

**BANANA PRICE SHOCKS AND THE MACROECONOMY
OF THE WINDWARD ISLANDS**

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Abstract

The paper traces the impact of a shock to banana prices on key macroeconomic variables for the Windward Islands and the ECCB Monetary Union as a whole. Net foreign assets of Dominica are expected to show the largest decline while those for Grenada the least. The impact on the net foreign assets of the sub-region may be mitigated by other foreign exchange inflows. In addition there was little variation in the growth in M1 with the exception of Dominica suggesting output neutrality. Government revenue were not adversely affected suggesting that the terms of trade shock may be viewed as being temporary and agents borrow to maintain existing tastes and preferences. This result hinged on the nexus between government revenue and the reliance on trade taxes on imports suggesting some ambiguity in the explanation of the Harberger-Laursen-Meltzer effect.

Banana Price Shocks and the Macroeconomy of the Windward Islands

I Introduction

The banana industry is of significant importance to the economies of the Windward islands. Historically, Windward Islands bananas trade on the United Kingdom's (UK) market under preferential arrangements codified in one of the protocols of the Lome conventions. The Lome Conventions were co-operation agreements between the then European Community (and now European Union) and African, Caribbean and Pacific states (ACP). These Conventions were a derogation under the General Agreement on Tariffs and Trade (GATT) and in the past were noted and allowed, although not given formal sanction.

To lend consistency to the creation of a Single European Market (SEM) in 1992 the mechanism for granting preferential treatment to Windward Islands bananas had to be changed. The restructuring process led to the establishment of a new banana regime as promulgated in Regulation 404 of the European Commission and made operational on July 1, 1993. In that regime, a system of tariff quotas and licensing were established for the importation of bananas into the European Union which allowed Windward Islands bananas continued preferential access on the UK market. Preferential access by Windward Island bananas to the European Union (EU) in

the past has enabled these economies to achieve robust growth rates in the 1980's due to favourable terms of trade and consequently higher levels of public sector investment.¹

The general movement towards global trade liberalisation as manifested in the Uruguay Round of GATT negotiations and the consequent establishment of the World Trade Organisation, has unleashed pressures on preferential trade arrangement and practices. The new banana regime of the European Union was thus challenged by a few Latin American countries and the United States of America. The case was heard by the Dispute Settlement Panel of the WTO and in its preliminary ruling found the EU banana regime to be discriminatory. The final ruling could lead to the dismantling of the preferential treatment to Windward Islands bananas and could open an era of banana free trade on the European market.. A banana free trade regime could lead to a decline in banana price, which has the potential to directly affect the viability of the industry and consequently economic conditions in the economies. Should that occur there could be some macroeconomic consequences for the economies in question. Not much empirical research has been conducted thus far in an attempt at analysing the implication of a banana price shock to the economies of the Windward Islands.

As a contribution to the ongoing discussions on the importance of the banana industry and the possible consequences of a more liberal banana trading regime on the European market, this

¹ The Windward Islands consist of Dominica, St. Lucia, St. Vincent and the Grenadines and Grenada. They form part of a wider monetary union with the Eastern Caribbean Central Bank (ECCB) at the apex.

paper will attempt to empirically investigate the likely behaviour of some selected macroeconomic variables given a banana price shock. Section 11 of the paper will discuss the importance of the banana industry to the economies of the Windward Islands and at the same time present the structure of the banana trade preference granted to the Windward Islands by the European Community. From this it may be possible to infer the degree of price support implicit in the preferential arrangement. In Section III, our methodological approach to the empirical investigation will be advanced, while addressing some data considerations. In Section iv the results of the empirical investigation and their implications are discussed. Finally, some concluding remarks will be made.

II. Bananas' Contribution and the Preferential Regime

Of all the agricultural commodities produced in the Windward Islands, with the exception of Grenada, banana is the most important. The cultivation of bananas utilises approximately 27.2 per cent of all agricultural land in the Windward Islands. The use of agricultural land for banana production ranges from a high of 40.5 per cent in St. Vincent and the Grenadines and a low of 3.7 in Grenada. Estimates are that the industry employs approximately 56,428 persons in the Windwards and with the ancillary economic activity resulting from banana production the number could be higher. Although difficult to quantify, the banana industry has been critical to the economies from the standpoint of income distribution. Related to this is the weekly frequency in the receipt of banana income. Although the income may not be high, such frequency assists in cash flow management of farmers and others involve in the industry. In the absence of other major form of economic activity, banana production is the lifeblood of rural communities in the Windward Islands. In some sense it constitutes a way of life; a culture.

Given the limited range of merchandise export, banana accounts for a high proportion. In 1995, it constituted 36.5 per cent of the sub-region's merchandise exports. In St. Lucia and St. Vincent and the Grenadines it was 47.5 per cent and 46.4 per cent respectively. In Grenada, it was relatively insignificant at 7.3 per cent. In Grenada, merchandise export is dominated by cocoa and nutmeg.

The structure of the preferential treatment accorded to Windward Islands banana reflected a compromise between free-traders and protectionists. There was the recognition that trade had to be liberalised (in the context of the SEM and the Uruguay Round of GATT) but there was also the need to offer continued protection to traditional suppliers of bananas. A system of tariff quotas and licensing was thus established with Council Regulation (EEC) No. 404/93 and implemented in July of 1993 in an attempt to satisfy both objectives.

