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A GROWTH AND TRADE ORIENTED MODEL FOR THE SURINAMESE ECONOMY

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In association with

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Notes and Acknowledgements

This report was prepared in partial fulfilment of the terms of reference of UNDP contract # SUR2003/08. The objective was to prepare an analytical framework as a step to finalization of a fully operational macroeconomic and trade policy model for Suriname. The model was specified based on data and a background report on the macroeconomy of Suriname prepared by Imro San a Jong under the supervision of Vanus James, Senior Policy Advisor, UNDP. Training in model building was provided in partial fulfilment of the terms of the contract.

To prepare the report, two missions were undertaken to Suriname and extensive consultations held with UNDP consultant Imro San A Jong and Vanus James and with the Suriname Modeling Team. Consultations were also held with the stakeholder groups, including relevant Directors and senior officials at the Central Bank of Suriname, the Ministry of PLOS and the National Planning Office, the Ministry of Finance and the Ministry of Trade and Industry.

Background

At a generic level, a macroeconomic model can be thought of as a mathematical construct that represents a systematic but simplified account of macroeconomic phenomena by use of stylised relationships that are capable of being falsified. The formulation of relationships may be driven by theory or observed data patterns. Given uncertainty, econometrics becomes a useful devise for pursuing such an investigation.

As in other economies, a macroeconomic model can be of immense value to policy planning in Suriname. Suriname is becoming increasingly market driven, and is becoming more and more integrated into the global environment through regional, hemispheric and multilateral arrangements. The country is therefore undergoing stabilisation and structural adjustment programmes, in a bid to improve the environment conducive to promoting private sector investment.

The goal of the present effort at constructing a macroeconomic model for Suriname is to provide a quantitative framework that can be useful for simulation of growth through the analysis of controllable alternative scenarios. In particular, the model should prove useful in exploring the transmission of direct and indirect economic shocks on the economy. Moreover, the model should provide an underlying basis for understanding the implications of fiscal, monetary and trade policies for the economy.

In order for the model to be valuable as an official tool, it is critical that a consistent set of objectives be derived from policy makers. To this end, it is assumed that the Medium-term Macroeconomic Framework, 2001 to 2006, aptly describes the objectives of the government, which can be interpreted as stabilisation of prices in the short-run, and ultimately to realise growth and employment in a market driven environment.

The model therefore seeks to provide an analytical framework that can be used as a quantitative tool for evaluating scenarios in a manner that is consistent with the stated macroeconomic objectives. As a corollary, model also investigates the direction of causality which underlies the economic variables in the economy.

Characteristics of the Surinamese economy

Following the military coup in 1980, Suriname adopted an inward looking state centred model of development. The government undertook industrial planning with the aim of being able to steer sectoral development to achieve desirable outcomes. Thus, economic development goals were expected to be executed through a series of development plans. Plans were developed covering 1987-1992. Inherent in these plans were the objectives of attaining 'Import Substitution Industrialisation' and the nationalisation of production. There was little reliance on market mechanisms nor was emphasis placed on export growth. Moreover, strong emphasis was placed on development, and less attention was paid to macroeconomic stability issues.

The economic outcome has not being encouraging. Growth in real output has been volatile, reflecting bouts of expansion and downturns. In the 1990s growth in real GDP spanned a range between negative 10.6 and 13.8 per cent. Amidst high economic uncertainty, the government sector played a major role in the economy, accounting on average for 20 per cent of GDP, only second to services, which accounted for 27 per cent of GDP. Moreover, the government sector is the largest single employer, accounting for an average of 45 per cent of total employment in the 1990s. Following government, the 'other services' sector accounts for 23 per cent of employment, while agriculture accounts for another 14 per cent.

The labour market is fairly flat, with very little changes taking place with respect to labour supply and demand. The growth of labour supply has been adversely affected by migration, particularly to Holland. The unemployment rate when migration is included, averaged 15.5 per cent in the 1990s. However, the unemployment data may mask employment in the informal sector, which is becoming more evident, given the growth of the sector. Since 1995, the sector has accounted for about a fifth of total output.

Suriname derives its major export earning from mining activities. In particular, bauxite, alumina and aluminium contribute about 75 to 80 per cent of export revenue. As a result, export earnings tend to be very sensitive to alumina prices. Foreign direct investment has been mainly in mining activities, but this has resulted in a net outflow of investment income as profits are repatriated. Moreover, official development assistance has been on the decline since 1992. Thus exports of the mining sector tend to be the major contributor to foreign exchange generation and therefore to import capacity.

Imports of productive inputs form a higher percentage of total imports compared to consumer imports. In the 1990s, productive imports ranged between 66 to 81 per cent, as compared to consumer goods. Evidently, weakened import capacity can have a deleterious effect on investment.

The government recognises that investment is more likely to occur in a stable environment. The economy is currently undergoing structural reforms and stabilisation. These include the use of tight fiscal policy and the use of monetary and exchange rate policies for stabilising commodity prices. In addition, plans are on for reform of the public service, and privatisation of public enterprises.

Policy Environment

The Medium-Term Macroeconomic framework (MTMF) for 2001 to 2006 is an important policy document from which a clear statement of government's objectives can be derived.[1] This plan sets out to target eight priority sectors -- Governance, environment, transport, trade and Integration into the Regional and International Economy, Education, Health, Housing, and Agriculture – with a view to laying out growth targets and prioritising investment. As such, the model will need to be flexible to accommodate the development plans that are currently being worked on.

[1] It is noted that this frame-work is to be upgraded to a longer-term plan running to 2020.

In an effort to reduce the incidence of poverty and improve living standards, growth and employment were the principal targets espoused by the plan for 2001 and 2002. The government was therefore committed to achieving economic stability, with the hope that this will instil investor confidence, and also lead to an improvement of the external current account. During the period 2001-2006, structural reforms are envisaged in the government and financial sectors, with the expectation that there will be institutional strengthening and strong private sector development. The government has also recognised that the development of the non-mining sector is important to employment creation. To this end, the government is targeting investment and productivity growth in this sector. The successful implementation of these measures is made even more urgent as the Surinamese economy is increasingly being incorporated into the global economy owing to multinational, hemispheric and regional agreements.

Growth and stabilisation issues are therefore central to the objectives of the modelling exercise. The immediate objective of this model will be to estimate statistically the cross sectoral linkages in the economy with a view of providing a framework for the forecasting the transmission of trade policies. The sectors can be broadly defined as households, the public sector and the private sector. Given the balance of payments constraint, in another sense the sectors can be categorised as the mining and non-mining sectors. The mining sector is the primary earner of foreign exchange, but it exhibits weak direct linkages with the rest of the economy. The non-mining sector on the other hand typically exhibits stronger internal linkages.

Previous Attempts at Model Construction

One of the earliest published models can be traced back to Tinbergen in 1936, on the Dutch economy. However, modelling activities really gained impetus over the last 40 years or so, following theoretical developments in the field of economics and advances in computer technology. A wide variety of models have been developed, varying in objectives, size, theoretical assumptions and type. Variations in models have also been largely due to the interests of institutions funding the exercise. In the US, models have been sponsored mainly for commercial interests, and used primarily for forecasting. In many other countries they have been publicly funded for official use by ministries and central banks so that not only forecasting motives may be found, but simulation exercises have also motivated their creation for use as planning tools.

Since 1970, a few statistical econometric models have been developed in the Caribbean Community, particularly with respect to Barbados, Guyana, Jamaica, and Trinidad and Tobago. These models were motivated by various objectives, including the simulation of: the effects of monetary and fiscal policies; trade effects; employment dynamics; the behaviour of aggregate demand; the behaviour of selected macroeconomic variables to policy shocks, and of various scenarios. Most of these models have been developed along Keynesian lines, but they have incorporated the balance of payments element and later the non-tradable, banking and the government sectors.

In Suriname, the Van Schaaijk model was constructed in the latter part of the 1980s and was used in the early 1990s to assist in planning. This model was fairly elaborate, consisting of 242 equations, with only 11 of these being macroeconomic in scope. The model was primarily concerned with simulating the impact of changes in the micro-sector on the macro-sector. In particular, the model simulated in detail how costs and prices at the micro level influenced production, growth and incomes at the macro level.

Critique of the Van Schaaijk Model

For theoretical and methodological reasons, the original model seems to have lost currency.[2] Indeed, a high level of aggregation, but not full aggregation, is useful for analysing the general inter sectoral dynamics and transmission effects. By attempting to build from the microeconomic foundations, the model misses the impact of macroeconomic factors on the allocation of resources, prices and output. Macro economic balances may in fact shape the microeconomic foundations. For example, volatility of macroeconomic aggregates and unsustainability of macroeconomic policies can fuel negative expectations and play a more important role than microeconomic factors in impacting on investment. Indeed, the role of expectations in impacting on investment decisions may in fact supersede simple price cost ratios. Thus, factors such as policy credibility, exchange rate, commodity price stability and debt burden can offset microeconomic gains in influencing investment. Moreover, the model is inward looking in its orientation, as it ignores many aspects of the price taking character of the Surinamese economy. Movements in external prices of bauxite and aluminium, for example, can be the source of major economic shocks in the economy.

Even more important, the model ignores the critical challenges to price stability, growth and restructuring that are created by foreign exchange bottlenecks and the general dynamics of the external sector. There is significant evidence that the external sector shapes prices within the economy and the model clearly underestimated this role. There is also now substantial evidence in output, employment and exchange rate data, that both monetary stability and the path of growth of output and employment of the Suriname economy are restrained directly by the available import capacity. For example, investments in infrastructure and directly into production in the non-mining sectors may in fact be limited by the import capacity of the country owing to scarce foreign exchange reserves.

Of related significance is that the Van Schaaijk model assumes that technological change traces out a constant path. This is neither a true nor a necessary assumption. Modelling devices now exist to address dynamic technical change and it is this assumption that is most crucial in guiding macroeconomic policy in support of investment in education and other forms of human capital to reflect government's current sectoral policy priorities. Further, the model captures the associated competitiveness of the supply response of the economy to variations in effective demand only through the price-cost ratio, with investment specified largely as a passive response to this variable. However, government's current interest in investment in human capital is part of its larger and more

[2] Consultations with the users revealed that they were generally dissatisfied with the model.

assertive effort to upgrade both the technology adopting and technology adapting strategy of the economy, consistent partly with the increasing need for the economy to initiate investment that might directly lead the adjustment of national and sector competitiveness. In this light, it is a significant drawback that other core indicators of competitiveness that are vulnerable to policy interventions, such as the real exchange rate and especially the productivity of labour and of imported inputs, are left out of consideration.

In terms of methodology, a drawback of the model is that it is data intensive and therefore difficult to use on a timely basis, given the resource constraints faced by the statistical authorities. While large scaled models confer the advantage of greater details and may therefore explain more, they are less manageable and more expensive to support. Moreover, the extensive data requirements can make the regular inputting of data quite unwieldy. In addition, the model was very brief in the examination of the implications of the macroeconomic foundations for the micro-economy, simply assuming that there is no macro-economy. Rather, the model focuses on an extensive specification of the micro-sector, in a partial equilibrium framework, based on the argument that the number of players and income producing sectors are small. In any event, such a high level of disaggregation does not reflect the current tendency of the policy environment to focus significantly less on microeconomic interventions and relatively more on getting the macroeconomic controls right and letting the market shape as much as possible the other adjustments. A sound and sufficiently aggregative macroeconomic model is necessary for such purposes and the Van Schaaijk model was not designed for such a strategy.

The construction of the present model

Since a model constitutes a simplification of reality, it is impossible to design a model capable of serving every imaginable objective. Thus a clear articulation of the model objectives is critical to its success as a planning tool. The present effort is intended to serve as a useful tool for the analysis of controllable alternative scenarios with a view of allowing for simulations and forecasting. In particular, it seeks to provide a basic understanding of the short to medium-term impact of trade on the macroeconomy.

The model is constructed with the recognition of the pertinent role the foreign exchange constraint plays in the operation of the macro-economy. The scarcity of foreign exchange undermines import of capital goods. Moreover, the performance of the macroeconomy has an important influence on expectations, which is manifested in terms of investments, exchange rate speculation, and economic absorption.

