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1. INTRODUCTION

During the past three decades, two widely used frameworks for macroeconomic analysis in developing countries have been the financial programming (FP) and the revised minimum standard model (RMSM), associated with respectively the International Monetary Fund (IMF) and the World Bank (WB). Yet, the FP and RMSM analytical tools are, in reality, little more than consistent macroeconomic accounting frameworks, which focus on short-term economic stabilization in the tradition of the monetary approach to the balance of payments (MABOP), on the one hand, and medium to long-term GDP growth along two-gap lines of thinking, on the other. Thus, while the two models, which trace their origins back to respectively Polak (1957) and Chenery and Strout (1966), are very different, they are both quite simple theoretical constructs with limited behavioural content (Edwards, 1989, and Addison, 1989).

It is therefore not surprising that the FP and RMSM frameworks have been criticised from a number of different perspectives (see Tarp, 1993, for a broad review), and key economic relationsships are certainly missing in the models. In their simplest versions, exports are, for example, exogenous, and there is no link between real GDP and private sector credit. It is, in addition, often pointed out that the two models are used without taking due account of structural and institutional characteristics of the economy in question. The financial programming framework assumes that a single competitive market exists for traded and non-traded goods, ignoring structural constraints and inflexibilities frequently present in developing economies. The RMSM, on the other hand, is a fix-price model. This implies that changes in demand have no price effects on economic behaviour. Consequently, the FP and the RMSM represent two extreme sets of assumptions about economic reality. Moreover, neither the FP nor the RMSM framework model the supply-side.

Nevertheless, while the simplicity of the FP and RMSM models is a critical weakness, to be counted with at all times, this characteristic is, at the same time, a strength. Policy debates in developing countries are often clouded by unfamiliarity with fundamental macroeconomic questions and linkages, and available statistics are scant and unreliable. While relevant macroeconomic data are more readily available in South Africa than in most other African countries, many difficulties remain (van Seventer *et al.*, 1992). The building of more complex models is a challenging and fascinating intellectual pursuit, which should definitely continue to be pursued in an effective manner in South Africa. Modelbuilding is, after all, an important means of gaining greater insights into the characteristics and operation of the economy. Yet, for practical purposes theoretically simple models are indispensable. In fact, the application of rudimentary analytical frameworks can, if used judiciously, help policymakers and analysts gain a clearer understanding of key macroeconomic constraints and policy options.

In a recent study by Tarp and Brixen (1994), the FP and RMSM frameworks are used in generating three fully quantified macroeconomic scenarios for South Africa. The scenarios capture essential differences among the many possible directions, the South African economy may take in the medium-term future. The study also demonstrates that more complete projections can be obtained if account is taken in a consistent manner of both the underlying models. In addition, a number of model experiments are implemented so as to highlight the main economic mechanisms of the FP and RMSM frameworks, and care is taken to uncover the strengths and limitations of the

two models. In the study, an iterative procedure is used to ensure that the three alternative scenarios are compatible in the sense that the variables appearing in both models have the same values. Finally, it is clear from this application that the FP and RMSM frameworks require few data and are relatively easy to understand and use in the South African context.

Basic assumptions, including the critical choice of model closure, are in focus in the financial programming and RMSM models, and as such they fulfil the requirement of being transparent and drawing attention to key issues. The two models can also be used as a practical organizing device, and due to their simple structure and extreme assumptions, they generate the widest possible range of economic outcomes in policy simulations. The actual result of a given simulation will depend, *inter alia*, on the choice of closure mechanisms, but the two frameworks can, in sum, be used to demarcate the confines within which the outcomes of more complex models must fall. Accordingly, the policy analyst should be particularly alert, if a more complex model, based on analogous empirical assumptions about economic reality, generates results that are more extreme than those of the FP and RMSM. Moreover, the FP and RMSM analytical frameworks illustrate quite well the fundamental perceptions of macroeconomic causality that is often implicit in the economic policy advice given by the two Bretton Woods institutions in practice.

