MACRO-ECONOMIC IMPACTS OF EXPORT INSTABILITY: THE CASE OF TREE CROP EXPORTS IN PAPUA NEW GUINEA

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Abstract

The tree crop export income is fluctuating by an average of 30 percent per year, and there is no conclusive evidence to verify the macro-economic impacts of export instability. The present study used a macro-econometric model to predict the macro-economic impacts of export instability. Impacts in terms of instability of Gross Domestic Product (GDP) growth, private consumption, Balance of Payments (BOP), investment and imports were significant during the pre-mineral boom period (1979-86), but the impact is significantly less after the mineral boom (1987-95). The instability is not adversely affecting the levels of employment at pre mineral boom although tree crop sector is the main provider of employment and income in the rural areas. The employment level is marginally affected during the post mineral boom period whenever the export income declined. Export instability is not strong enough to influence money supply, interest rate and the rate of inflation during pre and post mineral boom periods but still continues to influence the BOP position. The finding might contribute to the current policy debate on continuing the price stabilisation as a part of macro-economic policy frame-work.

Introduction

More than 75 percent of people in Papua New Guinea depend on tree crop exports for their livelihood (DAL 1995). There are some 574,000 households in PNG, and approximately 80 percent of them comprising some 468,000 households, are producers of major tree crop exports. Coffee, coconut (copra and coconut oil), cocoa, oil palm and rubber are the major agricultural export tree crops. Tree crop exports provide approximately 26 percent of GDP and 14 percent of export earnings (World Bank 1994). Tree crop exports account for K 222 million of annual export earnings and contribute to 90 percent of agricultural exports. Export income from coffee is approximately K 92 million followed by oil palm (K65 million). The lowest tree crop export value is rubber (K 2.5 million).

Tree crop export income fluctuates by an annual average of 30 percent (see Table.1). The variability in export earnings is mainly the result of variations in international commodity prices. In a country such as Papua New Guinea, that depends on agriculture, any unpredictable fluctuations in commodity prices must affect its micro and macro-economic stability. The impact of primary commodity instability on the economic growth of developing countries has been a principal concern for quite a long time. Maizels (1987) called for a fuller understanding of the role of the commodity markets as a mechanism that transmits growth and recession in an increasingly interdependent world economy and which operates to substantially increase the instability of the global economy itself. He suggested that a study of the interaction of commodity market fluctuations and inflationary or deflationary pressures must be a further research priority (ibid.).

The Department of Finance and Planning (1982) emphasised the important role of tree crop export instability in the economy and indicated that the price stabilisation schemes (for copra, cocoa, coffee and palm oil) should be an integral part of the government's macro-economic policy frame-work. This

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framework should be designed to provide, as far as possible, a steady trend in incomes and demand that is conducive to economic growth, a relatively low rate of inflation, adequate levels of international reserves, and a safe level of debt service throughout the commodity price cycle. The Central Bank (Bank of PNG) is keen on monitoring the extent to which commodity price instability is transmitted into macro-economic instability.

The macro-economic impacts of tree crop export instability are crucial in policy making, including price stabilisation policies. The ongoing export commodity price stabilisation policy aims at minimising the macro-economic and micro-economic impacts. However, there is no conclusive empirical evidence available to ascertain the macro-economic impacts. The discussions presented in this paper is based on the findings of a research project carried out at the National Research Institute. The project was undertaken with funding assistance from the Australian Centre for International Agricultural Research (ACIAR) and with technical collaboration from the Department of Agricultural and Resource Economics, University of New England. This paper evaluates and discusses the empirical evidence of macro-economic impacts of tree crop export instability.

Literature Review

According to Fisher (1993), reasonable macro-economic stability is necessary for sustained growth, but beyond that, an appropriate overall economic strategy is crucial. Export instability has been used to explain inflation and other macro-economic instability in developing economies by various economists (MacBean 1966; Argy 1970; Love 1986). Export instability is expected to have impacts similar to the 'Dutch Disease'. There are differing views on the effects of export instability on macro-economic stability and economic growth. However, it has been demonstrated that wide fluctuations in macro-economic aggregates are detrimental to economic growth (Lim, 1974, 1976; Rengarajan and Sundarajan 1976). There are some levels of agreement that the growth of export revenue is a more important determinant of the growth of Gross National Product (GNP) than the degree of instability of export revenue. Economic management is made more difficult by the disruptions caused by fluctuations in export earnings.

One of the main economic problems with which less developed countries (LDCs) have to cope is instability in their export earnings. Export instability is felt to constitute a problem as it can affect a country's domestic income, consumption, savings, investment, tax revenues, balance of payments, and the capacity to import (Bird 1978). According to Brook, Grilli and Waelbroeck (1977), the commodity prices and export revenue fluctuations cause concern, particularly for developing countries, in the areas of balance of payment management, employment, and fiscal policies. Severe employment difficulties are likely to arise unless counter-cyclical policies can be implemented promptly. On the other hand, if a commodity revenue boom causes a BOP surplus, inflationary pressures in the domestic economy usually result.

The results of empirical investigations by Knudsen (1975) suggested little systematic relation between export instability and other economic parameters. His findings conform with the permanent income theory of export instability. Higher levels of instability result in lower propensities to consume, and hence, a higher aggregate savings ratio. Higher savings results in higher investment and, with productivity apparently not adversely influenced, in higher economic growth. This indicates a positive effect of export instability on the rate of investment. However, earlier studies failed to recognise the multiplier effects of the transitory income on imports leading to BOP problems. Further, the consequent monetary or fiscal instability created, depending on the monetary or fiscal approach to BOP problems, must be studied to assess the possible impacts.

Newbery and Stiglitz (1981) observed that the instability in the prices of export goods in an economy with flexible wages and prices will lead, to instability in the prices of other goods. Thus, the costs of price stability are borne not only by those in the export industry, but are shared, in part, by all the sectors in the economy. Using models which they developed, they demonstrated, that if money wages are inflexible downwards and if monetary policy is permissive, then price fluctuations generate inflation at a rate that depends on the degree of price instability. They used various models and indicated the transmission mechanism by which the price instability is translated into fluctuations in investment, national income, and demand for non-traded goods.

Behrman (1987) reviewed the theoretical and empirical evidence for the frequent claims that instabilities in international markets have deleterious effects on the macro-economics and micro-economy of the primary-commodity exporting developing countries. He concluded that available evidence does not support these claims. Despite the lack of supporting evidence, the claims are strong, perhaps, because measurement problems and because of small but articulate groups with vested interests in overstating the problem. The measurement problems might have equally affected any findings that might have underestimated the problems, including the arguments of Behrman.

Export instability is considered as a development problem that affects the growth, investment, and productivity of capital (Guillaumont 1987). International Commodity Agreements (ICAs) were signed when the market produced excessive price fluctuations that have harmful micro-economic and macro-economic effects on the economies of exporting countries. The available literature failed to prove or disprove the effects of export instability on the macro-economies of exporting countries (MacBean and Nguyen 1987).

Guest (1989) studied the price stabilisation schemes in Papua New Guinea and strongly argued that the variability in export sector earning influences the business cycle in the domestic economy, and suspected that, without price stabilisation schemes, the average levels of employment and investment within the non-agricultural sector would be lower. He also expressed the view that the price variability, through its effect on aggregate import demand, and fiscal and monetary injections, do have a strong and direct impact on the balance of payments. His arguments are based on qualitative and subjective judgements and empirical evidence is needed to support his arguments.

