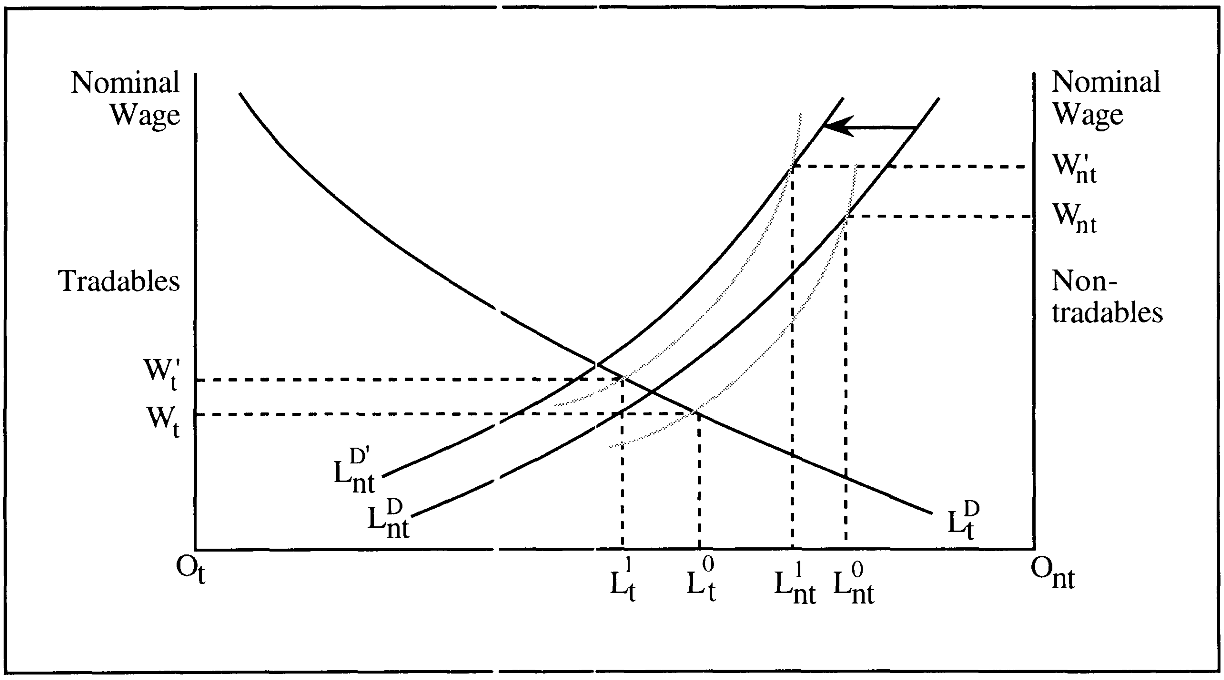
This implies that the two sectoral wage–employment combinations of (W_t, L_t) and (W_{nt}, L_{nt}) must lie on a common rectangular hyperbola such as RR'. In addition, the own-product real wage in each sector must equal the marginal product of labour in that sector, which requires combinations situated on the sectoral labour demand curves. Given point A therefore, the equilibrium combination in the T sector must lie at point B, the intersection of RR' and L_t^D. At that point, the T sector's money wage is W_t, and its labour force L_t^0. By inference, the amount of unemployment in the urban sector must be equal to distance L_t^0-L_{nt}^0.

As noted by Corden and Findlay (1975, p. 62), the implications of a binding urban minimum wage in the Harris-Todaro framework will vary between sectors. In the NT sector, output and employment will both be reduced by such a constraint, compared with the competitive equilibrium position (point C). In the T sector, by contrast, output, employment and wage levels could be higher, lower, or identical to those prevailing in the competitive case. If, as illustrated in figure 8.6, the L^D_{nt} curve has an elasticity greater than one[8], point B will lie to the south-east of point C. This implies output and employment levels in excess of competitive ones, and an equilibrium wage rate lower than at C.

8.3.2 Short run

Using the analytical framework detailed above, it is now possible to examine the impact of an aid inflow in the short run, in the absence of an external migration outlet. On the demand side, aid can be expected to produce effects identical to those outlined in the context of the unrestricted emigration model (see 8.2.2), namely an increase in absorption and an increase in the price of non-tradables. On the supply side, this increase in P_{nt} will result in the changes illustrated in figure 8.7. In the non-tradables sector, the demand for labour is now

Figure 8.7 **Short run impact of an aid inflow in an economy with no migration outlet**



[8] As can be verified from equations 8.6 and 8.7, this will always be the case when output is produced according to a Cobb-Douglas production function with CRS. This characteristic also rules out horizontal demand for labour curves.

represented by $L_{nt}^{D'}$, and sectoral employment increases to L_{nt}^{1}. As in the unrestricted model, this increase reflects the lowering of the own-product real wage in sector NT. Accompanying the shift in L_{nt}^{D}, there will be an upward shift in the rectangular hyperbola, which now intersects the L_t^D curve to the north-west of the initial equilibrium point. Thus, it can be seen that, in the tradables sector, sectoral employment has fallen (to L_t^1) while the money wage has risen (to $W_t^{'}$). Since P_t is fixed, it can be inferred that the own-product real wage in the tradables sector has risen also. While it is clear, from the diagram, what the direction of changes in sectoral employment levels is, nothing definite can be said regarding the magnitude of these changes. In order to identify the factors influencing the strength of sectoral responses, it is once again necessary to derive formal expressions measuring proportional changes in employment and output levels.

In the non-tradables sector, employment and output changes brought about by the expenditure of aid are identical to those obtained for the unrestricted model (see section 8.2.2). Therefore, by analogy with equation 8.15, it is possible to write that:

$$\widehat{L_{nt}} = \frac{\theta\, P_t}{\gamma\, CPI}\, \widehat{P_{nt}} \qquad (8.31)$$

Given equation 8.31 and the production function in sector NT, it follows that:

$$\widehat{X_{nt}} = \frac{\delta\, \theta\, P_t}{\gamma\, CPI}\, \widehat{P_{nt}} \qquad (8.32)$$

Turning to the tradables sector, it is possible to show (see appendix 8.6.) that:

$$\widehat{W_t} = \left[\frac{\alpha\bar{L} - \alpha L_t}{\alpha\bar{L} + \beta L_t}\right]\left[\frac{\theta P_t + \gamma(1-\theta)P_{nt}}{\gamma\, CPI}\right]\widehat{P_{nt}} \qquad (8.33)$$

Therefore, given the elasticity of the demand for labour in the T sector (equation 8.6), and noting that, since P_t is constant, $\widehat{W_t} = \widehat{MPL_t}$, it follows that:

$$\widehat{L_t} = -\frac{\widehat{W_t}}{\alpha} = -\left[\frac{\bar{L} - L_t}{\alpha\bar{L} + \beta L_t}\right]\left[\frac{\theta P_t - \gamma(1-\theta)P_{nt}}{\gamma\, CPI}\right]\widehat{P_{nt}} \qquad (8.34)$$

which, in turn, implies:

$$\widehat{X_t} = \beta\,\widehat{L_t} = -\left[\frac{\beta\bar{L} - \beta L_t}{\alpha\bar{L} + \beta L_t}\right]\left[\frac{\theta P_t + \gamma(1-\theta)P_{nt}}{\gamma\,CPI}\right]\widehat{P_{nt}} \tag{8.35}$$

given the Cobb-Douglas production functions used in the model.

Equations 8.34 and 8.35 provide confirmation of the fact that a short run increase in P_{nt} will cause the T sector to contract. The key to this contraction is the positive impact of $\widehat{P_{nt}}$ on $\widehat{W_t}$ (equation 8.33). Because P_t is assumed to be constant, an increase in W_t implies an increase in sector T's own-product real wage of the same magnitude, and hence a contraction in that sector's level of activity.

Equations 8.34 and 8.35 also allow the identification of the factors which influence the magnitude of sector T's employment and output response to a rise in P_{nt}. Thus, it can be seen that the relative contraction in that sector will be greater:

(i) the smaller the initial value of L_t;
(ii) the greater the percentage increase in P_{nt};
(iii) the greater the weight (θ) attached to P_t in the CPI; and
(iv) the more labour-intensive the tradables sector (given that $\bar{L} > L_t$, the greater β and the smaller α, the more negative the RHS of equations 8.34 and 8.35).

These four factors, which appear intuitively plausible, will thus determine the strength of the T sector's response to a change in P_{nt}. In turn, this response, combined with that of sector NT, will determine overall changes in the economy in the short run, in terms of total domestic employment for instance, or in terms of aggregate output.

