

FLUCTUATING INTERNATIONAL EXCHANGE RATES AND SECTORAL  
RATES OF RETURN IN SMALL OPEN ECONOMIES

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by

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This study sets out to determine the effects of flexible exchange rates among major industrial countries on the profitability of exporting sectors in less developed countries. The recent considerable variation in dollar/sterling exchange rates has made this a question of prime importance to Caribbean countries. Because exports to different countries are sold under different marketing arrangements, we need to specify the institutional framework in order to arrive at useful analyses of the impact of fluctuating exchange rates.

There has been considerable interest in the income distribution consequences of exchange rate changes and changes in tradable prices in less developed countries. Much of the work has been addressed to the functional distribution of income, but there has been some work on the sectoral distribution of income as well (see Knight [1976] and Corden and Neary [1982]). There have also been some attempts at empirical estimation (see Twomey [1982] and De Melo and Robinson [1982]). The income distribution effects have been seen as ends in themselves, as a necessary condition in order to explain real outcomes (Metcalf and Steedman ([1982]), and to explain policy reactions (Cassing and Warr [1982] as well as De Melo and Robinson already mentioned). Most of these studies have looked at real incomes and have measured

effects via factor price adjustment and relative price adjustments which affect expenditure. The results depend on factor intensities and spending propensities.

For our purposes, it is proposed to set up a model where the wage rate is the same for all export sectors so that we may concentrate on the effect of exchange rate changes on the rate of profit. The effects will depend on the marketing arrangements in each sector; on the exchange rate strategy pursued by the country; on the way in which output in each sector changes in response to exchange rate changes; on the output per unit of capital and labour; on the use of imported and domestic inputs per unit of labour; on the way in which factor use and input usage changes with increases in output; on the response of wage rates to changes in output and prices and on the effect of exchange rate changes on domestic prices.

In setting up a methodology which can deal with these effects, we establish three types of export market. In the first place we have a sector which is a price taker on export markets. The output in this sector is determined entirely by the shape of the supply curves. A second export sector is similar, except for the long supply lags characteristic of agriculture. Thirdly, we have markets for which the export demand conditions are important, where we can expect some price adjustment and output adjustment as exchange rate changes. The fourth type of market is one where output is given by a fixed quota and we can therefore expect no supply response to price changes.

We proceed to set down equations which might serve to explain output determination in export sectors in section 2 of the paper. In each sector the rate of profit varies with price, output and factor use. The several export equations enable us to show how the determinants of profit are influenced by exchange rate changes. In the third section of the paper we illustrate how one might measure the effects of exchange rate variation, using Barbados data.

#### The Factors Affecting Exports and Profitability

Output in the 'tourism' sector is determined on the demand curve, with the supply of hotel accommodation fixed in the short run. (Tourism is the major sector we believe to be demand-driven in the Caribbean.) The demand for tourism services is given by

$$(1) q_h = q_h (y_i, P+e_i-P_i-e, P+e_j-P_j-e); i=1,2,\dots j=1,2,\dots$$

where the  $q$ 's are constant values of tourism services,  $y$  is an index of real income in the tourists' countries of origin, the  $i$  are the countries of origin, the  $j$  are rival tourism destinations with comparable facilities,  $e$  is the value of domestic currency in terms of a numeraire and  $e_i$  and  $e_j$  the values of currencies  $i$  and  $j$  in terms of the same numeraire.  $P_i$  is the general consumer price in  $i$ , while  $P_j$  is the price of tourism services offered by  $j$ . Demand varies with income, the prices of tourism services

relative to other things in the tourist's budget, and the relative prices of competitive tourism packages.

In the 'mineral' sector (which includes some manufacturing) the multi-national corporations which manage operations have global output targets which, from the point of view of the small economy, may be taken for granted. The desired output will be allocated among the companies' facilities in many countries according to changes in marginal domestic costs. The principal local costs are wages and official levies, giving the following equation for determining output:

$$(2) \quad q_1 = q_1(q_1^*, w + e_1 - w_1 - e, tl - e - tl_1 + e_1)$$

where  $q_1^*$  is the company's global target output,  $w$  an index of domestic wages,  $w_1$  wages in alternative producing locations and  $tl$  a measure of the tax liability per unit of output.