To protect the Windward Islands, the EU established an annual duty free quota for the importation of bananas from each of the Islands.² The duty free quota was just above the annual historical level of banana export from each island. If the Windward Islands were to send more than its quota then a tariff of ECU750.0 per tonne would have to be paid. Latin American bananas were subject to a tariff quota of, initially, 2.0 million tonnes per year with a tariff of ECU750.0 per tonne. Exports in excess of the 2.0 million tonnes per year will be subject to a tariff of ECU850.0 per tonne. After some amount of protest and with the expansion of the EU, Latin American tariff quota was increased to 2.5 million tonnes per year, while the tariff was reduced to ECU750 per tonne.

The importation of all bananas required a license, and the Latin American tariff quota of 2.5 million tonnes was no exception. However, the EU devised a system for the distribution of the licenses for the 2.5 million tonnes such that not only Latin American producers will benefit

² See Nurse, Keith and Wayne Sandiford. Windward Islands Bananas: Challenges and Options Under the Single European Market, FES, 1996. Pgs. 103 - 111.

from the economic rent that can be derived from the lower level of tariff within the tariff quota. The system allowed for the distribution of licenses according to categories of operators and levels of engagement in the banana business. Three categories of operators and levels of engagement were specified. Of importance to the Windward Islands was the category B operators who were entitled to 30.0 per cent of the licenses for the importation of the 2.5 million tonnes. A category B operator was defined as one who, prior to 1992, has marketed community (i.e., European) bananas and/or traditional ACP bananas.

On the basis of the 30.0 per cent, category B operators were entitled to licenses to import 750,000 tonnes of the 2.5 million tonnes of Latin American tariff quota. But, the entitlement of any one category B operator was made dependent of the level of engagement and the number of levels engaged in. Simply, the three levels were shipping/importing (primary importers), green wholesaling (secondary importers), and ripening (ripeners). The levels were respectively assigned 57.0 per cent, 15.0 per cent and 28.0 per cent of the 750,000 tonnes. At best, a category B operator could be engaged in all three levels of the banana business.

The Windward Islands banana industry was thus awarded two levels of support through the EU banana regime. There was the support through the duty free quota they received and the tariff quota imposed on Latin American bananas. There was also support through the licensing system which allows the Windward Islands the possibility of sharing in the economic rent. Both prongs of support allow the Windward Islands reasonable access to the UK market and indirectly granted a measure of price support since the market was essentially regulated. If this regulated

market is dismantled there is the distinct possibility of a decline in the price of bananas, i.e., a banana price shock. The immediate issue then is trying to trace the impact of the shock on the macroeconomy of the Windward Islands.

III. Methodology and Data

To analyse the issue impulse response functions were employed as a tool to trace the response of selected macroeconomic variables to a unit shock from banana price. These impulse response functions are generated within a Vector Autoregression (VAR) framework which enables the data to determine the dynamic structure of the model for the macroeconomic variables in question. According to the theory of stochastic stationary processes (Anderson, 1971) a covariance stationary stochastic process $X = \{X_t\}$ can be written in a vector moving average (MA) form as follows:

$$1 \quad X_t = \xi_t + \psi_1 \xi_{t-1} + \psi_2 \xi_{t-2} - \dots,$$

where ξ_t in equation 1 is a white-noise innovation or error vector. This white-noise ξ has the following properties :

$$2 \quad \begin{aligned} E(\xi_t) &= 0, \forall t \\ E(\xi_t \xi_s) &= 0, t \neq s \\ E(\xi_t \xi_s) &= \Sigma, t=s \end{aligned}$$

The matrix ψ in equation 1 identifies the consequences of a one unit increase in the i th variable's innovation at date t (ϵ_{it}) for the value of the i th variable at time $t+s$ holding all other innovations at all dates constant (Hamilton, 1994). The impulse response function, or dynamic multiplier, traces the effects on current and future values of the endogenous variable to a shock from one of

the innovations ξ_t . In a linear model with no correlation in the error terms this dynamic multiplier is tractable, but if the errors are correlated there is no simple and unambiguous way to identify shocks with respect to specific variables (Pindyck and Rubinfeld 1992). In the event that the errors are correlated the common component is attributed to the variable that appears first in the system.

To circumvent this problem Sims (1980) renormalises the moving average representation into a recursive form such that the orthogonalizing transformation allows the error variance of the $H+1$ step-ahead forecast of X_t to be decomposed into components accounted for by the different shocks or innovations ξ_t . A Choleski decomposition is one method of orthogonalising the variance covariance matrix of the innovations such that it is diagonal. This decomposition eliminates current period cross-correlated error terms through a "Wold causal chain" in the ordering of the elements of the vector X . Other orderings and orthogonal transformations are possible such as that proposed by Bernanke (1986).

Given that the vector X is an infinite series, some approximation has to be derived for the purposes of application particularly in arrival at the optimal lag structure. Tiao and Box (1981) have suggested a likelihood ratio test based on the ratio of successive determinants of the restricted and unrestricted covariance matrices. The testing procedure employed is a modification of this procedure and the statistic was specified as follows:

where Σ_r and Σ_u are the restricted and unrestricted covariance matrices, T the number of observations and C a correction factor to improve small sample properties. This statistic is asymptotically distributed as a χ^2 with degrees of freedom equal to the number of restrictions.

The macroeconomic variables selected and ordered for the analysis were the U.K. banana green market price, M1, total net foreign assets and government's current revenue. The choice of variables were based on data availability and a reduction in the data generating process due to marginalisation and conditioning. Marginalisation was predicated on the partitioning of the universe of relevant information while the principle of conditioning implies causal structure and requires that no information is lost in analysing the variables of interest. This ordering, with price first, was based on the small country assumption of price transmission. These selected variables were transformed into natural logarithms and the data set covered the period 1984:1 to 1996:3. VAR systems using these variables were estimated for the Commonwealth of Dominica, Grenada, St. Lucia and St. Vincent and the Grenadines and for the ECCB area. A lag structure of four was

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$$(\hat{T}-C)(\log|\Sigma_r| - \log|\Sigma_u|)$$

determined for the Commonwealth of Dominica, St. Vincent and the Grenadines and the ECCB area while a lag structure of two was obtained for St. Lucia and Grenada. All variables were integrated of order one $I(1)$ forming some cointegrating relationship as demonstrated by Tables 1 through 5.