Thus, despite their critical shortcomings, there appears to be good reason to make sure that the FP and RMSM tools are fully understood and can be managed by South African policy analysts. This would, admittedly, be a small, but nonetheless important step in making sure that the future policy dialogue between South Africa, on the one side, and the international community, on the other, gets on a sounder footing than what is often reported to have been the case elsewhere in Africa during the 1980s (see Green, 1986; Helleiner, 1986, and Mosley *et al.*, 1991). Moreover, most of the key linkages in the FP and RMSM models must by definition also be present in more complex models. Finally, the two models can certainly be applied in a more flexible and thoughtful manner than often done in practice, provided the necessary analytical capacity exists and sufficient time and caution are provided for.

The financial programming and RMSM frameworks have over the years seldom been applied simultaneously and in a consistent manner in IMF/WB country economic analyses. However, the move towards closer collaboration among the two institutions at the country level, which took place during the 1980s, made it clear that a more coherent approach is needed in the analysis of what has commonly been termed growth-oriented adjustment programmes. Consequently, attempts at integrating the FP and RMSM frameworks have been made in a number of recent studies such as Khan *et al.* (1990). Another example is Everaert *et al.* (1990), who present an expanded version of the RMSM called RMSM-X. The RMSM-X includes not only the external balance and savings-investment identities of the RMSM, but also the fiscal and monetary identities of the FP model. The RMSM-X stops short, however, of incorporating and specifying behavioural functions for the main macroeconomic variables such as private consumption and investment, money demand, export supply and import demand. While little published material is available, it is understood that such behavioural information will be included in the RMSM-XX models (Easterly *et al.*, 1990).

The simulations, summarized in sections 3 and 4 of this paper, are based on a formal merger of the two parent frameworks. A few slight modifications have been included as compared to standard

representations, but they do not affect the basic properties of the model. Consequently, the iterative procedure used in the Tarp and Brixen (1994) study is skipped over. This implies, *inter alia*, that the potentially conflicting policy advice, which may emerge from implementing the FP and RMSM models separately, is avoided. Nevertheless, it is highlighted that the merged framework suffers from exactly the same shortcomings as the FP and RMSM models. Merging them adds nothing new in terms of theoretical insight. The merged model does illustrate in a stimulating manner important economic mechanisms and linkages, but to be meaningful in practice, the analysis must include additional qualitative and quantitative judgement from outside the model. This is so, in particular, since neither supply-side nor distributional issues are addressed explicitly. Thus, due to the simple structure and extreme assumptions, on which the FP and RMSM are built, policy analysis based on the merged framework often end up being `beside the point' (Taylor, 1988: 154). Similar warnings about applying the merged model in a mechanistic manner have been made by Polak (1990). Yet, this is, of course, no argument against becoming acquainted with the model and its two parents.

2. THEORETICAL FRAMEWORK

The merged version of the IMF financial programming and World Bank RMSM models applied in this paper consists of 25 equations, as shown in figure 2.1, which also contains a list of the 41 variables and 9 parameters. The model is divided into four sets of equations for respectively (i) the real sector, (ii) income effects from terms-of-trade adjustments, (iii) the balance of payments, and (iv) prices together with the monetary sector and government accounts. The FP and RMSM models are generally set up in their programming mode in the Meade-Tinbergen tradition, when applied in country economic analyses. However, in this paper focus is on the use of the model in its positive mode for policy simulations.

Total gross investments are determined in equation (1). This equation shows that the ratio of investments to GDP depends upon a constant and the GDP growth rate in the current period. This specification was derived from an assumption of a constant capital-output ratio. It is straightforward to show that the coefficient on GDP growth corresponds to the capital-output ratio, whereas the constant is approximately equal to the product of the physical depreciation rate and the capital-output ratio. This functional form differs from that in Addison (1989), but was chosen because it proved convenient to work with in model simulations. The aggregate import function in equation (2) makes import volume dependent on real output and the real rate of exchange. The latter variable is defined as the domestic price of imports divided by the price of domestic output. The function is specified in natural logarithms, implying that the coefficients of the two explanatory variables are elasticities.

Equations (3) and (4) take care of the disaggregation of total consumption and total investment between the public and private sectors. The simple functional form in equation (5) specifies nominal private sector consumption as a fixed proportion of nominal disposable income, defined as nominal gross domestic income less public sector domestic revenue net of government transfers to the private sector. The general price level, which is determined in equation (18) as a weighted average of the domestic price level and the domestic currency price of imported goods, is used in equation (5), assuming that the GDP and private consumption deflators are identical. Finally, equation (6) is the material balance national accounting identity.