It is assumed that the economy is moving progressively towards market reform, where government would play the role of creating economic conditions favourable to private sector investment. For this reason, prices and price expectations are modelled as a separate block, since getting prices right is a fundamental tenet of this paradigm. The exchange rate is seen as pivotal, and consequently, its pass through effect on other prices in the economy is examined.

In order to capture some of the development characteristics that may be associated with Suriname, however, the model draws on some of the tenets of the structuralist school. In particular, the primacy of the external sector in driving the economy is assumed, and it therefore forms a very important block in the study.

Given the importance of the government sector to GDP, government is assumed to play an active role in net capital formation. The government sector is therefore modelled as a separate block, around which the real and the monetary sectors will be intricately linked.

In assessing the factors impacting on output, a distinction between mining and non-mining sectors is made. The mining sector produces primarily for export, with very weak linkages with the domestic economy, except through its absorption of significant human capital. Investment in this sector is shaped primarily through foreign investment. Its major role is foreign exchange generation, which then breeds life into the non-mining sector. The non-mining sector in contrast has stronger direct linkages with the domestic economy, especially with respect to employment generation. Other factors influencing employment will also be examined.

Overall, the model specified is informed by a number of analytical perspectives. First, there is the Keynesian principle of effective demand that applies because there are unemployed capital and labour in the Suriname economy and one has to explain how they are absorbed into the production system. Then, there is the Walrasian principle of excess demand that guides modelling of the impact of the tight balance of payments constraint on the real exchange rate on the one hand, and investment and output on the other,

especially in the non-mining sectors. Finally, there is the principle of competitiveness of the supply response in shaping the dynamics of output in response to variations in effective demand under a tight foreign exchange constraint. This is expressed mainly in terms of the growth of labour and import productivity.

These principles are used to shape a framework that amounts to a model of how the economy grows with unemployed labour, domestic capital and with fully employed foreign exchange supplies, the essentials of which are mentioned here. Summarily, the pivotal growth equation of the model expresses the theory that economy grows primarily through a process of expanding its supply of foreign exchange in order to procure necessary imports required for investment in production and a significant share of its wage goods. Its explanatory variables show that an expanding effective exogenous export demand, triggered by expanding output overseas are an important source of that supply of foreign exchange and a simultaneous stimulus to domestic production and employment.

An associated crucial short-to-medium run aspect of this expansion is growth of labour productivity to increase supply competitiveness in export markets, even if this also reproduces unemployment in the domestic economy. However, increased labour productivity can tighten the balance of payments constraint if there is inadequate investment in domestic capital in the non-mining and associated growth of import productivity. The displacement of labour through rising labour productivity is the result of the primacy of skills-biased (logistic) technology adopted to gain competitiveness in the OECD markets. This tends to be a typical feature of foreign direct investment in the export sectors.

An important issue, which arises here, is how to make the best use of foreign exchange generated to raise and sustain import capacity in the future. The crucial long-run aspect of expansion of import capacity is growth of import productivity and the competitiveness of the non-mining sector. The latter can be achieved mainly by increased domestic investment in infrastructure, education and other forms of domestic capital, which can be absorbed by all sectors, along with their associated patterns of (logistic) technology adaptation. The critical role of the non-mining sector is confirmed by its greater impact on the level of output, when compared with the dominance of the mining sector with respect to export. Apart from stimulating employment and output in the non-mining sector, investment in domestic capital also has the effect of boosting price-making capacity in the non-mining sector and realigning the non-mining sector with the mining sector. Raising domestic linkages and improving domestic impact (short and long term) multipliers are necessary complements of such realignment, with the related increasing return expressed in rising import productivity. In principle, this result also suggests that the mining/non-mining dichotomy is an approximation to a more useful distinction between sectors that use imported productive inputs intensively and compete through rising labour productivity on the one hand and sectors that compete by using domestic capital more intensively and compete by raising import productivity in the economy. This more refined distinction can be captured when more data are available. The result also implies that, in contrast to OECD economies, macroeconomic policy in Suriname

must strike an appropriate balance between import productivity growth and labour productivity growth, if growth is to be optimised, and will generally obtain a relatively greater impact from the stimuli to import productivity. All other economic dynamics follow from this primary process.

Of interest in this regard is that our specification shows that the growth in foreign exchange supplies expands the money supply, while easing the balance of payments constraint (or increasing the import cover) and facilitating stability of both the (nominal and real) exchange rate and imported inflation. Expansion of supply fosters a rising sophistication of the financial sector to understand, stimulate and manage the changing demand for project financing that underlies the reallocation of foreign exchange to capital-intensive activity and the increase of import-productivity. The increasing sophistication of the financial sector supports endogenisation of the supply of money, making it respond flexibly to the level of output circulating within the domestic economy.

Also of interest, the wage rate is principally a payment for skill and human capital and embodies a related rate of return for such investment. It is influenced by both labour productivity and import productivity. The role of labour and import productivity is attended by wage suppression mechanism through unemployed labour and capital that emanates partly from the labour-displacing effects. Labour is displaced through labour-productivity growth and partly from the inappropriate balance between the productivity of labour and the productivity of imports. Out results show that a modification of that balance is one of the keys to increasing the standard of living achieved through wage increases in a context of unemployment of labour and capital. Inflation pressures also play a significant role in stimulating wage adjustment, suggesting that union power is present in the labour market but is limited and largely reactive.

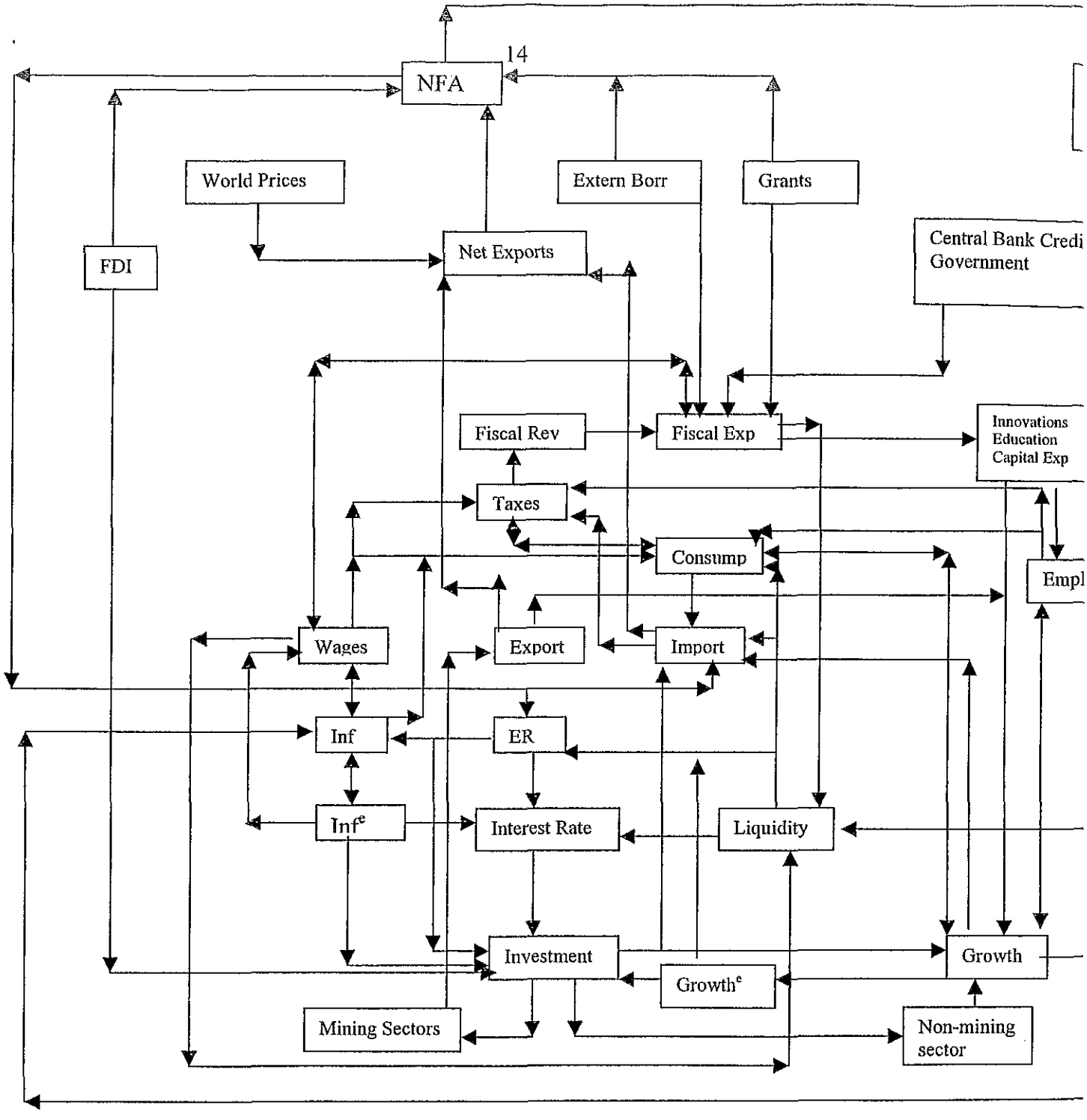
Block Assumptions

Construction of the model is preceded by the use of econometrics to investigate the pattern of association between macroeconomic variables. This is extremely important since it provides an empirical basis upon which strands of theory can be selected according to their usefulness in describing the Surinamese economy.[3] Following this, a flowchart of some of the main relationships uncovered is exhibited, (see Diagram 1). For simplification, the flow chart is constructed at a broader level of aggregation than the actual model specification.

The final specification consists of 34 variables, 9 of which are exogenous. The exogenous variables include import cover, imported inflation, gross capital formation, fiscal expenditure, velocity of circulation, unemployment rate, nominal GDP, private sector GDP and foreign GDP. For analytical convenience, the model is divided into five blocks – the external sector, output, government sector, labour market and money, prices and growth. Overall, the model consists of 25 equations, with 10 being identity relationships while the other 15 are behavioural relationships. The behavioural specifications includes 19 exogenous variables.

The following Diagram depicts the broad relationships uncovered from the econometric and theoretical reasoning. These relationships form the crust upon which the model is specified.

[3] There is indeed a paucity of empirical research on the economy. As a result there is very little available that can serve as an aid to the construction of a model tailor made to suit the characteristics of the economy.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Interest Rate
Liquidity
Investment
Growth
Growth^e
Mining Sectors
Non-mining
sector

Dagram 1

Output

In examining the magnitude of output, use is made of the Keynesian identity, so that output and therefore employment is set as being dependent partly on fiscal expenditure in capital goods, consumption, exports, imports, and investment in the non-mining sector. However, capacity is not assumed to be fixed, so that supply responses and competitiveness mechanisms are also assumed to influence output and will be specified in the growth block. The variables are presented in aggregate form, but they can be appropriately disaggregated to the sectoral level, if suitable data are available for that purpose.

Fiscal activities and trade are specified in the fiscal and external blocks respectively. Investment is incorporated into the model as an exogenous variable. Domestic investment is assumed to impact directly on growth through the multiplier effect. Exports are expected to raise the demand for investment goods. However, its impact on output may be weakened by weak linkages.

The External Sector

The external sector is disaggregated into the current account, unrequited transfers, and capital flows. On the current account side, the model pays explicit attention to the fact that mining accounts for the bulk of exports, and its value is principally a function of world prices. Being a price taker, world prices are modelled as exogenous. Exports are not modelled as a function of exchange rate, however, since it is assumed that exports will be exchange rate inelastic given the price taking behaviour of economic agents. There will be need to test the validity of this assumption. Tradeables are not modelled for the non-mining sectors, but they can also be modelled, using a world price to domestic price ratio (or related indicators) to model for competitiveness.

Central to the construction of the model is the recognition of the fact that the generation of foreign exchange sets a constraint on the capacity of the country to import investment goods. In addition, imports are assumed to be impacted on by expansion in output, exchange rates, liquidity, world prices and consumption. These variables capture the elasticity and the absorption views of the methods that are effective for controlling import demand. The elasticity view is that prices, especially the real exchange rate, will alter import demand. Indeed, the exchange rate is modelled as having a stronger effect on imports, rather than exports. Under the absorption approach, the current account balance is affected by the gap between output and absorption. Consumption is treated as the key macroeconomic variable impacting on absorption.