As in the case of the unrestricted model, it is desirable to endogenise $\widehat{P_{nt}}$ in order to find an expression for its equilibrium value. By specifying completely the general equilibrium model with restricted emigration ('the restricted model'), and solving for $\widehat{P_{nt}}$, the following expression is obtained (see appendix 8.7):

$$\widehat{P_{nt}}^* = \frac{\sigma F}{P_t C_{nt}\left\{\frac{\delta\theta P_t}{\gamma CPI}\left[1-\eta(1-\lambda)\right] + \eta\lambda R\left[\frac{\theta P_t + \gamma(1-\theta)P_{nt}}{\gamma CPI}\right] - \eta(1-\lambda) - \varepsilon_{nt}\right\}} \tag{8.36}$$

where $R = \left[\frac{\beta\bar{L} - \beta L_t}{\alpha\bar{L} + \beta L_t}\right]$

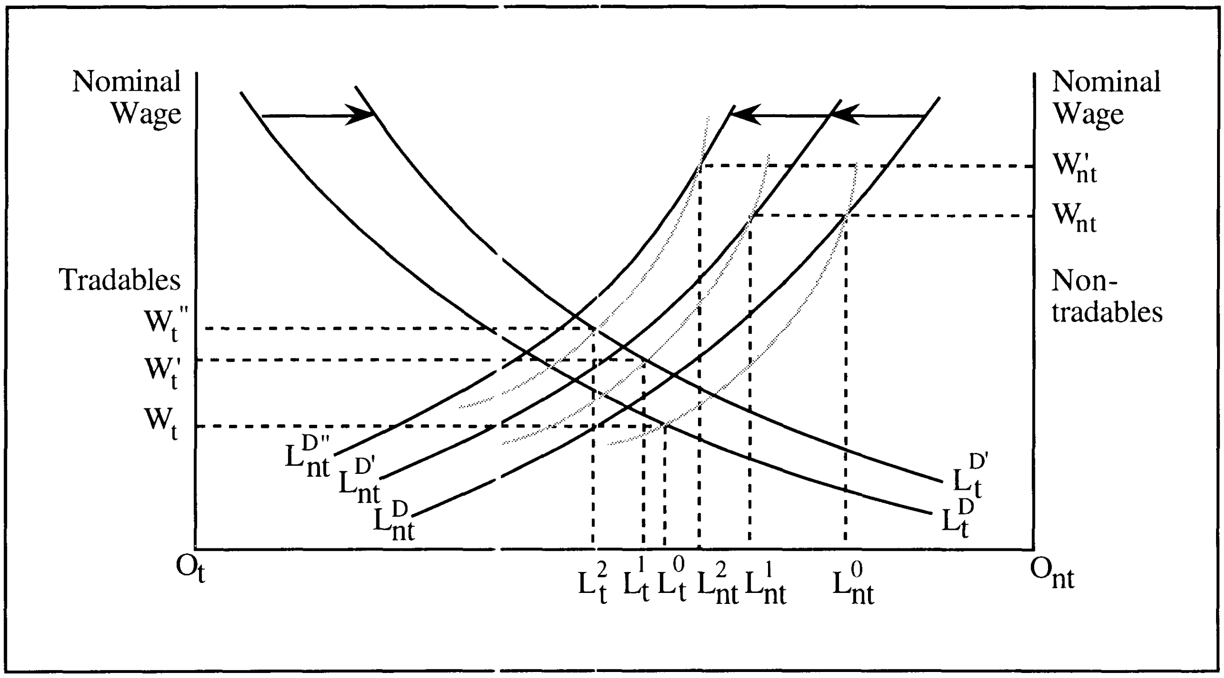
On the basis of this equation, it can be seen that the factors influencing $\widehat{P_{nt}}^*$ are almost identical to those in the unrestricted model (see equation 8.19). However, because of the Harris-Todaro migration process hypothesised in the present model, the initial composition of the labour force also has a role to play in the determination of $\widehat{P_{nt}}^*$. Specifically, the larger the initial level of employment in the tradables sector (L_t), and hence the smaller the R ratio, the larger the proportional change in the equilibrium value of P_{nt}. This may be explained by noting that, according to equation 8.35, a large value of L_t dampens the supply response of the T sector. Thus, when this sector contracts following an increase in P_{nt}, expenditure on NT goods (part of which is financed by income generated in the T sector) would not be as adversely affected as when the contraction was severe. Hence, there is a need for a relatively large increase in P_{nt} to restore equilibrium in the market for non-tradables.

Without estimating the parameters of equation 8.36, it is not possible to predict the magnitude of $\widehat{P_{nt}}^*$, and neither is it possible, therefore, to predict changes in other key variables such as sectoral output levels. All that can be stated, on the basis of the general results derived so far, is that, as long as P_{nt} does increase in the short run, sectoral responses would conform with Dutch Disease expectations of a reduction in the relative share of the tradables sector (employment and output). In this respect, the qualitative results of the restricted model mirror those of the unrestricted model. In the next chapter, an attempt is made to quantify the extent of the sectoral changes. However, prior to this, it is necessary to consider the long run impact of an aid inflow.

8.3.3 Long run

In the long run, the effects of aid-financed additions to the capital stock in both sectors will be as depicted in figure 8.8. In this diagram, the changes affecting the non-tradables sector are identical to those detailed in the unrestricted case. First, its demand for labour curve will shift upward to $L_{nt}^{D'}$, in a reflection of increased labour productivity. Given a fixed own-product real wage W_{nt}/P_{nt} in that first stage, and hence a fixed capital-labour ratio, the new equilibrium labour force in this sector will be L_{nt}^{1}. Second, should the price of the non-tradable commodity increase because of excess demand, the $L_{nt}^{D'}$ curve will itself shift, to $L_{nt}^{D''}$. The conditions required for an increase in P_{nt} will clearly be identical to those in the unrestricted model (see 8.2.3). When the NT market clears again, this sector's employment will be equal to L_{nt}^{2}. The nominal wage (W_{nt}') will have increased, and the own-product real wage (W_{nt}'/P_{nt}') decreased for the reasons already detailed in section 8.2.

Figure 8.8 **Long run impact of an aid inflow in an economy with no emigration outlet**



In the tradables sector also, a larger capital stock also causes an upward shift of the demand for labour curve to $L_t^{D'}$. The effect of this shift on equilibrium values of W_t and L_t will clearly depend on the exact position of $L_{nt}^{D'}$ and its accompanying rectangular hyperbola. While W_t can only increase (to W_t') following these first stage changes, L_t could rise *or* fall, depending on the relative magnitude of the shifts in L^D_{nt} and L^D_t, as well as on the elasticities underlying these curves. No such ambiguity exists in regard to second stage changes, as the second shift in L^D_{nt} will invariably lead, through a movement along $L^{D'}_t$, to a fall in L_t (from L^1_t to L^2_t), and to a further increase in W_t (to W_t''). Overall, nothing definite can be said regarding the net effect of these changes on unemployment, given the uncertainty surrounding the changes in sector T's level of employment in particular.

The changes occurring in the NT sector can be readily expressed algebraically, since they are identical to those already analysed in section 8.2.3. Thus, by analogy with equations 8.22 and 8.24, it is possible to write that:

$$\widehat{L_{nt}} = \widehat{K_{nt}} + \frac{\theta\, Pt}{\gamma CPI}\,\widehat{P_{nt}} \qquad (8.37)$$

$$\widehat{X_{nt}} = \widehat{K_{nt}} + \frac{\delta\,\theta\, Pt}{\gamma CPI}\,\widehat{P_{nt}} \qquad (8.38)$$

In each equation above, the first term on the RHS is the 'productivity effect' (first stage change), while the second term is the 'price effect' (second-stage change) of an aid inflow in the long run.

Turning to the T sector, it can been shown (see appendix 8.8) that:

$$\widehat{W_t} = \left[\frac{\alpha\bar{L} - \alpha L_t}{\alpha\bar{L} + \beta L_t}\right]\left\{\widehat{K_{nt}} + \widehat{P_{nt}}\left[\frac{\theta P_t + \gamma(1-\theta)P_{nt}}{\gamma CPI}\right] + \frac{L_t\,\widehat{K_t}}{(\bar{L} - L_t)}\right\} \qquad (8.39)$$

This expression—the second term on the RHS specifically—indicates that the total proportional change in sector T's wage rate (nominal *and* real) is a composite of (see figure 8.8):

(i) the change caused by the initial shift in L^D_{nt};
(ii) the change caused by the second shift in L^D_{nt}; and
(iii) the change caused by the shift in L^D_t.

Once $\widehat{W_t}$ is known, it becomes possible to calculate the total change in employment in the T sector thus:

$$\widehat{L_t} = \widehat{K_t} - \frac{\widehat{W_t}}{\alpha} \tag{8.40}$$

That is, the proportional change in L_t is the sum of the positive change caused by an expanding capital stock ($\widehat{L_t} = \widehat{K_t}$ during that stage since the real wage and hence the capital-labour ratio are held constant) and of the negative change caused by an increasing W_t (assuming P_{nt} has increased). Finally, given $\widehat{L_t}$, it is possible to obtain the change in output level:

$$\widehat{X_t} = \alpha\widehat{K_t} + \beta\widehat{L_t} = \alpha\widehat{K_t} + \beta\left(\widehat{K_t} - \frac{\widehat{W_t}}{\alpha}\right) = \widehat{K_t} - \frac{\beta\widehat{W_t}}{\alpha} \tag{8.41}$$

Equations 8.40 and 8.41 clearly allow either an overall expansion or contraction of the tradables sector, in terms of employment and output. Given the factors influencing the proportional change in W_t in equation 8.39, it can be inferred that a net expansion of the T sector (e.g. $L_t^2 > L_t^0$ in figure 8.8) is more likely:

(i) the greater the proportional increase in sector T's capital stock[9];
(ii) the smaller the proportional increase in sector NT's capital stock;
(iii) the larger the initial amount of employment in sector T (L_t)[10];
(iv) the less labour-intensive sector T is;
(v) the smaller the proportional increase in P_{nt}; and
(vi) the smaller the weight attached to P_t in the CPI (θ).

As is apparent from the points listed above, the range of factors influencing the size of the tradables sector in the long run is fairly large. As in the short run, however, one of these factors, $\widehat{P_n}$, can be defined more fully in the context of the general equilibrium model describing the restricted long run case. This is done in appendix 8.9, and the solution for $\widehat{P_{nt}}^*$ is presented below:

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[9] Even though an increase in K_t leads to an increase in W_t (through a movement along the rightmost rectangular hyperbola in figure 8.8), an increase in L_t, and hence in X_t, will result nonetheless.