In the manufacturing sector the demand is boundless in comparison with the amount that may be supplied by the producers in the small economy. However, the selling price is fixed, and output will be limited to the volume that may profitably be produced at that price:

$$(3) \quad q_f = q_f(P_i - e_1 + e, (1 + ti)P_m, w, r)$$

This is the equation of the supply function, with  $P_i$  the product price measured in foreign currency,  $P_m$  the price index for imported raw materials,  $ti$  the tariff on these materials,  $w$  an index of unit labour costs and  $r$  the cost of financing working capital.

In the agricultural sector output varies with non-economic factors which affect the yield from any given acreage. Yields vary with the weather, the incidence of plant disease and infestation and changes in husbandry. Actual output corresponds to the farmer's intentions only by accident. Those intentions may be governed by economic factors. We assume that agricultural exports face demand conditions similar to those for manufacturing and that farmers will gear their plantings along a supply function to a level suggested by the ruling market price. These intentions come to fruition in some future time period. Current output reflects decisions of a previous period, based on anticipated prices and costs in the current period. Expectations are assumed to have been based on earlier performance. Output therefore depends on a supply function whose arguments are lagged costs and prices, together with the non-economic factors affecting yields:

$$(4) \quad q_a = q_a(P_i(-t) - e_1(-t) + e(-t), P_m(-t), w(-t), r(-t), z_1, z_2, \dots), t = 1, 2 \dots)$$

where  $P_i$  are the prices of agricultural products sold to country  $i$  and  $t$  indicates the time period; the  $z$ 's are measures of the non-economic factors affecting output.

The factor price equation for sector  $i$  may be written

$$(5) \quad \sum_j p_j^i e_j q_j^i = r_i K_i + w_s L_i + \sum_j p_j^m e_j^i m_j^i + p_v^d q_v^i;$$

$p^i$  and  $p^m$  are the prices of product  $i$  and imports, respectively,

in each of the  $j$  markets on which outputs may be sold or inputs procured.  $q^i$  is the output of the  $i$ -sector, while  $q_i$  is the volume of domestic input used in that sector and  $m^i$  the volume of imports used.  $r_i$  is the return on capital (which may vary between sectors) while  $w$  is the wage rate, assumed to be the same for all sectors. From the above we may derive

$$\partial r_i / \partial e_j = \left\{ \beta_{1j} i_j [1 + 1/\sum_j q^i_j] - \beta_{2j} m^i_j + \beta_{2j} p_j^m q^i_v \right\} / K$$

$\beta_{2j}$  is a co-efficient which measures the effect of exchange rate fluctuations on domestic demand. It may be derived from the implicit supply function of local goods:

$$(7) \quad P^v = P^v(q^v, P_j^m e_j, w, r)$$

In order to simplify our problem a little we assume that  $r^v$  is not especially affected by exchange rate changes.

The ways in which the arguments of equation (6) change as  $e_j$  changes can be deduced from equations (1) to (4), and they will vary from sector to sector. For example, in the case of price-takers, the  $P_j^i$  will change by exactly the amount of the change in  $e_j$ , whereas in the case of tourism a contraction or expansion in demand might result in a higher or lower price change. Combining the equations of this model therefore enables us to simulate the effects of any changing constellation of exchange rates.

#### A Test with Barbadian Data

The model was tested on Barbadian data for the period 1958 to 1984. Three export sectors were considered - tourism, where output is demand-determined, manufacturing, where prices are given and output depends on the supply curve, and sugar, where output responds with a lag of one to one and a half years, and is subject to secular and random influences (weather, harvesting practices, labour market conditions). Only the two most important markets are considered - the UK and the US. Profit functions are estimated for each commodity on each market, in the form shown in equation 6. The elasticities of prices and output with respect to exchange rate changes are derived from estimates of slightly modified versions of equations (1), (2) and (4).