Capital inflows are modelled as exogenous. It consists of external borrowing, grants and foreign direct investment. These flows serve to build up net foreign assets and they therefore increase import capacity.

Fiscal sector

Government revenue is modelled as being generated by an endogenous component in the form of taxes, and exogenous components, in the form of external borrowing, grants, and central bank credit. Taxes are raised directly from the income of workers and from the cooperate sector and indirectly from external trade and domestic sales. The expenditure outlays are chiefly on wages and salaries, and capital goods and it is revenue constrained such that $\mathrm{Re}v - Exp \geq 0$.

Money and prices

The monetarist approach is used to model the monetary sector. The money supply is impacted on by government borrowing from the central bank, net foreign assets and expansion in output. It is assumed that there is a direct relationship between money supply and prices.

The prices in the economy are assumed to be inextricably linked. Depreciation of the exchange rate is assumed to have a pass through effect on inflation. The strength and nature of the pass through effect will be borne out by the investigation, but in theory, a depreciation of the exchange rate can cause imports to become more expensive. If demand for imports are inelastic, this can then be transmitted to higher prices of goods for consumers. Inflation is also perceived of as being impacted on by wage rates and inflationary expectations, with the latter two also impacting on each other.

Final Specification

Consumption Specification

The final consumption equation arrived at incorporates inflation alongside disposable income and past consumption. Various specifications pertaining to other Caribbean member countries follow the Keynesian tradition and relate consumption purely to income, perhaps with the assumption that there is a stable relationship between the two. However, the relationship was not found to be stable in the case of Suriname, despite the high correlation between the two.[4] Indeed, Cointegration was not found between the variables at a 5 per cent level of significance, thus suggesting the non-existence of a stable long-run relationship between both variables.[5] Cointegration was only obtained when inflation was included in the relationship. It is not surprising that the relationship became stable with the inclusion of the inflation parameter, given episodes of high inflation experienced by Suriname during the 1980s and 1990s. In fact, consumption was found to lead inflation by one period.[6]

Deeper inspection of the data through tests for the equality of the standard deviation measure of volatility reveals that disposable income was significantly more volatile than consumption for the period 1957 to 2001.[7] The result suggests that consumers may be smoothening their preferences over time in spite of higher income volatility. The data suggests, therefore, the relevance of the permanent income hypothesis in specifying the model for Suriname.[8] Accordingly, past consumption was also specified in the model. The use of impulse analysis reveal that shocks in the variables used in the specification tends to be sustained over long periods.[9] The final consumption specification, therefore, is as follows:

$$C_t = \alpha_0 + \alpha_1 C_{t-1} + \alpha_2 Y^d_{t-1} - \alpha_3 \pi_{t-1} + e$$
$$Y^d_{t-1} = Y^f_{t-1} - \left(T_{t-1} - T^{\text{int}}_{t-1}\right) + Y^{IS}_{t-1}$$

where

Y^d is real disposable income
π is domestic inflation
Y^f is income of the formal sector
T is total tax receipts
T^{int} is total tax receipts from international trade
Y^{IS} is income of the informal sector

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[4] See Table 1.
[5] See Tables 2 and 3 for unit root and cointegration results respectively.
[6] See Table 4.
[7] See Table 5.
[8] See Friedman 1957 for an exposition of this hypothesis.
[9] See Chart 1.

The Price Equations

Inflation

Suriname has recorded volatile inflation rates, with the highest rates occurring during the intervals: 1985-1987, 1993-1994, and between 1997-2000. As such, the economy encountered brief spells of high inflation. Not surprisingly, therefore, the central bank has as its primary ultimate target, the maintenance of low and stable inflationary rates.

In the final specification of inflation, the variable is specified as being a function of inflationary expectations, the interaction between imported inflation and the exchange rate, as well as the result of the growth of the money supply. There was some flirtation with the use of the wage rate as a proxy for cost push inflation, but the empirical evidence did not support the contention that increases in the wage rate lead to higher inflation. The estimation of Granger Causality through the Vector Error Correction process suggests that inflation Granger Causes the Wage rate.[10] This result is corroborated by the use of cross correlations and impulse analysis.[11] Wage rate was consequently dropped from the specification.

Domestic inflation was found to be highly correlated with the growth of the money supply and the interaction between inflation and the exchange rate.[12] Cointegration tests reveal the existence of a long-run relationship between inflation and the other two variables, growth in the interaction between imported inflation and the exchange rate, and money supply growth.[13] The relationship is strongest with respect to the interaction term, suggesting a pass through effect from both movements in the nominal exchange rates and import prices on inflation. This is evidenced by the use of VEC where the interaction term was found to Granger Cause inflation. The Generalised impulse response function also suggests that shocks in this variable linger for long periods. The evidence also support the role of expected inflation, as shocks on itself tended to linger for long periods of time. This finding therefore supports the notion that expected inflation does play a significant role in the movement of prices.

Money supply is not found to Granger Cause inflation. Moreover, the generalised impulse response function show a weak response of inflation to a shock in the growth of the money supply. It may be the case that credit may be more appropriate especially since it performs the role as an operating target for monetary policy. However, there were insufficient data available on credit as the time series were too short to produce statistically reliable estimates.[14] As a result, money supply growth is retained in the equation specification, only as an indicator of monetary conditions. There is room no doubt for finding a better indicator for which movements in it would provide a richer information set on inflation.

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[10] See Table 8.
[11] See Table 6 and Chart 2.
[12] See Table 9.
[13] See Table 10.
[14] A data set was attained only from 1990.

In summary, the evidence do not weigh heavily in favour of the notion that inflation in Suriname is a monetary phenomena. Rather, inflationary expectations, nominal exchange rates and import prices seem to play a more important and sustained role in driving movements in inflation. The equation is therefore specified accordingly:

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 \pi^{IM}_{t-1} + \alpha_3 Mg_{t-1} + e$$

$$\pi^{IM}_{t-1} = \frac{\left(P^f_{t-1} \times ER_{t-1} - P^f_{t-2} \times ER_{t-2}\right)}{P^f_{t-2} \times ER_{t-2}}$$

where

π is domestic inflation, defined as the percentage growth of the consumer price index,

π^{IM} is imported inflation;

Mg is the growth of the money supply measured as M2;

P^f is the foreign price represented as the index of industrial prices;

ER is the nominal exchange rate represented as the average between the exchange rate of the formal sector and the informal sector.

Real Exchange Rate

Real exchange rate has been calculated as an index of foreign to domestic prices multiplied by the nominal exchange rate. Theoretically the rate is useful as a crude indicator of competitiveness. An increase in the rate can be expected to increase a country's price competitiveness either through nominal exchange rate depreciation or owing to increase in foreign prices. Similarly, a relative increase in domestic prices leads to an erosion of competitiveness. An examination of the data for the period 1975 to 2001 suggests that the there has been a fair degree of volatility in the movement of the rate. It declined up to about 1982 and then staggered upwards up until 1993 after which it declined again. Most of the increases in the rate were associated with nominal exchange rate depreciation, while its subsequent decline can be attributed to the increase in relative inflation of the economy.

The real exchange rate is modelled as an autoregressive function of the previous two periods, foreign exchange earnings weighted by imports and the growth of the broad money supply. The rate is lagged two periods to capture the long-term reverberation of speculative activities based on prior movement of the rate. The use of generalised impulse response functions confirm that initial shocks in the rate tend to have a sustained effect.[15] The result is consistent with the notion that policy credibility takes a while to build.

Import cover, measured as gross foreign exchange inflows divided by the monthly average imports, is used as a proxy for the adequacy of foreign exchange reserves.

[15] See Chart 5.

Indeed, the desire by monetary authorities to maintain exchange rate stability needs to be backed by an abundance of foreign exchange inflows. However, a weakness of the use of import cover, is that it ignores the burden of capital outflows such as those that may arise owing to debt servicing obligations. Unfortunately, more information is needed in order to quantify and affix a timing pattern to such outflows.[16] For simplification, therefore, import cover is scaled by imports. The usefulness of import cover was confirmed by cross correlations, Granger Causality and impulse analysis, where it was found to lead the real exchange rate. The growth in the money supply was found also to convey useful information on exchange rate movements.

Money supply growth was included, since it should normally be expected that increases in its growth rate has the potential to lead to higher inflation levels and therefore reduce the real exchange rate. Similar to the inflation regression, the results did not support the contention that growth in the money supply Granger Cause inflation. However, impulse analysis does suggest that there are some effects, in favour of a priori expectations that increases in money growth reduces the real exchange rate. Thus, the real exchange rate is modelled as a function of exchange rate expectations, import cover and money supply growth. Thus the specification is as follows:

$$RER_t = \alpha_0 + \alpha_1 RER_{t-1} + \alpha_2 RER_{t-2} - \alpha_3 \,\mathrm{Im\,cov}_{t-1} - \alpha_5 Mg_{t-1} + e$$

where

RER	is the real exchange rate, calculated as $\frac{P^f}{P^d} ER$, with P^d being the index of consumer prices.
Im cov	is the import cover, defined as the ratio of gross foreign reserves to the monthly average of imports for the year.

Wage Rate

A proxy for the real wage rate was formulated as the gross labour cost divided by the number of persons employed in the economy. The reduced form of the equation is specified to include demand and supply factors.

The equation is formulated such that the wage rate is dependent on its lagged value, inflation expectation, the unemployment rate and the productivity of labour. An examination of the data suggests that real wages dipped during periods of high inflation, a result that is consistent with the finding that nominal wages adjust with a lag to inflation, rather than the reverse. The lagged growth in the wage rate is used to capture some sort of benchmark upon which workers and employers would base their wage increases. Use of impulse analysis suggests that positive shocks in the growth of wage rates, inflation and labour productivity tends to have short-term positive effects, while

[16] For example, the net present value can be used to approximate the stream of outflows, but the schedule of outflows must be known.

unemployment and productivity tends to have negative effects as was expected.[17] The relation between the inflation rate and the unemployment rate gives rise to the Phillips curve, while inflation expectations allow for the specification of the augmented Phillips curve that is popular in the neoclassical literature. The final specification is as follows:

$$Wg = \alpha_0 + \alpha_1 Wg_{t-1} + \alpha_2 \pi_{t-1} - \alpha_3 U_{t-1} + \alpha_4 AP^{L}_{t-1} + \alpha_5 AP^{IM}_{t-1} + e$$

$$AP^{L} = Y/Emp, \quad AP^{IM} = Y/IM$$

where

Wg_{t-1} is the percentage growth in the wage rate (WR). Total wages divided by the total numbers employed was used as a proxy for the wage rate.

U_{t-1} is the unemployment rate.

AP^{L}_{t-1} is the average productivity of labour, defined as the ratio of GDP to the total numbers employed.

Emp is the total employment.

AP^{IM}_{t-1} is the average productivity of imports

IM is total imports

External Flows

The external accounts are specified with five identity expressions - net foreign inflows, gross foreign inflows and the sum of outflows, total exports and total imports. Behavioural equations are specified for the current account while the capital flows are modelled as exogenous. Exports are disaggregated into exports of the mining sector, which includes the aggregate value of bauxite, alumina and aluminium, and exports of the non-mining sector, consisting of the remainder of exports. Imports are divided into consumer imports and capital imports.