[10] This is because, given equation 8.39, the negative term on the RHS of equations 8.40 and 8.41 decreases with L_t.

$$\widehat{P_{nt}}^* = \frac{\eta\lambda\left[1 - \left(\frac{\beta L_t}{\alpha\bar{L}+\beta L_t}\right)\right]\widehat{K_t} - \left[1+\eta\lambda(1+R)-\eta\right]\widehat{K_{nt}}}{\left\{\frac{\delta\theta P_t}{\gamma CPI}\left[1-\eta(1-\lambda)\right] + \eta\lambda R\left[\frac{\theta P_t + \gamma(1-\theta)P_{nt}}{\gamma CPI}\right] - \eta(1-\lambda) - \varepsilon_{nt}\right\}} \tag{8.42}$$

where $R = \left[\frac{\beta\bar{L} - \beta L_t}{\alpha\bar{L} + \beta L_t}\right]$

Such an extremely cumbersome expression is difficult to interpret intuitively; it is clear, however, that it allows P_{nt} to either rise or fall, since its numerator can be positive or negative depending on, among other things, the relative values of $\widehat{K_{nt}}$ and $\widehat{K_t}$. Overall, the factors influencing $\widehat{P_{nt}}^*$ in this variant of the model are identical to those already mentioned in relation to the short run restricted and long run unrestricted models.

Only when $\widehat{P_{nt}}^*$ is known (in addition to $\widehat{K_{nt}}$ and $\widehat{K_t}$) does it becomes possible to determine the magnitude and direction of change of sectoral employment and output levels (equations 8.37 to 8.41). In the absence of a specific value for $\widehat{P_{nt}}^*$ and for the other factors influencing these variables, it is impossible to formulate any definite predictions regarding long run changes in economic structure in the MIRAB economy. In the next chapter, plausible parametric values will be estimated and incorporated into the model, in an attempt to resolve this uncertainty.

8.4 Conclusion

In order to facilitate the overall assessment of the numerous comparative static results derived throughout this chapter, they have been summarised in table 8.2 below. As well as a presenting a recapitulation of the links between aid and the models' key variables, this table provides a succinct evaluation of each link in terms of its compatibility with the hypothesized Dutch Disease transformation of the economy. Essentially, any change which contributes to the relative decline of the tradables sector may be deemed to be compatible with this hypothesis.

A cursory glance at table 8 2 reveals that the likelihood of a Dutch Disease change in economic structure is fairly high, in a short run context. This is because, in that period, an increase in the price of non-tradables is the most probable consequence of the expenditure of aid, so that there can be no ambiguity regarding the direction of change in sectoral employment and output levels. In that initial period, therefore, an inflow of aid should always result in the relative decline of the tradables sector. This conclusion closely matches the empirical

Table 8.2 **Summary of comparative static results**

Unrestricted Emigration Model		Impact of aid on: L_t	L_{nt}	X_t	X_{nt}	W/P_t	W/P_{nt}	P_t/P_{nt}
	Short Run	-	+	-	+	+	-	-
	DD compatible	yes	yes	yes	yes	yes	yes	yes
	Long run*	?	?	?	?	+	-	-
	DD compatible	?	?	?	?	yes	yes	yes

Restricted Emigration Model		Impact of aid on: L_t	L_{nt}	X_t	X_{nt}	W_t/P_t	W_{nt}/P_{nt}	P_t/P_{nt}
	Short Run	-	+	-	+	+	-	-
	DD compatible	yes	yes	yes	yes	yes	yes	yes
	Long Run*	?	?	?	?	+	-	-
	DD compatible	?	?	?	?	yes	yes	yes

Notes: DD = Dutch Disease
+ denotes a positive relationship
- denotes a negative relationship
? denotes an indeterminate relationship
* long run changes reported in the last three columns are based on the assumption that P_{nt} increases.

results obtained by Weisman (1990) for Papua New Guinea. Significantly, the degree of ease with which MIRAB nationals can emigrate does not affect the short run qualitative results obtained in this chapter.

In the long run, a Dutch Disease outcome is uncertain. The crucial determinants of this process are the magnitude and direction of the change in the price of non-tradables, following this sector's first stage expansion. If P_{nt} were to fall, a Dutch Disease scenario would be less likely, as the tradables sector would then expand twice: once as its capital stock increased, once as its own-product real wage fell. Conversely, if P_{nt} were to increase, the disease would be more likely, although it could not be guaranteed to eventuate. If net capital stock growth in sector T was sufficiently larger than in sector NT, it could still be the case that the former sector experienced a relative expansion. As can be seen from table 8.2, the only unambiguously disease-like changes that would affect sector T if P_{nt} rose, are a rise in its own-product real wage (column 7), and an adverse movement in internal terms of trade (column 9). On the balance of probability, however, a relative decline in the T sector may still be expected in the event of an increase in P_{nt}, on the grounds that this sector's growth would be adversely affected by the price effect, while that of the NT sector would benefit from it. Thus, the likelihood of the aid-financed increase in the tradables sector's capital stock being sufficiently large for the sector to expand overall, would be diminished. Whether such speculative reasoning can be confirmed empirically is ascertained in the next chapter.

CHAPTER 9

EMPIRICAL VERIFICATION AND SIMULATIONS

9.1 Introduction

Following the construction of alternative MIRAB economic models in the previous chapter, their empirical estimation is now performed, as far as data constraints allow. In addition to the provision of order-of-magnitude measures of the impact of aid, it is hoped that the quantification of its main comparative static results will serve to resolve some of the uncertainties encountered in chapter 8. Both objectives require specific values to be assigned to the main variables and parameters appearing in the models. Accordingly, the derivation of these values is undertaken at the beginning of the section devoted to each model. These numerical estimates are then used in conjunction with the general comparative static results from the previous chapter, to generate quantitative results. Finally, for each model, simulations are carried out to test the robustness of the qualitative results obtained. It should be noted, at the outset, that an exercise in empirical estimation such as is undertaken below, cannot but lack in detail due to: (i) the eminently stylised nature of the two models concerned; and (ii) the scarcity of available data. Accordingly, the emphasis throughout the remainder of this chapter is far more on plausibility and wholistic accuracy than on numerical precision.

9.2 Unrestricted emigration model

As previously mentioned, the unrestricted emigration variant of the model applies to three MIRAB economies: Niue, Tokelau and the Cook Islands. Ideally, therefore, empirical estimation of this variant should be attempted for all three countries. However, such exhaustiveness is precluded by the absence of sufficient data pertaining to Niue and Tokelau. In sub-sections 9.2.1 and 9.2.2, therefore, estimates and results will be derived with exclusive reference to the Cook Islands.

9.2.1 Estimation of parameters and variables

All the determinants of the impact of aid in an economy with unlimited emigration appear in equations 8.19 and 8.25. Provided estimates of the parameters and variables entering these equations can be obtained, therefore, it should be possible to quantify all comparative static results pertaining to this first model.

Undoubtedly, the most easily estimated parameter is θ, the weight of tradable goods and services in the consumer price index. Recalling that this category of commodities is taken (subject to the caveats expressed in 6.5.2) to include food, alcohol and tobacco, and clothing and textiles, the value of θ found in published Cook Islands price statistics (SPD) is 0.50. This value naturally implies that the weight of non-tradables, $(1-\theta)$, is 0.50 also.

A second readily obtained statistic is the value of λ, the tradables sector's initial share of real GDP (deflated by an index of P_t). The tradables sector is taken as comprising agriculture, mining, forestry, fishing, and manufacturing. Subsistence output is excluded from measures of both tradable output and GDP, in order to ensure consistency with employment figures used later in this chapter. From national accounts figures (SPD), it is found that the tradables sector's share of real GDP averaged 9.24 per cent over the 1982-1990 period. This figure, rounded to 9 per cent, will be used below.

Next, the elasticity of the demand for non-tradables with respect to real income, η, and with respect to relative prices, ε_{nt}, are required. No prior estimates of either elasticity exist for the Cook Islands, or indeed for any MIRAB country. Economic theory based on Engel's Law suggests that consumption of non-tradable commodities such as most services, rises more than proportionately with income. Thus, an income elasticity value greater than unity could be expected. However, some authors have suggested that, in South Pacific countries, imported consumer goods (including food) assume the role of 'status symbol' (e.g. Connell 1990, 1991a; Maitra 1992), which would imply a high marginal propensity to spend on tradables. If such propensity existed in MIRAB economies also, and if it was sufficiently large to offset an already-high average propensity to import (see table 2.3), a relatively income-elastic demand for tradables would ensue. Conversely, a low value for the income elasticity of demand for non-tradables would be expected. This possibility, however, is not borne out by a survey of remittance use in the Cook Islands (Loomis 1990, p. 77), which found that, as the average level of income in an island increased, the share of some tradables (e.g. food and drink) in the expenditure financed by these remittances diminished. In a survey of another high-remittances country, Brown (1994, p. 357) found that the main use of cash remittances in Western Samoa was the purchase and improvement of private dwellings, a non-tradable commodity.

Given the incremental income nature of remittances, the two above-mentioned studies may be interpreted as indirect evidence of an income–elastic demand for non-tradables. It could be argued, however, that expenditure patterns will differ when financed by rent income, such as remittances, and when financed by other sources of income.

Regarding ε_{nt}, the elasticity of demand for non-tradables with respect to their relative price, a negative value is expected. However, demand should not be very elastic, given the very large group of commodities involved.