IV. Results and Discussion

In interpreting the impulse response function (Tables 11-15), the x-axis gives the time horizon or duration of the shock while the y-axis denotes the percentage variation or growth rate in the dependent variable from its base level. For all countries (with the exception of St. Vincent and the Grenadines) and the ECCB area, a shock to banana price from itself had its greatest impact within the first four quarters as price declined and continued in that direction over the time horizon.

A unit shock from banana price to M1 (which proxies the level of business activity in the economy) in Dominica has its greatest impact after three quarters with the cumulative effects gradually tapering off thereafter. Business activity appears to decline over time in Dominica with the fall in banana price. For Grenada, the largest impact on M1 occurs after two quarters and subsequently stabilises at approximately 0.4 per cent from its base level. In general, the impact of a banana price shock (and hence banana revenues) on the level of business activity appears to be small for Grenada. In St. Lucia M1 responds to the shock by accelerating rapidly reaching a maximum of 3.3 per cent above its initial position then gradually levelling off to approximately 0.5 per cent above the base level.

The responses of M1 in St. Vincent and the Grenadines and for the ECCB area follow a similar pattern. In both cases, there is an initial decline below the base level. In the case of St. Vincent and the Grenadines it reverts to and remains at the base level while for the ECCB area

it stabilises at about 1.0 per cent above the base level. The impact of a banana price shock on M1 appears to be surprisingly small given the role banana plays in the economy of St. Vincent and the Grenadines. This result may lend credence to a claim that the informal and the tourism sectors play a much larger role in this economy than is formally acknowledged. In the case of the ECCB area, the minimal impact of banana price shocks on M1 may be accounted for by the economic performance of the other economies in the monetary union that are more diversified in services.³ Additionally this result may reflect money output neutrality.⁴

The initial impact of unfavourable price movements on output may be reflected in falling national income associated with the decline in foreign exchange earnings from bananas. The impact of the initial contraction may explain the fall in demand deposits and currency in circulation associated with lower foreign currency inflows. However, as the economy adjusts to the price shock, M1 levels appear to stabilise at or above baseline levels.

The response of net foreign assets, in all countries with the exception of Grenada, is an initial rise followed by a gradual tapering off and stabilising above baseline levels. In the case of Grenada the net foreign assets continue to fall for up to three quarters and thereafter reverts to the baseline level. The reason for the rapid adjustment and stabilisation of net foreign assets in

³ Gross inflows on the services account within the monetary union account averaged 45.6 per cent of GDP over the period 1991-95.

⁴ An increase in the price of tradeable goods implies appreciation of the real exchange rate. The increase in real money balances leads to a reduction in the supply of the traded good but an increase in that of the non traded good.

Grenada may be due to the relatively small contribution of banana revenues to value added in the economy. Recently, Grenada has been the smallest exporter of bananas among the Windward Islands and farmers have continued to adjust out of banana production given price uncertainty, a lower level of risk exposure in the context of a more diversified agricultural export base and penalties associated with persistent low quality fruit. The largest impact on net foreign assets occurred in Dominica which showed a declining trend over time. For St. Vincent and the Grenadines, M1 exhibited an unusual pattern with very little variability. The transmission of the external sector shock to output appears to be transmitted to a contraction in economic activity and may result in a decline in demand for credit. In adjusting their portfolio resulting from rising liquidity conditions, commercial banks may initially increase their holdings of foreign assets. However, over time, with reduced deposit growth resulting from a decline in banana revenue inflows liquidity conditions could tighten.

The stabilisation of net foreign assets for the ECCB area over the time horizon after an initial decline may speak to the relatively small contribution of bananas to foreign exchange earnings of the sub-region viz-a-viz tourism and direct foreign investment. In both 1994 and 1995 tourism contributed an estimated EC\$2.1 billion dollars in contrast to banana earnings of EC\$217m and EC\$239m respectively. Moreover, as the economies become more service oriented, opportunities for direct foreign investment increase with the diversification process. Although cyclical in nature, direct foreign investment flows to the sub-region continue to increase, exceeding the foreign exchange earnings derived from bananas.

The response of government revenue to a shock from banana price was minimal in Grenada given the small contribution of banana earnings to value added and a proportional relationship between government revenue and gross value added. After an initial rise resulting from a unit shock from banana price, government revenue in Grenada gradually dies out remaining close to the base level. This result is predicated on the degree of diversification of the economy and the large role played by the service sector in the economy. In the case of Dominica the effects of the shock was a rise in government's revenue to approximately 0.5 per cent above the base after two quarters and peaking at 1.3 per cent by quarter five but is nevertheless not pronounced. The impact of the shock does not seem to die out in the medium term. In St. Lucia, St. Vincent and the Grenadines and the ECCB area the impact of the shock to government revenue takes on a cyclical pattern that tends to eventually stabilise at around the base level. In the case of the ECCB area the larger role played by services may tend to dampen the overall impact of a shock from banana prices on government revenue. These results suggests that the impact on government revenue may be minimised over time given economic adjustment and the fact that there are no direct taxes on banana exports.