The demand for both forms of exports are modelled as being dependent on the growth of foreign GDP. However, the demand for exports of the mining sector are assumed to be price elastic, given the price taking behaviour typical of small open economies such as Suriname. The real exchange rate is therefore not included in the specification of the mining sector. Given that adjustment to demand comes through quantity, rather than price, output capacity of the mining sector is modelled rather than price. Accordingly, increases in output capacity is modelled as being dependent on growth of exports of the sector in the last period and on growth in output of the mining sector in the same period. Such growth, whether positive or negative, allows for the accumulation or depletion of resources necessary for the expansion of the sector. In the final specification, therefore, mining exports is modelled as being dependent on foreign GDP, and output of the mining sector itself. Indeed, all three variables were found to be cointegrated.[18] Moreover, it is revealed in Table 11 that exports of the mining sector and foreign GDP are highly

[17] See Chart 4.
[18] See Table 12.

correlated. Moreover, from the use of impulse analysis, mining exports tends to react strongly to export shocks, followed by shocks in the output of the sector, while it responds to shocks in foreign GDP with a lag.[19]

In contrast, real GDP of the domestic economy and the real exchange rate are added to the regression for the value of exports of the non-mining sector. Real GDP is not included for the mining sector specification, given its characteristic weak direct linkage with the domestic economy. Instead linkages are assumed to be strongest between the non-mining sector and the economy.[20] In addition, economic agents in Suriname are expected to have a greater degree of control over prices of non-mining exports. As such, the success of exports of this sector are expected to depend on its competitiveness. Hence the real exchange rate is included in the model for this sector as a key price indicator of competitiveness. In similar fashion to the mining sector, the growth of exports of the non-mining sector is included to capture the rate at which the sector can expand capacity output. However, the empirical tests did not reveal cointegration between the final variables used, non-mining exports, real exchange rate, local GDP, and foreign GDP. Nevertheless, impulse analysis suggests that there is a strong positive impact of shocks on the non-mining sector on itself.[21] Moreover, non-mining exports was found to exhibit a positive response to shocks in foreign GDP, though with a lag. While it was immediately positive in its reaction to local GDP. Shocks in the real exchange rate did not appear to be effective, but real exchange rates are still included in keeping with conventional theory.

On the import side, consumer imports are modelled as a function of lagged values of imports, GDP, real exchange rate and growth of the money supply. The use of impulse analysis suggests that shocks in consumer imports on itself tend to be sustained over one period, (see Chart 8). Imports are therefore lagged once. The lag in imports is similar to the permanent income hypothesis where the consumer is assumed to take a while to adjust their demand for imports. Shocks in GDP reverberated in its impact on imports. Consequently imports are modelled as a function of GDP lagged twice. The real exchange rate is included since it is assumed that consumers react to the price of imports. Money growth is included since a proportion of the increases in the money supply can be expected to be quickly converted into imports. In similar vein, firms are assumed to adjust their capital imports over time to foreign exchange constraint. The demand for imported capital is expected to arise from new investments and level of confidence in the economy. Past GDP is used to capture the latter variable. The final specification of the external sector therefore, is as follows:

$$NFI_t = GFI_t - FO_t$$

$$GFI_t = X_{t-1} + Tran^*_{t-1} + Bor^*_{t-1} + FDI^*_{t-1} + e_t$$

$$X_t = X_t^{\min} + X_t^{n\min}$$

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[19] See Chart 6.

[20] For example, in 2001, the mining and quarrying sector only accounted for about 4 per cent of total employment in companies with 9 employees or more.

[21] See Chart 7.

$$X_t^{\min} = \alpha_0 + \alpha_1 X_{t-1}^{\min} + \alpha_2 gX_{t-1}^{\min} + \alpha_3 gY_{t-1}^{\text{int}} + \alpha_4 gY_{t-1}^{\min} + e$$

$$X_t^{n\min} = \alpha_0 + \alpha_1 X_{t-1}^{n\min} + \alpha_2 gX_{t-1}^{n\min} + \alpha_3 gY_{t-1}^{\text{int}} + \alpha_4 gY_{t-1} + \alpha_5 RER_{t-1} + e$$

$$FO = \text{Im} + DS + Oth$$

$$IM_t = IM_t^{cons} + IM_t^k$$

$$IM_t^{cons} = \alpha_0 + \alpha_1 IM_{t-1}^{cons} + \alpha_2 Y_{t-1} + \alpha_3 \text{Im}\, p\text{cov}_{t-1} - \alpha_4 RER_{t-1} + \alpha_5 Mg_{t-1} + e_t$$

$$IM_t^K = \alpha_0 + \alpha_1 IM_{t-1}^K + \alpha_2 IM_{t-2}^K + \alpha_3 I_{t-1} + \alpha_4 \text{Im}\, p\text{cov}_{t-1} + \alpha_5 Y_{t-1} + e_t$$

where

NFI is the net foreign exchange inflows
GFI is the gross foreign exchange inflows
FO is the total foreign exchange outflow
X is the value of exports
$X^{\min}$ is the combined value of bauxite, alumina and aluminium exports
$X^{n\min}$ is defined as $X - X^{\min}$
g is growth
Y^{int} is Foreign GDP
$Y^{\min}$ Output of mining sector
$Tran$ is grant financing and other transfers
Bor is government borrowing and government guaranteed debt
IM is the value of imports
IM^{cons} is the value of consumer imports
IM^K is the value of capital imports
I is investment, defined as gross capital formation
DS is debt service payments
Oth represents other outflows

Government

The government sector is modelled with two identities and a restriction. The identity relations are with respect to government revenue and taxes, while a restriction is placed on government expenditure. Taxes are disaggregated and treated as endogenous, while the other forms of government revenue are modelled as exogenous. Government expenditure is also modelled as being exogenous. With the exception of taxes arising from international trade, the other taxes are modelled as being dependent on GDP to account for both the inflation and growth effects. The velocity of circulation variable is included in the indirect tax equation to account for the volume of domestic transactions. Tax receipts from international trade are modelled as being dependent on imports of the overall economy and exports of the mining sector. The final specification is as follows:

$$GovR_t = T_t + Gr_t + PSE_t + Bor_t$$

$$T_t = T_t^{inc} + T_t^{\text{int}} + T_t^{ind} + T_t^{or}$$

$$T_t^{inc} = \alpha_0 + \alpha_1 Y_t + e$$

$$T_t^{\text{int}} = \alpha_0 + \alpha_1 IM_t + \alpha_2 X_t^{\min} + e_t$$
$$T_t^{ind} = \alpha_0 + \alpha_1 V_t + \alpha_2 Y_t^n + e_t$$
$$T_t^{or} = \alpha_0 + \alpha_1 Y_t^n + e_t$$
$$GovR - GovE \geq 0$$

where

$GovR$ is government revenue
Gr is grant financing
PSE is the profit of state enterprises
Bor is government borrowing
T^{inc} is the receipts from income taxes
T^{ind} is the receipts from indirect taxes
T^{or} is $T - \left(T^{inc} + T^{\text{int}} + T^{ind}\right)$
Y_t^n is nominal GDP
V_t is the velocity of circulation defined as $\frac{Y_t^n}{M_t^2}$
$GovE$ is government expenditure

Money

The money supply is treated as endogenous, being influenced by the monetisation of foreign exchange inflows, movements in inflation, economic growth, growth in wage rates and growth in credit by the banking sector, inclusive of the central bank to government. There is need, however, for a specialised study devoted to studying the monetary transmission mechanism. For example, the flow from credit to inflation via the exchange rate is of particular interest to the Central Bank. However, a richer collection of credit data is needed in order to refine the monetary aspect in line with current monetary policy.

$$Mg_t = \alpha_0 + \alpha_1 Yg_{t-1} + \alpha_2 GFI_{t-1} + \alpha_3 \pi_{t-1} + \alpha_4 Credg_{t-1} + \alpha_5 Wrg_{t-1} + e_t$$

where

Yg is the growth of GDP
$Credg$ is the growth of credit by the banking sector

Labour Market

The demand for labour is modelled as being dependent on the wage rate, government expenditure, private sector activity and productivity. Labour supply is treated as being exogenous. The specifications are:

$$Emp_t = \alpha_0 - \alpha_2 Wg_{t-1} + \alpha_3 GovE_{t-1} + \alpha_4 Y_{t-1}^{\text{Priv}} + e_t$$

$$U_t = LS_t - EMP_t$$

where

EMP	is total employment
Y^{Priv}	is total GDP minus government expenditure

Growth

Economic growth is outlined in structural form, with the final estimation equation specified in reduced form.

$$Y_t = Y_{t-1} + dY_t^{\min} + dY_t^{n\min}$$

$$dY_t^{d\min} = dY_t^{FC} + dY_t^{CU}$$

$$dY_t^{FC} = K_{t-1}^{D} + K_{t-1}^{IM} + I_t^{D} + I_t^{IM}$$

$$K_{t-1}^{s} = \alpha_0 + \sum_{i}^{n} \frac{\frac{K_{t-i} - K_{t-i-1}}{K_{t-i-1}}}{N} \quad \text{where } S = D, IM \text{ and } i = 1,2,3,\ldots,N$$

$$I_t^{m} = f\left(X_{t-1}^{\min}\right)$$

$$dY_t^{cu} = f\left(AP_{t-1}^{j}\right) \text{ where } j = \text{labour } (L), \text{ capital } (K), \text{ imports } (IM)$$

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 I_{t-1}^{d} + \alpha_3 gX_{t-1}^{\min} + \alpha_4 AP_{t-1}^{L} + \alpha_5 AP_{t-1}^{IM}$$

where

$dY_t^{\min}$	is the change in output of the mining sector
$dY_t^{n\min}$	is the change in output of the non-mining sector
dY_t^{FC}	is the change in fixed capacity
dY_t^{CU}	is the change in capacity utilisation
K_t^{D}	is the stock of domestic capital
K_{t-1}^{IM}	is the stock of imported capital
I_t^{D}	is the proportion of local resources used for investment
I_t^{IM}	is the proportion of imported capital used for investment
AP_{t-1}^{j}	is the average productivity of the factor of production

Model Estimation Performance

The model was designed to forecast one period ahead. However, owing to missing data, the model was estimated only for the period 1988 to 2000. The shortness of the data series can indeed adversely affect the quality of the forecasts, so that estimation results can at best provide only a guide as to the potential of the model as a simulation and forecast tool.

In spite of the data handicap, the model performed best at forecasting consumption and real GDP (See Charts 10-12). Among the price variables, there was a fair degree of success in forecasting the inflation and the real exchange rate. Unfortunately the growth in the real wage rate did not perform as well as expected. However, the manner in which the wage rate was computed, could have adversely affected the success of the forecast. In the trade segment, the forecast was best for exports of the mining sector. There may be need for a more detailed specification of this sector once more data becomes available. For example, the type of trade taxes and the actual rates should be decomposed, in order to yield a more clinical forecast of the sector.

The model was weakest at forecasting government revenues derived from taxes. Income taxes and indirect taxes seemed to bear little relation to economic output. This could be indicative of weaknesses in tax collection therefore leading to taxes being under collected.

Recommendations

Efforts should be extended to cleaning up data in order to improve the forecasts power of the models. Moreover, specifications should be decomposed to filter down into selected aspects of the micro-structure. In addition, growth targets should be firmed up so as to guide in the operationalizing of the model. Finally, the model needs to be operationalised through the creation of a spread sheet interface once the final specification is accepted.

Appendix I: Model Specification

Basic Output Identity

$$Y = C + I + G + X - IM$$

where

C	is Consumption
Y	is real GDP
I	is investment
G	represents government activities
X	represents exports
IM	represents imports

Consumption

$$C_t = \alpha_0 + \alpha_1 C_{t-1} + \alpha_2 Y^d_{t-1} - \alpha_3 \pi_{t-1} + e$$

$$Y^d_{t-1} = Y^f_{t-1} - \left(T_{t-1} - T^{\text{int}}_{t-1}\right) + Y^{IS}_{t-1}$$

where

Y^d	is real disposable income
π	is domestic inflation
Y^f	is income of the formal sector
T	is total tax receipts
T^{int}	is total tax receipts from international trade
Y^{IS}	is income of the informal sector

Price equations

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 \pi^{IM}_{t-1} + \alpha_3 Mg_{t-1} + e$$

$$\pi^{IM}_{t-1} = \frac{\left(P^f_{t-1} \times ER_{t-1} - P^f_{t-2} \times ER_{t-2}\right)}{P^f_{t-2} \times ER_{t-2}}$$

where

π	is domestic inflation, defined as the percentage growth of the consumer price index,
π^{IM}	is imported inflation;
Mg	is the growth of the money supply measured as M2;
P^f	is the foreign price represented as the index of industrial prices;
ER	is the nominal exchange rate represented as the average between the exchange rate of the formal sector and the informal sector.

