MONEY-PRICES CAUSATION IN FOUR CARICOM ECONOMIES:
A Preliminary Investigation

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Paper presented at the First Annual Conference for Monetary Studies
Hosted by Caribbean Centre for Monetary Studies and Eastern Caribbean Central Bank
November 8-11, 1995

November 1995

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INTRODUCTION

The causal relationship between money supply and the inflation rate is a much debated issue in the literature. In some studies [e.g. Feige and Pearce (1976)] money and prices are found to be independent while other studies, Sargent and Wallace (1973), Frenkel (1977), Brillembourg and Khan (1978) and Jones and Uri (1987)] suggest that the two economic variables are closely related, a fact supported by economic theory. The literature though is somewhat puzzling to the reader since many of these studies have produced conflicting results. In particular, Jones and Uri (1987) re-examined the study by Feige and Pearce (1976) and concluded that the study should be disregarded since acceptance of the hypothesis of the independence of money supply and inflation was obtained using a test procedure (i.e. Haugh-Pierce test) which accepted the null hypothesis of time series independence too frequently and hence gave unreliable results. By contrast Jones and Uri found that causal relationships do exist between Money (M1) and Prices (CPI). Hoover (1991) in a recent paper has re-opened the question on methodological grounds, arguing that prior knowledge about institutions and the economic environment must be combined with statistical techniques to gather evidence about the nature of causal relations.[1] Hoover's results show that the direction of causality runs from prices to money and not from money to prices.

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* *The views expressed in the paper are those of the authors and in no way represent the views of the institutions for which they work.*

1 The Hoover study re-examines the money-prices causal nexus using probabilistic formulations by Simon (1953).

The rapid growth in information technology and financial innovations and the greater degree of liberalisation in the financial sector are altering the nature of the linkages between money and prices in ways that are not readily understood by economists. Indeed, financial innovation has complicated the monetary process by further reducing the ability of the monetary authorities to control the money stock. Thorton and Stone (1992) have argued that the inability of the monetary authorities to predict velocity is affecting the options open to policy makers to control inflation through the control of the money supply.

In this paper, we investigate the direction of causality between money and prices in Barbados, Guyana, Jamaica and Trinidad and Tobago.[2] Section I of the paper explores the theoretical link between money and prices and discusses the main findings in the Caribbean literature as to the importance of money supply growth as a major determinant of inflation. Section II of the paper, discusses the major test procedures for causal inference. The Granger statistical methodology for causal testing is elaborated. Section III explores the major difficulties with the Direct Granger Test while in Section IV an attempt is made to gauge the direction of causality between money and prices in four Caribbean economies. In particular, an attempt is made to see whether the direction of causality remains unchanged as the various economies evolve from economic stability (1973-1980) through recession and structural adjustment (1981-1989) to financial liberalisation (1990-1995).

SECTION I: MONEY AND PRICES -- THEORETICAL ISSUES

Advocates of monetarism argue that inflation is primarily the result of successive growth rates of the nominal money supply over real money demand, that is,

$$\frac{dp_t}{dt} = \frac{dM_t^s}{dt} - \frac{dM_t^d / dt}{dP_t / dt} \qquad (1)$$

[2] The study builds on the earlier research by Nicholls and Christopher (1989).

where P = the price level

M^s = nominal money supply

M^d/P = real money demand.

Darrat and Arize (1990) argued that this basic inflation equation places emphasis on the stability of the money demand function. If the money demand function is stable over time then high inflation rates would result from increases in the money supply. In such circumstances, monetary policy controls become the main tools in any anti-inflation strategy. Conventional formulations of real money demand usually suggest the following formulation:-

$$\frac{M^d}{P} = f(\overset{+}{Y_t}, \overset{-}{P^e}, \overset{-}{i})^3 \qquad (2)$$

where Y = real income

P^e = expected rate of inflation

i = interest rate on alternative assets

If equation 2 is converted to growth rates and substituted into equation 1, the major influences on inflation can be re-expressed as follows:-

$$\dot{P}_t = \dot{M}_t^s - \beta_0 \dot{Y}_t + \beta_1 \dot{P}_t^e - \beta_3 \dot{i}_t \qquad (3)$$

Based on the above specification, monetarists assume that changes in the money supply are the most dominant influences on the rate of inflation.

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3 This function incorporates both the transaction, precautionary and speculative motives for holding money.

Investigations of the inflationary process in the Caribbean have benefitted from the works of Bourne and Persaud (1977), St. Cyr (1974-1979), Farrell (1984), Farrell and Christopher (1986), Downes (1985), Holder and Worrell (1985), Downes, Holder and Leon (1990) and Downes, Worrell and Scantlebury (1993). For example, St. Cyr (1974) utilizing a structuralist approach examined the inflationary process in Trinidad and Tobago between 1940 and 1971. He specified prices as a function of import prices, wages, government expenditure and per capita national income. St Cyr's results indicated that both prices and price expectations were the most important variables explaining the inflationary process over the period. In further work, St. Cyr (1979) examined the inflationary process in Trinidad and Tobago over the period 1965-1976. His price equation model included import prices, money supply and price expectations as explanatory variables. St Cyr found import prices, money supply and price expectations to be significant. Meanwhile, Bourne and Persaud (1977) investigating demand pull and cost-push hypotheses to explain the inflation process in Trinidad and Tobago (1967 -1974) and Jamaica (1968-1974) found that for Trinidad and Tobago the primary influences on the rate of inflation were wage rates, import prices, the commercial bank loan rate and government debt. In the Jamaican case, import prices and the loan rate were found to be important.

The research by Farrell (1984) incorporated money supply, import prices, price expectations, interest rate, real supply and nominal effective rate to explain the inflationary process over the period 1972-1982 in Trinidad and Tobago. He found real supply, wages, import prices and money supply to be statistically significant. Downes (1985) investigated the causes of commodity price inflation in Barbados over the period 1960 to 1977. He hypothesized that changes in the retail price index were influenced by changes in import prices, the loan rate and the wage rate. Downes' findings revealed that the import price index was the dominant variable in the inflationary process. Around the same time, Holder and Worrell (1985) developed a price formation model for the Caribbean. Utilizing data

from 1963 to 1983, they tested this model for Barbados, Jamaica and Trinidad and Tobago. The major variables they identified as influencing the level of prices were foreign prices, exchange rate changes, trade controls, interest rates, wage increase and real income. The significance of these variables varied for the three economies. Wages were found to be significant for Jamaica but not for Trinidad and Tobago while interest rates were only inflationary in Barbados. The more recent paper by Downes et al (1990) examined the wage-price nexus for Barbados. Domestic prices were specified as a function of prices of tradeables, import prices, wages, productivity, the cost of credit and unemployment. Their findings suggested that the rate of inflation increased with increases in the wage rate and import prices while increases in productivity acted as a damper on price increases.

Based on the studies reviewed, the interest rate variable was generally found to be insignificant for most of the countries with the exception of Barbados. Two reasons may account for this. Firstly, the majority of the studies were conducted in economies with underdeveloped financial systems. In such economies, the asset holder is largely restricted to holding either money or real goods. Secondly, interest rate yields in these countries were fixed over long periods of time and rarely reflected the dynamics of the financial markets. In sharp contrast, the studies have found that the money supply, wages, import prices and the expected rate of currency devaluation are important determinants of inflation in the Caribbean.

It is also noteworthy to mention here that while these studies have set out to investigate and test various hypotheses about the "causes" of inflation, they have made very little attempt to examine casual directions in the inflationary process. Most of the writers have assumed implicitly that the money supply is exogenous and that causal inference runs from money to prices ($M_t \Rightarrow P_t$). The statistic relied upon to give credence to these models are usually the Multiple Correlation Coefficient (R^2) or its adjusted conjugate ($\overline{R}_2$). However, it should

be noted that correlation is a measure solely of linear association and high correlation among variates does not necessarily establish any causal relationship between the two variables. Indeed as far back as the 1920s, Undy Yule (1926) cautioned about the use of correlations to make inferences about the relationship between variables. He proved that the R^2 of the regression in unrelated, non-stationary series tends to unity.

Whereas the stability of the money demand function was taken for granted in the majority of the Caribbean studies, recent evidence on changes in the velocity of money demand threaten the validity of the assumed causal direction implied by a stable money demand function. Christopher-Nicholls (1995) in a study of money demand in Trinidad and Tobago argued that since 1989, the income velocity of money has increased at a steady rate while Ramsaran (1992) reported fairly stable changes in velocity of money for Barbados during the decade of the 1980s. In recent times, rapid financial innovation brought about by increased trade and financial liberalization has led new classical macroeconomists to doubt the uni-directional causal link from money to prices. Kydland and Prescott (1982) and Long and Plosser (1983) have argued, using research on business cycles, that real economic activity tends to cause monetary growth rather than the reverse. These notions have re-opened the debate about the direction of causality between money and prices and are especially important as Caribbean economies embark upon a new phase of financial market development.

SECTION II: DEFINITION OF CAUSALITY

Despite the voluminous work on causality, there appears to be little consensus on whether the methodologies and definitions developed are sufficient to capture and explain the

interrelations in the real world. Granger (1980) noted that a unique definition of causality may be difficult to find in the economic literature. In his words,

> *" attitudes towards causality differ widely from the defeatist one that it is impossible to define causality, let alone test for it, to the populist view that everyone has their own personal definition so that it is unlikely that a generally acceptable definition exists".*

Controversies on causal interpretation have raged in the literature[4] and still persist up to the present time. Useful contributions to this debate in the 50's and 60's came from Simon (1953), Feigl (1953), Strotz (1960), Wold (1960) and Strotz and Wold (1960). Hoover (1991) supports Simon's (1953) analysis of causality as an asymmetrical relation of recursion between variables in the data-generating process and argues that tests of the stability of marginal and conditional probability distributions can provide evidence of causal ordering. Grilli (1992) by contrast uses graph theory to explore the recursive causal structures between variables. The intention of this paper is not to elaborate upon these difficulties. Suffice it to say, the definition utilised in this study is only one of the ways in which causality can be characterised from an empirical standpoint.

Borrowing notions from Weiner (1956), Granger (1969) notes that:

> *" A variable X causes another variable Y with respect to a given universe or information set includes X and Y if present Y can be better predicted by using past values of X than by not doing so all other information contained in the past of the Universe being used in either case".*

This definition identifies three types of causality, namely uni-directional causality, instantaneous causality and feedback. Following Granger, let X_t and Y_t be stationary stochastic processes where:-

$$\overline{X} = \{X_{t-1}, X_{t-2}, \ldots\ldots\ldots\ldots, X_{t-n},\}$$

$$\overline{\overline{X}} = \{X_t, X_{t-1}, \ldots\ldots\ldots\ldots, X_{t-n},\}$$

4 Zellner (1979) and Aigner and Zellner (1988) have presented excellent discussions of the difficulties and issues involved in causal inference.

$$\bar{Y} = \{Y_{t-1}, Y_{t-2}, \ldots\ldots\ldots\ldots, Y_{t-n},\}$$

$$\bar{\bar{Y}} = \{Y_{t}, Y_{t-1}, \ldots\ldots\ldots\ldots, Y_{t-n},\}$$

and σ^2 is the prediction error for Y_t.