The growth in banana revenues was highly variable relative to growth in government revenues. This variability in banana revenues reflected both price, quantity and exchange rate variability. Despite the heavy reliance of the economy of Dominica on banana exports, the growth in government's revenue had a coefficient of variation of 0.62 relative to that of bananas revenue of 4.0. While it may be argued that in the other economies exports of services play a significant role that may mitigate the effects of the volatility in banana revenues, the results suggest the

importance of other factors, whether they be the informal sector or an understatement of the contribution of tourism to value added in Dominica. In addition, given that the majority of government revenue is derived from taxes on international trade and transactions, there may be some element of consumption smoothing on the part of economic agents so as to maintain tastes and preferences. Hence a decline in banana revenues may not be associated with a commensurate decline in imports and consequently government's revenue.

If the effects of the terms of trade shock are deemed to be permanent then the current account of the balance of payments would improve based on a fall in permanent income and an increase in the relative price of capital goods i.e. the Harberger-Laursen Metzler effect. However, if the terms of trade shocks are perceived to be transitory then the impact on the current account and hence imports and investment can be ambiguous. This ambiguity arises because of expectations that drive intertemporal substitution between current and future consumption. Given that government revenues that depend on imports are relatively unaffected then it implies that agents either draw down on savings or borrow to maintain tastes and preferences. Other reasons for the ambiguity may relate to the import content of consumption and investment and the duration of the terms of trade shock.

In terms of the variance decomposition of the VAR which gives the proportion of forecast error k periods ahead accounted for by each innovation the second column in Tables 6-10 gives the forecast error of the variable for up to 20 quarters ahead. Columns 3-6 of the same tables show the percentage of the variance due to the innovations (banana price, M1, NFA and

Government's revenue) within the VAR system. For Dominica, banana price is important in explaining the error variance in M1, NFA and Government Revenue by accounting for 54.3 per cent, 54.8 per cent and 21.4 per cent respectively after 10 quarters (Table 6). These results reflect the dominance of banana production in the economy of Dominica. In contrast, banana price innovations do not explain much of the error variance in Grenada (Table 7). The significance of banana production in the Grenadian economy is minimal. In St. Lucia and St. Vincent and the Grenadines the relative importance of banana price in the variance decomposition of M1, NFAs and Government's revenue (Tables 8 and 9) is lower when compared to Dominica, but higher relative to Grenada's. Again these results speak to the relative importance of banana production in the respective countries. For the ECCB area, banana price innovations had their largest impact on NFAs by accounting for 40.7 per cent of the error variance of NFAs after 10 quarters. Given the degree of openness, trade dependence and vulnerability to external shocks, the net foreign asset position of the territories will be sensitive to export earnings and net capital inflows. Their contribution to the error variance of M1 and Government Revenue after 10 quarters was 11.4 per cent and 7.9 per cent respectively.

In sum, business activity is likely to be affected with varying degrees in each of the Windward Islands. Following a banana price shock, gyrations in business activity is expected to taper off and stabilise after three quarters, in Grenada, eight to ten quarters in St. Lucia and St. Vincent and the Grenadines and a much longer time in Dominica. For the ECCB area as a whole, the oscillations are expected to stabilise after approximately eight quarters. The Net Foreign Assets is likely to stabilise after a fairly short period of time, except in the case of Dominica where

the effects of a banana price shock is anticipated to be more prolonged. The expectation is that the impact on Government revenue will not be significant and any oscillations will taper off in a short period of time. A plausible explanation of this finding is the fact that most of Government's revenue is derived from taxes on international trade and transactions. In addition there is the strong possibility of some amount of consumption smoothening that is likely to take place following the banana price shock.

V. Conclusions

This paper sought to trace the impact of a shock from banana price on business activity, net foreign assets and government revenue of the Windward Islands, individually and at the level of the monetary union, i.e., the ECCB area. The results suggest that the greatest impact of a shock from banana prices will be experienced in Dominica and the least impact will be on the economy of Grenada. These findings give support to *a priori* expectations given the relative role played by bananas in the respective economies of the Windward Islands. Should there be a banana price shock, the empirical results suggest that the required adjustment process within the industry and the economy will be more pronounced in Dominica with implications for government's revenue, the accumulation of foreign assets, the level of business activity and consequently employment. The results for St. Vincent and the Grenadines were not totally consistent with *a priori* expectations given the fairly large role played by bananas in that economy. The decline in economic activity and net foreign assets within the monetary union may be mitigated by the foreign exchange inflows associated with services and direct foreign investment. The effects of price shocks on government revenue did not appear to be pronounced perhaps based on the fact that there are no direct taxes on banana exports. In addition, the role of other sectors of the economy appear to mitigate the impact of the volatility of banana revenues. This result was not anticipated for Dominica which relies more heavily on banana exports than the other countries in the study but may also be due to the reliance on trade taxes.

When taken in its totality, the results suggest that a banana price shock is not likely to have long lasting negative effects on the macroeconomy of the Windward Islands. Of the four islands, the negative effects of a banana price shock are likely to be of more concern for Dominica. The results also tend to lend credence to the contention that a devaluation of the Eastern Caribbean dollar need not have to occur following a banana price shock. Adjustment to the shock would more likely be on internal sectors of the economies of the Windward Islands.