Real Exchange Rate

$$RER_t = \alpha_0 + \alpha_1 RER_{t-1} + \alpha_2 RER_{t-2} - \alpha_3 \operatorname{Im}\operatorname{cov}_{t-1} - \alpha_5 Mg_{t-1} + e$$

where

RER is the real exchange rate, calculated as $\frac{P^f}{P^d} ER$, with P^d being the index of consumer prices.

Im cov is the import cover, defined as the ratio of gross foreign reserves to the monthly average of imports for the year.

Wage Rate

$$Wg = \alpha_0 + \alpha_1 Wg_{t-1} + \alpha_2 \pi_{t-1} - \alpha_3 U_{t-1} + \alpha_4 AP^L_{t-1} + \alpha_5 AP^{IM}_{t-1} + e$$

$$AP^L = Y/Emp, \quad AP^{IM} = Y/IM$$

where

Wg_{t-1} is the percentage growth in the wage rate (WR). Total wages divided by the total numbers employed was used as a proxy for the wage rate.

U_{t-1} is the unemployment rate.

AP^L_{t-1} is the average productivity of labour, defined as the ratio of GDP to the total numbers employed.

Emp is the total employment.

AP^{IM}_{t-1} is the average productivity of imports

IM is total imports

External Flows

$$NFI_t = GFI_t - FO_t$$

$$GFI_t = X_{t-1} + Tran^*_{t-1} + Bor^*_{t-1} + FDI^*_{t-1} + e_t$$

$$X_t = X^{\min}_t + X^{n\min}_t$$

$$X^{\min}_t = \alpha_0 + \alpha_1 X^{\min}_{t-1} + \alpha_2 gX^{\min}_{t-1} + \alpha_3 gY^{\text{int}}_{t-1} + \alpha_4 gY^{\min}_{t-1} + e$$

$$X^{n\min}_t = \alpha_0 + \alpha_1 X^{n\min}_{t-1} + \alpha_2 gX^{n\min}_{t-1} + \alpha_3 gY^{\text{int}}_{t-1} + \alpha_4 gY_{t-1} + \alpha_5 RER_{t-1} + e$$

$$FO = \text{Im} + DS + Oth$$

$$IM_t = IM^{cons}_t + IM^k_t$$

$$IM^{cons}_t = \alpha_0 + \alpha_1 IM^{cons}_{t-1} + \alpha_2 Y_{t-1} + \alpha_3 \text{Im}\, p\text{cov}_{t-1} - \alpha_4 RER_{t-1} + \alpha_5 Mg_{t-1} + e_t$$

$$IM^K_t = \alpha_0 + \alpha_1 IM^K_{t-1} + \alpha_2 IM^K_{t-2} + \alpha_3 I_{t-1} + \alpha_4 \text{Im}\, p\text{cov}_{t-1} + \alpha_5 Y_{t-1} + e_t$$

where

NFI is the net foreign exchange inflows

GFI is the gross foreign exchange inflows

FO is the total foreign exchange outflow

X is the value of exports

$X^{\min}$ is the combined value of bauxite, alumina and aluminium exports

$X^{n\min}$ is defined as $X - X^{\min}$

g is growth
Y^{int} is Foreign GDP
Y^{min} Output of mining sector
$Tran$ is grant financing and other transfers
Bor is government borrowing and government guaranteed debt
IM is the value of imports
IM^{cons} is the value of consumer imports
IM^{K} is the value of capital imports
I is investment, defined as gross capital formation
DS is debt service payments
Oth represents other outflows

Government

$$GovR_t = T_t + Gr_t + PSE_t + Bor_t$$

$$T_t = T_t^{inc} + T_t^{int} + T_t^{ind} + T_t^{or}$$

$$T_t^{inc} = \alpha_0 + \alpha_1 Y_t + e$$

$$T_t^{int} = \alpha_0 + \alpha_1 IM_t + \alpha_2 X_t^{min} + e_t$$

$$T_t^{ind} = \alpha_0 + \alpha_1 V_t + \alpha_2 Y_t^n + e_t$$

$$T_t^{or} = \alpha_0 + \alpha_1 Y_t^n + e_t$$

$$GovR - GovE \geq 0$$

where
$GovR$ is government revenue
Gr is grant financing
PSE is the profit of state enterprises
Bor is government borrowing
T^{inc} is the receipts from income taxes
T^{ind} is the receipts from indirect taxes
T^{or} is $T - \left(T^{inc} + T^{int} + T^{ind}\right)$
Y_t^n is nominal GDP
V_t is the velocity of circulation defined as $\frac{Y_t^n}{M_t^2}$
$GovE$ is government expenditure

Money

$$Mg_t = \alpha_0 + \alpha_1 Yg_{t-1} + \alpha_2 GFI_{t-1} + \alpha_3 \pi_{t-1} + \alpha_4 Credg_{t-1} + \alpha_5 Wrg_{t-1} + e_t$$

where
Yg is the growth of GDP
$Credg$ is the growth of credit by the banking sector

Labour Market

$$Emp_t = \alpha_0 - \alpha_2 Wg_{t-1} + \alpha_3 GovE_{t-1} + \alpha_4 Y_{t-1}^{Priv} + e_t$$

$$U_t = LS_t - EMP_t$$

where

EMP	is total employment
Y^{Priv}	is total GDP minus government expenditure

Growth

$$Y_t = Y_{t-1} + dY_t^{\min} + dY_t^{n\min}$$

$$dY_t^{d\min} = dY_t^{FC} + dY_t^{CU}$$

$$dY_t^{FC} = K_{t-1}^{D} + K_{t-1}^{IM} + I_t^{D} + I_t^{IM}$$

$$K_{t-1}^{s} = \alpha_0 + \sum_{i}^{n} \frac{K_{t-i} - K_{t-i-1}}{K_{t-i-1}} \Big/ \quad \text{where } S \quad D, IM \text{ and } i \quad 1,2,3,\ldots,N$$

$$I_t^{m} = \quad X_{t-1}^{\min}$$

$$dY_t^{cu} \quad |AP_t^{j}| \text{ where } \quad = \text{labour} \quad , \text{capital} \quad , \text{imports}$$

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 I_{t-1}^{d} + \alpha_3 gX_{t-1}^{\min} + \alpha_4 AP_{t-1}^{L} + \alpha_5 AP_{t-1}^{IM}$$

where

$dY_t^{\min}$ is the change in output of the mining sector

$dY_t^{n\min}$ is the change in output of the non-mining sector

dY_t^{FC} is the change in fixed capacity

dY_t^{CU} is the change in capacity utilisation

K_t^D is the stock of domestic capital

K_{t-1}^{IM} is the stock of imported capital

I_t^D is the proportion of local resources used for investment

I_t^{IM} is the proportion of imported capital used for investment

AP_{t-1}^j is the average productivity of the factor of production

Appendix 2

Table 1: Cross Correlation results: Consumption and Disposable Income

i	lag	Lead
0	0.9535	0.9535
1	0.9037	0.8600
2	0.8464	0.7717
3	0.7624	0.6876
4	0.6717	0.5927
5	0.5776	0.4947
6	0.4803	0.4241
7	0.3901	0.3702
8	0.2993	0.3164
9	0.2380	0.2670
10	0.1947	0.2407

Table 2 : Unit Root Tests

Variable	Level Series			First Difference		
	C	C&T	No C&T	C	C&T	No C&T
C	-0.73(0)	-2.70 (0)	1.22 (0)	-6.07 (0)*	-6.0 (0)***	-5.78 (0)***
YFC	-1.83(0)	-2.32(1)	1.44(0)	-4.74(0)***	-4.88(0)***	-4.45(0)***
Y^d	-0.88 (0)	-2.81(2)	1.20(0)	-8.82(0)***	-8.64(0)***	-8.99(0)***
π	-4.25(1)***	-5.10 (0)***	-3.66 (0)***			
Wrg	-4.64(0)***	-4.69(0)***	-4.65(0)***			
$X^{\min}$	-1.51(0)	-2.48(0)	0.09(0)	-5.59(1)***	-5.59(0)***	-5.59(0)***
$Y^{\min}$	1.26(0)	-3.23(0)	2.76(0)	-4.00(2)***	-5.12(0)***	-3.17(0)***
Yg^{int}	1.26(0)	-3.23(1)	2.76(0)	-4.05(0)***	-5.12(0)***	-3.17(0)***
IM^{cons}	-1.26(0)	-3.95(1)***	0.00(0)	-4.96(0)***		-4.95(0)***
Im p cov	-2.06(0)	-1.99(0)	-1.28(0)	-4.81(0)***	-4.73(0)***	-4.91(0)***
RER	-1.60(0)	-2.10(0)	-0.30(0)	-5.63(1)***	-5.56(1)***	-5.69(0)***
Mg	-2.80(0)*	-3.06(0)	-2.18(0)**			

Table 3: Tests for Cointegration of the Consumption Function

Relation	Eigen Value	Trace Statistic	Max-Eigen Statistic
Consumption, Income	0.227	11.78	11.08
Consumption, Income and Inflation	0.497	44.21**Ψ	28.87**Ψ

Notes: (**) denotes rejection of the null hypothesis at the 5 per cent level of significance. Statistics are quoted only for the null hypothesis that there are no cointegrating vectors. However, the symbol Ψ indicates that two cointegrating vectors were actually found.

Table 4: Cross Correlation results: Consumption and Inflation
(Consumption lag or lead inflation)

i	Lag	Lead
0	0.4947	0.4947
1	0.4141	0.4977
2	0.3625	0.4532
3	0.3681	0.3879
4	0.4080	0.3012
5	0.4020	0.1245
6	0.4061	0.0563
7	0.2952	0.1047
8	0.0744	0.1565
9	-0.0246	0.1994
10	-0.0450	0.1953
11	-0.0523	0.2094
12	-0.0653	0.2129

Table 5: Test of Equality of Variances Between the Series: Real Consumption and Disposable Income in Suriname: 1957 - 2001

Null Hypothesis: Variances are equal

	Standard Deviation		F-test	Bartlett	Levene	Brown-Forsythe
	Real Consumption	Real Disposable Income				
Value	349.3	484.3	1.92**	4.57**	3.45*	2.26

Notes: ** means significant at a 5 per cent level of significance, * means significant at a 10 per cent level of significance.

Table 6: Cross Correlation results: Inflation and Wages
(Inflation lag or lead wages)

i	lag	Lead
0	0.3311	0.3311
1	0.0025	0.4423
2	-0.4095	0.5595
3	-0.1139	0.3113
4	-0.0174	0.0754
5	0.0760	-0.2216
6	-0.0377	-0.1092
7	-0.2457	0.0905
8	-0.1136	0.0208
9	0.0239	0.0468
10	0.0856	0.0046

Table 7: Test of Equality of Variances Between the Series: Inflation and growth of real wages: 1957 - 2001

Null Hypothesis: Variances are equal

	Standard Deviation		**F-test**	**Bartlett**	**Levene**	**Brown-Forsythe**
	Inflation	Real Wages				
Value	0.67	0.17	16.68***	15.24***	5.71**	1.65

Notes: * means significant at a 1 per cent level, ** means significant at a 5 per cent level, and * means significant at a 10 per cent level.**

Table 8: Use of the VEC to test Granger Causality

Dependent Variable	ΔInf	ΔWrg
ECM	$\alpha_1 ECM^1_{t-1} = Inf - 3.92Wrg$	$\alpha_1 ECM^2_{t-1} = Inf - 3.92Wrg$
α_1	-0.32	0.18
T statistic	-1.42	3.71***

Notes: Equations are of the form $\Delta Y_t = \alpha_0 + \alpha_1 ECM_{t-1} + \alpha_2 \Delta Y_{t-1} + \alpha_3 \Delta X_{t-1}$. **However, for the purpose of estimating Granger Causality, only the ECMs are reported.**

Table 9: Correlation Between Inflation and Regressors

	Money Growth	Imported Inflation
Inflation	0.95	0.97

Table 10: Tests for Cointegration of the Inflation Function

Relation	Eigen Value	Trace Statistic	Max-Eigen Statistic
π, π^{IM}, Mg	0.60	32.53**	20.06*

Table 11: Correlation Between Mining Exports and Regressors

	Y^{int}	Y^{min}
X^{min}	0.84	0.31

Table 12: Tests for Cointegration of the Export Function for the Mining Sector

Relation	Eigen Value	Trace Statistic	Max-Eigen Statistic
$X^{min}, Y^{int}, Y^{min}$	0.61	27.86**	17.91**

Table 13: Correlation Between Non-Mining Exports and Regressors

	Y^{int}	Y	RER
X^{nmin}	0.89	0.90	0.52

Table 14: Tests for Cointegration of the Consumption Import Function

Relation	Eigen Value	Trace Statistic	Max-Eigen Statistic
$IM^{cons}, Y, \mathrm{Im}\, p\,\mathrm{cov}, RER, Mg$	0.868743	91.60547***	44.67316***

Notes: (***) denotes rejection of the null hypothesis at the 1 per cent level of significance. Statistics are quoted only for the null hypothesis that there are no cointegrating vectors. However, two cointegrating vectors were actually found.