In an attempt to ascertain the values of η and ε_{nt}, the absorption function postulated in appendix 8.3 was estimated econometrically, using Cook Islands data. The relationship hypothesised is:

$$C_{nt} = f(Y, \frac{P_{nt}}{P_t}) \qquad (9.1)$$

where C_{nt} = real absorption of non-tradables in terms of P_t

Y = real GDP in terms of P_t

$\frac{P_{nt}}{P_t}$ = relative price of non-tradables

Recalling that, in the non-tradables sector, production must equal absorption, *ex-post*, it is possible to use the observed real output of the non-tradables sector $(\frac{P_{nt}X_{nt}}{P_t})$ as a measure of C_{nt}. This sector is normally comprised of the following industries: electricity and water, construction, commerce, transport and communication, finance, public administration, health and education, and other services. However, 'Construction' was excluded from the estimate of X_{nt} on the grounds that its output includes both business and residential investment. Data sources and time-series used in the regression are given in appendix 9.1. The Ordinary Least Squares (OLS) estimate of the absorption function is presented in equation 9.2 below, in log-linear format:

$$\ln X_{nt} = -0.7611 + 1.0633^{**} \ln Y - 1.0667^{**} \ln\left(\frac{P_{nt}}{P_t}\right) \quad (9.2)$$
$$\qquad (-1.145) \quad (16.419) \qquad (-9.326)$$

t-values are in brackets

$\overline{R^2} = 0.995$

n = 8, df = 6

Durbin-Watson statistic = 0.716

** denotes significance at the 99.9 per cent level of confidence.

Inasmuch as is possible with an extremely small number of observations, equation 9.2 appears to confirm the relationship hypothesised in equation 9.1. Both the estimated slope coefficients have the expected sign, and are highly significant. The adjusted R-square value indicates that in excess of 99 per cent of the variation in X_{nt} can be explained by the regression equation. Since equation 9.2 is log-linear, it is possible to interpret the first and second slope coefficients as measures of income and relative price elasticities respectively. Accordingly, a value of 1.06 for η and -1.06 for $\varepsilon_{1,t}$ will be used subsequently.

As already mentioned, short run absorption is increased by the aid inflow. It was shown (see appendix 8.3) that the proportional change in C_{nt} is augmented, in the presence of aid, by an amount equal to $\frac{\sigma F}{P_t C_{nt}}$, a term which subsequently enters calculations of $\widehat{P_{nt}}^*$. In order to evaluate this term, it is necessary to obtain an estimate of σ, the proportion of aid spent on non-tradable commodities. Unfortunately, no information is available concerning the commodity composition of aid expenditure in the Cook Islands, or in other MIRAB countries. However, the national accounts of Kiribati (SPD) reveal that, on average between 1980 and 1988, 54 per cent of public capital expenditure consisted of payments for building and other construction activities[1]. The equivalent statistic was 59 per cent in Tuvalu (SPD: 1986-90 average). Given the predominantly non-tradable nature of these activities, and given that public capital expenditure is almost entirely financed by aid in these two countries, these percentages may be taken as a broad measure of the proportion of aid spent on non-tradable goods and services. It may be safely assumed that this proportion would be approximately of the same magnitude in the Cook Islands. Accordingly, an average figure of 0.56 is used for σ in the calculations below.

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[1] With the remainder spent on transport equipment and other equipment (i.e. tradables).

Finally, estimates of production function exponents α, β, γ, δ are required. The values of these parameters are clearly dependent upon the sectoral factor intensities in the economy under consideration. Since Cobb-Douglas production functions have been assumed, and since real factor rewards are assumed to be equal to their marginal products, the problem is equivalent to the estimation of functional income shares in each sector. As a rule of thumb, economy-wide shares are usually thought to fluctuate around 0.4 for capital and 0.6 for labour, a functional distribution which has proved remarkably stable in many contexts (see e.g. Spandau 1973, Douglas 1976). In the South Pacific, these values have been used by AIDAB (1992c) for Fiji, while Kioa (1993) assumed values of 0.3 and 0.7 for capital and labour respectively, in relation to PNG, Fiji and Tonga.

In order to obtain sectoral income shares for the Cook Islands, average weekly earnings by sector, for full-time male and female workers in cash employment, were combined with sectoral employment figures to yield estimates of the total wage bill in each sector. Each wage bill was then divided by the value of sectoral output (at current prices, excluding subsistence output), to yield an estimate of labour's share of income in two successive years. The relevant data, calculations, and sources are given in appendix 9.2, and the results are presented in table 9.1 below.

Table 9.1 **Estimation of labour income shares in the Cook Islands** (1989, 1990)

		Year	
	Sector	1989	1990
Income share	Tradables	0.69	0.78
accruing to labour	Non-tradables	0.52	0.52
	Weighted average*	*0.53*	*0.54*

* By output shares
Sources: See appendix 9.2.

The relative labour intensity of the tradables sector, in evidence in table 9.1, is not entirely unexpected given the nature of the Cook Islands' main exports (fruit and vegetables, pearlshell, clothing and footwear). This result is in accordance with predictions of the Heckscher-Ohlin model of international trade, since labour is likely to be the relatively more abundant factor in this country. More surprising, perhaps, is the value of the economy-wide labour share of income, somewhat below 0.6. This shortfall could be due to the fact that the income of unincorporated businesses contains a wage component, as well as interest, profit and rent components (Spandau 1973, p. 215). Since the implicit wage earned by business owners is not recognised in wages and salaries statistics, the labour share of income is likely to be biased downward. Given that in 1989 and 1990, around 9 per cent of all Cook Island enterprises were unincorporated (SPD), such bias in the figures presented is a distinct possibility. Thus, the true overall share of labour in income could be closer to 0.6 or even 0.7, with sectoral shares rising accordingly. Unfortunately, this supposition cannot be verified, due to the lack of data. Instead, estimates of sectoral income shares for use in the model are obtained by averaging the yearly values appearing in table 9.1, yielding:

$$\beta = 0.73 \qquad \text{and} \qquad \delta = 0.52 \tag{9.3}$$

which, in turn, implies:

$$\alpha = 0.27 \qquad \text{and} \qquad \gamma = 0.48 \tag{9.4}$$

With these four parameters, all the values required for the empirical estimation of the impact of aid in the unrestricted model have now been obtained. They are recapitulated in table 9.2 below.

Table 9.2 **Numerical estimates of parameters and variables used in the unrestricted model**

Parameter/Variable	Notation	Value
Weight of P_t in the CPI	θ	0.50
T sector's share of real GDP	λ	0.09
Income elasticity of absorption of non-tradables	η	1.06
Relative price elasticity of absorption of non-tradables	ε_{nt}	-1.06
Proportion of aid spent on non-tradables	σ	0.56
Capital's share of T sector output	α	0.27
Labour's share of T sector output	β	0.73
Capital's share of NT sector output	γ	0.48
Labour's share of NT sector output	δ	0.52

9.2.2 Results and simulations

By substituting the parametric values summarised above into equation 8.19, it is possible to obtain an estimate of $\widehat{P_{nt}}^*$, the proportional change in the equilibrium price of non-tradables. In the calculations, an arbitrary initial value of 100 is assigned to P_t, P_{nt} and, hence, to the CPI. Also, the value of the exogenous variable, $\frac{F}{P_tC_{nt}}$ is derived from the arbitrary assumption that the real aid inflow amounts to 10 per cent of real GDP[2]. Given the share of the NT sector in the Cook Islands ($1-\lambda = 0.91$), this means that aid represents ($\frac{10}{0.91}$ =) 10.98 per cent of the absorption/output of non-tradables. Finally, given the proportion of aid spent on non-tradables ($\sigma = 0.56$), aid leads to a (0.56×10.98 =) 6.1 per cent increase in the absorption of non-tradables. Hence a value of 0.061 is used for the $\frac{\sigma F}{P_tC_{nt}}$ term in equation 8.19.

Following the computation of $\widehat{P_{nt}}^*$, its value is used in equations 8.15 to 8.18 to obtain estimates of proportional changes in sectoral employment and output levels. All these results are reported in table 9.3 below.

Table 9.3 **Short run proportional changes in the unrestricted model**

Variable	Value (%)	Note
$\widehat{P_{nt}}^*$	25.04	from equation 8.19
$\widehat{L_{nt}}$	26.09	from equation 8.15
$\widehat{L_t}$	- 46.38	from equation 8.16
$\widehat{X_{nt}}$	13.56	from equation 8.17
$\widehat{X_t}$	- 33.85	from equation 8.18
$\widehat{Y}$ [a]	9.29	$= \lambda \widehat{X_t} + (1-\lambda) \widehat{X_{nt}}$

[a] Growth in GDP measured at constant prices.

As was expected, one of the short run effects of an aid inflow is to increase the equilibrium price of non-tradables. This increase then leads to the contraction of the tradables sector, and to the expansion of the non-tradables

[2] This percentage is not meant to reflect the actual value of the aid-to-GDP ratio in MIRAB countries which, as shown in table 1 2, is considerably higher. Rather, this arbitrary figure is chosen for simplicity, as it allows direct inter-country comparisons.

sector (see figure 8.4), with the former responding more strongly to the price change. In the case at hand, differences in the strength of sectoral responses can be entirely attributed to differences in factor intensity, since all other influences (including, coincidentally, θ) are equal for both sectors. As predicted in 8.2.2, the response is stronger in the more labour-intensive sector, T. In that sector, the reduction in size which aid causes is quite dramatic, with falls of about a third in output and almost half in employment. Despite the magnitude of this contraction, however, it can be seen that the overall growth rate of GDP, measured at constant, pre-aid, prices is strongly positive. This is undoubtedly attributable to the fact that sector NT's initial share of real GDP is ten times greater than that of sector T (0.91 as opposed to 0.09).