A study by the Asian Development Bank (1990) on the price stabilisation scheme in Papua New Guinea suggested that the macro-economic impact of the tree crop export instability was once fairly significant, but has been declining in recent years because of the smaller relative importance of tree crops in the economy. However, the study could not provide quantitative analytical evidence to justify the views that were expressed. The Australian Bureau of Agricultural and Resource Economics (ABARE 1990) reviewed the price stabilisation schemes in PNG and raised doubts about the macro-economic instability caused by tree crop export instability. It suggested that definitive research on macro-economic impact assessment should be carried out.

Fleming (1992) reviewed the price stabilisation schemes in South Pacific countries and suggested that any evaluation of the impact of agricultural commodity price stabilisation on macro-economic stability must concentrate on the degree of macro-economic instability caused by instability in commodity prices and the strength of linkages between the agricultural sector and their impact on economic development. Temu (1995) expressed the view that only minimal macro-economic instability may be generated by export fluctuations. Similar views have been expressed by Lim (1976) and Jarret and Anderson (1989), who argued that there is no negative or inverse relationship between economic growth and export instability.

Love (1992) examined the impact of short-run export instability on national income for a sample o twenty developing countries, each of which is heavily dependent on primary produce exports. H empirically showed that, for all the countries studied, there was evidence of causality running fr export instability to short-run instability in income. This evidence may support the view that instabilit export induces short-run macro-economic instability. Ghosh and Ostray (1994) studied the impact o export instability of selected developing countries and concluded that export instability is an importan source of macro-economic uncertainty in many developing countries.

The debate on macro-economic stability versus export instability is inconclusive. Some argument state that there is not much correlation between price and income variability. This argument is base on the assumption that the lagged elasticity of production response to price variability, often leads t average export income almost being constant. In a small open economy such as that of Papua Ne Guinea, assessment of macro-economic impact is necessary to verify the validity of maintaining th price stabilisation policy as an integral part of the government's macro-economic policy framework.

Methodology

The macro-economic impact of export income instability can be assessed by understanding th mechanism through which the instability is transmitted to the rest of the economy in terms o instability in employment level, growth, and inflation. According to Dernburg (1985), the levels o employment, growth of output, and price stability are the three major macro-economic targets. Th export price and quantity instability will be transmitted as instability of export income and exchang reserves. They might, in turn, affect the disposable income, consumption, aggregate demand, externa balance, and possibly the level of employment, inflation and growth. An econometric model is used i this study to assess the impact of tree crop export income variability on the macro-economy.

Framework of the Model

The model used in this study consists of six blocks - *national income, monetary, fiscal, externa employment* and *inflation*. These blocks are represented by the four macro-economic identities *national accounts, fiscal, balance of payments (BOP),* and *monetary equilibrium.* Employment an prices affect all these blocks and therefore are included as important components. The structural mode consists of eight stochastic equations and nine identities relating to the six blocks, with stochasti relationship among most variables. There are 47 variables including 9 endogenous and 28 lagge variables. Details of the simultaneous equations along with the identities of the model are furnished i Annex 1, and a description of all variables is given in Annex 2.

All equations are specified in linear form and the linear combinations of the variables are no stationary, ruling out the error correction specification. The model must be estimated by three-stag least squares (3SLS) analysis as the equations are over identified. However, ordinary least square (OLS) analysis was also carried out to compare and provide better diagnostics of the model. The OL results must be cautiously interpreted in view of the likelihood of simultaneous equations bias.

The formation of expectations and lagged adjustment in the PNG economy is different from that o developed economies. At present, the rational expectations hypothesis may not be applicable to PN because of a lack of information and expertise. The model is built on the assumption of naiv expectations, although there might be some degree of adaptive expectations. The model also assume that there will be a time lag between the causes and effects as the adjustment process is slow. Lagge dependent and explanatory variables are added to capture the lagged responses and dynamics.

The approach taken in this study involves:

- estimating the model, using 3SLS and OLS, to evaluate the predictive capacity of the model and predict the base-level values of the macro-economic variables by in-sample forecasting;

- simulating the export instability and estimating the model again using 3SLS, to measure the simulated values of macro-economic variables by in-sample forecasting; and

- comparing the simulated values of macro-economic variables with those of the base-level predictions and measuring the macro-economic instability caused by the export instability.

First, the base-level projections of the values of various macro-economic variables were estimated using 3SLS and OLS. The analyses were carried out using the Shazam econometric computer package Version 7.0. The GDP, total exports, BOP, net foreign assets (NFA), and other variables such as growth rates were adjusted to account for the changes in tree crop exports in order to forecast the simulated impact. The 'list' command was used along with the system command in Shazam to predict the simulated values. The simulated results were divided into two time periods - the pre-mineral boom (1979-1986), and after the mineral boom (1987-'95) as the impact of mineral exports might have made the impacts of tree crop exports on the economy different between the two periods.

The estimated results at base level were compared with the simulated values to evaluate the impact of export instability. The percentage changes in the macro-economic variables because of variations in export revenue were estimated. The mean and percentage change over the base period of all variables were estimated.

Test of stationarity: Normally, most time series macro-economic variables (GNP, CPI, wages, etc.) follow a random walk process (non stationary), and using nonstationary variables in analysis might lead to spurious regressions. When they are non-stationary in level terms, their first or second differencing will usually be stationary (Griffiths et al. 1993). The augmented Dickey-Fuller (DF) test was used to test stationarity of fourth-order differenced variables (being quarterly data) and all the variables were stationary at difference (fourth order). DeJong and Nankervis, Savin and Whiteman (1992) studied the power problems of unit root test in time series with autoregressive errors. They concluded that the augmented DF test procedure is reasonably well behaved.

Autocorrelation: In a time series, quarterly data autocorrelation of disturbance term is common. Further in the model, most equations use lagged dependent variables as explanatory variables and being quarterly data there must be fourth-order autocorrelation (AR(4)). The Durbin-Watson (DW) test is not valid to test the higher order processes (Ramanathan 1992). The Jarque-Bera lagrange multiplier test (LM test) is appropriate (Dougherty 1992; Ramanathan 1992) to detect fourth-order autocorrelation in the presence of lagged dependent variables as explanatory variables. Breusch and Godfrey (1981), Kiviet(1986), and Aznar(1989) suggested the application of the LM test to dynamic simultaneous equations model.

Test of Homoskedasticity: Whenever the error variance is changing or growing over time with each observation, the Gauss Markhov's second condition is violated. This specific problem, that is heteroscedasticity, is not only a common problem with cross-sectional data, but also with time-series data (Griffiths, Hill and Judge 1993; Gujarati 1988; Dougherty 1992). In the presence of heteroscedasticity, the regression estimators may not be efficient and the tests of hypotheses are no longer valid. The Breusch-Pagan-Godfrey (B-P-G), Harvey, ARCH, and Glejser test were used to verify homoskedasticity. Various diagnostic methods (Doran 1989; Gujarati 1988) were used to test

the model for its predictive accuracy, stability (Chow test), and specification errors (Ramsey RESET Regressions Specification Error Test).