Unidirectional causality from X to Y implies that causality runs in one direction and can be written as follows:

$$x \rightarrow y$$
$$\sigma^2(Y / \bar{X}, \bar{Y}) < \sigma^2(Y / \bar{Y})$$

Causality is instantaneous if the current value of X i.e. X_t has an additional significant influence on the optimal prediction (variance, σ^2) so that;

$$x \rightarrow y$$
$$\sigma^2(Y / \bar{\bar{X}}, \bar{Y}) < \sigma^2(Y / \bar{X}, \bar{Y})$$

while feedback exist when causality runs in both directions.

$$x \leftrightarrow y$$
$$\sigma^2(Y / \bar{X}, \bar{Y}) < \sigma^2(Y / \bar{Y})$$
and $$\sigma^2(X / \bar{X}, \bar{Y}) < \sigma^2(X / \bar{X})$$

A series of operational tests emanates from Granger's definition of Causality. Gupta (1987) classifies these into (i) Regression Based Methods Sims (1972) Test, Direct Granger Test [Sargent (1976)] and the modified Sims Test [Geweke et al (1983)] and (ii) Time Series Methods [Pierce and Haugh (1977) test]. In the context of this analysis, we concentrate our efforts on the Direct Granger Test. This concentration[5] stems largely from

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5 In the case of time series data complied in the Caribbean, the length of most vectors of annual data sets does not exceed fifty (50) observations [see Nicholls and Watson (1989)].

conclusions by Guilkey and Salemi (1983) and Geweke et al (1983) who have recommended the Direct Granger for empirical investigation in a small sample environment.

Statistical Methodology: The Direct Granger Test

The Direct-Granger test can be illustrated using the Bivariate Autogressive System.

$$\begin{bmatrix} P_t \\ M_t \end{bmatrix} = \begin{bmatrix} \phi(L) & \gamma(L) \\ \delta(L) & \theta(L) \end{bmatrix} \begin{bmatrix} P_t \\ M_t \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \end{bmatrix}$$

where $\tilde{u}_t = \begin{bmatrix} u_t \\ v_t \end{bmatrix}$

and $E(\tilde{u}_t) = 0; \quad E(\tilde{u}_t , \tilde{u}_t') = \Sigma; \quad E(\tilde{u}_t , \tilde{u}_{t-j}') = 0$

where $(j \neq 0)$

and $\phi(L)$, $\gamma(L)$, $\delta(L)$ and $\theta(L)$ are polynomials in the lag operator L such that $L^k M_t = M_{t-k}$.

In the context of the Bivariate Autoregressive system unidirectional causality from

(a) Prices to Money implies :-

$P_t \rightarrow M_t$

if

$\gamma(L) = 0, \delta(L) \neq 0$

(b) Money to Prices implies:-

$M_t \rightarrow P_t$

if

$\gamma(L) \neq 0, \delta(L) = 0$

while (c) feedback between Prices and Money implies:-

$P_t \leftrightarrow M_t$

if

$\gamma(L) \neq 0, \delta(L) \neq 0$

Sargent (1976) and Geweke et al (1983) have operationalized the Granger test by assuming that the polynomials are of finite order. Expansion of the finite polynomials of the Bivariate system yields:-

$$P_t = \sum_{i=1}^{p} \phi_i P_{t-i} + \sum_{j=0}^{q} \gamma_j M_{t-j} + u_t$$

$$M_t = \sum_{i=1}^{p} \theta_i M_{t-i} + \sum_{j=0}^{q} \delta_j P_{t-j} + v_t$$

The practical implementation of the Direct Granger Test uses a series of constrained and unconstrained regressions of the following form:-

$$P_t = \sum_{i=1}^{p} \phi_i P_{t-i} + u_{1t}^c$$

$$P_t = \sum_{i=1}^{p} \phi_i P_{t-i} + \sum_{j=0}^{q} \gamma_j M_{t-j} + u_{2t}^u$$

$$M_t = \sum_{i=1}^{p} \theta_i M_{t-i} + v_{1t}^c$$

$$M_t = \sum_{i=1}^{p} \theta_i M_{t-i} + \sum_{j=0}^{q} \delta_j P_{t-j} + v_{2t}^u$$

The restrictions on the coefficients in the unconstrained polynomials $\gamma(L)$ and $\delta(L)$ can be determined by employing either a Wald, Lagrange Multiplier (LM), Likelihood Ratio (LR) or F test [See Geweke, Meese and Dent (1983) for an exposition of the Wald (W), Likelihood Ratio (LR) and Lagrange Multiplier test (LM) and Guilkey and Salemi (1982) for the F-test].

SECTION III: LIMITATIONS OF THE DIRECT GRANGER TEST

In applying the Direct Granger test a number of important problems must be borne in mind. The most significant of these relate to (i) selection of the appropriate functional form (ii) selection of the optimal lag structure and (iii) stationary properties of the time series.

III.1 Functional Form

Practitioners in testing empirical econometric specifications generally experiment with linear or log-linear specifications and often choose the results which seem most consistent with their a priori intuition. However, Robert and Nord (1985) have shown that the results derived from causal tests are quite sensitive to the functional form utilized. They allude to the fact that in the absence of tests for functional form specification causal inferences may be unreliable. Box and Cox (1964) have developed a transform which allows the choice of an appropriate functional form which is consistent with the data. This transform is defined as follows:-

$$X^{\lambda} = \begin{cases} (X^{\lambda} - 1) / \lambda, & \lambda \neq 0 \\ \ln X, & \lambda = 0 \end{cases}$$

More recently Box and Draper (1987) have outlined a simple practical sequential method of utilizing the Box-Cox transform to select the appropriate transformation. The Box-Cox transformation is not however with its problems. A major problem stems from the fact that the approach assumes that the transformation simultaneously yields the appropriate functional form as well as disturbances which are approximately normal and

homoscedastic. However, these assumptions of homoscedasticity and normality are quite problematic in empirical econometric research.[6]

III.2 LAG-LENGTH SELECTION

The question of the arbitrary selection of the optimal lag structure has been one of the most important criticisms of Sargent's (1976) characterisation of Granger causal inference. In fact arbitrary choice of the lag structures can result in misleading causal inferences. Thornton and Batten (1985) investigated the effects of lag-length specification on the results for causal testing and suggested the use of some statistical or model selection criteria to choose the optimal lag length. They concluded that

> *"... there appears to be no substitute for selecting a model specification criterion ex ante or for an extensive search of the lag space if one is to ensure that the causality test results are not critically dependent on the judicious (or perhaps fortuitous) choice of the lag structure" [p. 177].*

Nakhaeizadeh (1987), in addition, utilising various lag lengths analysed the effects of varying lag structures on the F-test for causal inference and concluded that:

> *"one can obtain different results when the employed lag structures are different in view of which the validity of the results of causality tests based on Granger and Sims procedures and use only a small number of lag structures is questionable". [p. 837].*

While the issue of lag-length selection is important[7] Nakhaeizadeh's suggestion that "causality tests must be conducted using a larger number of lag structures in order to ascertain a reliable result" [p. 837] imposes a grave restriction on the use of these tests for

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6 Recently, there have been attempts to deal with these problems [See Seaks and Layson (1983)].

7 Usually the more detailed the past history of a variable, the better one can expect to perform causal inferences.

causal inference in circumstances in which the data sets are relatively short. However, from an intuitive standpoint, it must be recognized that if one can find a linear combination of subspaces containing a few lags which characterises a substantial proportion of the information then use of the entire lag space or a larger segment thereof may not be essential.

Numerous suggestions have been made in respect of procedures for selection of the optimal lag length. Among the more popular are the Akaike Information Criterion (AIC) developed by Akaike (1974); the H-Q criterion of Hannan and Quinn (1979); the Schwarz Criterion [Schwarz (1978)] and Hsiao's (1979, 1982a, 1982b); characterisation of Akaike's (1970) Final Prediction Error Criterion (FPE).[8]

III.3 STATIONARITY

The Granger causal methodology is predicated on the assumption of stationarity. Indeed, the definition utilised by Granger (1969, 1980) to characterize causality assumes explicitly that X_t and Y_t are generated by stationary stochastic processes. Thus if the method is to be adopted reliably then there must be an absence of unit roots in the data both at the zero and seasonal frequencies. Granger (1988) warns that some care ought to be taken in respect of empirical causal analysis when the series are non-stationary. Most of the applied work in econometrics has focusssed on the implications of unit roots at the zero frequency and several tests have been devised for establishing the orders of integration at this frequency.[9] Within recent times more attention is being devoted, especially where quarterly data is

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8 De Gooiger et al (1985) contains a more complete discussion of these model selection criteria.

9 See in particular Dickey and Fuller (1981), Engle and Granger (1987), Phillips (1987), Johansen (1988) and Engle and Yoo (1990).

utilized, to the presence of unit roots at seasonal frequencies.[10] Generally a stochastic process, X_t is integrated of order (n,s), i.e I(n,s), if the process becomes stationary after first period differencing n times and seasonal differencing s times. Hylleberg, Engle, Granger and Yoo (1988) have recently extended the standard procedure of testing for a unit root to allow for the presence of unit roots at the seasonal frequencies as well as the zero frequency simultaneously. The test is based on the following auxiliary regression:-

$$\begin{aligned}(1-L^4)Y_t = {} & \alpha_1 Q_{1,t} + \alpha_2 Q_{2,t} + \alpha_3 Q_{3,t} + \alpha_4 Q_{4,t} \\ & + \delta t + \Pi_1 Z_{1,t-1} + \Pi_2 Z_{2,t-1} \\ & + \Pi_{32} Z_{3,t-2} + \sum_{i=1}^{p} \phi_i (1-L^4) Y_{t-i} + \varepsilon_t\end{aligned}$$

where $Z_{1t} = \hat{\theta}(L)(1+L+L^2+L^3)Y_t$

$Z_{2t} = -\hat{\theta}(L)(1-L+L^2-L^3)Y_t$

$Z_{3t} = -\hat{\theta}(L)(1-L^2)Y_t$

This equation allows the null hypothesis of I(0,1) to be tested against the alternatives of I(1,0) and I(0,0). The null hypothesis of I(0,1) i.e. the presence of non-stationary seasonally, must be accepted unless Π_2 and Π_3 or Π_4 are non-zero.