Chart 1: Impulse Response analysis of the Consumption Function

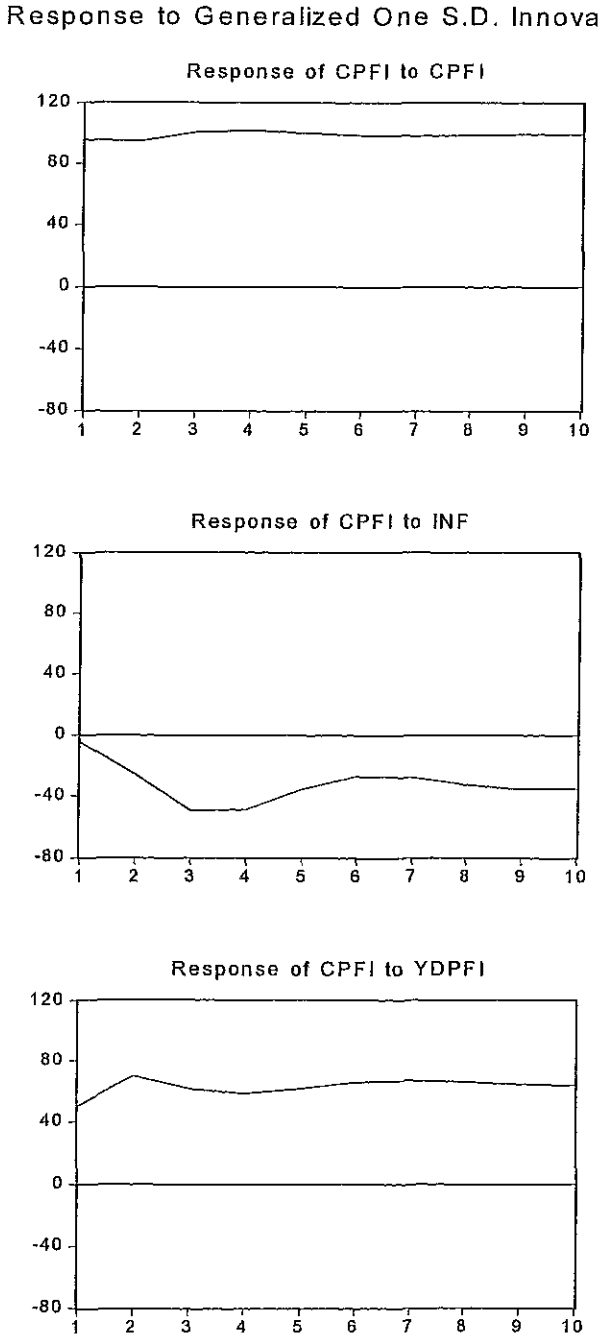


Chart 2: Impulse Response Analysis of the Inflation Function

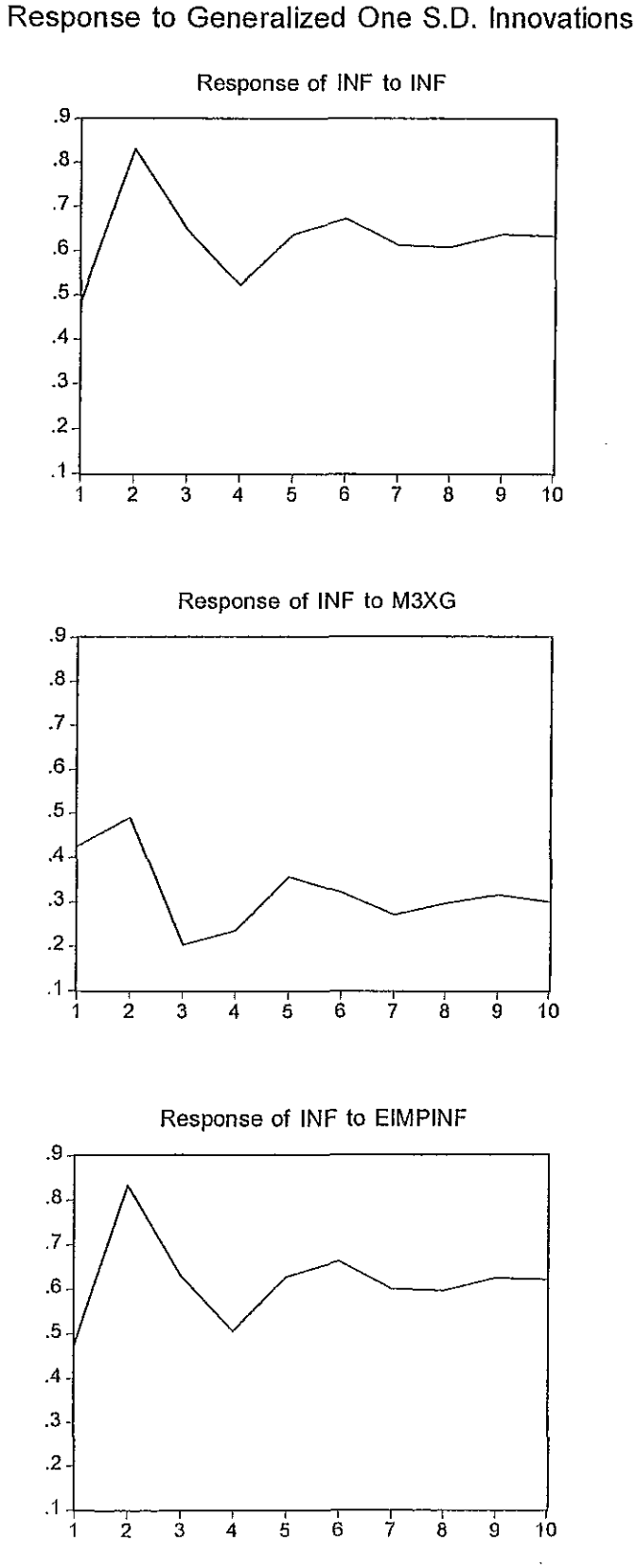


Chart 3: Impulse Response Analysis of Inflation and Wage Rates

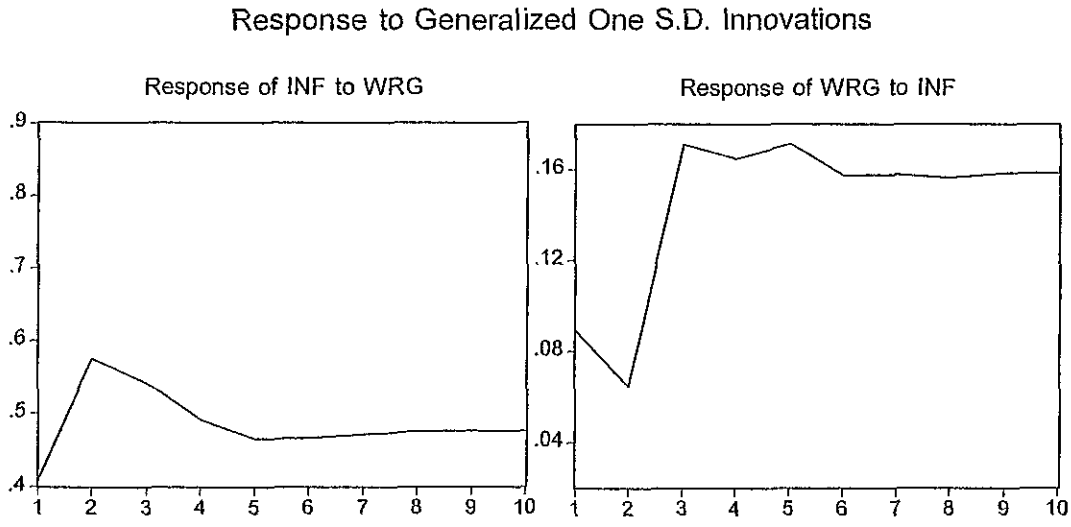


Chart 4: Impulse Response Analysis of the Wage Rate Function

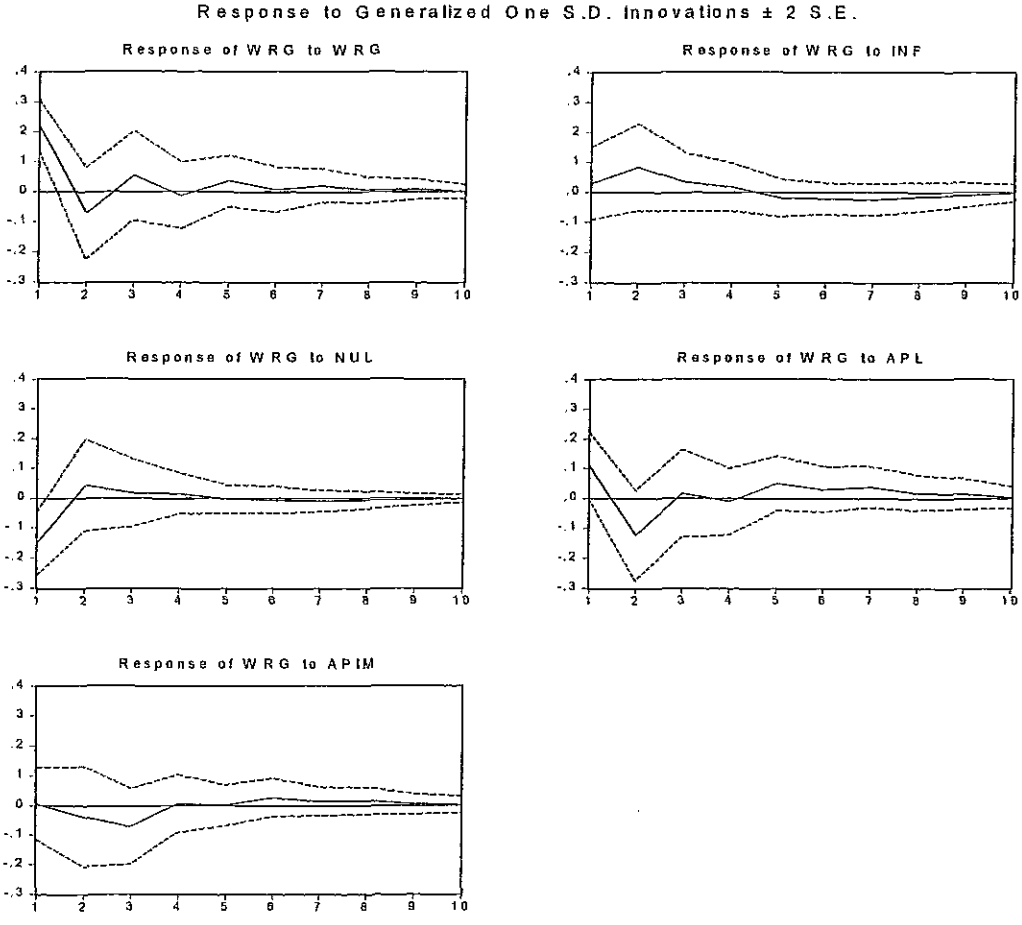
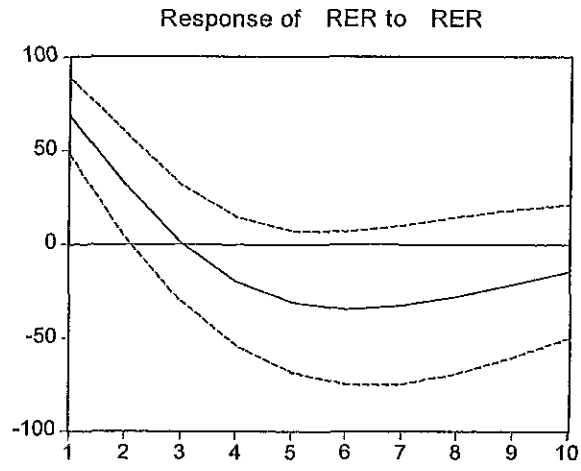
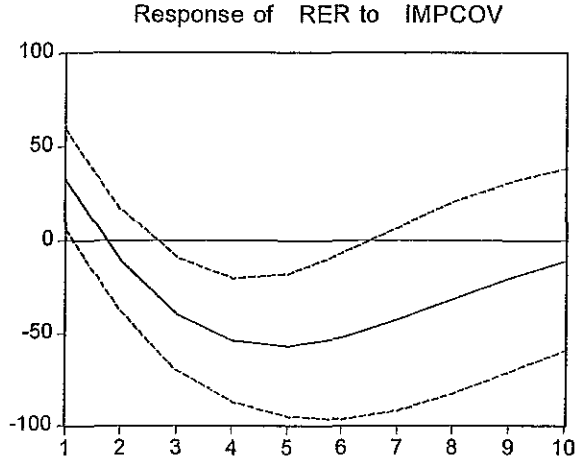


Chart 5: Impulse Response Analysis of the Real Exchange Rate Function

Response to Generalized One S.D. Innovations ± 2 S.E.