In Papua New Guinea, commodity price stabilisation (CPS) programs have been implemented fo about four decades. *Levies* are collected and paid into the stabilisation fund when the prices are abov threshold level, and *bounties are* paid out of the fund when the prices are low. The present stud assesses the impact over the base period, after the price stabilisation effect. The price stabilisation onl affects the price paid to the ultimate producers, and therefore, the GDP, BOP and net foreign assets ar not affected by the CPS. Similarly, the monetary stability is not affected by the price stabilisation, a the stabilisation fund is not sterilised and is available to the banking system. In reality, pric stabilisation leads to the transfer of funds from the producers to the rest of the economy and vice versa Another important point is that the producers share in the FOB price is less than 60 percent an therefore the stabilisation might reach them to a maximum of 60 percent, in some cases less, whereas the levies are fully passed onto the farmers (Gumoi 1993). The stabilisation equally benefits th processing and marketing agencies to stabilise their incomes.

Data Description

The quarterly time series data for the period from 1975 (since the independence of PNG) to 1995 wer collected from the International Financial Statistics of the IMF, Quarterly Economic Bulletins of Ban of PNG, International Development Reports of AusAID, Statistical Bulletins of the National Statistica Office (NSO), and various reports of the World Bank and the National Research Institute. Th quarterly data on national accounts (GDP with break-up details of consumption, investment, export and imports) are not readily available. The quarterly data on government consumption and investmen expenditure, exports and imports were used to derive the quarterly data of GDP using the nationa accounts identity. The data on Australian inflation (CPI) and export price indexes were supplied by th Australian Bureau of Statistics.

The tree crop export price and volume indices were estimated using the package available in Shazam The quarterly data on price and employment indices were overlapping (with various years as th base), and therefore, new spliced indices for a single base period were estimated using the Shazan package for splicing index number series. As changes in policies or changes in macro-variables wil be transmitted to the macro-economy with lagged adjustment process, lagged responses wer evaluated for most of the explanatory variables. After preliminary processing and estimation of lagge variables, the sample period was restricted to 1979-I - 1995-IV.

Results and Discussions

1 Model Testing and Base-Level Projection

The estimated macro-econometric model is presented in Tables 3.(1) (OLS) and 3.(2) (3SLS) an provides the base-level projection of the macro-economic variables and other information to test th predictive capacity and appropriateness of the model. Various diagnostic tests were conducted.

1.1 All variables were non-stationary at levels except growth rates of money, income, employment an other variables expressed as percentage. Stationarity of fourth-order difference of all the variables wa tested using augmented Dickey-Fuller tests and the results furnished in Table 2. All the variable (fourth-order differenced) used in this study are stationary.

1.2 There is no autocorrelation as indicated by the Jarque-Bera LM (JBLM) normality test results, both under the 3SLS and OLS methods. The stochastic disturbance terms of all equations, except impor

functional equation, are homoskedastic as revealed by BPG, ARCH, Glejser and Harvey tests. In the case of import equation BPG and Glejser tests suggest homoskedatic error terms where as Harvey and ARCH tests suggest heteroskedasticity.

1.3 The R-square values for all the stochastic equations under the 3SLS and OLS methods are almost the same. However, the regression coefficients of individual variables are different under both methods, which indicates the simultaneous equation bias under the OLS method. All the calculated F values to measure goodness of fit are higher than the critical F values at 5 percent significant level, thereby indicating the significant degree of reliability of the coefficient of determination. The R-square values for the investment and import equations are in the range of 40-50 percent, and that must be because of a significant level of policy driven components of investment and imports resulting from public sector consumption and investment policies.

1.4 The signs of all the estimated coefficients are as expected. In the case of the private consumption equation, the positive sign for nominal interest rate indicates that the increased interest always accompany increased consumption. As indicated by Dernberg (1985), there is uncertainty as to how a change in interest affects the consumption. Similarly, Dornbusch (1990) suggested that it is hard to find a strong response between interest rate and savings.

1.5 The system R-square under the 3SLS method is 0.99. This higher R-square must be carefully interpreted as the results frequently will be very high in view of the total number of variables and equations involved. The adjusted R-squares in all the equations indicate that there is no penalty for the number of explanatory variables used, except under the equations for inflation and imports. However, the adjusted R-square statistic is probably one of the least important ones in model specification when compared with other diagnostic statistics (Dougherty 1992).

1.6 The Breusch-Pagan LM test for diagonal covariance matrix for the system of equations under the 3SLS method indicates homoskedasticity. The calculated chi-square value is less than the critical value at point one percent significance level.

1.7 The three most common measures of predictive accuracy that have been used to evaluate ex-ante and ex-post forecast are root mean squared error (RMSE), mean absolute error (MAE) and Theil inequality coefficient 'U'. These predictive accuracy tests were carried out and the results are given in Table 3(1). The tests were carried out with OLS estimates for each equation using the forecast command in Shazam. The results are satisfactory and the U value is less than one in all cases. The model passed the predictive accuracy tests within the in-sample forecast. Its capacity in out-sample forecast must be evaluated at a future date and the model must be continuously improved to account for changes in the economy.

1.8 For a specification error test, Ramsey's RESET (Regression specification error test) results suggest that the calculated F value is less than the critical value at five percent significant level in all cases, except in the case of imports. Therefore, there is no specification error in all these equations, except imports. In the case of imports the F value for RESET(3) is marginally higher than the critical value. The import price index must be included as one of the explanatory variables but the data is not available.

1.9 A Chow test was also conducted to evaluate the predictive stability and the structural break under each equation of the model. The results indicate that there is no structural break, and the equations are stable in the case of money demand, nominal interest, investment, tree crop exports, and inflation. In the cases of the private consumption, imports, and employment equations, there are marginal structural breaks mainly for the years 1992-1995. The fiscal and external balances were highly

unstable during this period because of fiscal indiscipline, and therefore, stabilisation and structural adjustment programs are being implemented. Further, in the third quarter of 1994, the currency was devalued and subsequently floated thereby leading to a depreciation of the currency by about 25 percent (Duncan and Kpiran et al, 1996). In the case of the employment equation, as well as the instabilities already mentioned, the closure of the Panguna copper mine and the insurgency in North Solomon Province, a major producer of tree crop exports, must have contributed to the instability. Dummy variables were tried to capture these impacts and the results were not impressive.

2 Base-Level Projection Simulation and Comparison

The Graph 1 presents the actual and predicted (base level) values of macro-economic variables. As could be seen from the graph, most variables are predicted well by the model and the trends between the actual and predicted values are almost the same. Based on the analysis and a comparison of the base-level and simulated values of the macro-economic variables, the following inferences were drawn

2.1 Before the Mineral Boom (1975-1986)

- The demand for money was almost stable (although it is slightly positive with increased export instability), and therefore monetary stability is not adversely affected by the 30 percent or 50 percent increase or decrease in tree crop exports. Similarly there is not much impact on the nominal interest rate. Even though there is positive change (0.001% per quarter) under the scenario of increasing exports at 30 percent and 50 percent. This might be the result of the impact of instability on banks' liquidity as well as the demand for credit caused by export instability.

- Private consumption increased by 0.77 percent and 1.2 percent per quarter (3.0% and 4.8% per year) when export income increases by 30 percent and 50 percent, respectively. It decreases by 0.62 percent and 0.1 percent per quarter (2.5% and 0.4% per year), respectively, when the export income decreases by 30 percent and 50 percent respectively. This might be a result of the direct impact on consumption by tree crop producers and the multiplier effect in the economy. Further, the marginal propensity to consume is higher with the subsistence smallholder producers, and therefore, tree crop income variability affects private consumption. This is one of the key areas to evaluate the policy options to smooth consumption.