SECTION IV: EMPIRICAL ANALYSIS

IV.1 Methodological Issues

The causal inferences were conducted using the Direct-Granger test on quarterly data over the periods 1973-1980, 1981-1989, 1990-1995 and 1973-1995, respectively. The null hypothesis being tested is that the coefficient of the polynomials $\gamma(L)$ and $\delta(L)$ are zero

[10] See Dickey, Hasza and Fuller (1984), Osborn et al (1988), Osborn (1990) and Hylleberg, Engle, Granger and Yoo (1988).

against the non-zero alternative. Preliminary estimates indicate that the ratio (x_{max}/x_{min}) generally is not too large thus making choice of the log specification a reasonable assumption.[11]

In the Appendix Charts 1-4 illustrate the logarithmic series of the monetary aggregates and the RPI for the various countries. Generally, these series have been trending upwards. In addition, for almost all the countries, the prices series tracked the monetary series and was positioned below the monetary series. However, for Guyana RPI was found to lie above the monetary base series.

The logarithms of the money and prices data were then analysed for non-stationarity by examining the behaviour of the sample autocorrelation function (ACF). Plots of the sample autocorelation functions indicated non-stationary behaviour in both the seasonal and non-seasonal components. As a first step, the data was deseasonalized using the X-11 Method to remove the influence of the seasonal components and unit root tests (Augmented Dicker Fuller(ADF)) were performed on the series to check for stationarity.

Table A.I reports the ADF statistics for the logarithmic values of the seasonally adjusted series. The null hypothesis is that the variables are integrated of order one, whereas the alternative hypothesis is that the variables are integrated of order zero. The critical value at the 5% level of significance is 3.46 for stationary time series about a deterministic trend. The null hypothesis is accepted for all the variables. The test on the first difference of the variable revealed that the null hypothesis that the variables are integrated of order two was rejected in most cases. However, further test on the variables indicated that the various

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[11] It should be noted that when the ratio X_{max}/X_{min} (where X_{max} and X_{min} are the maximum and minimum data values respectively) is not too large log transformation behave localy like linear ones and it makes very little difference as to which is used.

data series may comprise I(1) and I(2) variables. [See Charts 5-8 for illustrations of the first differences of the seasonally adjusted series].

Choice of the lag length was determined by use of three model selection criteria namely Akaike's Information Criterion (AIC), Final Prediction Error Criterion (FPE) and the criterion by Hannan and Quinn (HQ). The AIC measure however, does not lead to a consistent estimator of the true lag length since it overestimates this asymptotically with a non-zero probability while the Hannan-Quinn Criterion, is less likely, to underestimate the true order of the model.

Practical implementation of the lag selection procedure involved:

I. Fitting the constrained autoregressive polynomial and choosing the optimal lag length by the HQ method.

II. Next, fitting the unconstrained model with the lag length for the dependent variable fixed from Step I and choosing the optimal lag length (by the HQ method) for the manipulated regressor by scanning the relevant lag subspace.

III. Comparing (at the 5% level) the additional explanatory power of the $\gamma(L)$ and $\delta(L)$ polynomials by use of an F-test to establish the existence of Granger causality.

IV.2 Analysis of Causal Results

Barbados: (1973:1-1995:2)

The results of the F test indicate that over the period 1973-1980, no casual links were found from money to prices for any of the monetary aggregates [See Table 1]. A similar result was obtained for the period 1981-1989. In contrast, over the period 1990-1995, the

F test indicated causation from money to prices for the variables M0, M1A and M1C. For the overall period (1973-1995), however, causal relationships were identified from M1C to prices and from M2 to prices.

TABLE 1

BARBADOS: MONEY-PRICE CAUSATION
SUMMARY OF GRANGER CAUSAL FINDINGS BASED ON THE HQ SELECTION CRITERION
(5 % LEVEL)

DIRECTION OF CAUSALITY	(1973-1980)	(1981-1989)	(1990-1995)	(1973-1995)
MO→RPI	No Causation	No Causation	Causation	No Causation
MIA→RPI	No Causation	No Causation	Causation	No Causation
MIC→RPI	No Causation	No Causation	Causation	Causation
M2→RPI	No Causation	No Causation	No Causation	Causation
RPI→MO	Causation	Causation	No Causation	Causation
RPI→MIA	No Causation	No Causation	No Causation	No Causation
RPI→MIC	No Causation	No Causation	No Causation	No Causation
RPI→ M2	No Causation	No Causation	No Causation	No Causation
SUMMARY				
RPI↔MO	Undirectional	Undirectional	Undirectional	Undirectional
RPI↔MIA	Independent	Independent	Undirectional	Independent
RPI↔MIC	Independent	Independent	Undirectional	Undirectional
RPI↔ M2	Independent	Independent	Independent	Undirectional

In respect of causality in the reverse direction ($P_t \longrightarrow M_t$), the F-test revealed causation from prices to base money for periods 1973-1980, 1981-1989 and for the overall period, 1973-1995, respectively. Furthermore, no causal relationships were established from prices to money for any of the other monetary aggregates in the 1990s (i.e. (1990-1995).

A summary of the Barbadian results seems to suggest that with the exception of the causal links from prices to base money, money and prices were generally independent during the periods 1973-1980 and 1981-1989, respectively. However, in the period of financial liberalisation the results indicate that the main causal pattern was unidirectional from money

to prices. At first glance the results seem to suggest that the wage-price nexus of Downes et al may be more valid in the Barbadian context.

Guyana: 1973:1-1989:2

In the Guyanese scenario, the F-test indicated no causal links existed from money to prices in the period of economic stability (1973-1980) while causation running from the broad money supply (M2) to prices was only evident in the period 1981 to 1989. For the period as a whole, however, there was strong evidence of money-prices causation for all the monetary aggregates with the exception of base money (M0).

TABLE 2

GUYANA: MONEY-PRICE CAUSATION
SUMMARY OF GRANGER CAUSAL FINDINGS BASED ON THE HQ SELECTION CRITERION
(5 % LEVEL)

DIRECTION OF CAUSALITY	(1973-1980)	(1981-1989)	(1973-1989)
MO→RPI	No Causation	No Causation	No Causation
MIA→RPI	No Causation	No Causation	Causation
MIC→RPI	No Causation	No Causation	Causation
M2→RPI	No Causation	Causation	Causation
RPI→MO	No Causation	Causation	Causation
RPI→MIA	Causation	Causation	Causation
RPI→MIC	Causation	Causation	Causation
RPI→ M2	No Causation	Causation	Causation
SUMMARY			
RPI↔MO	Independent	Undirectional	Undirectional
RPI↔MIA	Undirectional	Undirectional	Feedback
RPI↔MIC	Undirectional	Undirectional	Feedback
RPI↔ M2	Independent	Feedback	Feedback

In the case of casual inferences from prices to money, causation was found in the case of M1A and M1C for the period 1973 to 1980 while the same was true for all monetary aggregates in the period 1981 to 1989 and for the overall period 1973 to 1989. A summary

of the casual links for Guyana as reported in Table 2 indicates feedback effects between prices and money during the overall period and during the 1981-1989 period. From 1973 to 1980 unidirectional causality was found from prices to M1A and prices to M1C while independent relationships were established between prices and base money and prices and the broader definition of money. Meanwhile in the period 1981 to 1989 money-prices causation was generally unidirectional from prices to money. This phenomenon may seem peculiar at first sight, but in the period of recession and high inflation in Guyana, rational individuals most likely increased their demand for money in an effort to maintain their real money balances.

Jamaica: (1973:1-1995:1)

The causal inferences for Jamaica indicate that in the first period under consideration (1973-1980) no casual relationships were found between money and prices in either direction. A similar pattern emerged over the periods (1981-1989) and (1990-1995). In the period 1981-1989, causation from money to prices was established for M0 and M1C while in the latter period (1990-95) reverse causation from prices to money was found only for the broad definition of money.

A summary of the Jamaican results indicate that money and prices were largely independent during the periods (1973-1980) and (1990-1995). This seems to indicate that during these two periods other factors such as wages and imported cost push inflation may have had greater influences.

TABLE 3

JAMAICA: MONEY-PRICE CAUSATION
SUMMARY OF GRANGER CAUSAL FINDINGS BASED ON THE HQ SELECTION CRITERION
(5 % LEVEL)

DIRECTION OF CAUSALITY	(1973-1980)	(1981-1989)	(1990-1995)	(1973-1995)
MO→RPI	No Causation	Causation	No Causation	Causation
MIA→RPI	No Causation	No Causation	No Causation	Causation
MIC→RPI	No Causation	Causation	No Causation	No Causation
M2→RPI	No Causation	No Causation	No Causation	No Causation
RPI→MO	No Causation	No Causation	No Causation	No Causation
RPI→MIA	No Causation	No Causation	No Causation	No Causation
RPI→MIC	No Causation	No Causation	No Causation	Causation
RPI→ M2	No Causation	No Causation	Causation	No Causation
SUMMARY				
RPI↔MO	Independent	Undirectional	Independent	Undirectional
RPI↔MIA	Independent	Independent	Independent	Undirectional
RPI↔MIC	Independent	unidirectional	Independent	Undirectional
RPI↔ M2	Independent	Independent	unidirectional	Independent

Trinidad and Tobago: (1973:1 -1995:2)

The results of the F test summarised in Table 4 for Trinidad and Tobago indicate causation from base money (M0) to prices in the recession and structural adjustment period (1981-1989). While for the overall period (1973-1995) money-prices causation was found only when the narrow definition of money (M1A) was utilized. In respect of causality in the reverse direction i.e. from prices to money, the results indicate no causation in any of the periods under review. It is evident from the Trinidad and Tobago results that the pattern of causation is unidirectional largely from base money to prices and from M1A to prices. There were no feedback relationships between prices and money in the Trinidad and Tobago case.

TABLE 4

TRINIDAD & TOBAGO: MONEY-PRICE CAUSATION
SUMMARY OF GRANGER CAUSAL FINDINGS BASED ON THE HQ SELECTION CRITERION
(5 % LEVEL)

DIRECTION OF CAUSALITY	(1973-1980)	(1981-1989)	(1990-1995)	(1973-1995)
MO→RPI	No Causation	Causation	No Causation	No Causation
MIA→RPI	No Causation	No Causation	No Causation	Causation
MIC→RPI	No Causation	No Causation	No Causation	No Causation
M2→RPI	No Causation	No Causation	No Causation	No Causation
RPI→MO	No Causation	No Causation	No Causation	No Causation
RPI→MIA	No Causation	No Causation	No Causation	No Causation
RPI→MIC	No Causation	No Causation	No Causation	No Causation
RPI→ M2	No Causation	No Causation	No Causation	No Causation
SUMMARY				
RPI↔MO	Independent	Undirectional	Independent	Independent
RPI↔MIA	Independent	Independent	Independent	Undirectional
RPI↔MIC	Independent	Independent	Independent	Independent
RPI↔ M2	Independent	Independent	Independent	Independent

CONCLUSION

The results of this preliminary investigation of causality using seasonally adjusted data indicated varied results for the large economies in CARICOM. In the context of the most stable economy, Barbados, the evidence suggest that in the periods prior to financial liberalization, money-prices causation was not evident. Thus findings seems to indicate that other factors, in particular wages and import prices may have been more important causes of inflation over these periods. Indeed, evidence of this can be found in the contributions of Downes and other Barbadian writers.