The role of equations (7)-(11) is to calculate various national accounting variables that account for income effects from changes in the terms-of-trade. Thus, the foreign currency value of exports is deflated by the import price index in equation (8), while the difference between this figure and the export quantity is calculated in equation (9). Next, gross national income is calculated in equation (7) as the sum of the gross domestic product and the terms-of-trade adjustment. Finally, gross domestic saving and the external resource gap are calculated in equation (10) and (11), respectively. Without terms-of-trade changes, the resource gap equals the trade balance deficit.

Equations (12)-(17) relate to the balance of payments. Thus, equation (12) defines the trade or resource balance as the difference between export and import, both valued at their foreign currency price. Net factor income from abroad is defined in equation (13) as interest payments on government and private sector external debt and net other factor payments received from the rest of the world. All of these variables are in foreign currency values. Equation (14) explicitly relates the interest payments on the government's external debt to its size, and the current account surplus

is equal to the sum of the trade balance, net factor income and net transfers received by the public and private sectors from abroad as indicated in equation (15). The change in foreign reserves is linked with the change in the foreign currency value of imports as shown in equation (16), and the reserve change also equals the current account surplus plus net new foreign borrowing by the government and the private sector, respectively. This can be noted from equation (17), where the balance of payments identity is imposed on the system.

The price level is, as already noted, determined in equation (18), and nominal GDP is defined in equation (19). Subsequently, the money market is described by four equations. First, money demand is specified in the Quantity Theory and Cambridge-equation traditions. Thus, the demand for money, equation (20), is determined as a fixed proportion of nominal GDP, where the proportionality factor is the velocity of money circulation. Since, money is the only liability of the financial sector, it is by definition equal to the value of the sector's assets. These consist of domestic credit and international reserves. The money supply function, equation (21), is specified in first differences. Therefore, the change in money supply equals the change in international reserves, valued at the current period exchange rate, and the change in credit extended to domestic sectors. Moreover, a third term appears on the right-hand side of the equation, which accounts for valuation changes in the international reserves, resulting from exchange rate changes. Equation (22) is a simple identity stating that total domestic credit consists of credit granted to the private and the government sectors. The description of the money market is completed by an equilibrium condition, equation (23), which implies that money demand always equals money supply.

Turning next to the government sector, equation (24) defines its borrowing requirement as the difference between expenditure and income. The following expenditure types are distinguished: Consumption, investment, interest payments on foreign debt and other expenditures. Two types of income appear in the equation, namely total income from domestic sources and net transfers received from the rest of the world. The government can satisfy its borrowing requirement through foreign borrowing, by issuing bonds on the domestic market and/or by increasing its domestic credit. Accordingly, the budget constraint of the government can be written as in equation (25). Often, domestic debt finance is not an option for governments in the developing world. In South Africa, however, this source of finance is substantial, and its inclusion is therefore necessary in the present context.

It is evident from the above presentation that the merged framework is, indeed, a very simple framework when considered as an applied economic model. Only three behavioural equations are specified, namely import, private consumption and money demand, in addition to equations linking output with investment, international reserves with imports and government foreign interest payments with external debt. The remaining 16 equations are identities or relations that hold by definition. Moreover, while most of the variables can be identified as respectively exogenous or endogenous in a straightforward manner, there are also choices to be made in the partitioning of the 41 variables, with the particular set up chosen depending on the nature of the policy simulation. In fact, a considerable number of combinations exists within the merged model as to how the material balance, the balance of payments and the monetary sector/government accounts can, in principle, be closed, although some of these will be of only limited interest in practice.