References

- Anderson, T. W. *The Statistical Analysis of Time Series*. New York: John Wiley and Sons, 1971
- Bernanke, B. "Alternative Explanations of the Money-Income Correlation." *Carnegie-Rochester Conference Series on Public Policy*, 25(1986):51-58
- Hamilton, J. D. *Time Series Analysis*. New Jersey: Princeton University Press, 1994.
- Nurse, Keith and Wayne Sandiford. *Windward Islands Bananas: Challenges and Options Under the Single European Market*. FES. 1995.
- Osterwald-Lenum, M. "A Note with quantiles of the Asymptotic Distribution of the ML Cointegration Rank Test Statistics." *Oxford Bulletin of Economics and Statistics*. 54(1992):461-72
- Pindyck, R. S. and D. I. Rubinfeld. *Econometric Models and Economic Forecasts*. McGraw Hill, 1991
- Sims, C. "An Autoregressive Index Model for the U.S. 1948-1975." *Large Scale Macroeconomic Models*, ed. J. Kmenta and J. Ramsey, pp. 283-327. Amsterdam: North-Holland Publishing Co., 1981.
- Tiao, G. C. And G. E. P. Box. "Modelling Multiple Time Series: With Applications." *Journal of the American Statistical Association*. 76(1981):802-16.

Table 1. Dominica Trace Test for Alternative Cointegration Specifications with and without a Linear Trend

p-r	r	T	C(5%)	T*	C*(5%)	T*	C*(5%)
4	0	60.08	53.12	48.68	47.21	69.88	62.99
3	1	32.23	34.91	23.74	29.68	26.75	42.44
2	2	13.07	19.96	10.76	15.41	11.19	25.32
1	3	4.58	9.24	4.39	3.76	4.41	12.25

The tests are based on restrictions on the following prototype model:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \alpha \begin{bmatrix} \beta \\ \mu_1 \\ \delta_1 \end{bmatrix} z_{t-k} + \alpha_1 \mu_2 \delta + \alpha_1 \delta_2 t - \mu_t$$

- T The trace test is based on Table 1* of Osterwald-Lenum(1992) and tests for no linear trends in the data such that the first differenced data have zero mean i.e. $\delta_1 = \delta_2 = \mu_2 = 0$.
- T* The trace test is based on Table 1 of Osterwald-Lenum(1992) and tests for linear trends in the levels of the data allowing non-stationary relationships in the model to drift i.e. $\delta_1 = \delta_2 = 0$.
- T** The trace test is based on Table 2* of Osterwald-Lenum(1992) and tests for a time trend in the cointegration vectors i.e. $\delta_2 = 0$.
- P is the number of series
- r is the number of cointegrating vectors

Table 2. Grenada Trace Test for Alternative Cointegration Specifications with and without a Linear Trend

p-r	r	T	C(5%)	T*	C*(5%)	T*	C*(5%)
4	0	43.75	53.12	33.61	47.21	73.15	62.99
3	1	23.29	34.91	15.29	29.68	30.54	42.44
2	2	13.05	19.96	5.42	15.41	12.22	25.32
1	3	3.25	9.24	0.11	3.76	4.15	12.25

The tests are based on restrictions on the following prototype model:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \alpha \begin{bmatrix} \beta \\ \mu_1 \\ \delta_1 \end{bmatrix} z_{t-k} + \alpha_1 \mu_2 \delta + \alpha_1 \delta_2 t + \mu_t$$

- T The trace test is based on Table 1* of Osterwald-Lenum(1992) and tests for no linear trends in the data such that the first differenced data have zero mean i.e. $\delta_1 = \delta_2 = \mu_2 = 0$.
- T* The trace test is based on Table 1 of Osterwald-Lenum(1992) and tests for linear trends in the levels of the data allowing non-stationary relationships in the model to drift i.e. $\delta_1 = \delta_2 = 0$.
- T** The trace test is based on Table 2* of Osterwald-Lenum(1992) and tests for a time trend in the cointegration vectors i.e. $\delta_2 = 0$.
- P is the number of series
- r is the number of cointegrating vectors

Table 3. St. Lucia Trace Test for Alternative Cointegration Specifications with and without a Linear Trend

p-r	r	T	C(5%)	T*	C*(5%)	T*	C*(5%)
4	0	73.35	53.12	66.24	47.21	88.85	62.99
3	1	41.65	34.91	35.64	29.68	53.65	42.44
2	2	15.96	19.96	10.46	15.41	23.32	25.32
1	3	6.06	9.24	2.84	3.76	6.75	12.25

The tests are based on restrictions on the following prototype model:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \alpha \begin{bmatrix} \beta \\ \mu_1 \\ \delta_1 \end{bmatrix} z_{t-k} + \alpha_1 \mu_2 \delta + \alpha_1 \delta_2 t + \mu_t$$

T The trace test is based on Table 1* of Osterwald-Lenum(1992) and tests for no linear trends in the data such that the first differenced data have zero mean i.e. $\delta_1 = \delta_2 = \mu_2 = 0$.

T* The trace test is based on Table 1 of Osterwald-Lenum(1992) and tests for linear trends in the levels of the data allowing non-stationary relationships in the model to drift i.e. $\delta_1 = \delta_2 = 0$.

T* The trace test is based on Table 2* of Osterwald-Lenum(1992) and tests for a time trend in the cointegration vectors i.e. $\delta_2 = 0$.

P is the number of series

r is the number of cointegrating vectors

Table 4. St. Vincent Trace Test for Alternative Cointegration Specifications with and without a Linear Trend

p-r	r	T	C(5%)	T*	C*(5%)	T*	C*(5%)
4	0	79.97	53.12	72.45	47.21	114.06	62.99
3	1	40.21	34.91	34.64	29.68	59.22	42.44
2	2	14.31	19.96	11.20	15.41	28.93	25.32
1	3	3.05	9.24	0.14	3.76	8.31	12.25

The tests are based on restrictions on the following prototype model:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \alpha \begin{bmatrix} \beta \\ \mu_1 \\ \delta_1 \end{bmatrix} z_{t-k} + \alpha_1 \mu_2 \delta + \alpha_1 \delta_2 t + \mu_t$$

T The trace test is based on Table 1* of Osterwald-Lenum(1992) and tests for no linear trends in the data such that the first differenced data have zero mean i.e. $\delta_1 = \delta_2 = \mu_2 = 0$.