During the period (1973-1980) when the rate of inflation was relatively stable in all the four countries, as expected, little evidence was established for causation between money and prices. However, in the period of recession and structural adjustment, the results for the four countries were mixed. Whereas monetary expansion in Jamaica and Trinidad and Tobago seem to have impacted on inflation, for Guyana the direction of causation was reversed and even feedback causality was found between prices and the broad definition of money.

Following the period of financial liberalisation the money-prices relationships became a bit more complex. Causal linkages were established for Barbados but surprisingly there was little connection between monetary expansion and inflation for Jamaica and Trinidad and Tobago. The latter result seems a little counter-intuitive. When the whole period (1973-1995) is considered several patterns emerged. For both Jamaica and Trinidad and Tobago the expansion of the narrow definition of money (M1A) seems to have had an influence of inflation. However, in the Barbadian case, it is the growth in the broader definitions of money (M1C and M2) which seemed to have influenced movement in prices.

In advancing the study, we will examine whether there are any causal patterns that emerge when the seasonal component of the various data series are considered. Furthermore, we will also be interested in examining whether the causal relationships between money and prices are affected by the periodicity of the data.

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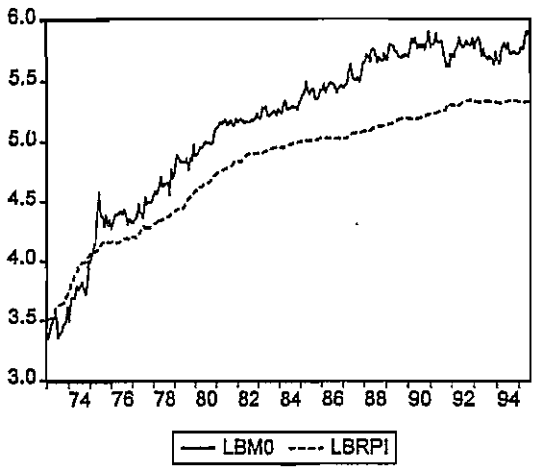
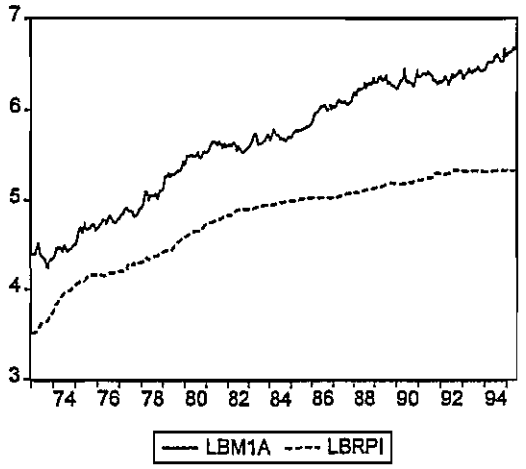
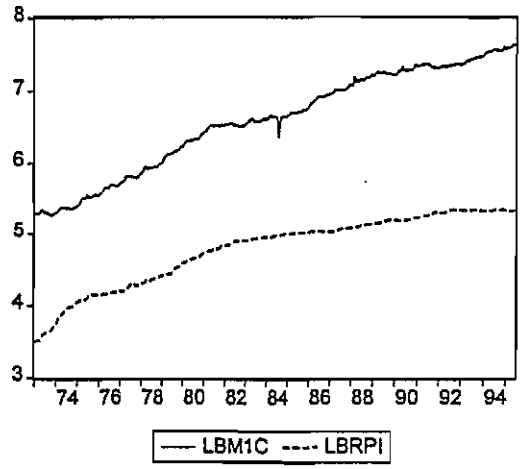
CHART 1

BARBADOS: MONETARY AGGREGATES AND RPI, 1973-1995







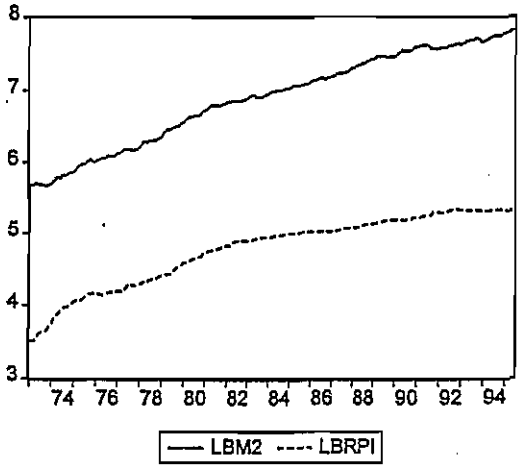
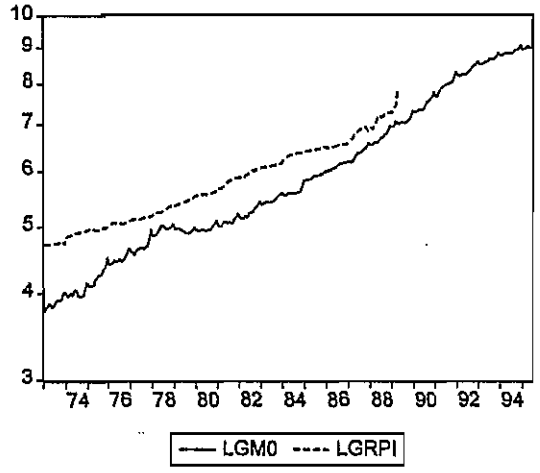
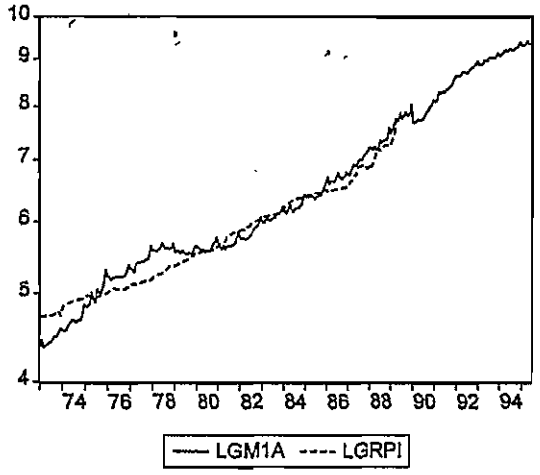
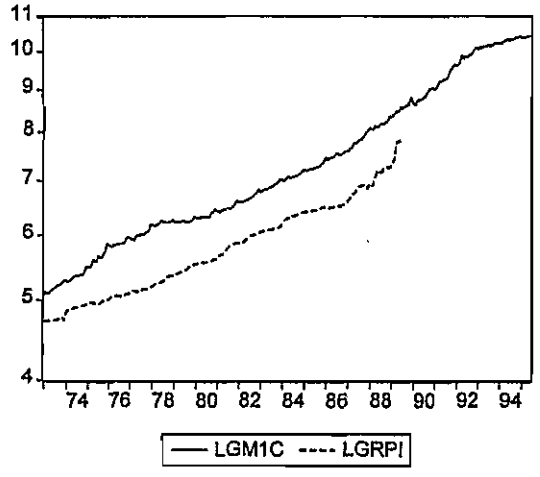


CHART 2

GUYANA: MONETARY AGGREGATES AND RPI, 1973-1995







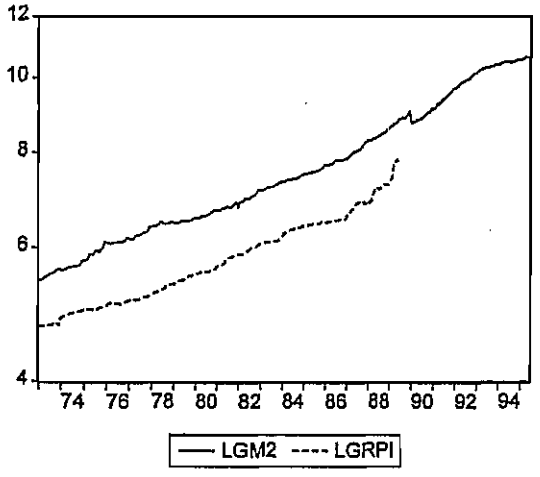
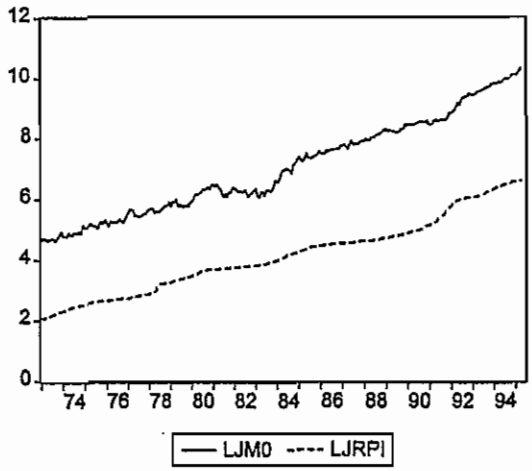
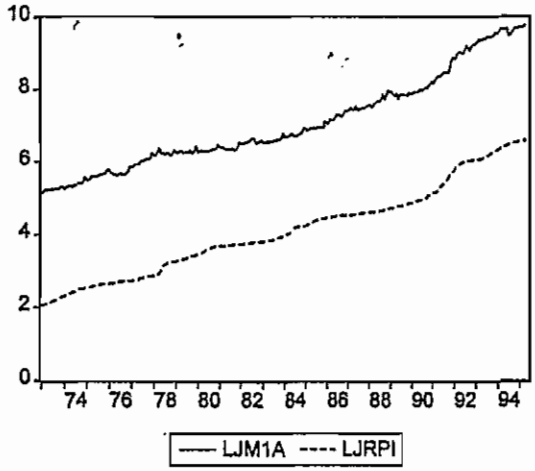
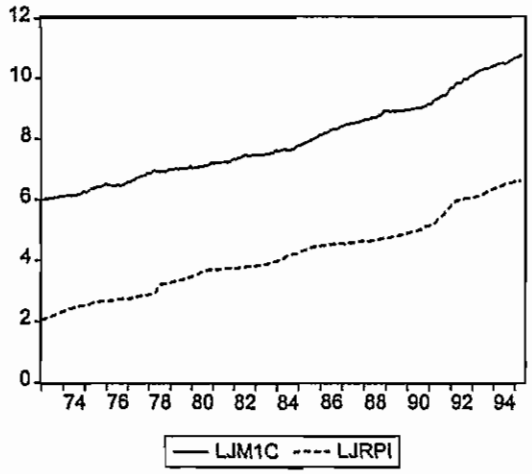


