
APPENDIX I

The Model

Output and Prices

$$\begin{aligned}q_i &= q_i(p_r, s, r) \\q_n &= q_n(a^*, p_i(1 + Mtm)/p_n, q_n(-1)) \\p_n &= p_n(p_i(1 + Mtm), q_n, s, r, dNg) \\w &= w(N/L, p^*, dq/dN) \\I_i &= I_i(rr^*, z_i) \\q_i &< q_i(-1) + XCAP(-1) + I_i(-1)/ICOR \\s &= w \cdot dq/dN \\rr &= p_i(1 - m_i - n_i \cdot w - f_i \cdot r)(1 - Mty') \\q &= q_i + q_n \\p &= p_i \cdot q_i/q + p_n \cdot q_n/q \\p_c &= (1 - c_m)p(1 + Mte) + c_m \cdot p_i(1 + Mtm) \\a^* &= q + dMO/p \\p_i &= p_r e\end{aligned}$$

Balance of Payments

$$\begin{aligned}m &= m(a^*, p_i(1 + Mtm)/p_n) \\dR &= (b \cdot q_i - m)p_i + K \\K &= Ks(X, M, e^*) + Ig + If - DS + OCA \\de &= e(dR, R(-1)), e' = 0, dR < -(R(-1) + cn) \\X &= b \cdot q_i \cdot p_i \\M &= m \cdot p_i\end{aligned}$$

Money

$$\begin{aligned}r &= r_i(1 + e^*) + cft \\dMO &= dR + dCRG + dCRB \\dCRB &= CR(a^*, r) \\dCRG &= G - Rv - Ig - FBP \\FBP &= FBP(a^*, r)\end{aligned}$$

Government

$$\begin{aligned}Rvy &= Rvy(-1) + Aty(dp \cdot dq - DS) \\Rvm &= Rvm(-1) + Atm \cdot dM \\Rve &= Rve(-1) + Ate \cdot da \\Rv &= Rvy + Rvm + Rve \\Gw &= Gw(-1)(1 + dw + dNg) \\Gr &= Gr(Kg, NDD, r, r_i) \\G &= Gw + Gr + Ig + Go\end{aligned}$$

Economic Policies for the Caribbean

a*	intended absorption
Ate	average rate of expenditure tax
Atm	average import tariff rate
Aty	average income tax rate
b	ratio of total sales to value added in tradables
cft	cost of international financial transactions
c _m	proportion of final imports in consumption
cn	constant (value)
da	change in absorption
dCRB	change in central bank lending to banks (value)
dCRG	change in central bank lending to government (value)
de	exchange rate change (percentage)
dM	change in the value of imports
dMO	change in high powered money (value)
dNg	change in government employment (number)
dq/qN	productivity change
dR	change in foreign reserves (value)
DS	net foreign investment income
dw	wage change (percentage)
e	exchange rate
FBP	finance to government from banks and the public
f _t	input coefficient for finance in tradables
G	government expenditure
Go	government spending residual
Gr	government interest payments
Gw	government wage bill
ICOR	incremental capital output ratio
If	private foreign investment
Ig	government investment
I _t	investment in tradables
K	the non-trade account of the balance of payments
Kg	government foreign debt
Ks	short term capital flow
L	labour force
m	imports
M	nominal imports
m _t	input coefficient for imports used in the tradable sector
Mte	marginal rate of expenditure tax
Mtm	marginal import tariff rate
Mty'	marginal income tax rate, adjusted for exemptions for tradables
N	employment
NDD	government domestic debt
n _t	input coefficient for labour in tradables
OCA	balance of payments residual
p	deflator
p*	expected price
p _c	consumer price index
p _f	foreign price index
p _n	price of non-tradables
p _t	price of tradables

q	domestic output
q_n	output of non-tradables
q_t	output of tradables
r	interest rate
R	foreign reserve level
r_f	foreign interest rate
rr	rate of return
rr^*	discounted rate of return
Rv	government revenue
Rve	receipts from expenditure tax
Rvm	receipts from import tariffs
Rvy	receipts from income tax
s	unit labour cost
w	wage rate
X	nominal exports
$XCAP$	index of excess capacity
z_i	vector of investment determinants not influenced by the model

Notes to the Model

Output and Prices

The output of tradables is determined by the supply equation; p_t represents the output price, as well as the cost of imported inputs, and the other costs are unit labour costs and the unit cost of finance. If there are taxes on exports and imports p_t is replaced by two variables, the selling price $p_t(1 + Mte)$ and the price of imported inputs $p_t(1 + Mtm)$.