T* The trace test is based on Table 1 of Osterwald-Lenum(1992) and tests for linear trends in the levels of the data allowing non-stationary relationships in the model to drift i.e. $\delta_1 = \delta_2 = 0$.

T* The trace test is based on Table 2* of Osterwald-Lenum(1992) and tests for a time trend in the cointegration vectors i.e. $\delta_2 = 0$.

P is the number of series

r is the number of cointegrating vectors

Table 5. ECCB Area Trace Test for Alternative Cointegration Specifications with and without a Linear Trend

p-r	r	T	C(5%)	T ⁺	C ⁺ (5%)	T [*]	C [*] (5%)
4	0	65.85	53.12	50.06	47.21	67.57	62.99
3	1	36.75	34.91	28.43	29.68	38.60	42.44
2	2	16.05	19.96	14.44	15.41	22.33	25.32
1	3	6.34	9.24	5.72	3.76	8.44	12.25

The tests are based on restrictions on the following prototype model:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \alpha \begin{bmatrix} \beta \\ \mu_1 \\ \delta_1 \end{bmatrix} z_{t-k} + \alpha_1 \mu_2 \delta + \alpha_2 \delta_2 t + \mu_t$$

T The trace test is based on Table 1* of Osterwald-Lenum(1992) and tests for no linear trends in the data such that the first differenced data have zero mean i.e. $\delta_1 = \delta_2 = \mu_2 = 0$.

T⁺ The trace test is based on Table 1 of Osterwald-Lenum(1992) and tests for linear trends in the levels of the data allowing non-stationary relationships in the model to drift i.e. $\delta_1 = \delta_2 = 0$.

T^{*} The trace test is based on Table 2* of Osterwald-Lenum(1992) and tests for a time trend in the cointegration vectors i.e. $\delta_2 = 0$.

P is the number of series

r is the number of cointegrating vectors

Table 6: Dominica: Proportion of Forecast Error k Quarters Ahead Accounted by Each Innovation

Error Forecast in	k quarters	Banana Price	M1	NFA	G. Revenue
Banana Price	1	100.00	0.0	0.0	0.0
	5	68.37	0.89	8.62	22.11
	10	64.39	1.84	8.19	25.58
	15	64.67	2.38	7.75	25.19
	20	64.97	2.55	7.59	24.88
M1	1	7.64	92.36	0.0	0.0
	5	42.46	35.98	10.76	10.78
	10	54.25	22.42	8.23	15.09
	15	57.20	18.53	10.81	13.45
	20	58.99	17.56	10.52	12.92
NFA	1	7.01	3.04	89.95	0.0
	5	36.36	8.24	48.70	6.69
	10	54.77	5.68	31.21	8.34
	15	55.23	4.95	32.58	7.23
	20	55.56	5.05	32.24	7.15
G. Revenue	1	0.11	0.07	5.45	94.36
	5	8.39	4.31	4.56	82.74
	10	21.42	3.75	5.36	69.46
	15	30.92	3.05	5.60	60.42
	20	37.96	2.61	5.32	54.10

Table 7: Grenada: Proportion of Forecast Error k Quarters Ahead Accounted by Each Innovation

Error Forecast in	k quarters	Banana Price	M1	NFA	G. Revenue
Banana Price	1	100.0	0.0	0.0	0.0
	5	91.14	5.71	14.37	10.61
	10	69.29	7.14	21.07	10.46
	15	59.49	7.32	22.79	10.38
	20	59.03	7.32	23.31	10.34
M1	1	0.24	99.75	0.0	0.0
	5	2.27	73.70	15.36	8.66
	10	1.56	64.33	24.46	9.65
	15	1.34	60.94	27.72	9.99
	20	1.23	59.29	29.31	10.16
NFA	1	3.21	0.20	96.58	0.0
	5	1.73	8.77	88.35	1.15
	10	1.20	14.19	82.52	2.09
	15	0.99	17.96	78.14	2.90
	20	0.91	20.58	74.99	3.52
G. Revenue	1	7.44	18.16	0.12	74.28
	5	8.44	22.66	0.28	68.61
	10	8.16	26.51	0.34	64.99
	15	7.94	28.33	0.69	63.04
	20	7.75	29.29	1.17	61.76

Table 8: St. Lucia: Proportion of Forecast Error k Quarters Ahead Accounted by Each Innovation

Error Forecast in	k quarters	Banana Price	M1	NFA	G. Revenue
Banana Price	1	100.0	0.0	0.0	0.0
	5	74.01	1.95	5.34	18.70
	10	68.18	1.81	12.51	17.49
	15	66.65	1.81	14.32	17.22
	20	66.18	1.81	14.87	17.12
M1	1	2.45	97.54	0.0	0.0
	5	6.97	83.06	1.89	8.07
	10	7.26	73.58	5.13	14.01
	15	9.22	62.03	12.83	15.91
	20	10.64	54.33	18.62	16.40
NFA	1	16.09	1.25	82.65	0.0
	5	10.94	0.32	85.06	3.67
	10	14.36	0.64	79.42	5.57
	15	14.88	0.78	78.54	5.79
	20	15.01	0.87	78.03	5.81
G. Revenue	1	6.07	6.41	0.35	87.16
	5	5.91	15.34	1.64	77.12
	10	6.57	18.29	3.66	71.47
	15	7.49	18.02	7.22	67.26
	20	8.20	17.32	10.06	64.42