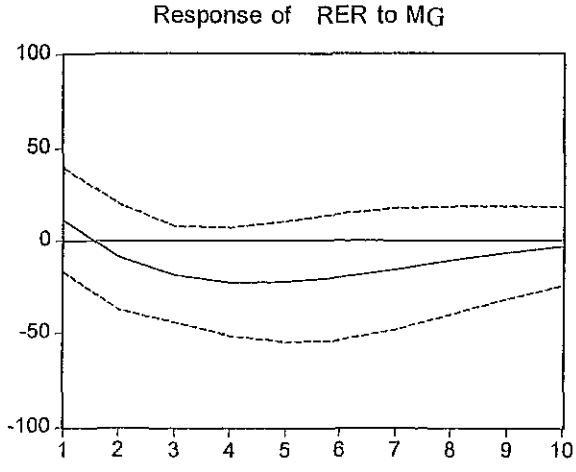


Chart 6: Impulse Response Analysis of Exports of the Mining Sector

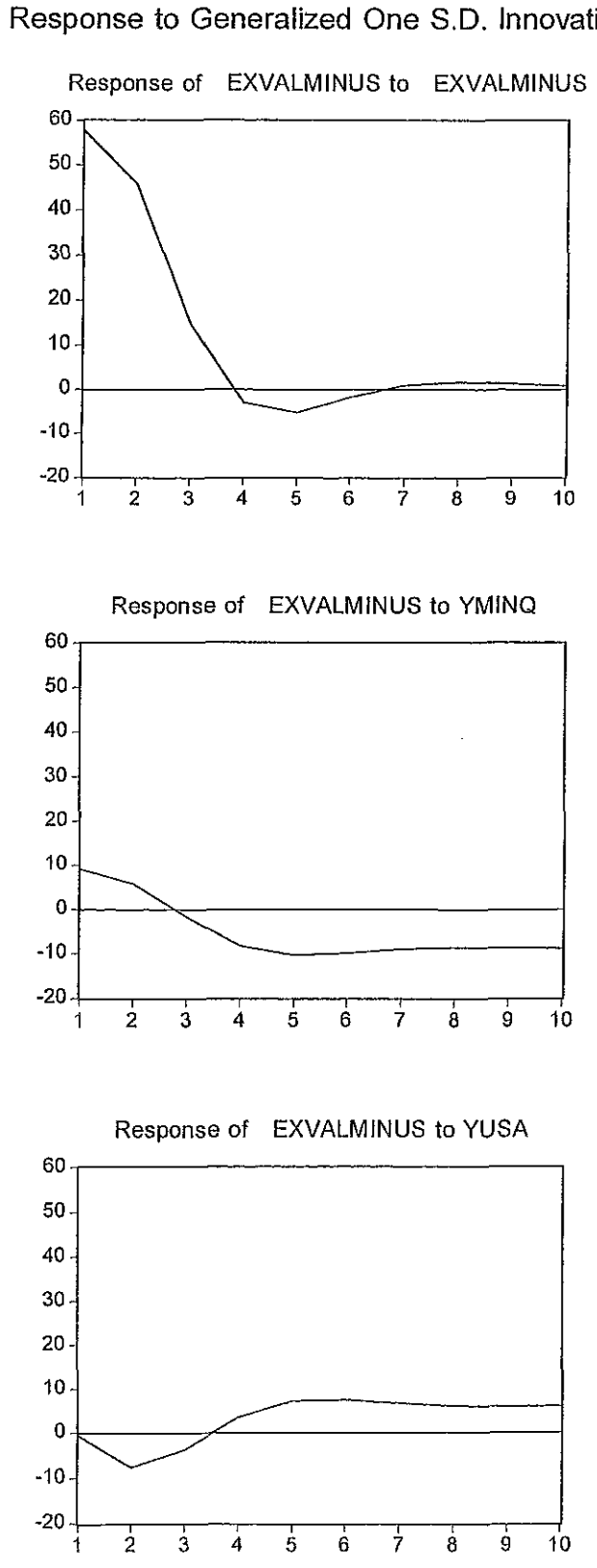


Chart 7: Impulse Response Analysis of the Non-Mining Sector

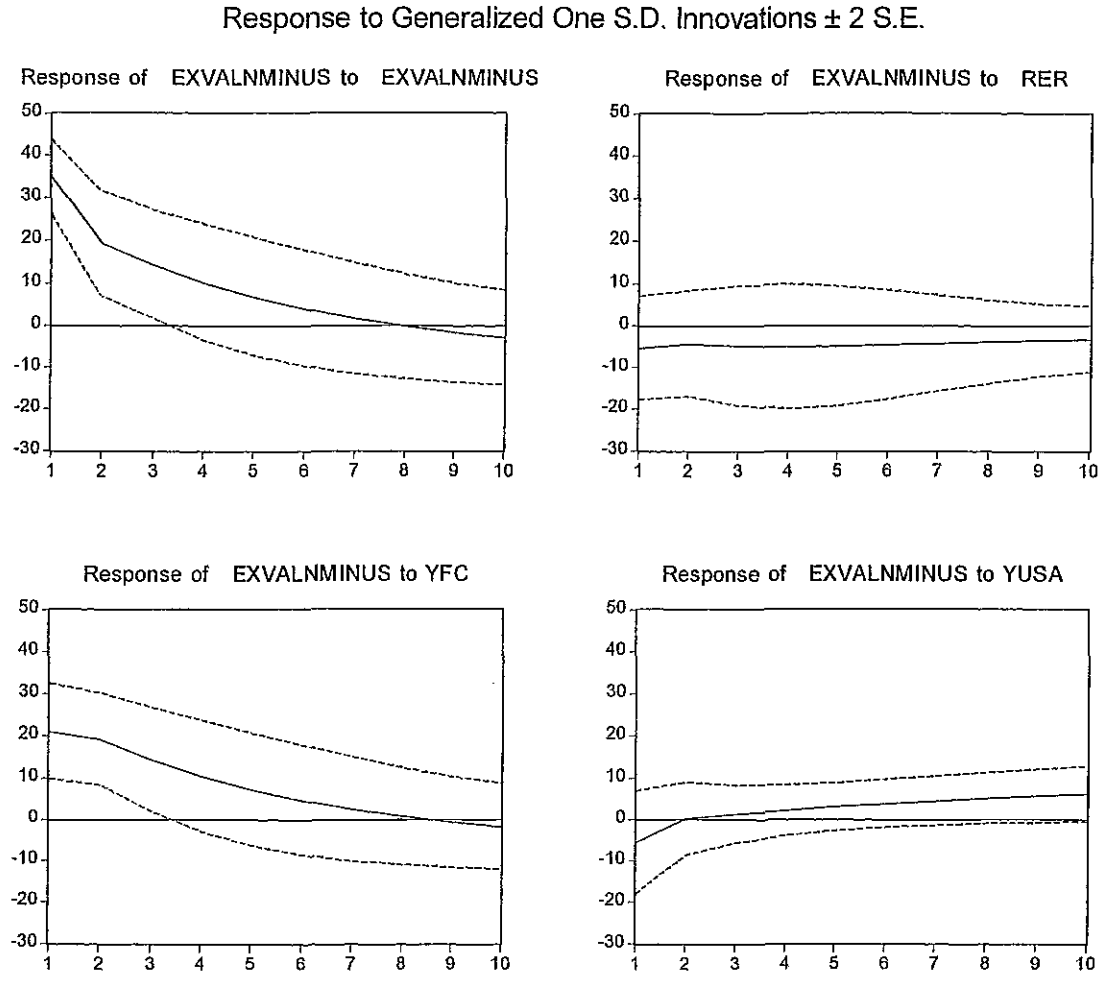


Chart 8: Impulse Analysis of the Consumer Import Function