Figure 2.1. Merged Framework

A. Core equations for real sector

(1) $IV_t/GDP_t = \kappa 0_t + \kappa 1_t*((GDP_t - GDP_{t-1})/GDP_t)$

(2) $\log(M_t) = \alpha 0_t + \alpha 1_t*\log(GDP_t) + \alpha 2_t*\log(E_t*MPI_t/PD_t)$

(3) $C_t = CP_t + CG_t$

(4) $IV_t = IVP_t + IVG_t$

(5) $P_t*CP_t = (1 - \beta_t)*(P_t*GDY_t - (TG_t - GT_t))$

(6) $C_t = GDP_t - IV_t - X_t + M_t$

B. Income effects from terms-of-trade

(7) $GDY_t = GDP_t + TTADJ_t$

(8) $XTTADJ_t = X_t*XPI_t/MPI_t$

(9) $TTADJ_t = XTTADJ_t - X_t$

(10) $GDS_t = GDY_t - C_t$

(11) $RG_t = M_t - XTTADJ_t$

C. Balance of payments - all variables in foreign currency

(12) $RESBAL_t = X_t*XPI_t - M_t*MPI_t$

(13) $NETFSY_t = - INTG_t - INTP_t + NFP_t$

(14) $INTG_t = NFBG_{t-1}*IR_t$

(15) $CURBAL_t = RESBAL_t + NETFSY_t + NTRG_t + NTRP_t$

(16) $R_t - R_{t-1} = (M_t*MPI_t - M_{t-1}*MPI_{t-1})/\delta_t;$

(17) $R_t - R_{t-1} = CURBAL_t + (NFBG_t - NFBG_{t-1}) + (NFBP_t - NFBP_{t-1})$

D. Prices, monetary sector and government accounts

(18) $P_t = (1 - \theta)*PD_t + \theta*E_t*MPI_t$

(19) $GDPN_t = P_t*GDP_t$

(20) $MD_t = (1/v_t)*GDPN_t$

(21) $MS_t - MS_{t-1} = E_t*(R_t - R_{t-1}) + (DC_t - DC_{t-1}) + (E_t - E_{t-1})*R_{t-1}$

(22) $DC_t = DCG_t + DCP_t$

(23) $MS_t = MD_t$

(24) $BRG_t = P_t*CG_t + P_t*IVG_t + GT_t + E_t*INTG_t - TG_t - E_t*NTRG_t$

(25) $BRG_t = E_t*(NFBG_t - NFBG_{t-1}) + (DCG_t - DCG_{t-1}) + (GOB_t - GOB_{t-1})$

Variables:

BRG_t	Government borrowing requirement
C_t	Total consumption - constant 1992 prices
CG_t	Government consumption - constant 1992 prices

CP_t	Private sector consumption - constant 1992 prices
$CURBAL_t$	Current account surplus
DC_t	Total domestic credit
DCG_t	Government domestic credit

(figure continues)

Figure 2.1. Continued

DCP_t	Private sector domestic credit
E_t	Nominal exchange rate - 1992 = 1.000
GDP_t	Real GDP - constant 1992 prices
$GDPN_t$	Nominal GDP
GDS_t	Gross domestic saving
GDY_t	Gross domestic income
GOB_t	Government domestic debt
GT_t	Other government expenditures
$INTG_t$	Government interest payments on foreign debt
$INTP_t$	Private interest payments on foreign debt
IR_t	Foreign interest rate
IV_t	Total investments - constant 1992 prices
IVG_t	Government investments - constant 1992 prices
IVP_t	Private investments - constant 1992 prices
M_t	Import quantity - constant 1992 prices
MD_t	Money demand
MPI_t	World import price index - 1992 = 1.000
MS_t	Money supply
$NETFSY_t$	Net factor services from abroad - foreign currency
$NFBG_t$	Government foreign debt - foreign currency
$NFBP_t$	Private foreign debt - foreign currency
NFP_t	Other factor services - foreign currency
$NTRG_t$	Net transfer from ROW to government - foreign currency
$NTRP_t$	Net transfer from ROW to private sector - foreign currency
P_t	General price index - 1992 = 1.000
PD_t	Domestic price index - 1992 = 1.000
R_t	International reserves - foreign currency
$RESBAL_t$	Trade balance
RG_t	Resource gap
TG_t	Government revenue
$TTADJ_t$	Terms of trade adjustment
X_t	Export quantity - constant 1992 prices
XPI_t	World export price index - 1992 = 1.000
$XTTADJ_t$	Terms of trade adjusted export

Parameters:

$\alpha 0_t$	Constant in import function
$\alpha 1_t$	GDP elasticity of import
$\alpha 2_t$	Real exchange rate elasticity of import
β_t	Private sector saving propensity
δ_t	Ratio of reserve to import change
$\kappa 0_t$	Constant in investment function