Table 9: St. Vincent: Proportion of Forecast Error k Quarters Ahead Accounted by Each Innovation

Error Forecast in	k quarters	Banana Price	M1	NFA	G. Revenue
Banana Price	1	100.0	0.0	0.0	0.0
	5	70.40	8.45	8.53	12.62
	10	61.62	7.51	13.79	17.08
	15	58.51	8.11	15.20	18.18
	20	55.01	8.68	17.57	17.74
M1	1	6.63	93.36	0.0	0.0
	5	18.69	40.25	8.18	32.87
	10	15.38	28.11	21.63	34.87
	15	12.34	25.13	23.88	38.64
	20	10.54	22.72	26.94	39.79
NFA	1	0.57	5.25	94.17	0.0
	5	0.85	5.08	76.04	18.02
	10	6.25	11.07	68.58	14.01
	15	8.16	11.83	67.67	12.33
	20	7.63	12.45	65.52	14.40
G. Revenue	1	3.25	0.96	1.72	94.07
	5	9.56	2.60	7.67	80.16
	10	11.71	5.27	9.75	73.26
	15	11.36	7.16	12.39	69.07
	20	10.97	7.62	15.48	65.91

Table 10: ECCB Area: Proportion of Forecast Error k Quarters Ahead Accounted by Each Innovation

Error Forecast in	k quarters	Banana Price	M1	NFA	G. Revenue
Banana Price	1	100.0	0.0	0.0	0.0
	5	82.81	1.26	6.47	9.45
	10	76.16	5.68	7.27	10.88
	15	74.27	6.07	7.81	11.84
	20	73.08	6.81	8.13	11.97
M1	1	0.58	99.42	0.0	0.0
	5	8.46	76.70	6.21	8.63
	10	11.35	69.19	7.86	11.59
	15	14.08	62.29	8.69	14.92
	20	14.65	59.80	8.82	16.72
NFA	1	0.12	33.33	66.55	0.0
	5	27.53	22.64	36.18	13.64
	10	40.68	14.01	25.45	19.85
	15	42.86	12.66	22.42	22.05
	20	42.12	13.00	22.15	22.72
G. Revenue	1	7.63	3.76	4.94	83.66
	5	7.13	32.06	8.56	52.24
	10	7.88	33.10	9.21	49.79
	15	8.29	33.70	10.23	47.77
	20	8.89	33.14	10.61	47.35

Figure 1
DOMINICA

Impulse response functions based on one (1) standard deviation shock to banana innovations.

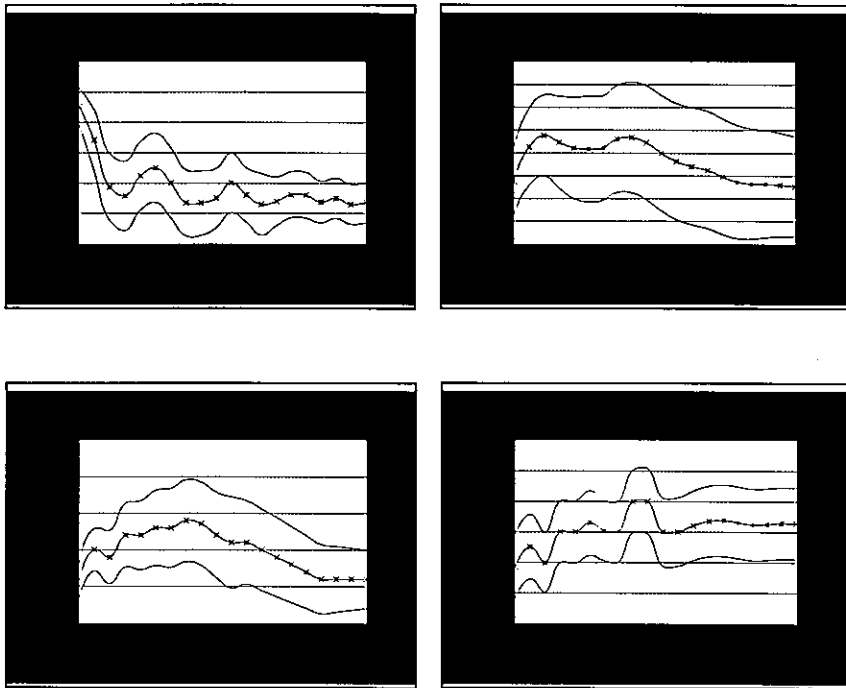


Figure 2
GRENADA

Impulse response functions based on one (1) standard deviation shock to banana innovations.