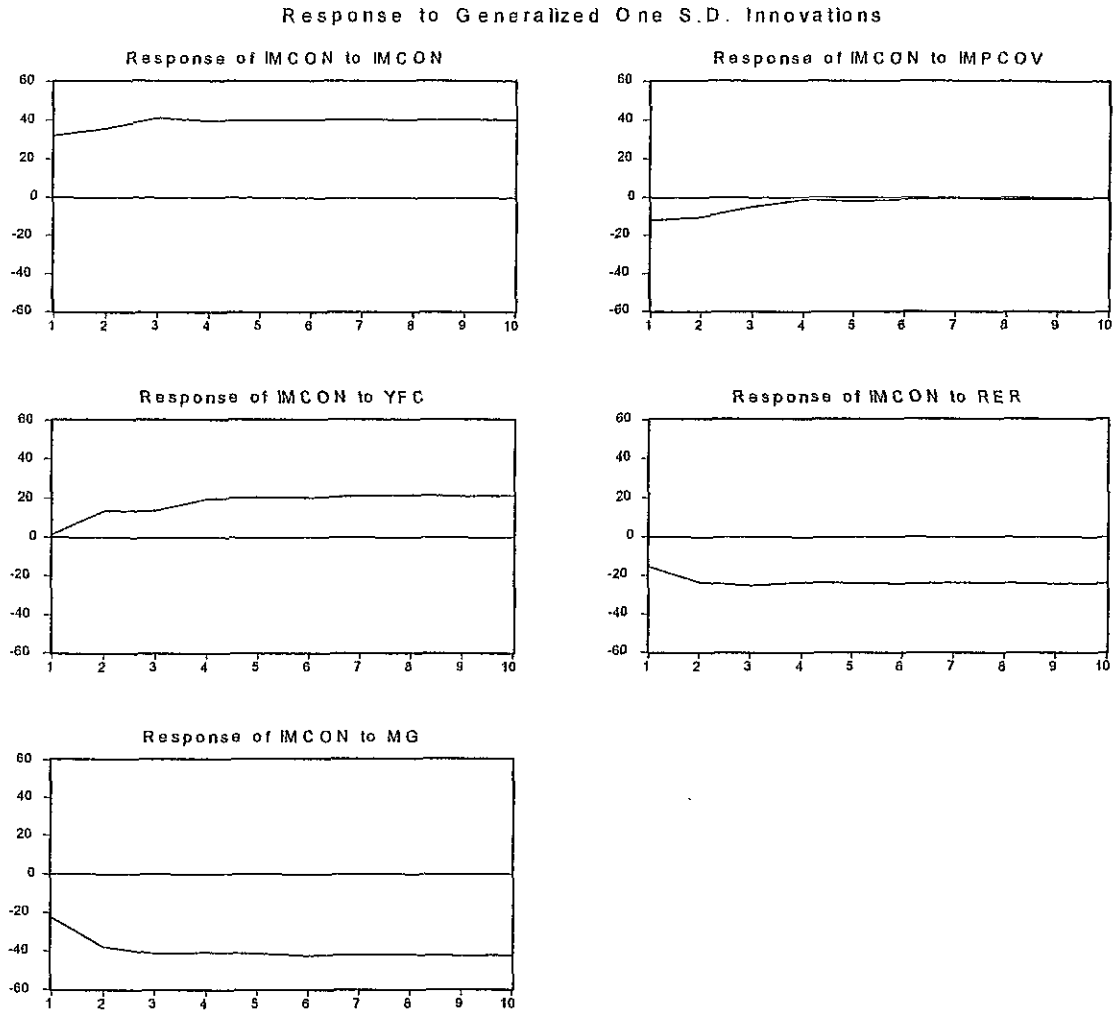


Chart 9: Impulse Analysis of the Capital Import Function

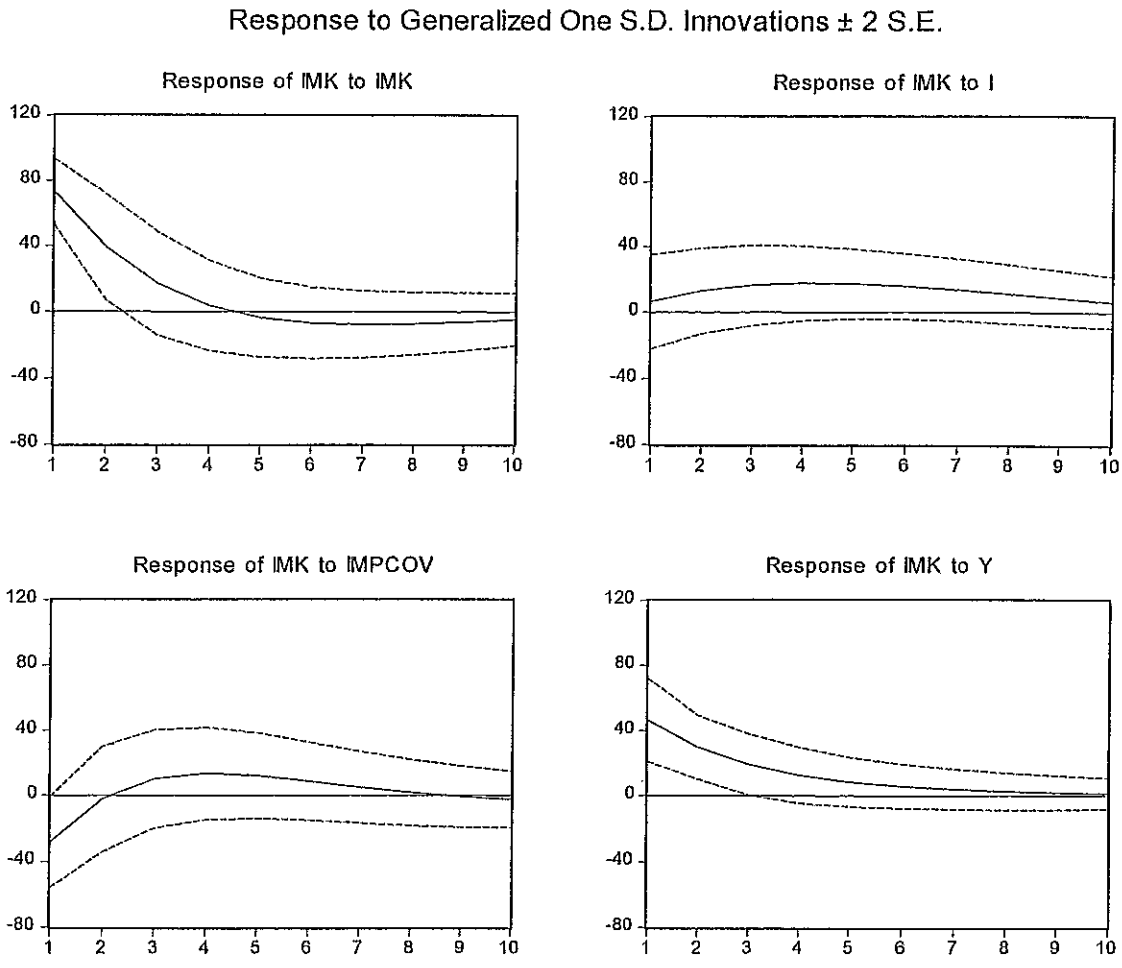


Chart 10: Deterministic-Static Simulation

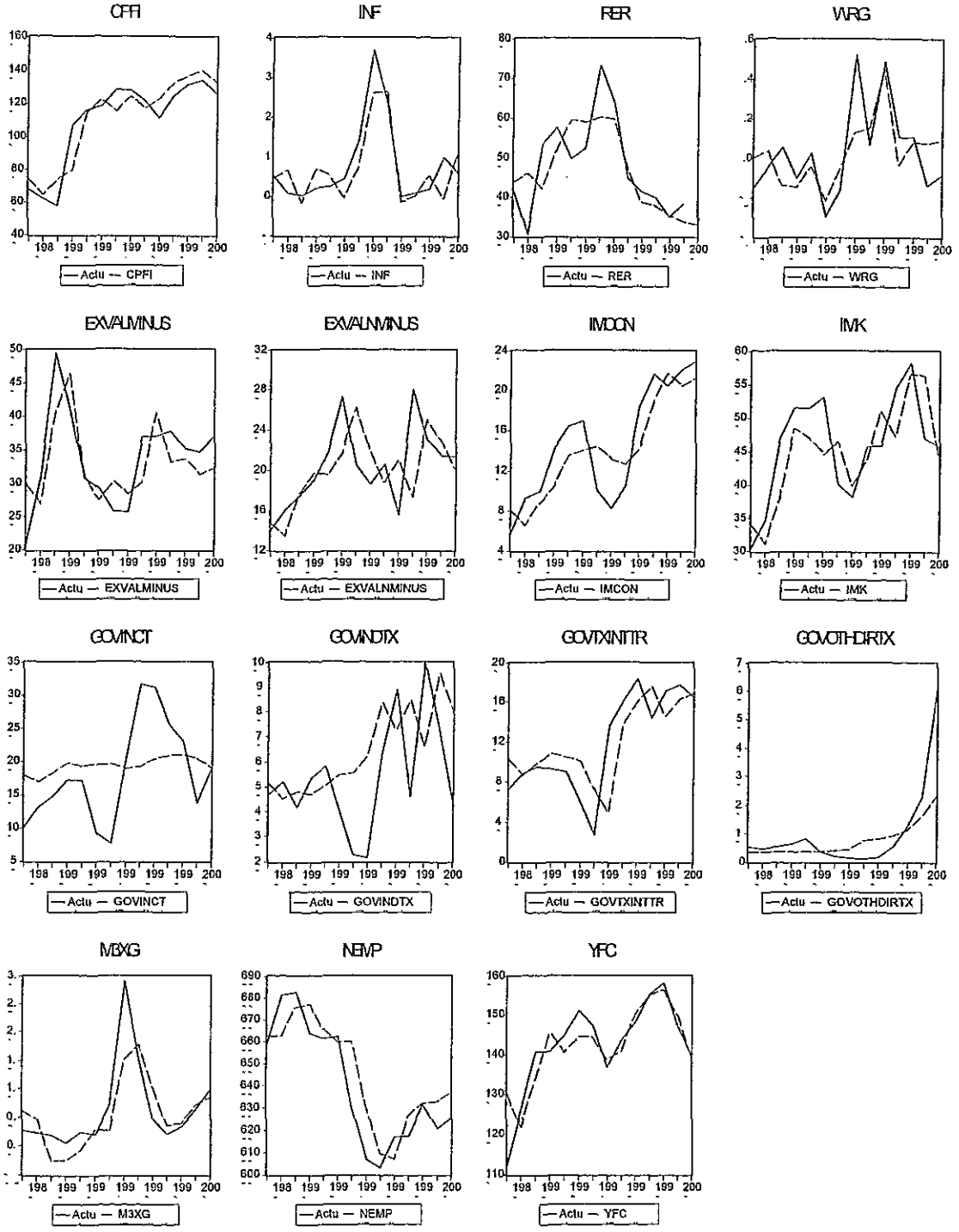


Chart 11: Stochastic-Static Simulation

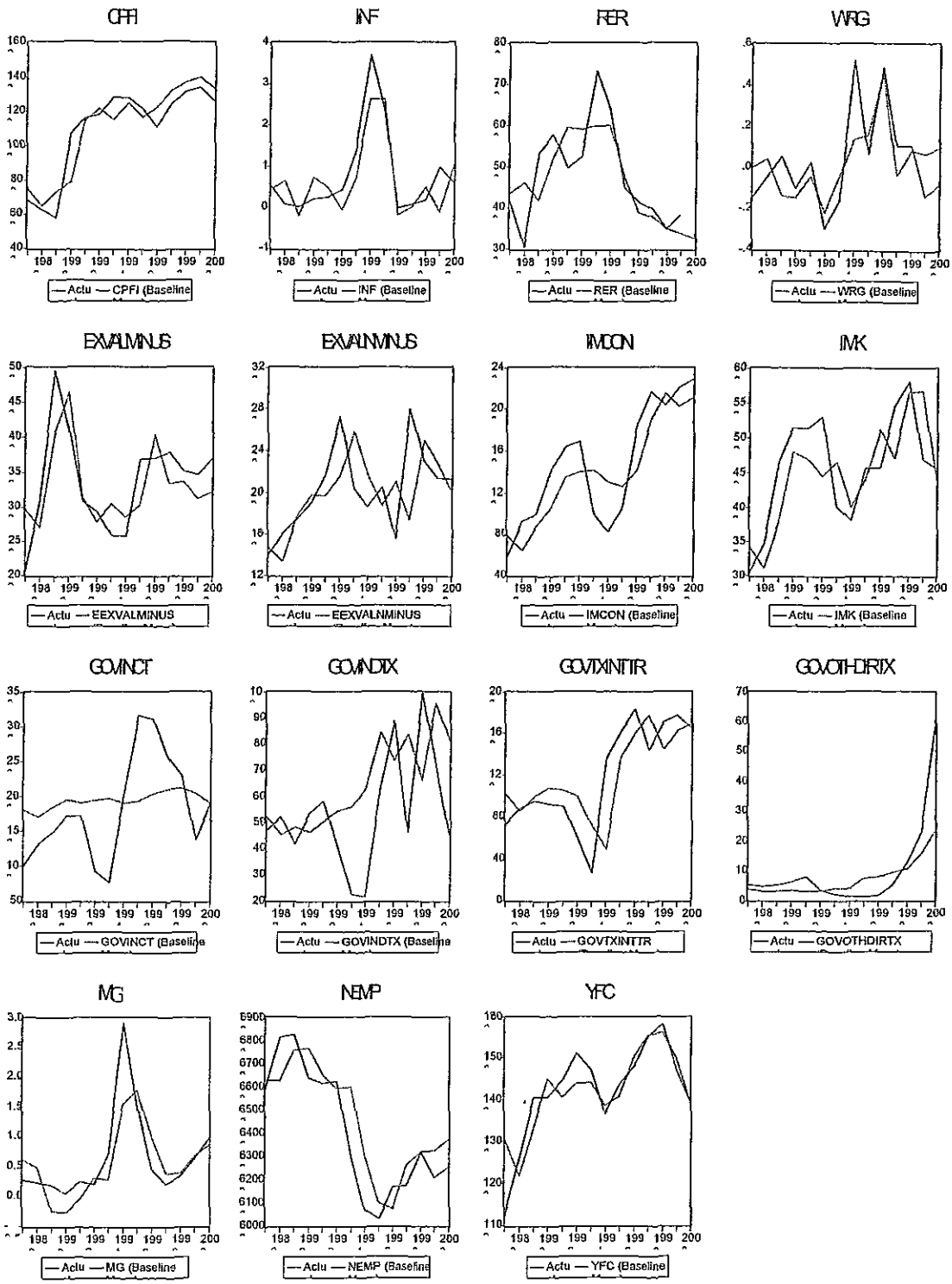


Chart 12: Dynamic-Stochastic Forecast