$\kappa 1_t$	Incremental capital-output ratio
v_t	Money velocity
θ	Weight in price index

3. POLICY SIMULATIONS

Before policy simulations can be carried out in the framework outlined above, the sets of endogenous and exogenous variables need to be specified. Most variables are as already noted naturally either endogenous or exogenous, but choices are not obvious as far as the material balance, or the domestic saving-investment balance, and the balance of payments are concerned. Considering the material balance first, one variable must to be determined residually to ensure equality between demand and supply. Government consumption and investment are necessarily exogenous in policy simulations where government expenditures are increased. It is, moreover, natural to maintain the import function as a behavioural relationship. This leaves GDP, export as well as private consumption and investment as candidates for the adjusting variable. The framework shown in figure 2.1 contains both a private consumption and an investment function, which also determines private investment since government investment is exogenous. Consequently, it is necessary to drop one of these functions if both GDP and export are specified as exogenous. In the RMSM, private consumption is normally determined as the residual, and this will also be the case in the basic policy simulations below. The reasons for not selecting the alternatives are as follows:

(i) Closing the model through private investments gives outcomes that are qualitatively identical to those, which result from omitting the private consumption function. The only difference appears in the distribution of total private sector absorption between consumption and investment.

(ii) Using exports as the adjusting variable causes excessive price changes as evident from some initial attempts to carry out the policy simulations.

(iii) Endogenizing GDP has some unattractive features given the specification of the framework and in particular the investment function. Thus, the relationship between current GDP and current investment through the capital-output ratio implies that aggregate demand has an elasticity with respect to changes in GDP, which is greater than 1. Consequently, changes in autonomous spending have effects that are contrary to those of the standard Keynesian demand-driven macromodels, as discussed in, for example, (Vines, 1990).

In sum, it seemed reasonable to drop the private sector consumption function in the basic versions of the policy simulations, maintaining GDP and export as exogenous. This is in essence also what is done in both the financial programming framework and the RMSM. However, to emphasize the importance of closure choices in policy simulations it is discussed below how results change if GDP is selected as the adjusting variable and the private consumption function is included in the framework.

In the balance of payments, the choice is between an endogenous or exogenous nominal exchange rate in combination with respectively exogenous and endogenous private sector capital flows. This classical choice of external macroclosure has been discussed intensively elsewhere (e.g., Robinson, 1989) as it generally influence the properties of applied models significantly. Given the importance of this choice, results of policy simulations using both closures are discussed below, but it was decided to use an endogenous exchange rate and fixed private sector capital flows in the standard set-up. Finally, public sector capital flows are left out in this discussion because they have an independent role in the policy simulations as a source of budget deficit finance.

The baserun, which underlies the policy simulations, is a six-year projection of the South African economy based on moderately optimistic assumptions about economic growth and the inflow of foreign capital (see annex A). Unless stated otherwise, the policy simulations are specified as identical proportional changes in exogenous variables for every year in the period.

3.1. Simulation 1: Increased Government Spending

In the first set of policy simulations, the effects of increased government spending is analyzed under different assumptions concerning financing, the composition of the expansion and its timing. The basic experiment is a 10 per cent increase in nominal government consumption and investment as well as other government expenditures. Interest payment on public external debt is the only government expenditure type, which is not changed since it is linked with the size of debt. Nominal changes in the exogenous variables were preferred because real changes would produce very large effects, bordering to instability, on prices in some variants of the experiment.

3.1.A. Variant 1A: Different Methods of Financing

Higher government expenditures can be financed either by increasing income or by additional borrowing. The following four possible types of financing will be considered here; (i) increased tax revenue, (ii) credit from the domestic banking system, (iii) domestic borrowing through bond issues, and (iv) foreign borrowing. The four policy simulations are considered using the standard closure of the framework, i.e., the private consumption function is omitted from the framework, while GDP and export are exogenous. Moreover, the nominal exchange rate is endogenous and the net external borrowing of the private sector is exogenous. Subsequently, it is discussed how alternative closures affect the results.