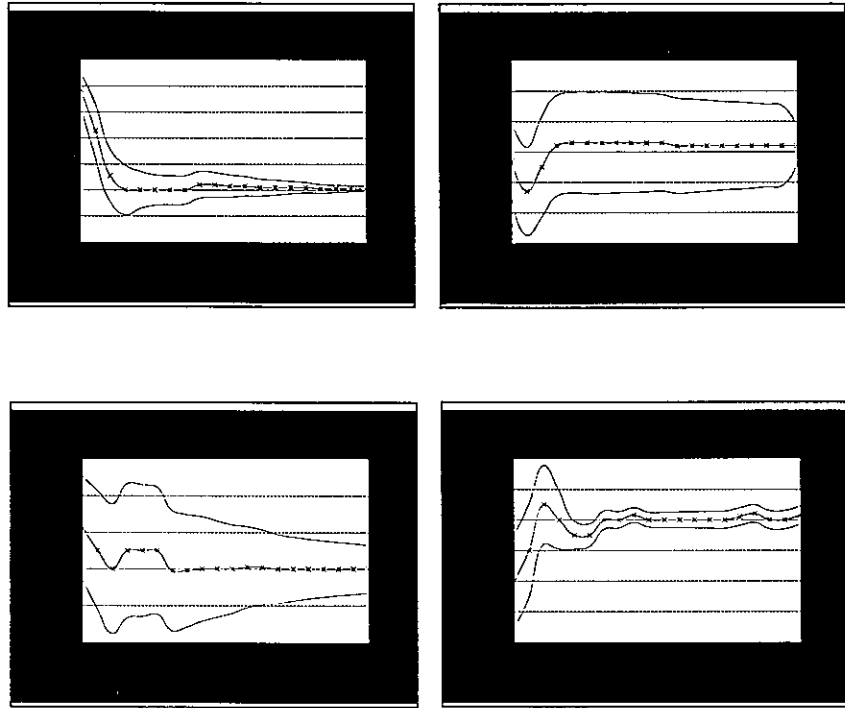


Figure 3
ST. LUCIA

Impulse response function based on one (1) standard deviation shock to banana innovations.

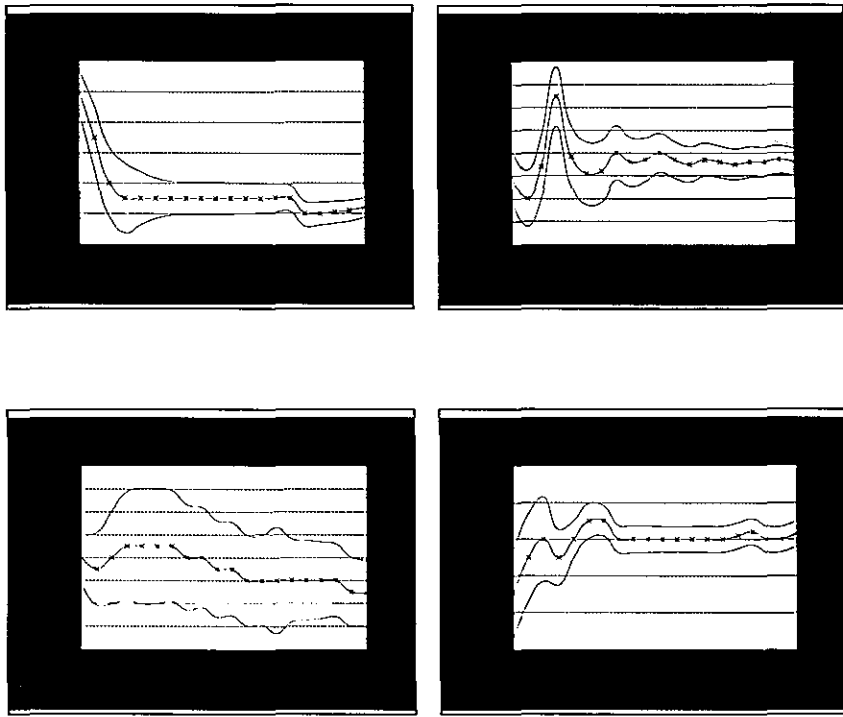


Figure 4
ST. VINCENT & THE GRENADINES
Impulse response functions based on one (1) Standard deviation shock to banana innovations.

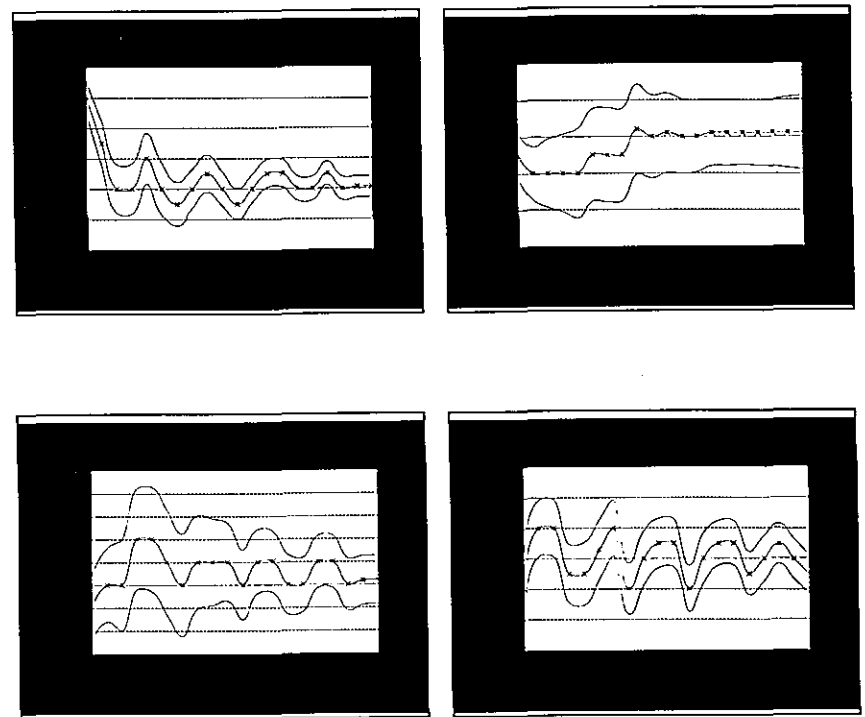


Figure 5

E. C. C. B.

**Impulse response functions based on one (1) standard deviation shock
to banana innovations.**