- The impact on changes in investment is well pronounced. The investment increased by 1.6 percentage and 4.0 percentage per quarter (6.4% and 16% per year) and declined by 2.4 percent and 1.3 percentage (9.6% and 5.2% annual), with 30 percent and 50 percent increase and or decrease in tree crop exports, respectively. As investment includes the policy-driven public sector investments, there is possibility of an inconsistent response to market forces. Segregating investment into private and public sectors is a desirable option, but could not be done for want of necessary data.

- In the case of imports, every increase in tree crop exports by 30 percent or 50 percent led to an increase in imports by 1.4 percent and 0.5 percent per quarter (2 to 6% per year). The higher rate of increase in imports in response to 30 percent when compared to 50 percent increase in exports might be because of a declining marginal propensity to consume (or decreasing marginal utility of) imported goods and services as export earnings reach a certain limit. However, with a decrease in exports the proportionate decrease in imports is almost negligible (less than 1.5% per year) with 30 percent decrease and interestingly import increased by almost 5.7% per quarter with 50% decrease in exports. This sudden spurt in imports might be due to the depreciation of kina value that almost coincided with the declining commodity export income. Presumably, the marginal propensity to

import increases with an increase in exports, but decreases slowly as export earnings are decreasing. Imports play an important role in household consumption, especially food items. Most industrial materials and inputs are also imported. Every increase in export income might increase the consumption (marginal propensity to consume) of imported goods and services (marginal propensity to import). However, the adjustment to a decline in export income is very slow, and therefore, the import is not declining immediately. This might be one of the reasons for the frequent instability in external balance (BOP). The general belief is that the increased income directly affects the BOP rather than inflation. However, under the current floating exchange rate regime, a deterioration in BOP might influence the inflation by adversely affecting the currency value.

- The external balance, as measured in terms of BOP, responds positively to an increase in tree crop exports, and negatively to a decline in exports. In the cases of 30 percent and 50 percent changes, the BOP position improved by an average of 13.6 percent and 20.5 percent per quarter (55% and 82% annual) for an increase in exports, but deteriorated by a higher proportion of 14.3 percent and 32.5 percent (58% and 130% annual) whenever there is a decrease in exports. The major producers of tree crop exports are subsistence smallholders, and therefore, unlike the other sectors, there is a negligible amount of repatriation of export income. The tree crop exports, other than by the foreign-owned largeholder sector, contribute substantially to the stability of BOP. It is generally believed that tree crop export revenue is more influential than other exports in maintaining the stability of BOP.

- The impact on the level of employment is almost negligible at 30 percent and its impact is marginal at 50 percent. Though the conclusion must be interpreted cautiously, given the degree of impact on private consumption, GDP, and imports, there are valid reasons to support the findings. The major tree crop producers (subsistence farmers) are earning only 50 percent of their income from tree crops and the balance from other crops and livestock (Overfield, 1993). There is evidence of diversification of production and consumption (import substitutes) whenever the export income is declining. This diversification stabilises the level of employment. Factor mobility, therefore, minimises the adverse impacts. Another important aspect is the measurement of underemployment - to some extent disguised unemployment (in traditional villages) - in the informal and rural sectors, is normally not accounted for in the official documents.

- There is not much impact on inflation of export instability. The variability in inflation is also highly unpredictable. However, in Papua New Guinea's economy, imports of goods and services affect the inflation in two ways - imported inflation, and reduced demand for import substitutes. Total export income might have some impact other than the changes in level of export income. With increased export income, the propensity to import increases, thereby leading to imported inflation (depending on the source of imports and possible impact on currency value). On the other hand, decreased exports might reduce the propensity to import, thereby leading to increased demand for import substitutes and causing demand-push inflation. Ultimately inflation cannot be linked to export instability directly; but indirectly, export instability might have an effect by influencing the consumption patterns, demand for imports or import substitutes, imported inflation, and others.

- In the case of GDP, there were clear positive and negative responses to 30 percent and 50 percent changes in export income with increases and decreases in tree crop exports, respectively. There was an increase in GDP by 4.2 percent and 6.7 percent per quarter (9% and 27% annual) with an increase in exports of 30 percent and 50 percent, respectively. Similarly, there was a decrease in GDP by 4.5 per cent (18.0% per year) and 8.2 percent (38.8% per year) with a decrease in export income. Again, this must, be the result of direct as well as multiplier impacts of tree crop exports.

Before the mineral boom, the tree crop exports provided more than 30 percent of GDP and therefore export instability was influencing the GDP at a higher degree. For 25 percent or 50 percent variability in export income, the changes in GDP must be in the range of 7-15 percent whereas the changes are in the range of 18- 38 percent, indicating the possible multiplier effect of tree crop export income.

2.2 After the Mineral Boom (1987-95)

- As in the pre-mineral boom case, there is no evidence of impact on monetary stability and on the nominal interest rate under the scenario of decreasing as well as increasing exports at 30 percent and 50 percent. Mining exports and the service sector would have increased their share in the economy, thereby decreasing the importance of tree crop exports.

- Private consumption, in contrast to the pre-mineral boom period, is not seriously affected by tree crop export instability. In fact, consumption declined by 0.6 percent and 1.0 percent per quarter (2.4% to 4.0% per year) with increases in income by 30 percent and 50 percent respectively. This type of change might indicate the possible link between excess export earnings and repatriation of earnings by overseas companies associated with production, processing and marketing of tree crop exports. As shown in Table 1, since 1986, the share of palm oil export is increasing at a higher rate. All the major largeholder palm oil producing companies are owned by overseas companies. The lower investment when the export increased, might be, therefore, the result of repatriation of export income by the foreign-owned largeholder sector. In any event, the post-mineral boom period and the ongoing diversification of the rural sector into areas of food, forestry, fisheries and livestock, the importance of tree crop exports in maintaining private consumption is decreasing.

- The level of investment negatively responded to the changes in export income. The investment declined by 1.4 percent and 3.5 percent per quarter (5.6% and 14.0% per year) under a 30 percent and 50 percentage increase. This decline in investments by 1.43 percent and 3.5 percent per quarter (5.7% to 14.0% per year) is indicating the possible savings and investments elsewhere than the domestic economy because of the repatriation of export earnings as discussed earlier. Investment increased at 2.14 percent and 3.5 percent per quarter year (8.5% and 14% per year) at 30 percent and 50 percent decline in exports. A study by Knudson et al. (1975) indicated that instability has had a positive effect on investment by reducing the propensity to consume. The findings of the present study also support the similar view.

- In contrast to the pre-mineral boom period, imports decreased by about 3.2 percent and 1.1 percent per year with an increase in exports where as there is a decrease in imports by 2 percent and 1 percent per year with a decrease in tree crop exports at 30 percent and 50 percent, respectively. This must be an indicator of the declining marginal propensity to import by the rural producers and the level of import replacement due to the declining per capita income in the rural areas. The terms of trade is also adversely affecting the purchasing power per unit of exports produced. Moreover, the currency devaluation in 1990 and again in 1994 might have increased the Kina value of imports at a higher proportion than the increased Kina income of exports. This area needs further detailed investigation to assess the real impact.

- Again, the external balance (BOP) is adversely influenced by export instability at 30 percent and 50 percent, but to a lesser extent than the pre-mineral boom period. The BOP favourably improved by 4 percent per year with 30 percent increase in exports but declined by less than 1 percent with a 50 percent increased export income. The BOP position declined by 7.2 percent and 40 percent per year with a decrease in tree crop exports by 30 percent and 50 percent, respectively. After the

mineral boom, the tree crop export instability is not that much powerful in influencing the imports, private consumption, and income. The mining and services sector exports and imports and the public sector spending of foreign exchange might have taken a lead role in determining the external balance. Ultimately, its impact on the external balance has been declining over the years. However, decrease in tree crop export income continues to adversely affect the BOP position. It is better to assess the impact beyond the mineral boom period when tree crop export might likely to regain its influence on the external balance.