Tax Financing

The first way to finance the expansion of government expenditures is to increase taxes, keeping the borrowing requirement unchanged. This policy simulation yields particularly simple results, cf. table 3.1. Total investments are determined by the exogenous GDP growth rate, and private investments must, therefore, fall to offset the increased public investment. Similarly, private consumption is crowded out by higher government consumption, as total consumption is determined residually by the exogenous GDP, investments and exports and imports that do not change since all prices remain at their baserun levels. Nothing else change in this simulation.

Although, these results are consistent in the sense that all national accounting identities are satisfied, it must be emphasized that the framework does not explain how the falls in private consumption and investment are realised. Private consumption does, for example, fall by more than should be expected given the savings rate and net increase in taxation. Thus, the savings rate must have increased compared to its baserun value, but the framework does not provide any explanation of why this change has occurred. This limitation of the framework for policy analysis must be recognized both here and in the following.

Domestic Credit Financing

Using domestic credit as the source of finance results in qualitative effects that are opposite to those obtained with the other three types of finance. Thus, expansion of credit to the government increases the money supply and raises the general price level, cf. table 3.2. This reduces the real value of the additional government consumption and investment, but private consumption and investment continue to be crowded out in the first year when the price level increases by 5.9 per cent. However, from the second year onwards prices go up by more than 10 per cent leaving the government with falling consumption and investment in real terms. Prices continue to increase since a higher government budget deficit and, therefore, more credit financing affects the rate of inflation. In the final year, the inflation rate is thus three percentage-points higher than in the baserun. There is one additional effect, which pushes the general price level upwards. As the real exchange rate has to remain unchanged to be consistent with unaltered imports both the domestic price level and the exchange rate increase in parallel with the general price level. The depreciation of the nominal exchange rate raises the domestic value of international exchange reserves and, therefore, the money supply so the general price level must increase. On the other hand, the need for domestic credit is reduced somewhat by the exchange rate depreciation as it increases the domestic value of foreign borrowing, which is fixed in terms of foreign currency units. The net effect of these two mechanisms depend on the baserun values of international reserves and foreign borrowing by the government.

Although, the results of this policy simulation in terms of real variables are due to the specification of nominal increases in government expenditures, it can be noted that if government expenditures were fixed in real terms, extremely high levels of inflation would have resulted.

Domestic Bond Issues

In the chosen set-up of the framework, bond financing has exactly the same effects as tax financing, cf. table 3.3. Thus, falls in private consumption and investment match the increases in government consumption and investments.

Foreign Borrowing

Contrary to the three previous simulations, total domestic supply of goods can change through imports, when the expansion of government expenditures are financed by external borrowing. Therefore, private consumption is not necessarily crowded out by the increased government consumption. Imports actually increase enough in this policy simulation, which enables higher consumption levels in both sectors, cf. table 3.4. Since total investments continue to be determined by the fixed GDP growth rates a similar effect does not exist as far as private investments are concerned, and they also fall under this financing type.

The additional import that follows from increased external borrowing require that the real exchange rate appreciates, i.e., the nominal exchange rate must fall relative to the domestic price level. As the general price level remains almost unchanged, the result is an appreciation of the nominal exchange rate and a higher domestic price level. The small increase in the general price level is caused by the faster accumulation of international foreign exchange reserves following from increased imports. However, this effect consists of an initial jump in the price level, whereas the rate of inflation remains virtually unchanged throughout the remainder of the period.

Results Under Different Closures

Given the simplistic structure of the framework, the results of policy simulations will tend to represent extreme outcomes as many economic linkages are missing, which often would counteract or dampen the more direct effects. Although, this feature limits the usefulness of the framework as a tool for policy advice, it is possible to test the sensitivity of the results by performing the same policy simulations using alternative closures. Thus, all four policy simulations in this section were repeated under different assumptions concerning the closures of the material balance and the balance of payments. As the number of simulations is large, general features rather than a complete review is in focus.