Once proportional changes are known, they can be applied to the initial values of the variables to derive absolute changes. This procedure is of particular interest in the area of employment, since it allows the change in the overall level of domestic employment to be computed. As can be seen in table 9.4, this level would increase by 755 persons or 16.35 per cent, other things remaining constant.

Table 9.4 **Short run absolute changes in the unrestricted model**

Variable	Initial value [a]	Change	Final value
L_{nt}	3 996	1,043	5,039
L_t	620	- 288	332
$L_{nt} + L_t$	4 616	755 (16.35%)	5,371
X_{nt}	80 478	10,913	91,391
X_t	6 613	-2,239	4,374

[a] Average of 1989 and 1990 values (see appendix 9.2).

The results presented in tables 9.3 and 9.4 are strongly dependent, in terms of their magnitude, on the value of the real wage elasticity of the demand for labour in each sector. As indicated in the previous chapter, this elasticity is equal to the reciprocal of the income share of capital, and hence is greater than unity (see 8.2.2). Given the estimates of α and γ appearing in table 9.2, these elasticities equal 3.7 and 2.08 in the T and NT sectors respectively. Undoubtedly, such values seem very high and, according to some authors (e.g. Solow 1980, p. 7), unrealistic. Empirical studies have shown (e.g. Haessel 1978, p. 33: footnote 3) this elasticity to be generally lower than 1, sometimes considerably so. However, such low values are inconsistent with the Cobb-Douglas production functions postulated in this model. Nonetheless, if low elasticities were found in the Cook Islands, the numerical results presented above would clearly be significantly reduced. Qualitative results, however, need not be affected as long as the tradables sector is assumed to have the more wage-elastic demand for labour.

The measurement of the impact of aid in the long run requires that the same series of steps be followed as in the short run, starting with the calculation of a value for $\widehat{P_{nt}}^*$. This value is obtained via equation 8.25 (see 8.2.3), in which parameters are replaced with the values appearing in table 9.2. In addition, it is assumed that aid leads to a 10 per cent expansion in the capital stock of each sector, thus $\widehat{K_{nt}}$ and $\widehat{K_t}$ are both set equal to 10 per cent initially in the calculations. This figure, it should be noted, is chosen for convenience, and is unrelated to the short run aid inflow previously assumed. Indeed, such an increase in sectoral capital stocks need not be the result of a single aid inflow, but could have been caused by a series of inflows. In the final analysis, the direction of the change in economic structure depends on the relative values, not the absolute values, of $\widehat{K_{nt}}$ and $\widehat{K_t}$. Finally, P_t, P_{nt}, and the CPI are once again set equal to 100 at first. The results of the calculations are reported in table 9.5 below.

Table 9.5 **Long run proportional changes in the unrestricted model**

Variable	Value (%)	Note
$\widehat{P_{nt}}^*$	2.46	from equation 8.25
$\widehat{L_{nt}}$	12.56	from equation 8.22
$\widehat{L_t}$	5.43	from equation 8.21
$\widehat{X_{nt}}$	11.33	from equation 8.24
$\widehat{X_t}$	6.66	from equation 8.23
$\hat{Y}$[a]	10.91	$= \lambda \widehat{X_t} + (1-\lambda) \widehat{X_{nt}}$

[a] Growth in GDP measured at constant prices.

The most significant phenomenon reflected in the results above, is the relative decline of the tradables sector, which occurs despite a positive rate of growth. The key to this outcome lies in the increase in the equilibrium value of P_{nt}. While its magnitude is considerably less than in the short run, this price increase nonetheless serves to restrict the expansion of the T sector below that which the increase in capital stock would have warranted. By contrast, the expansionary effects of capital stock growth in the NT sector are compounded by the price effect, resulting in an even larger output and employment growth. Not unexpectedly given this sector's share of GDP, the overall rate of constant-prices GDP growth is nearly as high as $\widehat{X}_{nt}$.

As in the short run, it is possible to translate the long run proportional changes discussed above into absolute values, subject to the caveats already mentioned in relation to the magnitude of the labour demand elasticities. These results are reported in table 9.6.

Table 9.6 **Long run absolute changes in the unrestricted model**

Variable	Initial value [a]	Change	Final value
L_{nt}	3,996	502	4,498
L_t	620	34	654
$L_{nt} + L_t$	4,616	536 (11.61 %)	5,152
X_{nt}	80,478	9,118	89,596
X_t	6,613	440	7,053

[a] As defined in table 9.4.

The initial values of the variables appearing in the table above are the same as in the short run. This is in accordance with the methodology used in the previous chapter, in which aid is considered to be a 'one-off' occurrence, allowing a temporary increase in absorption in the short run. If this first effect were to wane without bringing any long run expansion in capital stocks, the economy would revert to its original equilibrium. In contrast, relative and absolute changes brought about by aid that adds to capital stocks in the long run, are of a much more permanent nature. Capital stock expansion in each sector, combined with increases in sectoral employment levels, mean that the production possibility frontier of the economy has expanded. This, in turn, is synonymous with a greater capacity to generate income with which to absorb goods and services.

However, it should be noted that, in both the short run and the long run, relative changes in total output and total employment imply that average physical output per worker has fallen as a result of aid. As can be verified from the comparison of tables 9.3 and 9.4, and 9.5 and 9.6, the proportional increase in the sum of L_t and L_{nt} always exceeds that in Y measured at constant prices. This can be partly attributed to the rise in equilibrium P_{nt} which occurs in each period.

The effect of this price increase on own-product real wages means that the optimal capital-labour ratio increases in sector T and falls in sector NT. The net effect of these opposing changes on the the *economy-wide* capital-labour ratio and average physical productivity of labour are influenced by such factors as sectoral employment shares and sectoral labour intensities. The fall in the average product of labour in the present instance should not, therefore, be regarded as a result applicable to the impact of aid in general.

Given the greater permanency of the long run changes triggered by aid, it may be asked if the relative decline of the tradables sector, reflected in tables 9.5 and 9.6, could be avoided. This is a question which MIRAB proponents have already answered in the negative. In terms of the present model, this is akin to asking whether any plausible alteration in the sectoral allocation of aid would be capable of leading to the relative expansion of the tradables sector. In an attempt to answer this question, the computable model was run using alternative combinations of $\widehat{K_{nt}}$ and $\widehat{K_t}$. Originally arbitrarily set at 10 per cent, these instrumental variables are dependent on both the amount of aid received by each sector and on their existing capital stock. It is possible, therefore, that the reapportioning of the same overall amount of aid could lead to values of $\widehat{K_{nt}}$ and $\widehat{K_t}$ which would see the Dutch Disease process negated. An alternative, chosen here, is to assume that the amount of aid directed at the tradables sector is increased further, so that, while $\widehat{K_{nt}}$ remains at 10 per cent, $\widehat{K_t}$ is progressively increased in an attempt to reverse the relative decline of the tradables sector. However, this outcome is not simply a matter of achieving the highest possible value for $\widehat{K_t}$. As already noted in relation to the equilibrium $\widehat{P_{nt}}$ equation for the long run model (equation 8.25: see 8.2.3), a positive $\widehat{P_{nt}}^*$ is increased by a greater value of $\widehat{K_t}$, so that employment and output levels in the T sector (equations 8.21 and 8.23) are subjected to conflicting forces. Moreover, an increasing $\widehat{P_{nt}}^*$ value has a positive effect on the size of the non-tradables sector. It is conceivable, therefore, that no value of $\widehat{K_t}$ would be sufficient to reverse the decline of the tradables sector. The results of these simulations are presented in table 9.7 below, and are based on a constant $\widehat{K_{nt}}$ value of 10 per cent.

As this table indicates, the negation of the Dutch Disease process, in the long run, is only achievable in terms of output, not employment. With regard to the latter, the goal of increasing the share of the tradables sector is ruled out by sectoral responses to increases in P_{nt}. Specifically, it is not possible, through

Table 9.7 **Values of $\widehat{K_t}$ required for the relative expansion of the tradables sector** (unrestricted model)

Objective	$\widehat{K_t}$ value (%) required [a]	Accompanying values (%) of				
		$\widehat{P_{nt}}^*$	$\widehat{L_t}$	$\widehat{L_{nt}}$	$\widehat{X_t}$	$\widehat{X_{nt}}$
$\widehat{X_t} \geq \widehat{X_{nt}}$	$\widehat{K_t} \geq 28.08$	9.54	10.40	19.94	15.17	15.17
$\widehat{L_t} \geq \widehat{L_{nt}}$	Not achievable	n.a.	n.a.	n.a.	n.a.	n.a.

[a] Assuming $\widehat{K_{nt}}$ = 10 per cent.
Note: n.a. = not applicable.

increases in $\widehat{K_t}$, to overcome the employment effects of $\widehat{P_{nt}}^*$ on the tradables sector (negative) and on the non-tradables sector (positive). This conclusion must be qualified, however, in the light of the very high demand for labour elasticities at the centre of the model. If real elasticities were smaller than has been hypothesized here, the likelihood of a relative expansion of the tradables sector in terms of employment would rise accordingly.

Turning to the question of output, the feasibility of the required 28 per cent increase in sector T's capital stock is difficult to ascertain in the absence of sectoral capital stocks figures. In relative terms, this requirement is that the proportional increase in K_t be equal to almost three times that in K_{nt}. According to data shown by the World Bank (1991, p. 80), 60 per cent of New Zealand aid to five South Pacific countries was allocated to sectors which could be considered predominantly non-tradables[3]. Assuming that this percentage also applies to the Cook Islands (where New Zealand is the main bilateral donor), it may be concluded that the required 2.8:1 ratio of $\widehat{K_t}$ to $\widehat{K_{nt}}$ is unlikely to be met. However, the long-standing infrastructural bias of aid (see 2.3.3) means that the initial capital stock level is likely to be smaller in the T sector, so that even a relatively small amount of aid might result in a sizeable proportional change. In other words, it is not impossible that a fairly modest reapportioning of aid towards that sector could achieve the required result of negating the Dutch Disease. The feasibility of this reapportioning cannot, however, be quantified in the present model.