CHART 3

JAMAICA: MONETARY AGGREGATES AND RPI, 1973-1995







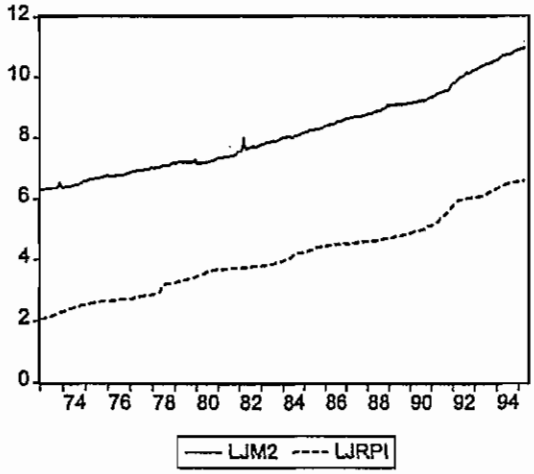
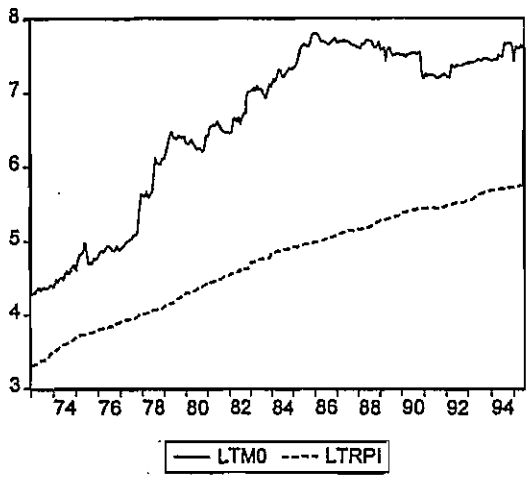
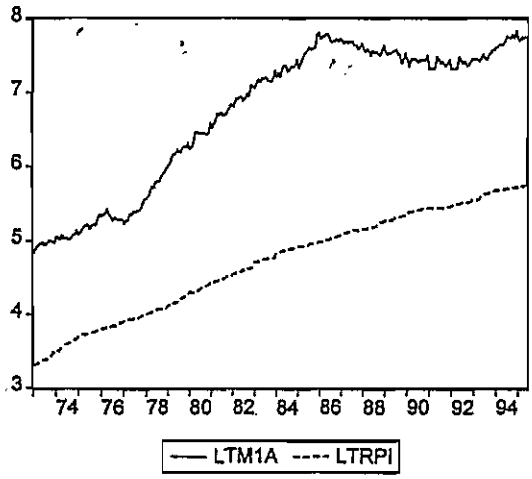
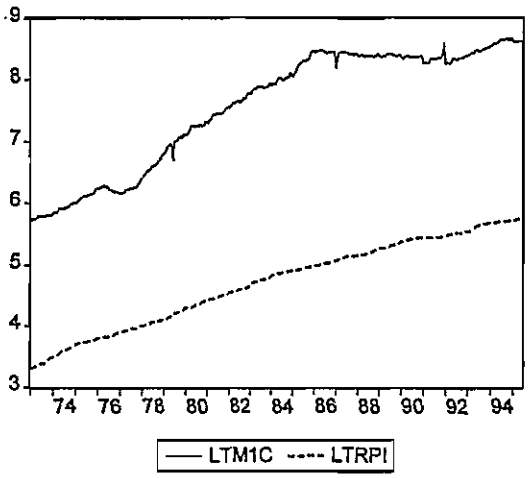


CHART 4

TRINIDAD & TOBAGO: MONETARY AGGREGATES AND RPI, 1973-1995







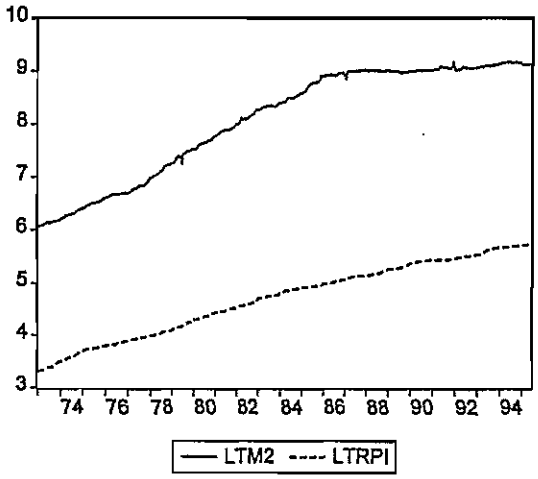
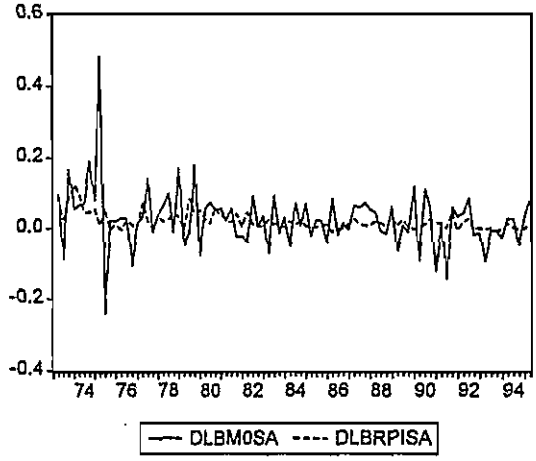
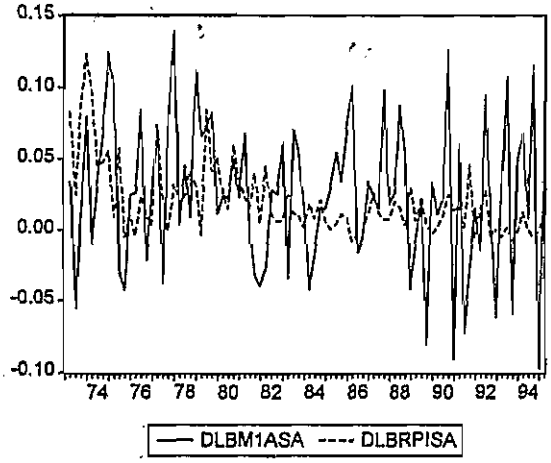
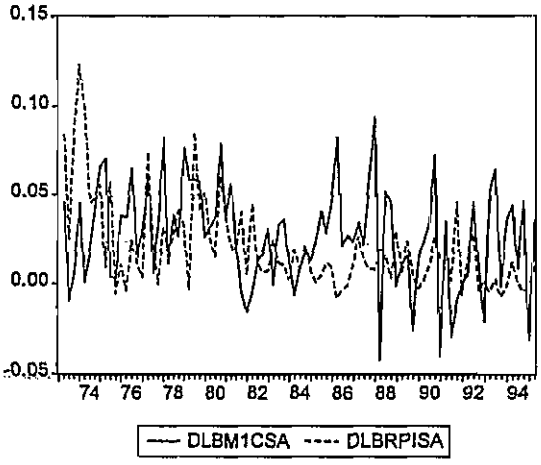


CHART 5

BARBADOS: SEASONALLY ADUJUSTED MONETARY AGGREGATES AND RPI, (1st difference)







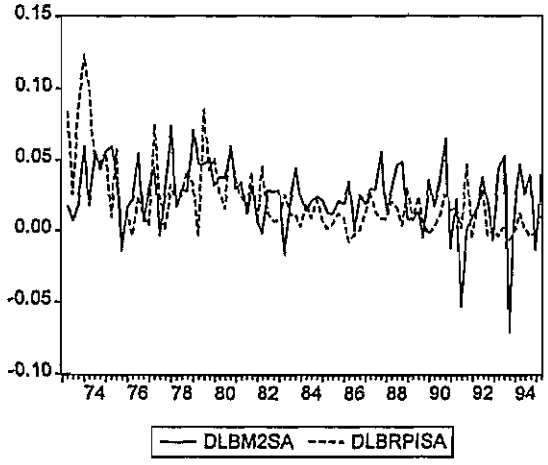
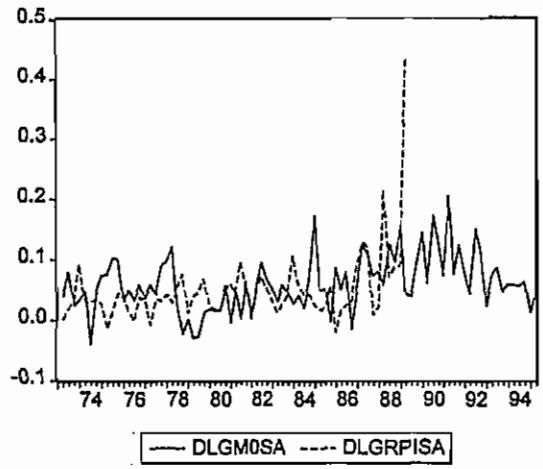
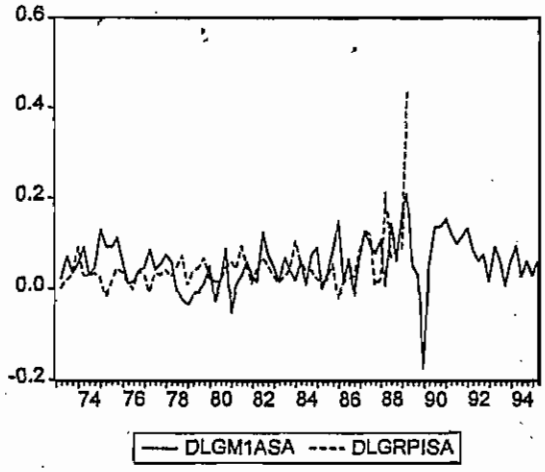
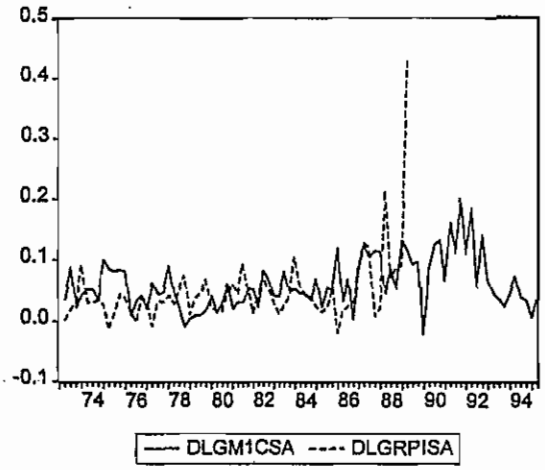