- Similar to the pre mineral boom period, the levels of employment and inflation are not affected at a significant level (less than 0.05%). However, there is some degree of positive response to export instability and the levels of employment and rates of inflation changed by less than 0.05 percent. There is scope for further research into the level of underemployment and factor mobility in order to justify these findings.

- Unlike the pre-mineral boom period, the impact of tree crop export instability on GDP growth rate is not pronounced. Surprisingly, the GDP declined by 0.6 percent and 0.9 percent and increased by 0.8 percent and 1.74 percent, as tree crop export increased and/or decreased by 30 percent and 50 percent, respectively. This raises doubts about the contribution of the tree crop sector to the national income and the response is somewhat surprising. Further detailed investigation must be undertaken to verify whether the government support (including price support of K 247 million in the last four years) to the tree crop sector is having any economic benefits, or whether there is resource misallocation. This must also be considered an indicator of the declining share of tree crop exports in GDP, and the increasing share of other diversified rural activities. The agriculture share is also declining over the period, and therefore, the agricultural sector policy emphasises the need to improve the GDP contribution of the agricultural sector (DAL 1995).

Conclusions

The macro-economic impacts of tree crop exports were at a considerable level during the pre-mineral boom periods and were declining over the years particularly after the mineral boom. With increased diversification in rural sector and mineral explorations, the economy is growing stronger to withstand the shock of tree crop export instability. These findings raise doubt on the validity of maintaining commodity price stabilisation as an integral part of the macro-economic policy frame-work. However, the export instability continued to contribute substantially in the management of balance of payments.

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Macroeconometric Model: Annex: 1

Classification of Equations and identities:
(All variables in real terms - Prefix 'D' stands for 4th order difference)

Stochastic Equations:

$$DM = \alpha + \beta DM_{-1} + \chi DY_t + \delta DY_{-1} + \varepsilon DNR_t + \phi DINF_t + u_t \quad (1)$$

$$DNR = \alpha + \beta_1 DNR_{-1} + \chi MR_{-1} + \delta DINF_{-1} + \varepsilon DHPO_{-1} + u_t \quad (2)$$

$$DCP = \alpha + \beta DCP_{-1} + \chi DYD_t + \delta DNR_t + u_t \quad (3)$$

$$DI = \alpha + DI_{-1} + \beta DY_{-1} + \chi DRR_{-1} + \delta DKA_t + u_t \quad (4)$$

$$DT = \alpha + \beta DPI_{-1} + \chi DPI_{-2} + \delta DPI_{-3} + T + u \quad (5)$$

$$DZ = \alpha + \beta DY_{-1} + \chi DY_{-2} + \delta DY_{-3} + \varepsilon DI_{-1} + \phi DEX_{-4} + \varphi DAAP_{t-1} + \gamma DNFA_t + u_t \quad (6)$$

$$IR = \alpha + \beta IR_{-1} + \chi YR_{-1} + \delta IR_{t-1} + \varepsilon DINF_t + \phi DXM_t + u_t \quad (7)$$

$$DINF = \alpha + \beta IC_{-1} + \chi IC_{-4} + \delta MY_{t-1} + \varepsilon MY_{t-4} + \phi DAIN_{-4} + \varphi DEX_{t-1} + \gamma NMYR_{t-1} + \eta DTAX_{t-4} + \iota ER_{t-1} + u_t \quad (8)$$

Identities

$$M = ANFA_t + MDC_t \quad (1)$$

$$M_t = M_t \quad (2)$$

$$CG_t + IG_t + TR_t - TAX_t = F_t + D_t \quad (3)$$

$$Y_t = CP_t + CG_t + IP_t + IG_t + X_t - Z_t \quad (4)$$

$$YD_t = Y_t + NT_t - DCR_t - TAX_t \quad (5)$$

$$RR_t = NR_t - INF_t \quad (6)$$

$$X_t = TX_t + OX_t \quad (7)$$

$$BOP = CA_t + KA_t \quad (8)$$

$$CA_t = X_t - Z_t \quad (9)$$

Description of Variables: **Annex: 2.**

DM = Change in Demand for Money(M)
(Super script 'd' and 's' stand for Demand/Supply)
DY = Change in GDP(Y)
DINF = Change in rate of inflation(INF=CPI%)
DLIQ = Change in liquidity (LIQ) of Banks(actual)
DCP = Change in Private consumption(CP)
DYD = Change in Disposable income(YD)
DI = Change in investments(I)
DRR = Change in real interest rate(RR)
DKA = Change in capital account(KA)
DXM = Change in ratio of exports(X) to imports(Z)
DTX = Change in tree crop export (TX) income
DEX = Change in nominal exchange rate(EX = $ per K)
DPV = Change in export volume index(PV of Tree crops)
DPI = Change in export price index(PI of Tree crops)
DAXP = Change in Australian Export Price Index(AXP)
DNFA = Change in Net foreign assets(NFA)
MY = Growth rate of money minus growth rate of GDP
DC = Domestic credit
CG = Government consumption
IG = Government investment
IP = Private investment
TR = Transfers (Government)
F = Foreign borrowing/investment
D = Domestic borrowing/ investment
X = Exports
Z = Imports(includes services)
CA = Current account
OX = Other exports(other than tree crops)
MR = Growth rate of Money(M)%
ER = Growth rate of employment (%)
YR = Growth rate of GDP(%)
ZC = Ratio of imports (Z) to consumption(C)
DAIN = Change in Australian Inflation rate(AIN)
DTAX = Change in tax revenue(TAX)
NMYR = Growth rate of non-mining income
DZ = Change in imports
NT = Net transfer on foreign investments
DCR = Interest paid on domestic Credit(DC)
T = Technical change(Proxied by time)

Notes:
1. 'D' as a prefix stands for fourth order difference of variables.
2. Subscript 't-1....n' refers to lagged variables.

Graph 1 Actual and Predicted Values of Marcoeconomic Variables (1979-'95)