[3] Administration and Planning; Education, Health and Social; Economic Infrastructure; Trade, Finance and Tourism (loc. cit.).

It should be mentioned, finally, that increased values of $\widehat{K_t}$ relative to $\widehat{K_{nt}}$ may not represent the only counter-influence to the emergence of the Dutch Disease. If, for instance, there existed positive output externalities flowing from the non-tradables to the tradables sector, the infrastructural bias of aid would not be a great cause for concern. Such externalities could arise as a result of improved transport and communications, for example, or greater workers' skills. If, however, aid was also characterised by a strong urban bias, a mainly rural tradables sector may fail to reap the benefits of these externalities.

The comparative static results derived above appear to lend support to MIRAB proponents' contention that aid leads to the relative decline of the tradables sector. This is particularly true of the short run, when aid has not yet been translated into increases in productive capacity, and its spending effects alone are determining its impact. Yet, even in the long run, the Dutch Disease scenario appears the more likely one. While a relative expansion of the tradables sector cannot be ruled out in that period, the simulations carried out above reveal fairly stringent conditions for this outcome to eventuate, within the assumptions of the model. Even then, as these analyses showed, an increase in the tradables sector's share of domestic employment may not be within reach. Thus, in the context of the Cook Islands, and subject to the reliability of the numerical estimates used, indications are that aid will, in most cases, lead to the relative decline of the tradables sector.

9.3 Restricted emigration model

As with the unrestricted emigration model, the empirical verification of the general conclusions reached for the restricted emigration model must begin with the estimation of some parameters and variables. Since this model seeks to describe two MIRAB economies Kiribati and Tuvalu, comparative static results should ideally be derived for both. However, data constraints prevent the estimation of a complete set of parameters for Tuvalu. To use estimates derived for Kiribati in a Tuvalu model would be to run the risk of introducing a bias into the numerical results. It was decided, therefore, to attempt the empirical verification of the restricted model in relation to Kiribati only.

9.3.1 Estimation of parameters and variables

The empirical verification of the restricted model requires the estimation, in addition to the same parameters and variables as in 9.2.1 above, of sectoral employment levels and the total labour force. In brief, it is necessary to obtain values for all the entries on the RHS of equations 8.36 and 8.42 (see sections 8.3.2 and 8.3.3).

As in the previous section, the most readily estimated entry is θ, the weight of tradables (as defined in 9.2.1) in the CPI. Kiribati's consumer price index statistics (SPD) reveal this weight to be equal to 0.72. Accordingly, this value will be used henceforth, together with a value of 0.28 for (1-θ).

The value of λ, the T sector's share of real GDP (measured in terms of P_t) is equally easily measured, from Kiribati's national accounts and price statistics (SPD). Between 1980 (the first year after the end of phosphate mining) and 1988 (the last year for which subsistence output can be excluded from GDP), this share averaged 20.2 per cent. This value, rounded to 0.2, will therefore be used henceforth.

Next, values for η and ε_{nt}, the elasticities of the absorption of non-tradables with respect to real income and relative prices respectively, are required by the analysis. As no prior estimates of these elasticities exist, the same functional form as in the Cook Islands (see equation 9.1) is tested for Kiribati, using linear regression analysis on data pertaining to the 1980-1988 time period. Once again, the *ex-post* equality between the supply and absorption of non-tradables is used to obtain a measure of C_{nt}. The data for the regression are given in appendix 9.1, and results are reported in equations 9.5 below:

$$\ln X_{nt} = \underset{(2.487)}{6.9041} + \underset{(1.010)}{0.2828} \ln Y + \underset{(1.003)}{0.3498} \ln\left(\frac{P_{nt}}{P_t}\right) \qquad (9.5)$$

t-values are in brackets

$\overline{R^2} = 0.3535$

n = 8, df = 6

Durbin-Watson statistic = 2.574

No clear picture emerges from the OLS estimates presented above. None of the slope coefficients appearing in equation 9.5 is significant and, in the case of the relative price elasticity, the sign of the coefficient is not as expected. Both these problems could be due to a number of factors, such as the extreme shortness of the time-series used, or the omission of a relevant variable. Less plausibly in the light of the estimated Cook Islands equation, the problems encountered could be a reflection of a genuine lack of causality between the variables. The absence of a sufficient number of observations precludes the verification of that last possibility. There is, however, no *a priori* reason to believe that the determinants of absorption will differ between Kiribati and the Cook Islands. Furthermore, if the determinants are the same, the two elasticities may be assumed to have similar values in both countries. For these reasons, it was decided to use elasticity values derived for the Cook Islands, that is, η = 1.06 and ε_{nt} = -1.06, in the following calculations.

As mentioned in section 9.2.1, it is possible to use the percentage of public capital expenditure directed at non-tradables commodities, equal to 54 per cent in Kiribati (see 9.2.1), as a proxy for the proportion of aid spent on this class of goods. Accordingly, a value of 0.54 for σ is used below.

Next, estimates of sectoral factor intensities are needed. Since no data on sectoral earnings are available for Kiribati, the following estimation procedure was adopted:

(i) national accounts figures for the compensation of resident employees were obtained for 1987 and 1988; in terms of the restricted model, these figures measure the total wage bill (B) in each year:

$$B = L_t W_t + L_{nt} W_{nt} \qquad (9.6)$$

(ii) in accordance with the Harris-Todaro hypothesis, it was assumed that earnings in the tradables sector were equal to the expected value of non-tradables sector earnings, that is:

$$W_t = \frac{L_{nt}}{L_u} W_{nt} \qquad (9.7)$$

(iii) using equation 9.7 to substitute for W_t in equation 9.6, it is possible to show (see appendix 9.3) that:

$$W_t = \frac{B}{\overline{L}} \qquad (9.8)$$

(iv) multiplying the result of equation 9.8 by sector T's employment figure, an estimate of that sector's wage bill can be obtained; by subtracting that sectoral wage bill from B, the NT sector's wage bill is then inferred;

(v) dividing each sector's wage bill by the value of its output (at current prices, excluding subsistence), estimates of labour's sectoral income shares are obtained.

The data, sources, and calculations pertaining to this estimation procedure are given in appendix 9.4, while its results are reported in table 9.8.

Table 9.8 **Estimates of labour income shares in Kiribati** (1987, 1988)

		Year	
	Sector	1987	1988
Income share accruing to labour	Tradables	0.84	0.41
	Non-tradables	0.53	0.50
	Weighted average*	*0.59*	*0.47*

* By output shares.
Sources: See appendix 9.4.

As is apparent from the table, a significant reduction in labour's income share in the T sector, between 1987 and 1988, does not permit unambiguous conclusions to be drawn, initially, regarding relative factor intensities in the Kiribati economy. It should be remembered, however, that compensation of employees statistics can only reflect imperfectly the importance of labour as a factor of production in each sector. This type of bias is likely to be greater in the tradables sector, where a large number of cash employment workers are self-employed farmers and fishermen, whose labour does not attract an explicit wage. In the non-tradables sector, the existence of unincorporated businesses means that a similar bias may exist, albeit a weaker one given the prevalence of wage employment.

A further bias is almost certainly introduced, in the estimation of the labour share in the tradables sector, by fluctuations in agricultural production. Copra output, in particular, was especially low in 1987, both in volume and value terms (AIDAB 1992a, p. 63). Conversely, in 1988, a record level of production and exports was recorded, equivalent to about three times that of the previous year (four times in value terms). Since the number of workers engaged in copra production is not likely to have fluctuated to the same extent over those two years, the labour shares shown in table 9.8 probably suffer from both an upward (in 1987) and a downward (in 1988) bias. Data are unfortunately unavailable to allow the calculation of the labour share in a 'normal' year. However, if a two-year average is taken of the 1987 and 1988 values, the result points to a relatively labour-intensive tradables sector, which appears plausible given the large overlap between the tradables and agricultural sectors in Kiribati (see e.g. table 8.1). Accordingly, such an average is used to calculate labour shares of sectoral income in both sectors. Thus, after rounding:

$$\beta = 0.62 \qquad \text{and} \qquad \delta = 0.51 \tag{9.9}$$

and:

$$\alpha = 0.38 \qquad \text{and} \qquad \gamma = 0.49 \tag{9.10}$$

Finally, 1987-88 averages of the values of $\bar{L}$, L_{nt}, and L_t used in the estimation of the parameters above (see appendix 9.4) will be used for the calculation of comparative static results in sub-section 9.3.2. These labour force and employment figures are, however, only speculative, since they are derived from 1990 figures, deflated by the rate of overall population growth.

The values of the parameters and variables used in the empirical estimation of the restricted emigration model are recapitulated in table 9.9.

9.3.2 Results and simulations

The approach adopted below is identical to that used in section 9.2, consisting in the calculation of short run and long run results using the parametric values listed above, followed by the implementation of selected simulations. Letting once again $P_t = P_{nt} = CPI = 100$ initially, and assuming an aid inflow equivalent to 10 per cent of real GDP[4], the results obtained for the short run period are as reported in table 9.10.

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[4] Given the values of λ and σ used in this second model, this aid inflow represents an increase in absorption of non-tradables of $(\frac{10 \times 0.54}{0.8} =)$ 6.7 per cent, hence a value of 0.067 used for $\frac{\sigma F}{P_t C_{nt}}$ in the calculations.