The amount of non-tradables made available is a partial response to the gap between the demand, which is a function of the intended absorption and the relative prices, and the previous year's output. The relative price includes expenditure taxes, which are levied equally on tradables (imports) and non-tradables (and therefore cancel out), and import duties, which apply only on p_t at the marginal rate of Mtm .

Non-tradables are supplied by the private sector and by the government, whose provision of services is proportional to numbers employed in government. The supply price of non-tradables depends on the amount produced, the proportion of that amount provided by government, and the costs of private supply, which comprise the cost of imports (including the import tariff), unit labour costs and the unit cost of finance.

The wage equation is the reduced form of the labour market adjustment equations. The demand is

$$N_d = N_d(dq/dN, p^*, w)$$

and the supply is

$$N_s = N_s(p^*, w).$$

The result of bargaining between workers and employers may be represented by

$$w = w((N_d - N_s), N/L),$$

where the employment rate N/L determines workers' bargaining strength. This gives

$$w = w(p^*, dq/dN, N/L).$$

Investment in the tradable sector depends on the discounted rate of return and on other exogenous investment determinants z_i .

The output of tradables may not increase by more than the amount of excess capacity, plus the new capacity created as a result of investment. New capacity is related to investment by the incremental capital output ratio; government investment may improve the productivity of private investment in many countries. In this case we might replace the investment equation and the inequality with an equation for capacity output of the form

$$q_i \max = q_i \max(rr^*, I_g, XCAP, z_i)$$

with lags on the right hand variables. The limit on tradables would then be written

$$q_i < q_i \max.$$

Unit labour costs are a product of the wage rate and the marginal productivity of labour.

The mobility of finance for investment drives the overall rate of return towards the rate obtainable in the tradable sector, which is the product price less the unit costs of inputs. To obtain the after tax rate we adjust for the tax rate applicable to tradables, incorporating all incentives and rebates given for investment in that sector.

The remaining equations in this section are definitions.

Balance of Payments

Imports are demand determined. This relationship holds even in the presence of quantitative restrictions on imports and foreign exchange rationing. In the open economy the restrictions do not ration the supply of imports, except in the short run while informal institutions are being set up. Instead, they divert demand to these informal markets. Demand will be driven down by the higher cost of foreign exchange purchased on the informal market. (The exchange rate in this model is the nominal rate, an average of formal and informal rates.)

Tradables are all exported, and the ratio of value added to total sales b gives exports.

Short term capital flows are determined by the need for trade credits. Fear of exchange rate depreciation may accelerate foreign exchange outflows. There is no interest rate arbitrage because the domestic interest rate is tied to the foreign rate. Alternatively, we might have relaxed the interest rate stipulation and allowed for capital movements in response to interest differentials at home and abroad. These movements would tend to equate the interest rates. The relationship will not hold instantaneously in either case, and the interest rates in question include informal as well as formal rates. There seems no reason to choose one representation over the other, since neither is expected to hold exactly.

Foreign private investment responds to the investment determinants given for I_i . The proportion of foreign investment in total investment depends on the knowledge of markets and technology, and on the skills and organisation of local firms, particularly those in the tradable sector. If they are able to exploit most areas of dynamic comparative advantage (looking to future factor and product prices, the evolution of technology and markets, and the sources of actual and potential competition) the amount of foreign investment may be quite small.

The debt service depends on the size of the foreign debt, its maturity structure and the international interest rate.

The exchange rate depreciates if the loss in reserves reduces the stock below the

“confidence” level cn , at a rate which is proportional to the reserve loss. There is no exchange rate movement if reserves increase. The exchange rate may be regarded as an average of official and unofficial rates; if the official rate is not depreciated in line with market sentiment transactions are increasingly diverted to the unofficial market, where the rate then tends to depreciate more rapidly. The weighted average rate might work out to be much the same whether or not the official rate were depreciated, except that the unofficial market is unregulated (and therefore risky) and poorly informed, so it tends to depreciate faster than underlying circumstances warrant. Timely official adjustment avoids overshooting and excessive fluctuation.