When the framework is specified including the private consumption function and letting GDP be determined residually, it produces outcomes that are counter-intuitive under three of the four methods of financing. Thus, GDP falls except when external borrowing covers increased government spending. This result is caused by the specification of an investment function that implies an elasticity of aggregate demand with respect to changes in GDP, which is greater than one for all plausible parameter values. To be more specific, the problem is that investment is linked with current production by the capital-output ratio, which generally is estimated to be well above one. Hence, the economy will be supply constrained when fiscal expansion is attempted, and it does not produce results consistent with those of demand-driven macromodels, which would appear appropriate under present South African conditions. If the framework was to be used more consistently in policy analysis the solution must be to look for a different specification of investment, but it should be noted that the RMSM, which provided the function for this study, suffers from the same shortcoming. In sum, an expansion of government consumption reduces the

amount of goods available for investment, and GDP, therefore, has to decrease, which leads to further reductions in investment. However, private consumption does also fall as result of lower income, and the process does converge to a new equilibrium. Compared to the effects under the standard set-up, endogenous GDP implies lower private consumption and investment as well as lower real government consumption and investment. This latter effect works through the price level, which increases as a consequence of the fall in GDP. The final effect in these simulations is that the decrease in GDP reduces the demand for imports, which then has to be countered by an appreciation of the real exchange rate given the fixed amount of capital flows.

All these effects are, however, reversed when the expanded government expenditure is financed abroad. In this case, increased import is made possible through more government foreign borrowing, so total investment increases leading to higher GDP. This lowers the price level as compared with the standard set-up of this policy simulation.

The alternative external closure consists of exogenizing the nominal exchange rate and instead making private sector capital flows endogenous. It was also tested how this closure affects the outcomes when government spending is expanded using the four different types of financing. The central feature, implied by this change of closure, is that the balance of payments can now be maintained through adjustments in either import or the real exchange rate, while only the latter possibility exists in the standard set-up of the model. However, in two of the four cases, tax and domestic bond financing, the results are independent of the choice of external closure. The common feature of these two policy simulations is that the only effects are that increases in government consumption and investment directly crowd private consumption and investment out. This implies in particular that none of the external variables are influenced, and the external closure is, therefore, without importance.

When the expansion of government spending is financed by domestic credit, the general price level increases in response to the larger money supply. Since the nominal exchange rate is now fixed, and cannot therefore contribute to the overall price increase needed, this implies a greater rise in the domestic price level than in the standard set-up, and the real exchange rate appreciates. This leads to an expansion of imports and, consequently, a greater total supply of goods. In addition, the real value of the increases in government consumption and investment are smaller under the alternative external closure as the general price level increases more than in the standard set-up. Therefore, more goods are available for private absorption and both private consumption and investment are higher.

The choice of external closure also affects the outcome of policy simulations when the government is allowed to finance increased expenditure in the international capital markets. Under the closure with a fixed nominal exchange rate and endogenous private sector capital flows, increased government borrowing abroad simply replaces private sector borrowing so the balance of payments is unaffected. Consequently, the only effects in this simulation are that private consumption and investment are crowded out by government consumption and investment. The experiment, therefore, results in exactly the same effects as when taxes or domestic bonds are used to finance the change in the budget deficit. In the standard set-up of the framework, this was not the case as increased government borrowing abroad led to increased imports, which implied that several additional effects occurred.

Policy Conclusion

It clearly transpires from the above policy simulations that the choice of financing source of expanded government activity can matter a great deal for economic outcomes. Moreover, while tax financing and the issuance of government bonds may ensure that increased government expenses crowd out private consumption and investment in a similar manner, this similarity can easily break down. The mechanisms ensuring the necessary adjustments in private consumption and portfolio demand are left unspecified. Thus, while bond financing is certainly an option to be considered, it remains, for example, debatable whether this avenue is indeed a feasible one. Issuance of government bonds may require interest rate increases, which are so substantial that their effects cannot be ignored. Yet, another policy conclusion, which transpires from the policy experiments considered is that the effect of domestic credit financing on inflation must be monitored carefully. Finally, the advantage of increased foreign borrowing is that it, in general, allows absorption to increase across the board. How far this latter option can and should be pursued will depend, however, on developments in the cost and availability of external financing.

3.1.B. Variant 1B: Changes in the Composition of Government Spending

All policy simulations discussed in the previous section were also carried out using a different composition of the expansion in government spending. Thus, nominal government investment was raised by 20 per cent and other government expenditure by 10 per cent, while the increase in nominal government consumption was set so that an overall 10 per cent increase was maintained. This resulted in nominal government consumption, which was between 7.6 per cent and 8.3 per cent higher than in the baserun.