Table 9.9 **Numerical estimates of parameters and variables used in the restricted model**

Parameter/Variable	Notation	Value
Weight of P_t in the CPI	θ	0.72
T sector's share of real GDP	λ	0.20
Income elasticity of absorption of non-tradables	η	1.06
Relative price elasticity of absorption of non-tradables	ε_{nt}	-1.06
Proportion of aid spent on non-tradables	σ	0.54
Capital's share of T sector output	α	0.38
Labour's share of T sector output	β	0.62
Capital's share of NT sector output	γ	0.49
Labour's share of NT sector output	δ	0.51
Total formal sector labour force	$\bar{L}$	11,084
Employment in sector T	L_t	2,979
Employment in sector NT	L_{nt}	7,423

Table 9.10 **Short run proportional changes in the restricted model**

Variable	Value (%)	Note
$\widehat{P_{nt}}^*$	10.57	from equation 8.36
$\widehat{L_{nt}}$	15.54	from equation 8.31
$\widehat{L_t}$	- 24.75	from equation 8.34
$\widehat{L_u}$	9.09	from appendix 8.6 [b]
$\widehat{X_{nt}}$	7.92	from equation 8.32
$\widehat{X_t}$	- 15.34	from equation 8.35
$\hat{Y}$ [a]	3.27	$= \lambda \widehat{X_t} + (1-\lambda) \widehat{X_{nt}}$

[a] Growth in GDP measured at constant prices. [b] Result B.

As in the unrestricted model, the short run effects of an aid inflow result in the simultaneous expansion of the non-tradables sector and contraction of the tradables sector. This pattern of change can be traced to the 10 per cent increase in the equilibrium price of non-tradables, which serves to handicap the T sector and stimulate the NT sector. In this model also, the tradables sector is relatively labour-intensive, which explains why it responds much more strongly to the change in P_{nt} caused by aid. In terms of output (and ignoring signs), that sector's response is almost double that of the NT sector. Regarding the impact on the overall level of economic activity, the net outcome of these opposite-sign sectoral changes is an increase in real GDP at constant prices of 3.27 per cent only, reflecting the fact that initial output shares are not as unequal as in the case of the Cook Islands (see 9.2.2).

When the proportional changes appearing in table 9.10 are translated into absolute values, the following results are obtained (see table 9.11):

Table 9.11 **Short run absolute changes in the restricted model**

Variable	Initial value [a]	Change	Final value
L_{nt}	7,423	1,154	8,577
L_t	2,979	- 737	2,242
$L_{nt} + L_t$	10,402	417 (4.0%)	10,819
Unemployment	682	- 417 (-61.1%)	265
X_{nt}	25,263	2,001	27,264
X_t	8,647	-1,326	7,321

[a] Average of 1987 and 1988 values (see appendix 9.4). [b] Equal to $(\bar{L} - L_{nt} - L_t)$.

Absolute changes in the key variables provide ample illustration of the Dutch Disease effects of aid in the short run. As can be seen by comparing initial and final values, the tradables sector's shares of total employment and output fall, from 29 to 21 per cent, and from 25 to 21 per cent respectively. On the positive side, however, absolute changes in sectoral employment result in a 61 per cent reduction in the number of unemployed workers. Perhaps unexpectedly, therefore, the internal migration of rural workers to the urban sector has been accompanied by a fall in urban unemployment. This is confirmed by the larger value of $\widehat{L_{nt}}$ compared with $\widehat{L_u}$ in table 9.10. Thus, it must be the case that the L_{nt}/L_u ratio has risen, and that therefore, the real wage of remaining T sector workers, measured in terms of their consumer purchasing power (W_t/CPI; henceforth referred to as the 'perceived real wage') has risen also[5]. By contrast,

[5] Since $W_t = \frac{L_{nt}}{L_u} W_{nt}$, it must be the case that $\widehat{W_t} = \widehat{L_{nt}} - \widehat{L_u} + \widehat{W_{nt}}$ (see appendix 8.6: Result A). By definition, however, $\widehat{W_{nt}} = \widehat{CPI}$. Thus, if $\widehat{W_{nt}}$ is replaced with $\widehat{CPI}$ in the expression for $\widehat{W_t}$, it follows that $\widehat{W_t} > \widehat{CPI}$ whenever $\widehat{L_{nt}} > \widehat{L_u}$.

the perceived real wage of NT sector workers must have remained constant, since it is, by definition, indexed to changes in the CPI. Given that W_t has been shown (see appendix 9.3) to measure also the average labour income per member of the total labour force (employed + unemployed), it follows that the average labour income has increased in line with W_t/CPI. This increase can be shown (see appendix 9.5) to have equalled 6.45 per cent.

Long run effects of aid in the restricted model are now computed. Letting once again $\widehat{K_t}$ and $\widehat{K_{nt}}$ equal 10 per cent initially, and setting $P_t = P_{nt}$ = CPI = 100, the following proportional changes are obtained (see table 9.12):

Table 9.12 **Long run proportional changes in the restricted model**

Variable	Value (%)	Note
$\widehat{P_{nt}}^*$	- 2.84	from equation 8.42
$\widehat{L_{nt}}$	5.81	from equation 8.37
$\widehat{L_t}$	- 1.62	from equation 8.40
$\widehat{L_u}$	0.59	from appendix 8.6 [b]
$\widehat{X_{nt}}$	7.86	from equation 8.38
$\widehat{X_t}$	2.79	from equation 8.41
$\hat{Y}$ [a]	6.85	$= \lambda \widehat{X_t} + (1-\lambda) \widehat{X_{nt}}$

[a] Real GDP growth measured at constant prices. [b] Result B.

The salient result in this table is the fall in the equilibrium price of non-tradable goods. This may be intuitively seen as an indication that the injection of capital into the NT sector has allowed its output to grow sufficiently, in the first instance, to outweigh the increase in demand generated by a higher real income level in the economy. In spite of the fact that the price movement has favoured the tradables sector, table 9.12 shows that this sector has once again experienced a relative decline. Furthermore, in contrast to the long run unrestricted model (see table 9.5), this decline is now also absolute with respect to employment. The key to this phenomenon lies in the contradictory forces affecting the size of the tradables sector in the restricted model. On the one hand, an increase in sector T's capital stock and, in the present case, a fall in P_{nt}^*, combine to lift employment in the T sector. On the other hand, however, the expansion of the NT sector causes the T sector to contract, *ceteris paribus*, due to a rise in the latter's own-product real wage (see figure 8.8). Ultimately, this contractionary force was sufficiently strong for the tradables sector to experience an absolute fall in the number of its workers.

The conversion of proportional changes into absolute changes yields the following results (see table 9.13):

Table 9.13 **Long run absolute changes in the restricted model**

	Initial value [a]	Change	Final value
L_{nt}	7,423	431	7,854
L_t	2,979	- 48	2,931
$L_{nt} + L_t$	10,402	383 (3.7%)	10,785
Unemployment	682	- 383 (- 56%)	299
X_{nt}	25,263	1,986	27,248
X_t	8,647	241	8,888

[a] Defined as in table 9.1[illegible].

As was the case in the short run, the employment impact of aid is a beneficial one, with the number of unemployed workers falling by more than half. While this reduction is marginally smaller than that achieved in the short run (see table 9.11), it is obviously more durable. It is also achieved through considerably less rural emigration than in the short run: only 48 workers leave the tradables sector, as opposed to 737 in the short run (see table 9.11). From the values of $\widehat{L_{nt}}$, $\widehat{L_u}$, and $\widehat{P_{nt}}$, it can be shown that the perceived real wage of the remaining T sector workers has increased by 5.22 per cent (see appendix 9.5). As already mentioned, this figure also measures the proportional change in the average labour income per member of the total labour force. Moreover, in contrast to the unrestricted model, the economy-wide average physical product of labour has increased in the long run restricted model. As can be seen from tables 9.12 and 9.13, the proportional increase in total output (at constant prices) exceeds that in total employment (L_t+L_{nt}). This is due, in part, to the fact that the long run equilibrium price of non-tradables has fallen, causing that sector's own-product real wage and hence its capital-labour ratio to rise.

The analysis of the long run changes in the restricted model underlines the fact that a fall in the price of non-tradables is not always sufficient to avoid the onset of the Dutch Disease. As illustrated in tables 9.12 and 9.13, the expansion of sectoral capital stocks can still result in the relative decline of the tradables sector, notwithstanding the negative value of $\widehat{P_{nt}}^*$. This outcome, however, rests upon the initial assumption that sectoral capital stocks have both been expanded by 10 per cent. As in the case of the unrestricted model, it is of interest to establish whether any plausible alteration in aid-financed investment could allow the decline in tradables output or employment to be avoided. To this end, the computable model was run with alternative values of $\widehat{K_t}$, while keeping $\widehat{K_{nt}}$ constant at 10 per cent. The results of this simulation are reported in table 9.14 below.

Table 9.14 **Values of $\widehat{K_t}$ required for the relative expansion of the tradables sector** (restricted model)

Objective	$\widehat{K_t}$ value (%) required [a]	Accompanying values (%) of				
		$\widehat{P_{nt}}^*$	$\widehat{L_t}$	$\widehat{L_{nt}}$	$\widehat{X_t}$	$\widehat{X_{nt}}$
$\widehat{X_t} \geq \widehat{X_{nt}}$	$\widehat{K_t} \geq 37.70$	3.59	10.40	-2.62	12.69	12.69
$\widehat{L_t} \geq \widehat{L_{nt}}$	Not achievable	n.a.	n.a.	n.a.	n.a.	n.a.