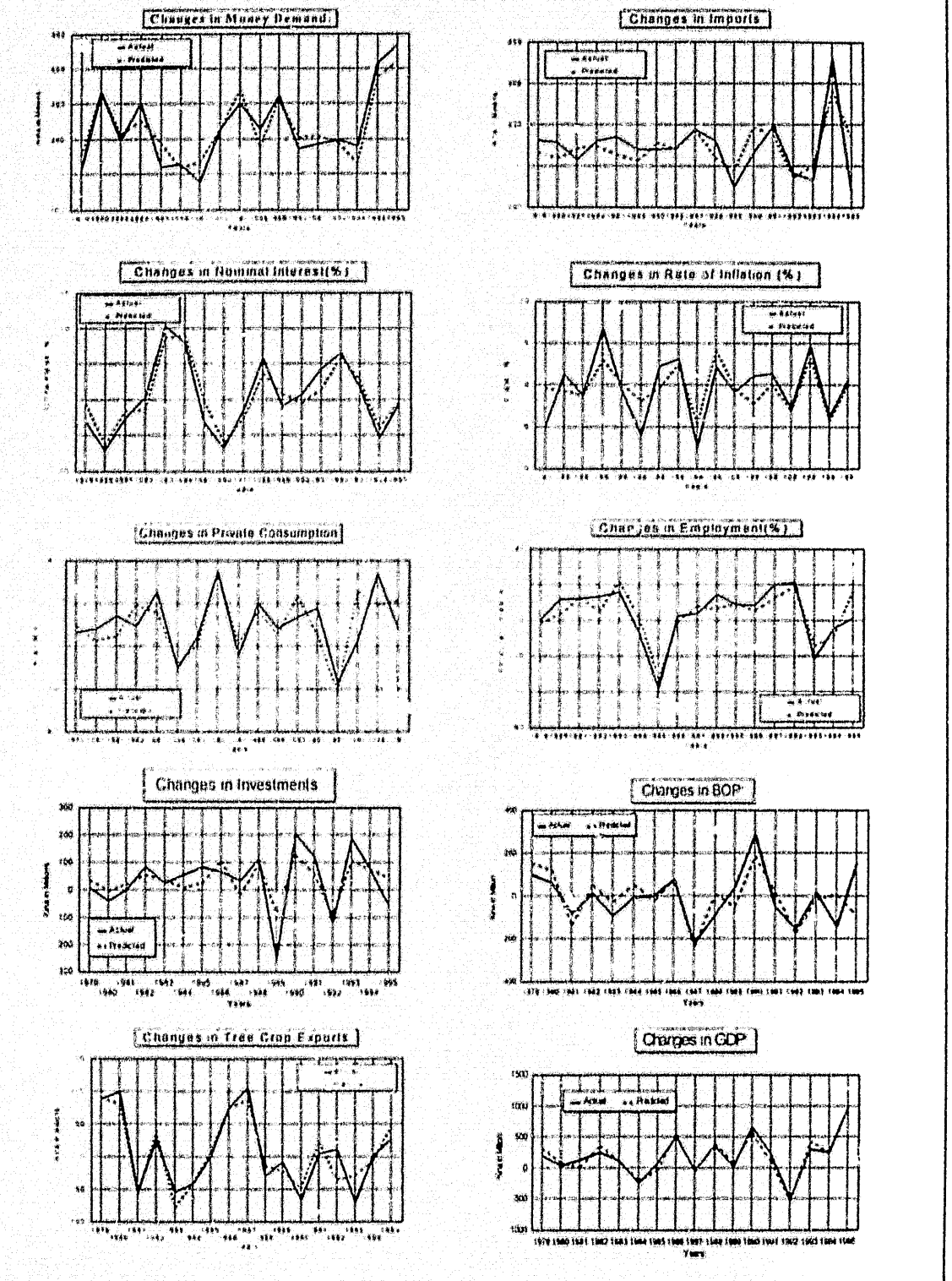

Table.1. Export Prices(FOB), Quantity and v. lume Variability of Tree Crops Exports:

Year	Average fob Prices Kina/tonne					Average export volume '000 Tonnes/Year					Total
	Cocoa	Coffee	Copra	Copra-oil	Oil-Palm	Cocoa	Coffee	Copra	Copra-oil	Palm-oil	Income
1980	1638.0	2316.0	267.0	487.0	359.0	28.7	51.0	91.7	33.6	37.3	219.36
1981	1235.0	1518.0	196.0	360.0	323.0	27.8	47.1	99.4	34.8	44.0	152.05
1982	1118.0	1857.0	172.0	322.0	282.0	28.7	41.1	37.6	37.6	76.7	148.61
1983	1494.0	1930.0	287.0	554.0	305.0	26.3	52.5	36.2	36.2	77.9	194.82
1984	1951.0	2280.0	524.0	968.0	583.0	34.1	49.4	93.5	40.7	129.9	343.28
1985	2022.0	2894.0	324.0	571.0	498.0	30.9	40.6	103.5	41.5	123.8	298.86
1986	1768.0	3927.0	108.0	253.0	219.0	31.9	53.1	93.0	41.1	129.0	313.62
1987	1634.0	2079.0	180.0	361.0	246.0	34.4	64.8	84.1	40.2	97.3	244.51
1988	1240.0	2533.0	253.0	479.0	321.0	37.1	44.8	76.8	36.3	102.6	229.24
1989	970.0	1652.0	231.0	442.0	291.0	46.6	85.0	60.7	34.6	131.7	253.26
1990	882.0	1632.0	157.0	333.0	229.0	33.9	63.3	55.3	34.8	142.7	186.15
1991	950.0	1706.0	118.0	386.0	263.0	35.8	46.6	44.0	33.2	199.6	184.01
1992	882.0	1285.0	247.0	625.0	286.0	38.6	53.0	47.5	34.8	206.1	194.58
1993	859.0	1479.0	251.0	441.0	315.0	37.8	62.8	59.0	45.5	245.7	237.62
1994	1115.0	3165.0	292.0	620.0	336.0	26.0	64.7	50.3	34.7	230.8	347.52
1995	1550.0	3900.0	430.0	880.0	760.0	22.1	40.9	44.8	24.5	139.0	340.23
Mean	1331.75	2259.56	252.31	505.13	351.00	32.54	53.79	67.34	36.51	132.13	242.98
STD	381.15	800.54	105.12	190.55	139.59	5.85	11.44	23.04	4.60	60.08	65.18
CV%	28.62%	35.43%	41.66%	37.72%	39.77%	17.97%	21.27%	34.21%	12.60%	45.47%	26.83%

Sources: 1 Bank of Papua New Guinea, Quarterly Economic Bulletins, (various issues)
2 Department of Agriculture and Livestock (1991)

Table.3.1. Results of OLS Analysis and Diagnostic Tests of Equations of the Model:

Dependent Variable DM

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF =62
DM1	0.714	0.077	9.222
DY2	0.0[illegible]5	0.031	[illegible].744
DY4	0.[illegible]61	0.032	[illegible].908
DNR	-6.213	3.382	-1.837
DINF	-5.757	3.596	-1.[illegible]01
Constant	16.380	7.080	2.[illegible]14

Critical 't' value at 10% (2 tailed)	1.670
R-Square	0.663
Adjusted R-Square	[illegible].635
F Value	[illegible]
F-crit 5%	[illegible]
Autocorrelation Test	
Jarque-Bera asymptotic LM normality test	
Chi-square with 2 DF	8.99[illegible]
Critical Chi-square Value at 1%	9.210

Heteroskedasticity tests

	Chi-square	DF	Crit at 1%
B-P-G Test	1.250	5.000	15.080
ARCH Test	0.310	1.000	6.635
Harvey Test	4.375	5.000	15.080
Glejser test	0.847	5.000	15.08[illegible]

Regression Specification Error Test

Ramsey Reset

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 61	3.631	4.000
Reset(3)	2 & 60	2.224	3.150
Reset(4)	3 & 59	1.[illegible]47	2.760

Predictive Accuracy Tests

Root Mean Squared Error (RMSE)	36.982
Mean Absolute Error	28.770
Theil Inequality Coefficient U	0.821

Dependent Variable DNR

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF =62
DNR1	0.721	0.083	8.735
MR	-0.005	0.009	-0.594
DINF6	[illegible].124	0.078	1.599
DLIQ	-[illegible].051	[illegible].018	-2.[illegible]
Constant	-0.010	0.157	-0.06[illegible]

Critical 't' value at 10% (2 tailed)	[illegible].670
R-Square	0.714
Adjusted R-Square	0.695
F Value	23.17[illegible]
F-crit 5%	2.350
Autocorrelation Test	
Jarque-Bera asymptotic LM normality test	
Chi-square with 2 DF	1.576
Critical Chi-square Value at 1%	9.[illegible]