The change in experiment design does affect the outcome of policy simulations when GDP is determined residually in the material balance. On the other hand, when private consumption is the freely adjusting variable only the distributions of total consumption and total investment between public and private are affected. This conclusion depends neither on how the higher government expenditure is financed nor on the choice of external closure. The explanation of this phenomenon concerns the different roles of government consumption and investment in the material balance equation. As already mentioned, the investment function determines total investment so an increase in government investment is completely offset by a fall in private investment. Thus, domestic aggregate demand remains unchanged. However, an increase in government consumption leads to higher domestic aggregate demand unless private consumption is determined as a residual. Consequently, changes in the composition of government spending can influence the results of policy simulations under the two closures mentioned above.

It was shown previously that higher government expenditure led to a fall in GDP, when this variable was allowed to vary. Hence, a decrease in government consumption implies an increase in GDP. Thus, a change in the composition of the expansion of government expenditure where capital expenditures are favoured over current expenditures reduces this fall in GDP. When the expansion is tax financed, the chosen experiment design even makes GDP rise as the fall in private consumption, which results from higher taxes, more than offsets the increase in government consumption. Consequently, aggregate demand is initially reduced, which in this framework implies an increase in GDP.

Since changes in composition only affect the results of policy simulations notably with non-standard closures and, moreover, are relatively simple to explain, actual data for these experiments are not included. However, it is notable that the quantitative effects in some policy simulation are changed quite substantially.

In sum, changes in the composition of government spending can affect economic outcomes in terms of both real output and other macroeconomic variables. However, the fact that government investment may crowd out private investment on a one-to-one basis leaving total capacity unchanged within the merged framework is an extreme case. This assumption is unlikely to hold in practice, provided government investment is as productive as private investment. Higher government investment will *ceteris paribus* increase total investment and consequently productive capacity and real output. This is only the case for government consumption, if higher consumption makes it possible to utilize installed capacity more efficiently. Thus, if higher growth is desired, investment rather than consumption, must usually be given priority.

3.1.C. Variant 1C: Timing of Spending Increases

The timing of increases in government spending does not qualitatively affect the outcomes of policy simulations in the framework. Quantitatively, the effects are, of course, smaller during the period when the expansion of government expenditure is phased in. However, also results in subsequent years are influenced when they depend on cumulative changes in the stock variables of the framework. The change in the general price level is, for example, determined by the cumulated change in money supply. Since these stock variables are changed less in, say, the last year of the period, phasing in of government spending tends to dampen the effects in policy simulations.

3.2. Simulation 2: Increased Export

The framework applied in this study is ill-suited to analyze policies for export-promotion since export appears as an exogenous variable, which is a feature carried over from both the RMSM and the financial programming framework. However, a set of policy simulations were carried out where the effects of a 10 per cent increase in export were analyzed under different assumptions about the closure of the framework. The outcomes did not warrant detailed presentations and only the choice of external closure is of some interest, since it has significant impact as far as commodity supply is concerned. Thus, when all international flows are fixed and the exchange rate is endogenous, the exogenous increase in export must be matched by higher import. The exact expansion of import depends on the size of the simultaneous accumulation of foreign reserves, because the balance-of-payments specification implies that changes in export equals the sum of import and reserve changes, all measured in foreign currency units. Assuming constant GDP, import can only be expanded if the real exchange rate appreciates. Finally, since the change in import almost offsets the increase in export, total commodity supply for domestic absorption is virtually unaltered, and its allocation among the different types of domestic demand depends as before on the behaviour of prices.

In the framework used in this paper, it is simple to predict the effects that will result if the expansion of export is accompanied by an exogenous change in international capital flows. Thus, if the net borrowing abroad is reduced, it will limit the effects of the expanded export, whereas increased capital inflows will enforce the effects.

If the other external closure, i.e., exogenous exchange rate and endogenous private sector capital flows, is chosen, the export windfall is simply used to bring down the net external debt of the private sector. Hence, domestic absorption is crowded out by the expansion of export, while the real exchange rate and the different price indices remain unchanged. Since, the economy under this closure is free to vary international capital flows, any exogenous changes in the transactions with the rest of the world will immediately be countered by corresponding changes in private sector capital flows.

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