[a] Assuming $\widehat{K_{nt}}$ = 10 per cent.
Note: n.a. = not applicable.

As table 9.14 indicates, the negation of the relative decline in tradable output, in the long run, would require a proportional increase in that sector's capital stock of 37.7 per cent. Such an increase is, however, not feasible given the assumptions underlying the restricted model, and given the 10 per cent increase in K_{nt}. As inspection of figure 8.3 will confirm, it is possible for K_t to increase to such an extent that no unemployment remains in the economy. Graphically, such a stage is reached when the L_t^2 and L_{nt}^2 employment levels coincide, and both sectors face the same nominal wage rate ($W_t = W_{nt}$). Given that this wage rate is institutionally determined, further expansions in either sectoral capital stock could not lead to a competitive nominal wage increase, and to the movement of labour from one sector to the other. Thus, with nominal wages and prices fixed, each sector faces a constant own-product real wage which, given profit maximisation, requires a constant capital-labour ratio. It follows that any further addition to sectoral capital stocks will be redundant, and that sectoral outputs must therefore remain constant. In the present model, this stage is reached when $\widehat{K_t}$ is increased to 22.3 per cent, that is, *before* the value required to reverse the Dutch Disease (37.7 per cent: see table 9.14).

The previous result is, however, based on the assumption that $\widehat{K_{nt}}$ is equal to 10 per cent. If this variable was arbitrarily set at 1 per cent, say, the required $\widehat{K_t}$ value would be only 3.7 per cent Following these capital stock increases, the total supply of labour would not be exhausted and, therefore, the decline of the tradables sector in terms of output could be averted. Such a result could not be repeated in terms of unemployment, however, irrespective of the initial value chosen for $\widehat{K_{nt}}$. Undoubtedly, the reason for this impossibility lies once again with a labour-intensive tradables sector facing a rising own-product real wage. The latter is due to the fact that P_{nt} starts to rise when $\widehat{K_t}$ is increased while $\widehat{K_{nt}}$ is kept constant (see equation 8.42). This, in turn, triggers a chain reaction which sees the demand for labour increase in the non-tradables sector and W_t/P_t rise (see figure 8.8). In the case at hand, the rise in W_t/P_t is such as to disallow any increase—absolute and relative—in T sector employment, irrespective of the value of $\widehat{K_t}$ (data not shown). The validity of this result is, however, subject to the caveats already expressed regarding the high labour demand elasticity values implicit in the model.

Returning to the feasibility of a relative expansion in tradables output, it must be noted that the required $\widehat{K_t}$ to $\widehat{K_{nt}}$ ratio is higher than in the unrestricted model (3.7 v. 2.8). This is expected since, in the present model, an increase in K_t is accompanied by a rise in L_t, but also by a rise in W_t/P_t which serves to reduce L_t (see figure 8.8). The net effect of these opposing forces is that X_t rises more slowly than in the unrestricted model. The greater value of the required ratio in the restricted model makes its achievement even less likely. As mentioned in section 2.3.3 (see table 2.9), aid-financed capital expenditure is largely of an infrastructural, social, and administrative nature in Kiribati, with 15 per cent only directed at production sectors. Even if it is assumed that the output of these sectors is entirely tradable, such a sectoral allocation of aid makes it doubtful whether a relative expansion of the tradables sector is feasible in that country.

The simulation exercises carried out above can provide some indication of the robustness of the qualitative conclusions based upon the numerical results presented in tables 9.12 and 9.13. In brief, these results unanimously point towards a change in economic structure consistent with Dutch Disease expectations, following an injection of aid. By outlining the conditions required for an avoidance of this change the simulations are able, indirectly, to confirm its likely occurrence, when plausible assumptions are made regarding key exogenous variables. The magnitude of the change in economic structure, that is, the magnitude of the relative decline of the tradables sector, will naturally depend on the precise values used in the calculations, as well as on the functional forms of the production functions. Given the arbitrary choice of the latter, and given the paucity of the data used in estimating some of the parameters and variables, a degree of caution must be exercised in interpreting the results presented above. They are, at best, order-of-magnitude indicators of the sectoral and economy-wide impact of aid. At worst, they are simply indicators of the likely direction of change in some of the variables.

9.4 Conclusion

In this chapter, an empirical verification of the two MIRAB models developed in chapter 8 has been performed, with a view to quantifying and clarifying some of the general results obtained previously. Following the derivation of numerical estimates for the parameters and variables appearing in each model, comparative static results were calculated and simulation exercises carried out in each case. The main results obtained in this chapter are summarised in table 9.15 below, to allow their comparison.

From this recapitulative table, the prevalence of Dutch Disease effects, following an injection of aid, is apparent. Even when the tradables sector is growing in absolute terms, it is experiencing a decline in relative terms as a result of the structural effects of aid. In a further symptom of the disease, real exchange rate appreciation[6] is experienced in all cases except the long run restricted model. Thus, the results obtained in this chapter and summarised above, offer broad support to the contention of MIRAB theorists that the impact of aid on the economic structure of the recipient is to hinder the tradables sector. Simulation exercises carried out in this chapter confirm the likelihood of such an outcome. While the decline of the tradables sector would normally be considered detrimental to growth in most developing countries, primarily because of foreign exchange earning considerations, this need not be the case in MIRAB countries. This is because their capacity to export—or to compete with imports—cannot be considered a growth-limiting factor, as long as foreign aid and other forms of external income are available to finance imports. Thus, it is possible for a country to reap real benefits from aid, notwithstanding a growing trade imbalance and lop-sided economic structure. Among such benefits, the

[6] Caused by an increase in P_{nt}, with P_t remaining constant.

Table 9.15 **Summary of numerical results**

Unrestricted Emigration Model		Impact of aid on:						
		P_{nt} %	L_t %	L_{nt} %	X_t %	X_{nt} %	W/CPI [c] %	Domestic employment (%)
	Short run [a]	25.04	-46.38	26.09	-33.85	13.56	0	16.35
	DD compatible	yes	yes	yes	yes	yes	n.a.	n.a.
	Long run [b]	2.46	5.43	12.56	6.66	11.33	0	11.61
	DD compatible	yes	yes	yes	yes	yes	n.a.	n.a.
Restricted Emigration Model		**Impact of aid on:**						
		P_{nt} %	L_t %	L_{nt} %	X_t %	X_{nt} %	W_t/CPI [d] %	Unemployment (%)
	Short run	10.57	-24.75	15.54	-15.34	7.92	6.45	-61
	DD compatible	yes	yes	yes	yes	yes	n.a.	n.a.
	Long run [b]	-2.84	-1.62	5.81	2.79	7.86	5.22	-56
	DD compatible	no	yes	yes	yes	yes	n.a.	n.a.

[a] Assuming a real aid inflow equal to 10 per cent of real GDP. [b] Assuming $\widehat{K_t} = \widehat{K_{nt}} = 10$ per cent. [c] Economy-wide perceived real wage. [d] Perceived real wage in the T sector.
Notes: n.a. = not applicable.
DD compatible = compatible with the Dutch Disease theory prediction of a relative decline in the tradables sector.

increase in domestic employment, and hence the reduction in unemployment in the restricted model) or emigration (in the unrestricted model) are significant. In addition, decreased unemployment in the restricted model is accompanied by an increase in average income per available worker, measured in terms of purchasing power. If it can be assumed that population figures remain constant, a rise in real GDP per capita would follow the injection of aid in both models, since real output increases. However, the impact of aid on economy-wide average labour productivity is indeterminate since it depends on the direction of change in the equilibrium price of non-tradable commodities.

The benefits of aid notwithstanding, it is conceivable that island governments will wish to avoid any contraction of the tradables sector. From a demographic perspective, this contraction is accompanied, in the restricted model, by a concurrent rise in the size of the urban/non-tradables sector workforce, a phenomenon which may be judged undesirable in countries already faced with overcrowded urban areas. Economically, the decline of the tradables sector may be combated in order to preserve the existing export and import-competing base. The Dutch Disease literature offers a number of policy options which can be implemented to cancel or dampen the effects of a boom. According to van Wijnbergen (1984), production subsidies to the non-booming tradables sectors are appropriate if it is not possible to use part of the foreign exchange windfall to accumulate foreign assets. If part of the windfall can be sterilised through its saving overseas, domestic expenditure need not increase, so that the real exchange rate need not be affected. It may be argued that this second course of action is the one chosen by Kiribati and Tuvalu: as suggested in section 6.3.2, these countries' re-investment of part of their trust fund income is really equivalent to saving part of their aid allocation. Another method, proposed by Snyder (1992), is to absorb a permanent shock, such as that provided by yearly large foreign aid inflows, by letting imports increase. This can be done by removing any existing import controls. A third policy, consisting in preventing a real exchange rate appreciation through nominal exchange rate management and/or inflation control (Corden and Neary 1982; Snyder 1992), is not readily available to MIRAB economies given their exchange rate regime and vulnerability to imported inflation.

According to country studies by Gelb et al. (1988), some oil-exporting countries such as Indonesia were successful in avoiding a contraction in their (non-oil) tradable goods sectors through a judicious use of windfall gains. Other countries, such as Trinidad and Tobago, were not so successful, so that the termination of the oil boom revealed economies in a precarious position, with little foreign exchange earning capacity remaining. This may be, ultimately, the dilemma faced by MIRAB countries: as with oil, the benefits which aid can provide may not outlast it. If aid ceased, or was drastically reduced, the relative decline in the tradables sector experienced during the aid 'boom' might constitute a daunting obstacle on the recipient's road to self-sustaining growth, which would then be as arduous as any travelled by other isolated, resource-poor developing countries.