Money

Domestic interest rates may deviate from foreign interest rates only by the cost of foreign financial transactions cft , apart from any expectation that the currency will be devalued. If depreciation is expected, the interest rate will be driven higher by the flight of capital. The interest differential is seldom so powerful as to compensate for expected exchange losses, so other policies will be needed to restore credibility to the exchange rate.

The increase in high powered money is a reflection of the accumulation of reserves, and additional central bank accommodation for government and the banks. The banks need central bank funds if there is an excess domestic demand for credit at prevailing interest rates. Government’s borrowing needs depend on the size of the deficit, the amount of prudent foreign borrowing and the amount of finance available from the banks and the public at prevailing interest rates. This latter amount depends on the excess demand for private sector credit.

Government

Government revenue is of three types, each calculated by adding to the previous year’s revenue an amount equal to the average rate of tax times the increase in the tax base. As a separate exercise the effect of any tax changes (in rates, exemptions, administration or any other structural aspect) on average and marginal tax rates would have to be estimated.

Government’s wage bill is the result of wage increases and changes in government employment since the previous year.

Interest payments depend on the outstanding foreign and domestic debt, the interest rates and the maturity structure of the debt.

APPENDIX II

Quantifying Taxes and Spending

Economics offers more useful insights for taxation than for government spending, and this is reflected in our suggestions here for quantifying the government budget. We are able to give much firmer guidelines for taxation than for expenditure.

Taxation

Tax policy may be set within a macroeconomic framework with the help of information on tax structures, much of which is available in most countries, or could be easily researched. The information includes average and marginal tax rates for the major categories of taxation, together with more detailed information outlined in what follows. The parameters for average and marginal taxation may be derived from information on tax receipts and the tax base for each type of tax. They are entered into the macroeconomic model in order to carry out simulations with alternative tax regimes. The tax base should be adjusted to take account of discretionary tax changes during the estimation period. (The allowance for discretionary changes must be judgemental, because a theory-based estimate would require prior knowledge of the marginal tax rate.)

For the *personal income tax* effective tax rates for individual households are a useful supplement to overall marginal and average rates. Rates may be computed for representative households at different income levels, with different family structures, with differing wealth endowment and with different sources of income. The information helps to assess the potential effect of tax changes on the supply of skills. Skilled labour is more internationally mobile than unskilled, and tax rates that are too high relative to those abroad, which do not seem to offer sufficient premium on skills in the local market, or which are excessive in light of the quality and comprehensiveness of government services, may trigger emigration of skilled workers. (By multiplying the tax rate in each category with the number of taxpayers and aggregating one may make a comparison with actual tax receipts, for a tentative estimate of tax avoidance and evasion; the estimate includes measurement and statistical errors.)

The society will insist on making qualitative judgements on the progressivity of the tax system, and data should be provided for informed opinion. The income levels at which marginal rates increase may be normalised on the average wage to provide a basis for international comparison of progressivity (see Babb, 1990). Income distributions may be computed, with taxes and without. Only qualitative inferences may be drawn.

The personal exemption available to all taxpayers is usually assessed in terms of the poverty level; that needs to be made explicit by deriving a value for that level, taking account of needs for nutrition, health, education and housing, and allowing for cultural norms such as preferences for types of food and forms of preparation, informal family income supplements, etc. The basic exemption will not usually be at the poverty level, since government provides some of the essentials free of cost.

For the *corporate income tax* average and marginal rates will be supplemented by effective tax rate calculations for firms in different sectors and activities, taking account of the combination of personal and corporate taxes and exemptions. At the minimum we are interested in the tax incentive for firms producing tradables, as compared with those in the non-tradable sector, because of the crucial importance of tradables for the country's overall growth. There is an established methodology for such calculations (for example see King and Fullerton, 1984). A more favourable rate of return for tradables should attract investment away from non-tradables if all other circumstances are equal. In the more usual case, more favourable tax treatment of tradables is needed to compensate for the greater certainty or familiarity of non-tradable activity, even though the expected returns may well be higher in tradables. Over time the shift of investment to tradables would improve the after-tax return on non-tradables sufficiently to neutralise the more favourable tax treatment. By this time vigorous growth in tradables would reduce the need for special tax treatment. In any case, one should not exaggerate the importance of tax treatment for the growth of tradables. It appears to be very much a subsidiary influence (Worrell, 1989).