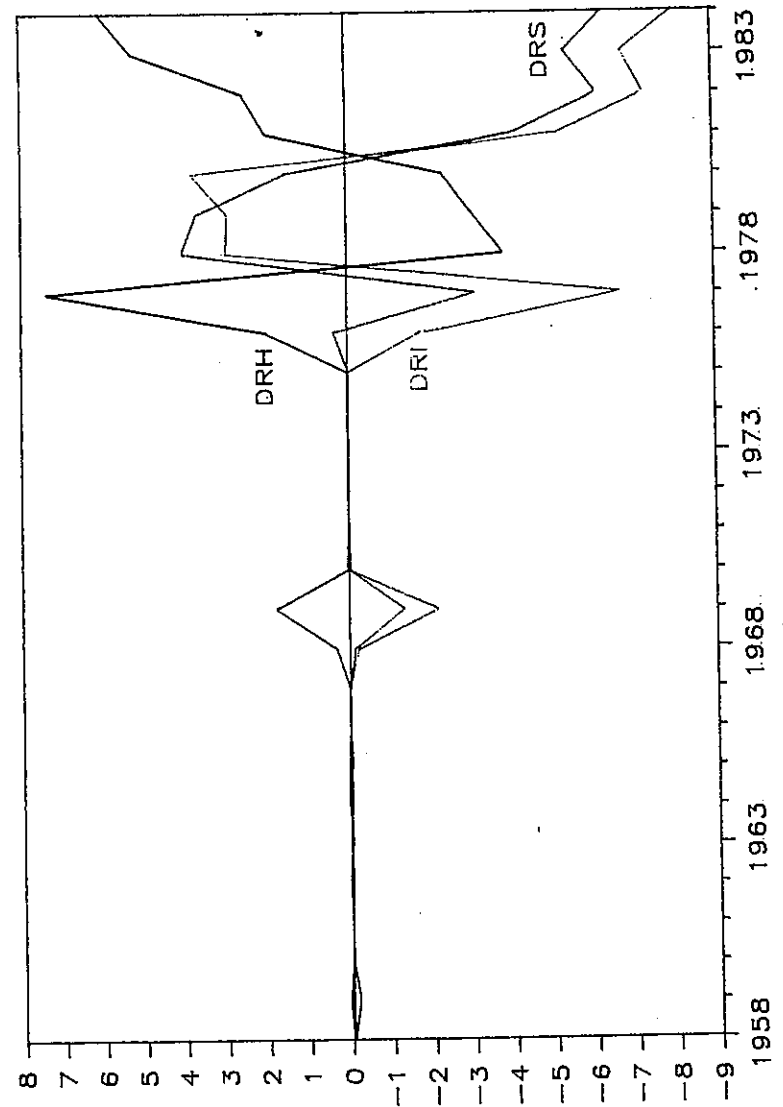
Combining these estimates and applying the actual percentage changes in exchange rates we may compute estimates of the effects of exchange rate changes on the rate of profit in each sector. Changes in the rate of profit, in percentages, are shown on the accompanying chart. DRH is the percentage change in the rate of profit for tourism, and DRI and DRS are the corresponding changes for manufacturing and for sugar exports. The stable exchange rates of the 1960s left relative profits unchanged, except for the effect of Britain's devaluation in 1967. Noticeable effects on relative profitability show up in 1976, with tourism benefitting initially at the expense of other

sectors. That situation was reversed in 1978, and again in 1981, when tourism once more gained the advantage over other sectors.

Although the strength of the US dollar relative to sterling has depressed the UK market for tourism, in relative terms sugar has been much more seriously affected, so the relative profitability of investment in tourism has been enhanced by the dollar's strength. The strength of the dollar has made tourism more attractive in comparison to manufacturing as well, because of the significantly higher proportion of US raw materials used in the manufacturing sector.

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## CHANGE IN PROFITS



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