Heteroskedasticity tests

	Chi-square	DF	Crit at 1%
B-P-G Test	8.338	4.000	15.080
ARCH Test	0.148	1.000	6.635
Harvey Test	6.[illegible]70	4.000	15.080
Glejser test	8.501	4.000	15.080

Regression Specification Error Test

Ramsey Reset

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 63	1.477	4.000
Reset(3)	2 & 62	1.314	3.150
Reset(4)	3 & 61	0.873	2.760

Predictive Accuracy Tests

Root Mean Squared Error (RMSE)	0.794
Mean Absolute Error	0.628
Theil Inequality Coefficient U	0.876

Dependent Variable DCP

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=62
DCP2	0.09[illegible]	0.064	1.564
DYG	0.482	0.033	14.562
DNR	5.[illegible]21	3.599	1.617
Constant	10.406	5.629	1.849

Critical 't' value at 10% (2 tailed)	1.670
R Square	0.780
Adjusted R-Square	0.770
F Value	33.280
F-crit 5%	2.350
Autocorrelation Test:	
Jarque-Bera asymptotic LM normality test:	
Chi-square with 2 DF	0.860
Critical Chi-square Value at 1%	9.210

Heteroskedasticity tests:

	Chi-square	DF	Crit at 1%
B-P-G Test	3.640	3.000	15.080
ARCH Test	0.040	1.000	6.635
Harvey Test	2.320	3.000	15.080
Glejser test	5.020	3.000	15.080

Regression Specification Error Test:

Ramsey Reset:

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 61	0.788	4.000
Reset(3)	2 & 60	0.633	3.150
Reset(4)	3 & 59	0.420	2.760

Predictive Accuracy Tests:

Root Mean Squared Error (RMSE)	40.010
Mean Absolute Error	31.248
Theil Inequality Coefficient U	0.335

Table.3.1. Results of OLS Analysis and Diagnostic Tests of Equations of the Model (Contd.):

Dependent Variable DI

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=63
DI1	0 314	0 097	3 235
DY	0 150	0 031	4 836
DRR6	0 894	2 210	0 404
DKA	0 073	0 066	1 105
CONSTANT	-0 947	4 220	-0 224

Critical 't' value at 10% (2 tailed)	1 670
R-Square	0 430
Adjusted R-Square	0 400
F Value	7 670
F-crit 5%	2 240
Autocorrelation Test	
Jarque-Bera asymptotic LM normality test	
Chi-square with 2 DF	2 030
Critical Chi-square Value at 1%	9 210

Heteroskedasticity tests

	Chi-square	DF	Crit at 1%
B-P-G Test	2 720	4 000	15 080
ARCH Test	4 260	1 000	6 635
Harvey Test	1 710	4 000	15 080
Glejser test	2 320	4 000	15 080

Regression Specification Error Test

Ramsey Reset

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 62	0 865	4 000
Reset(3)	2 & 61	0 252	3 150
Reset(4)	3 & 60	1 070	2 760

Predictive Accuracy Tests

Root Mean Squared Error (RMSE)	31 630
Mean Absolute Error	25 250
Theil Inequality Coefficient U	0 683

Dependent Variable DTX

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=63
DPV	0 301	0 150	2 007
DPI	30 630	3 880	7 894
DPI2	10 630	3 820	2 783
T	0 049	0 080	0 619
Constant	-1 070	3 402	-0 315

Critical 't' value at 10% (2 tailed)	1 670
R-Square	0 680
Adjusted R-Square	0 660
F Value	15 938
F-crit 5%	2 100
Autocorrelation Test	
Jarque-Bera asymptotic LM normality test	
Chi-square with 2 DF	0 200
Critical Chi-square Value at 1%	9 210

Heteroskedasticity tests

	Chi-square	DF	Crit at 1%
B-P-G Test	3 330	4 000	16 810
ARCH Test	0 020	1 000	6 635
Harvey Test	4 350	4 000	16 810
Glejser test	2 220	4 000	16 810

Regression Specification Error Test

Ramsey Reset

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 62	3 250	4.000
Reset(3)	2 & 61	2 820	3 150
Reset(4)	3 & 60	1 850	2 760

Predictive Accuracy Tests

Root Mean Squared Error (RMSE)	11.370
Mean Absolute Error	8.740
Theil Inequality Coefficient U	0.610

Dependent Variable DZ

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=56
DEX4	46 446	62 880	0.739
DY2	0 089	0.036	2 472
DY3	0 091	0.035	2.561
DY4	0 136	0.036	3 739
DI	0 581	0.131	4.428
DAXP3	-1 925	1.086	-1.772
DNFA	0 099	0.083	1 188
Constant	10 531	7.461	1.408
Critical 't' value at 10% (2 tailed):			1.670
R-Square			0.468
Adjusted R-Square			0.401
F Value			6.370
F-crit 5%			2 030
Autocorrelation Test			
Jarque-Bera asymptotic LM normality test:			
Chi-square with 2 DF			2 534
Critical Chi-square Value at 1%			9.210

Heteroskedasticity tests

	Chi-square	DF	Crit. at 1%
B-P-G Test	10 100	7 000	15.080
ARCH Test	7 984	1.000	6.635
Harvey Test	16.600	7.000	15.080
Glejser test	12 712	7 000	15.080

Regression Specification Error Test:

Ramsey Reset

	DF1 & 2	F Value	Fcrit. 5%
Reset(2)	1 & 55	0.756	4.000
Reset(3)	2 & 54	3.619	3.200
Reset(4)	3 & 53	2.614	2.790

Predictive Accuracy Tests:

Root Mean Squared Error (RMSE)	39.893
Mean Absolute Error	32.2[illegible]5
Theil Inequality Coefficient U	0.833

Table.3.1. Results of OLS Analysis and Diagnostic Tests of Equations of the Model (Contd.):

Dependent Variable ER

Variable Name	Estimated Coefficient	Standard Error	T-Ratio DF=62
ER1	0.762	0.081	9.466
DINF3	0.706	0.275	2.567
YR2	0.018	0.010	1.733
YR6	0.017	0.011	1.600
DXM	0.010	0.005	1.986
Constant	-0.243	0.419	-0.580

Critical 't' value at 10% (2 tailed)	1.670
R-Square	0.640
Adjusted R-Square	0.610
F Value	18.074
F-crit 5%	2.240

Autocorrelation Test

Jarque-Bera asymptotic LM normality test

Chi-square with 2 DF	0.171
Critical Chi-square Value at 1%	9.210

Heteroskedasticity tests

	Chi-square	DF	Crit at 1%
B-P-G Test	3.020	5.000	15.080
ARCH Test	2.150	1.000	6.635
Harvey Test	5.950	5.000	15.080
Glejser test	3.080	5.000	15.080

Regression Specification Error Test

Ramsey Reset

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 61	1.910	4.000
Reset(3)	2 & 60	0.960	3.150
Reset(4)	3 & 59	1.610	2.760

Predictive Accuracy Tests

Root Mean Squared Error (RMSE)	2.770
Mean Absolute Error	2.130
Theil Inequality Coefficient U	0.841

Dependent Variable DINF

Variable Name	Estimated Coefficient	Standard Error	T-Ratio DF=58
ER	0.086	0.033	2.578
ZC3	0.077	0.031	2.508
ZC4	0.090	0.030	2.993
MY5	0.008	0.004	2.215
MY6	0.007	0.004	1.820
DAIN3	0.339	0.127	2.675
DEX1	-4.908	1.712	-2.867
DTAX4	0.030	0.011	2.786
NMYR3	-0.003	0.002	-1.919
Constant	-0.220	0.166	-1.324