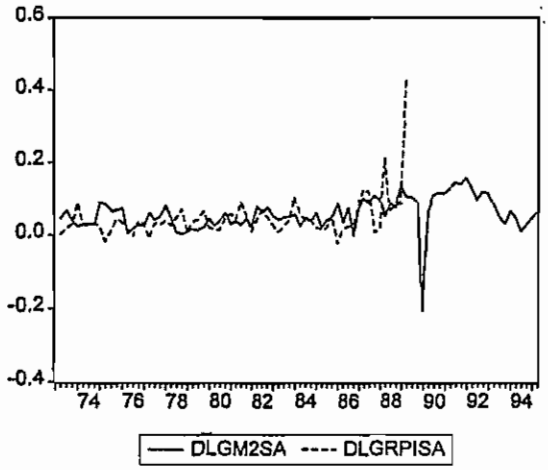
CHART 6

GUYANA: SEASONALLY ADJUSTED MONETARY AGGREGATES AND RPI, (1st difference)



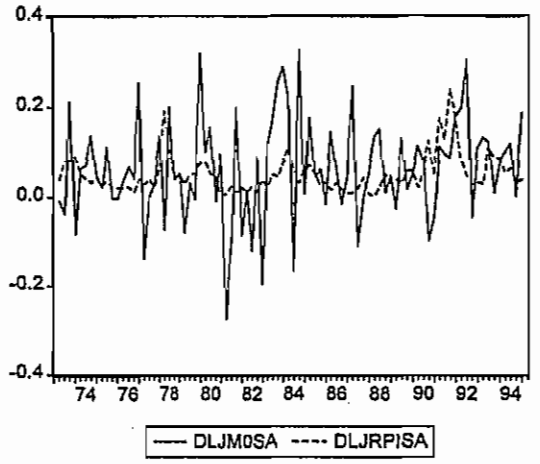


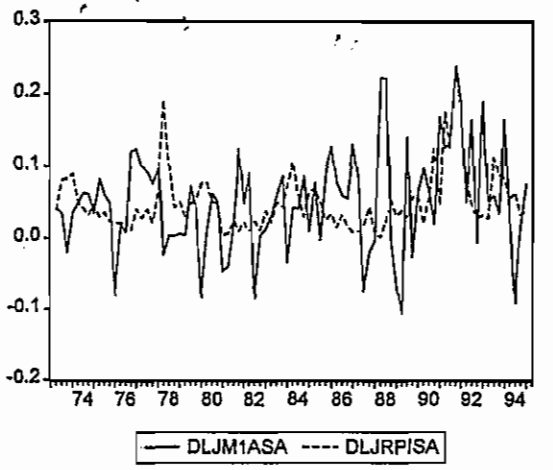


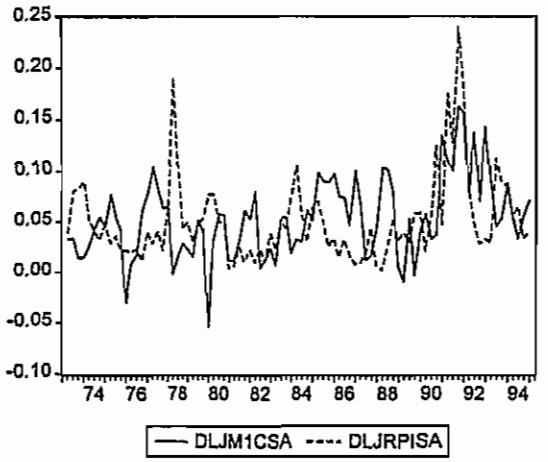


GRAPH 7

JAMAICA: SEASONALLY ADJUSTED MONETARY AGGREGATES AND RPI
(1st difference)







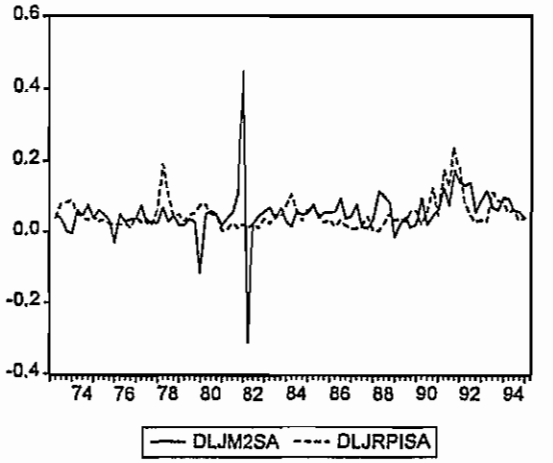
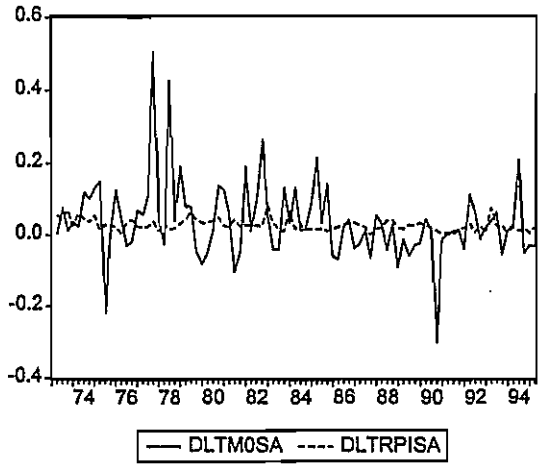
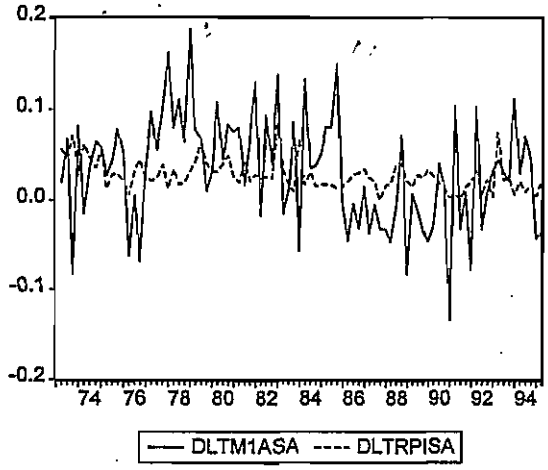
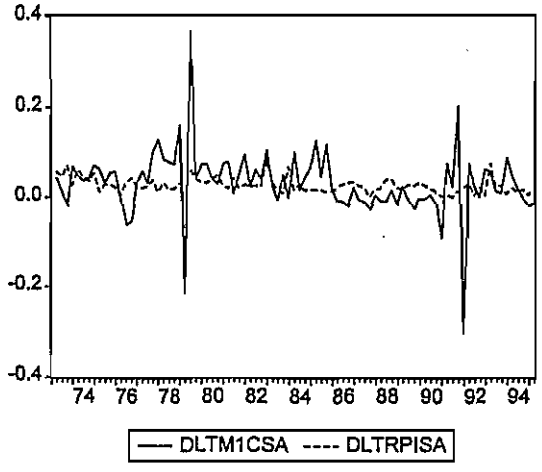


CHART 8

TRINIDAD AND TOBAGO: SEASONALLY ADJUSTED MONETARY AGGREGATES AND RPI
(1st difference)







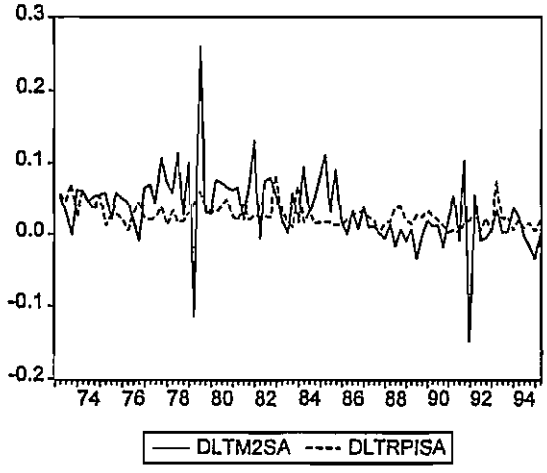


TABLE A.I

AUGMENTED DICKEY FULLER TEST (ADF): INTERCEPT & TREND

(SEASONAL ADJUSTED DATA)

Country	Variable	Level 5% CV ∫ 3.46	1st Diff 5% CV ∫ 3.46	2nd Diff 5% CV ∫ 3.46
Barbados	MO	-2.63	-4.46*	
	M1A	-1.60	-4.37*	
	M1C	-1.35	-3.90*	
	M2	-1.38	-4.12*	
	RPI	-1.21	-4.99*	
JAMAICA	MO	-1.84	-4.72*	
	M1A	-0.78	-3.54*	
	M1C	-0.66	-3.63*	
	M2	-0.02	-4.14*	
	RPI	-1.58	-3.37	-5.34*
TRINIDAD	MO	-1.07	-3.81*	
	M1A	-1.14	-3.02	-4.93*
	M1C	-0.80	-3.42	-6.37*
	M2	0.17	-3.03	-6.32*
	RPI	-0.93	-4.03*	
GUYANA	MO	-1.11	-2.74	-6.90*
	M1A	-0.65	-3.49*	
	M1C	-1.46	-2.53	-6.21*
	M2	-0.90	-4.71*	
	RPI	1.69	1.77	3.48*

TABLE A.II

LAG LENGTH SELECTION FOR CONSTRAINED REGRESSION (SEASONALLY ADJUSTED DATA)

Variables	1973-1980			1981-1989			1990-1995			1973-1995		
	AIC	FPE	HQ	AIC	FPE	HQ	AIC	FPE	HQ	AIC	FPE	HQ
Barbados												
MO	1	4	1	2	4	2	4	4	4	2	3	2
M1A	1	4	1	1	3	1	1	2	1	3	3	3
M1C	3	4	1	3	3	3	1	4	1	3	4	3
M2	4	4	3	4	4	4	1	1	1	4	4	4
RPI	3	4	3	4	2	2	3	2	3	3	4	3
Guyana*												
MO	1	2	1	4	4	4				4	4	4
M1A	1	4	1	2	4	2				3	4	3
M1C	1	4	1	2	4	4				2	4	3
M2	1	4	1	2	2	2				2	4	2
RPI	4	4	4	4	1	4				4	4	4
Jamaica												
MO	2	4	2	2	4	2	1	4	1	4	4	4
M1A	1	4	1	4	4	1	2	4	2	3	4	2
M1C	1	1	1	1	4	1	3	3	3	4	4	2
M2	1	4	1	1	4	1	2	3	2	4	4	4
RPI	1	4	1	4	4	1	2	1	2	2	4	2
Trinidad & Tobago												
MO	1	2	1	1	4	1	1	4	1	1	1	1
M1A	2	4	2	3	4	3	1	4	1	4	4	3
M1C	3	4	3	2	2	2	1	3	1	4	4	4
M2	4	4	4	3	4	4	1	3	1	4	4	4
RPI	2	3	2	4	4	4	2	4	2	4	4	4