In addition to the average and marginal *import tariff* the effective rates on consumer and producers' goods will be of interest. In cases where these differ, the appropriate adjustment can be made to the parameters of the macro model. The improvement in the rate of return for tradables and non-tradables as a result of more favourable tariff treatment for producers' goods may be estimated; it depends largely on the relative use of imported factors in the two sectors. The combined effect of tariffs and income taxes on investment in tradables may be assessed.

A similar exercise to distinguish between the effective rates for consumer and producers' goods, and the impact of favourable treatment of the latter on tradables, may be undertaken for *taxes on purchases and sales of goods and services*. There is a bias towards tradables only if they have relatively lower value added (and therefore higher input) per unit of output.

To simulate tax changes in this framework, one adjusts tax structures in directions which reflect any preferences the society may have for stronger incentives for tradables, relief of poverty and a 'fairer' progression of personal taxes. The implied average and marginal tax rates may be computed, substituted into the model, and a solution found, for output, investment in tradables, prices, the foreign reserves change, tax revenues and the fiscal deficit. Alternative tax structures may be simulated to find the one which offers the most acceptable compromise.

Government Expenditure

The targets for public provision of goods and services, and for the satisfaction of basic needs, will guide government expenditure decisions, but only general guidelines are available, and the links between the crude measures of performance which are all that we have and the amounts of government spending are quite tentative. It is not possible to determine a level of spending on the basis of a list of services, nor is it possible to establish rules for the services that government should provide. To be realistic government managers must start with the existing expenditure, use rule of thumb indicators to indicate where changes are desirable, and adjust spending accordingly. Performance gains will come as a result of persistent pursuit of goals over some years, rather than as a result of drastic surgery. A sharp reduction in government expenditure always means a reduction in the delivery of government services.

The *wage rate* is endogenous to the model, and government's wage bill varies with

the decision to expand or reduce services. That decision should be informed by data on maintenance of state property, indicators of public safety and the protection of rights and property, the deficit (or surplus) in the satisfaction of basic needs, and relevant international comparisons of the administration of government offices.

These indicators determine whether *government employment* should be expanded or contracted.

Interest payments are determined by the amount of outstanding debt, its maturities and the interest rates. Projections must be based on an assessment of borrowing capacity, using debt service ratios and expected foreign earnings, and the projected borrowing requirements. The accumulation of domestic debt is a problem only if its servicing results in an unacceptable redistribution of income, or if government finances debt service by money creation.

Subsidies to firms should be designed to enhance the after tax rate of return in the tradable sector. If government maintains price control on essential foods and medicines as part of its package of poverty relief, firms supplying these items must be subsidised to cover the difference between their costs and the fixed price, if we are to avoid an upsurge in unofficial market activity. The amount of subsidies will be constrained by the overall budget.

Transfers to households are an income supplement to the poor. Whether the provisions should be altered will depend on the deficit in entitlements for the poor, discussed below, the most cost efficient means of satisfying them and the budget constraint.

Government investment spending will be determined by the adequacy of infrastructure, to be judged by indicators such as the congestion of ports and airports, facility of transport and communications, and the reliable supply of public utility services. Government investment might also be influenced by a strong positive relationship between government investment and private investment.

In order to determine the targets for *social support through the budget* expenditure surveys are desirable. They should establish, at the minimum, what are the levels of dependence on free government services, the services of subsidised institutions and income transfers from government, for poor households where the head is in permanent employment and for those where the head has no permanent job. In each case the total consumption of essential services should be compared against the (culturally determined) minimum necessary, and the deficit to be made up established. The information might be arranged somewhat as follows:

Poor Households, Employed Head

	<i>% of requirements for:</i>			
	<i>Nutrition</i>	<i>Health</i>	<i>Education</i>	<i>Housing</i>
Provided from:				
Subsidised				
Services	u_{11}	u_{12}	u_{13}	u_{14}
Government				
Services	u_{21}	u_{22}	u_{23}	u_{24}
Transfers	u_{31}	u_{32}	u_{33}	u_{34}
Own Income	u_{41}	u_{42}	u_{43}	u_{44}
Deficit	U_1	U_2	U_3	U_4

The cost to the budget of making up the deficit in one of the three available ways can be estimated from the unit cost of delivering the service in each case times the amount required per household times the number of households, and the minimum cost alternative identified. The exercise should also be undertaken for households with unemployed heads. The minimum cost of making up the deficits will not be unambiguous because of the imprecision of the measures of cost of delivery. The remedial measures will have to be phased in, if the expenditure cannot be increased sufficiently (or at all) in the short run.