Critical 't' value at 10% (2 tailed)	1.670
R-Square	0.490
Adjusted R-Square	0.410
F Value	5.260
F-crit 5%	1.980

Autocorrelation Test

Jarque-Bera asymptotic LM normality test

Chi-square with 2 DF	0.583
Critical Chi-square Value at 1%	9.210

Heteroskedasticity tests

	Chi-square	DF	Crit at 1%
B-P-G Test	6.873	9.000	15.080
ARCH Test	0.105	1.000	6.635
Harvey Test	4.720	9.000	15.080
Glejser test	8.096	9.000	15.080

Regression Specification Error Test

Ramsey Reset

	DF1 & 2	F Value	Fcrit 5%
Reset(2)	1 & 57	1.919	4.000
Reset(3)	2 & 56	0.943	3.150
Reset(4)	3 & 55	0.796	2.760

Predictive Accuracy Tests

Root Mean Squared Error (RMSE)	0.948
Mean Absolute Error	0.760
Theil Inequality Coefficient U	0.602

Table 3.2 Results of 3SLS Analysis of the Simultaneous Equations of the Model:

Dependent Variable DM
R-Square 0 66 Adj R Square 0 63
F-Value =19 74 F-crit 5%=2 25

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF =62
DM1	0 65	0 07	8 82
DY2	0 05	0 03	1 69
DY4	0 06	0 03	2 03
DNR	8 49	3 45	2 46
DINF	-7 27	4 00	-1 82
Constant	20 95	6 91	3 03

Jarque Bera asymptotic LM normality test
Chi-square 8 957 2 DF -Crit at 1%= 9 21

Dependent Variable DCP
R Square 0 77 Adj R Square 0 75
F Value = 39 27 F crit 5%= 2 38

Variable Name	Estimated Coefficient	Standard Error	T Ratio DF =64
DCP2	0 68	0 05	1 36
DYD	0 51	0 03	16 71
DNR	4 97	3 54	1 49
Constant	9 94	5 60	1 61

Jarque Bera asymptotic LM normality test
Chi-square 1 495 2 DF - Crit at 1%= 9 21

Dependent Variable DTX
R-Square 0 67 Adj R Square 0 64
F Value = 16 42 F-crit 5%= 2 11

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=63
DPV	9 27	0 13	2 07
DPI	31 68	3 45	9 00
DPI2	9 71	3 44	2 83
T	0 10	0 07	1 45
Constant	3 13	3 13	1 00

Jarque-Bera asymptotic LM normality test
Chi-square 0 234 2 DF -Crit at 1%=9 21

Dependent Variable DINF
R-Square 0 48 Adj R Square 0 44
F Value =5 26 F-crit 5%= 1 98

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=58
ER	0 07	0 03	2 01
ZC3	0 07	0 03	2 47
ZC4	0 09	0 03	3 22
MY5	0 01	0 00	2 34
MY6	0 01	0 00	2 35
DAIN3	0 35	0 11	3 10
DEX1	-4 65	1 61	-2 90
DTAX4	0 03	0 01	3 05
NMYR3	-0 00	0 00	-1 79
Constant	-0 21	0 16	-1 33

Jarque-Bera asymptotic LM normality test
Chi-square 1 00 2 DF -Crit At 1%=9 21

Notes
Critical T values at 10% -Two tailed
DF 50 to 65 = 1 678 to 1 670

Dependent Variable DNR
R-Square: 0.70 Adj R-Square: 0.68
F Value= 28 26 F-crit 5%= 2.35

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=63
DNR1	0 70	0.08	8 42
MR	-0 01	0 01	-0 87
DINF6	0 10	0 08	1.29
DLIQ	-0.06	0 02	-3.20
Constant	-0 02	0.15	-0.11

Jarque-Bera asymptotic LM normality test:
Chi-square 1 126 2 DF -Crit at 1%=9.2

Dependent Variable DI
R-Square 0 43 Adj R-Square 0 38
F Value = 7 67 F-crit 5%= 2 25

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=63
DI1	0 27	0 09	3 08
DY	0 17	0 03	6 04
DRR6	-0 27	2 03	-0 13
DKA	0 09	0 06	1 49
Constant	-1 20	4 24	-0 28

Jarque-Bera asymptotic LM normality test
Chi-square 1 65 2DF - Crit at 1%= 9 2

Dependent Variable [illegible]
R-Square = 0 43 Adj R-Square 0 38
F Value = 5 49 F-crit 5%= 2.04

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=60
DEX4	16 20	50 72	0 32
DY2	0 08	0 03	2.44
DY3	0 05	0 03	1 76
DY4	0 10	0 03	3 36
DI	0 51	0 12	4 18
DAXP3	-2 51	0 88	-2 84
DNFA	0 04	0 07	0 58
Constant	17 16	6 63	2 59

Jarque-Bera asymptotic LM normality test
Chi-square 7 997 2 DF -Crit. at 1%=9.2

Dependent Variable ER
R-Square = 0 64 Adj. R-Square: 0.61
F Value = 13.48 F-crit 5%= 2 18

Variable Name	Estimated Coefficient	Standard Error	T- Ratio DF=64
ER1	0.74	0 08	9.85
DINF3	0 80	0.25	3.13
YR2	0 02	0 01	1.67
YR6	0 02	0 01	1.70
DXM	0 01	0.00	2.27
Constant	-0 20	0.41	-0.48

Jarque-Bera asymptotic LM normality test:
Chi-square 0 11 2 DF -Crit. at 1%=9.2

Breusch-Pagan LM Test for Diagonal Covariance Matrix:
Chi-square 56.157
Critical Value at 0.1% DF 28 = 56.89

Table 4. Percentage Changes (Quarterly) in Macroeconomic Variables:
(After Simulation of Export Instability - Plus or Minus 30% and 50%)

Variables	Before the Mineral Boom - 1979-'86			
(Real terms)	Plus 30%	Minus 30%	Plus 50%	Minus 50%
Money Demand	0 38	0 01	0 01	0 02
Nominal Interest Rate	0 00	0 00	0 00	0 00
Private Consumption	0 77	-0 62	1 24	-0 09
Investment	1 60	-2 42	4 00	-1 30
Imports	1 38	0 83	0 49	5 70
Inflation Rate(%)	-0 02	0 02	0 00	0 02
Employment Rate(%)	0 01	0 06	-0 00	0 11
Balance of Payments	13 62	-14 34	20 52	-32 36
Income -GDP	4 21	-4 40	6 77	-8 19
	After the Mineral Boom -1987-'95			
	Plus 30%	Minus 30%	Plus 50%	Minus 50%
Money Demand	-0 21	-0 01	0 00	-0 01
Nominal Interest Rate	-0 02	-0 02	-0 02	-0 02
Private Consumption	-0 63	0 51	-1 01	0 07
Investment	-1 43	2 14	-3 54	1 11
Imports	-0 79	-0 48	-0 28	-3 30
Inflation Rate(%)	0 06	0 03	0 04	0.03
Employment Rate(%)	0 01	-0 04	0 02	-0 09
Balance of Payments	0 94	-1 83	-0 05	-9 69
Income -GDP	-0 63	0 83	-0 95	1 74

Note

Plus 30% and 50 % - Export Income increased by 30% and 50%

Minus 30% and 50% - Export Income decreased by 30% and 50%