*The overall period for Guyana is 1973-1989

TABLE A.III

BARBADOS:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1973 - 1980						1981 - 1989					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ	VARIABLES [D.VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
[RPI, MO]	[3,1]	0.082	-4.181	0.011	-4.152	[RPI, MO]	[2,1]	0.78	-5.546	0.003	-5.501
	[3,2]	0.204	-4.101	0.011	-4.062		[2,2]	1.23	-5.542	0.003	-5.481
	[3,3]	0.128	-4.001	0.011	-3.953		[2,3]	1.83	-5.580	0.003	-5.504
	[3,4]	0.093	-3.902	0.011	-3.844		[2,4]	1.66	-5.560	0.003	-5.469
[RPI, M1A]	[3,1]	0.39	-4.199	0.011	-4.170	[RPI, M1A]	[2,1]	2.52	-5.603	.003	-5.558
	[3,2]	0.65	-4.155	0.011	-4.116		[2,2]	1.299	-5.546	0.003	-5.485
	[3,3]	0.705	-4.108	0.010	-4.060		[2,3]	0.837	-5.484	.003	-5.408
	[3,4]	0.697	-4.058	.009	-3.999		[2,4]	0.841	-5.454	.003	-5.363
[RPI, M1C]	[3,1]	0.28	-4.192	0.011	-4.163	[RPI, M1C]	[2,1]	1.192	-5.560	0.003	-5.515
	[3,2]	0.723	-4.163	0.010	-4.124		[2,2]	0.622	-5.501	0.003	-5.440
	[3,3]	0.890	-4.140	0.010	-4.091		[2,3]	0.692	-5.469	0.003	-5.393
	[3,4]	0.817	-4.086	0.009	-4.028		[2,4]	2.389**	-5.645	0.002	-5.554
[RPI, M2]	[3,1]	0.65	-4.214	0.011	-4.185	[RPI, M2]	[2,1]	0.77	-5.546	.003	-5.501
	[3,2]	0.96	-4.190	0.010	-4.151		[2,2]	1.85	-5.581	.003	-5.521
	[3,3]	0.94	-4.149	0.010	-4.100		[2,3]	1.51	-5.551	.003	-5.475
	[3,4]	0.801	-4.082	0.007	-4.024		[2,4]	1.09	-5.488	.003	-5.397
[M0, RPI]	[1,1]	7.59*	-2.504	0.061	-2.475	[M0, RPI]	[2,1]	1.625	-2.687	0.056	-2.64
	[1,2]	3.69*	-2.415	0.060	-2.376		[2,2]	0.91	-2.632	0.056	-2.572
	[1,3]	2.31	-2.315	0.060	-2.266		[2,3]	0.585	-2.570	0.056	-2.494
	[1,4]	3.22*	-2.487	0.046	-2.429		[2,4]	3.07*	-2.832	0.040	-2.741
[M1A,RPI]	[1,1]	1.09	-3.095	0.034	-3.066	[M1A,RPI]	[1,1]	0.123	-2.681	0.057	-2.635
	[1,2]	0.529	-2.997	0.033	-2.958		[1,2]	0.09	-2.620	0.057	-2.560
	[1,3]	0.696	-2.963	0.031	-2.914		[1,3]	0.78	-2.635	0.052	-2.559
	[1,4]	0.489	-2.863	0.031	-2.805		[1,4]	1.534	-2.701	0.046	-2.610
[M1C, RPI]	[1,1]	1.41	-4.46	.009	-4.431	[M1C, RPI]	[3,1]	0.77	-3.601	0.023	-3.55
	[1,2]	0.71	-4.365	0.009	-4.326		[3,2]	0.38	-3.540	0.023	-3.47
	[1,3]	1.175	-4.391	0.008	-4.342		[3,3]	0.25	-3.478	0.023	-3.402
	[1,4]	0.898	-4.308	.007	-4.250		[3,4]	2.24**	-3.684	0.017	-3.593
[M2, RPI]	[3,1]	0.738	-4.612	0.007	-4.582	[M2, RPI]	[4,1]	0.286	-4.729	0.007	-4.683
	[3,2]	0.35	-4.512	.007	-4.473		[4,2]	0.187	-4.670	0.007	-4.609
	[3,3]	1.07	-4.564	0.006	-4.516		[4,3]	0.63	-4.662	0.007	-4.586
	[3,4]	0.81	-4.478	0.006	-4.420		[4,4]	2.63**	-4.872	.005	-4.780

* significance at 5% level

** significance at 10% level

TABLE A.III (Cont'd)

BARBADOS:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1990 - 1995						1973 - 1995					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ	VARIABLES [D.VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
[RPI, MO]	[3,1]	3.57**	-5.698	0.002	-5.678	[RPI, MO]	[3,1]	.0097	-3.676	0.023	-3.640
	[3,2]	3.42**	-5.771	0.002	-5.743		[3,2]	0.355	-3.660	0.023	-3.612
	[3,3]	5.241*	-6.055	0.001	-6.021		[3,3]	0.472	-3.644	0.023	-3.584
	[3,4]	3.77*	-5.966	0.003	-5.925		[3,4]	0.404	-3.622	0.023	-3.549
[RPI, M1A]	[3,1]	1.307	-5.568	0.003	-5.547	[RPI, M1A]	[3,1]	0.0013	-3.676	0.023	-3.640
	[3,2]	0.68	-5.466	-.003	-5.439		[3,2]	1.206	-3.683	0.023	-3.634
	[3,3]	2.48	-5.715	.002	-5.681		[3,3]	0.866	-3.660	0.23	-3.60
	[3,4]	3.18*	-5.874	0.003	-5.833		[3,4]	2.15**	-3.718	0.021	-3.640
[RPI, M1C]	[3,1]	1.38	-5.572	0.003	-5.552	[RPI, M1C]	[3,1]	0.517	-3.683	0.023	-3.647
	[3,2]	0.73	-5.473	0.003	-5.445		[3,2]	2.688**	3.721	0.022	-3.672
	[3,3]	2.03	-5.647	0.002	-5.613		[3,3]	1.787	-3.696	0.022	-3.635
	[3,4]	3.62*	-5.943	0.003	-5.903		[3,4]	3.613*	-3.782	0.020	-3.710
[RPI, M2]	[3,1]	1.71	-5.593	0.003	-5.572	[RPI, M2]	[3,1]	0.55	-3.684	0.23	-3.647
	[3,2]	0.79	-5.481	0.003	-5.454		[3,2]	3.06*	-3.73	0.022	-3.682
	[3,3]	1.47	-5.555	.002	-5.521		[3,3]	2.48**	-3.72	0.021	-3.662
	[3,4]	1.81	-5.625	.004	-5.584		[3,4]	3.55*	-3.780	0.020	-3.707
[M0, RPI]	[4,1]	1.71	-2.87	0.040	-2.855	[M0, RPI]	[3,1]	7.23*	-1.262	.262	-1.226
	[4,2]	0.85	-2.772	0.040	-2.744		[3,2]	4.338*	-1.255	.257	-1.207
	[4,3]	0.683	-2.692	0.039	-2.658		[3,3]	2.90*	-1.231	.257	-1.171
	[4,4]	1.96	-2.938	0.054	-2.897		[3,4]	2.61*	-1.228	.251	-1.156
[M1A,RPI]	[1,1]	.0188	-2.515	0.058	-2.495	[M1A,RPI]	[3,1]	0.088	-1.540	0.199	-1.503
	[1,2]	0.904	-2.525	0.051	-2.497		[3,2]	0.192	-1.518	0.198	-1.470
	[1,3]	0.94	-2.489	0.048	-2.454		[3,3]	0.136	-1.493	0.198	-1.432
	[1,4]	0.694	-2.389	0.094	-2.348		[3,4]	0.111	-1.468	0.198	-1.395
[M1C, RPI]	[1,1]	1.09	-3.906	0.014	-3.885	[M1C, RPI]	[3,1]	0.301	-2.69	0.063	-2.658
	[1,2]	2.81**	-4.063	0.011	-4.035		[3,2]	0.266	-2.67	0.062	-2.623
	[1,3]	2.19	-4.023	0.010	-3.989		[3,3]	0.468	-2.658	0.062	-2.598
	[1,4]	1.82	-3.978	0.019	-3.937		[3,4]	0.361	-2.633	0.062	-2.561
[M2, RPI]	[1,1]	0.162	-3.683	0.018	-3.66	[M2, RPI]	[4,1]	0.194	-3.072	0.043	-3.035
	[1,2]	0.363	-3.61	0.017	-3.58		[4,2]	0.568	-3.059	0.042	-3.010
	[1,3]	0.297	-3.52	0.017	-3.483		[4,3]	0.777	-3.049	0.042	-2.989
	[1,4]	0.430	-3.473	0.032	-3.432		[4,4]	0.737	-3.032	0.041	-2.960

* significance at 5% level

** significance at 10% level

TABLE A.IV

GUYANA:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1973 - 1980						1981 - 1989					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ	VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
[RPI, MO]	[4,1]	1.01	-4.825	0.006	-4.796	RPI, MO]	[4,1]	1.28	-1.91	0.121	-1.86
	[4,2]	1.05	-4.791	0.006	-4.752		[4,2]	0.64	-1.84	0.121	-1.78
	[4,3]	0.77	-4.710	0.005	-4.662		[4,3]	0.559	-1.79	0.119	-1.720
	[4,4]	0.57	-4.619	0.005	-4.561		[4,4]	0.819	-1.791	0.112	-1.701
[RPI, M1A]	[4,1]	0.63	-4.803	0.006	-4.774	[RPI, M1A]	[4,1]	3.16**	-1.974	0.114	-1.929
	[4,2]	0.299	-4.704	0.006	-4.665		[4,2]	1.54	-1.908	0.114	-1.848
	[4,3]	0.187	-4.604	0.006	-4.555		[4,3]	0.99	-1.842	0.114	-1.768
	[4,4]	0.141	-4.506	0.006	-4.448		[4,4]	0.933	-1.807	0.110	-1.718
[RPI, M1C]	[4,1]	2.79	-4.919	0.005	-4.890	[RPI, M1C]	[4,1]	3.49**	-1.984	0.113	-1.939
	[4,2]	1.67	-4.857	0.005	-4.818		[4,2]	1.720	-1.920	0.112	-1.861
	[4,3]	1.44	-4.821	0.005	-4.773		[4,3]	1.24	-1.868	0.111	-1.793
	[4,4]	1.196	-4.761	0.005	-4.703		[4,4]	1.71	-1.914	0.099	-1.824
[RPI, M2]	[4,1]	1.269	-4.839	0.006	-4.810	[RPI, M2]	[4,1]	4.48*	-2.016	0.109	-1.972
	[4,2]	0.601	-4.739	0.006	-4.70		[4,2]	2.20	-1.953	0.109	-1.893
	[4,3]	0.707	-4.699	0.006	-4.650		[4,3]	1.47	-1.892	0.108	-1.817
	[4,4]	0.563	-4.616	0.005	-4.558		[4,4]	1.54	-1.892	0.101	-1.802
[M0, RPI]	[1,1]	.025	-3.635	0.020	-3.600	[M0, RPI]	[4,1]	5.09*	-2.94	0.043	-2.898
	[1,2]	0.829	-3.633	0.018	-3.594		[4,2]	2.49**	-2.878	0.043	-2.818
	[1,3]	1.24	-3.656	0.016	-3.608		[4,3]	3.86*	-3.02	0.035	-2.942
	[1,4]	1.22	-3.634	0.014	-3.576		[4,4]	2.87*	-2.961	0.035	-2.871
[M1A, RPI]	[1,1]	0.243	-3.569	0.021	-3.540	[M1A,RPI]	[2,1]	9.59*	-2.543	0.064	-2.498
	[1,2]	1.99	-3.677	0.017	-3.639		[2,2]	4.66*	-2.479	0.064	-2.42
	[1,3]	3.43*	-3.877	0.013	-3.829		[2,3]	5.35*	-2.603	0.053	-2.53
	[1,4]	2.84**	-3.850	0.012	-3.791		[2,4]	4.37*	-2.586	0.050	-2.50
[M1C, RPI]	[1,1]	0.396	-4.225	0.011	-4.196	[M1C, RPI]	[4,1]	6.57*	-3.43	0.026	-3.39
	[1,2]	0.71	-4.187	0.10	-4.148		[4,2]	3.2**	-3.37	0.026	-3.311
	[1,3]	3.37*	-4.52	0.007	-4.47		[4,3]	3.83*	-3.462	0.022	-3.39
	[1,4]	2.39**	-4.424	0.007	-4.37		[4,4]	2.76*	-3.396	0.022	-3.306
[M2, RPI]	[1,1]	0.055	-4.445	0.009	-4.416	[M2, RPI]	[2,1]	4.04*	-3.731	0.020	-3.686
	[1,2]	0.73	-4.429	0.008	-4.391		[2,2]	2.33	-3.690	0.019	-3.630
	[1,3]	1.93	-4.568	0.006	-4.519		[2,3]	4.05*	-3.855	0.015	-3.780
	[1,4]	1.44	-4.487	0.006	-4.428		[2,4]	3.00*	-3.797	0.015	-3.708

* significance at 5% level

** significance at 10% level

TABLE A.IV (Cont'd)

GUYANA:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1973 - 1989					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
RPI, MO]	[4,1]	1.28	-1.91	0.121	-1.86
	[4,2]	0.64	-1.84	0.121	-1.78
	[4,3]	0.559	-1.79	0.119	-1.720
	[4,4]	0.819	-1.791	0.112	-1.701
[RPI, M1A]	[4,1]	3.16**	-1.974	0.114	-1.929
	[4,2]	1.54	-1.908	0.114	-1.848
	[4,3]	0.99	-1.842	0.114	-1.768
	[4,4]	0.933	-1.807	0.110	-1.718
[RPI, M1C]	[4,1]	3.49**	-1.984	0.113	-1.939
	[4,2]	1.720	-1.920	0.112	-1.861
	[4,3]	1.24	-1.868	0.111	-1.793
	[4,4]	1.71	-1.914	0.099	-1.824
[RPI, M2]	[4,1]	4.48*	-2.016	0.109	-1.972
	[4,2]	2.20	-1.953	0.109	-1.893
	[4,3]	1.47	-1.892	0.108	-1.817
	[4,4]	1.54	-1.892	0.101	-1.802
[M0, RPI]	[4,1]	5.09*	-2.94	0.043	-2.898
	[4,2]	2.49**	-2.878	0.043	-2.818
	[4,3]	3.86*	-3.02	0.035	-2.942
	[4,4]	2.87*	-2.961	0.035	-2.871
[M1A,RPI]	[2,1]	9.59*	-2.543	0.064	-2.498
	[2,2]	4.66*	-2.479	0.064	-2.42
	[2,3]	5.35*	-2.603	0.053	-2.53
	[2,4]	4.37*	-2.586	0.050	-2.50
[M1C, RPI]	[4,1]	6.57*	-3.43	0.026	-3.39
	[4,2]	3.2**	-3.37	0.026	-3.311
	[4,3]	3.83*	-3.462	0.022	-3.39
	[4,4]	2.76*	-3.396	0.022	-3.306
[M2, RPI]	[2,1]	4.04*	-3.731	0.020	-3.686
	[2,2]	2.33	-3.690	0.019	-3.630
	[2,3]	4.05*	-3.855	0.015	-3.780
	[2,4]	3.00*	-3.797	0.015	-3.708

* significance at 5% level

** significance at 10% level

TABLE A.V

JAMAICA:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1973 - 1980						1981 - 1989					
VARIABLES [D. VAR, ID. VAR.]	LAGS [I , J]	F	AIC	FPE	HQ	VARIABLES [D. VAR, ID. VAR.]	LAGS [I , J]	F	AIC	FPE	HQ
[RPI, MO]	[1,1]	0.147	-3.464	0.023	-3.435	[RPI, MO]	[1,1]	15.03*	-4.663	0.008	-4.618
	[1,2]	0.737	-3.365	0.023	-3.326		[1,2]	8.43*	-4.654	0.007	-4.594
	[1,3]	0.845	-3.412	0.020	-3.363		[1,3]	5.528	-4.599	0.007	-4.523
	[1,4]	1.625	-3.537	0.016	-3.479		[1,4]	4.37*	-4.572	0.007	-4.481
[RPI, MIA]	[1,1]	1.56	-3.543	0.021	-3.514	[RPI, MIA]	[1,1]	0.937	-4.277	0.012	-4.232
	[1,2]	0.88	-3.460	0.021	-3.422		[1,2]	0.459	-4.215	0.012	-4.154
	[1,3]	0.617	-3.372	0.021	-3.323		[1,3]	0.326	-4.156	0.011	-4.080
	[1,4]	0.479	-3.284	0.021	-3.226		[1,4]	2.08	-4.336	0.009	-4.245
[RPI, MIC]	[1,1]	0.787	-3.501	0.022	-3.472	[RPI, MIC]	[1,1]	0.066	-4.248	0.012	-4.202
	[1,2]	0.622	-3.431	0.022	-3.392		[1,2]	0.051	-4.187	0.012	-4.126
	[1,3]	0.576	-3.365	0.021	-3.316		[1,3]	0.498	-4.174	0.011	-4.098
	[1,4]	0.715	-3.341	0.019	-3.283		[1,4]	2.99*	-4.437	0.008	-4.346
[RPI, M2]	[1,1]	0.15	-3.465	0.023	-3.435	[RPI, M2]	[1,1]	0.271	-4.255	0.012	-4.209
	[1,2]	0.94	-3.367	0.023	-3.329		[1,2]	0.381	-4.210	0.012	-4.149
	[1,3]	0.710	-3.270	0.023	-3.221		[1,3]	0.974	-4.223	0.011	-4.147
	[1,4]	0.193	-3.209	0.022	-3.151		[1,4]	0.714	-4.162	0.011	-4.071
[MO, RPI]	[2,1]	0.71	-1.209	0.221	-1.180	[MO, RPI]	[2,1]	0.0267	-0.559	-.474	-0.513
	[2,2]	0.335	-1.109	0.221	-1.071		[2,2]	0.383	-0.523	0.462	-0.462
	[2,3]	0.643	-1.089	0.204	-1.041		[2,3]	0.644	-0.502	0.443	-0.426
	[2,4]	0.494	-1.000	0.202	-0.942		[2,4]	0.691	-0.472	0.429	-0.380
[MIA, RPI]	[1,1]	0.703	-2.557	0.057	-2.528	[MIA, RPI]	[1,1]	0.235	-1.490	0.187	-1.445
	[1,2]	0.363	-2.461	0.057	-2.422		[1,2]	0.531	-1.457	0.181	-1.396
	[1,3]	0.330	-2.381	0.056	-2.332		[1,3]	1.86	-1.545	0.156	-1.469
	[1,4]	0.285	-2.295	0.055	-2.237		[1,4]	1.66	-1.522	0.150	-1.431
[MIC, RPI]	[1,1]	0.125	-3.441	0.024	-3.411	[MIC, RPI]	[1,1]	0.003	-3.310	0.030	-3.265
	[1,2]	0.058	-3.341	0.024	-3.302		[1,2]	0.06	-3.295	0.029	-3.235
	[1,3]	0.093	-3.252	0.023	-2.915		[1,3]	1.167	-3.307	0.027	-3.231
	[1,4]	0.194	-2.909	0.030	-2.857		[1,4]	0.941	-3.258	0.026	-3.167
[M2, RPI]	[1,1]	0.118	-3.162	0.031	-3.133	[M2, RPI]	[1,1]	0.669	-1.107	0.274	-1.062
	[1,2]	0.057	-3.062	0.031	-3.023		[1,2]	0.495	-1.057	0.271	-0.996
	[1,3]	0.041	-2.963	0.031	-2.915		[1,3]	0.339	-0.997	0.270	-0.921
	[1,4]	0.194	-2.909	0.030	-2.851		[1,4]	0.263	-0.937	0.269	-0.846

* significance at 5% level

** significance at 10% level

TABLE A.V (Cont'd)

JAMAICA:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1990 - 1995						1973 - 1995					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ	VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
[RPI, MO]	[2,1]	0.633	-2.640	0.050	-2.625	[RPI, MO]	[4,1]	1.13	-2.028	0.122	-1.991
	[2,2]	1.165	-2.643	0.044	-2.623		[4,2]	0.66	-2.005	0.121	-1.956
	[2,3]	2.80**	-2.891	0.031	-2.867		[4,3]	1.609	-2.025	0.116	1.965
	[2,4]	2.79**	-2.944	0.052	-2.915		[4,4]	2.39*	-2.061	0.109	-1.988
[RPI, MIA]	[2,1]	1.87	-2.721	0.046	-2.706	[RPI, MIA]	[4,1]	4.41*	-2.070	0.117	-2.034
	[2,2]	0.99	-2.620	0.045	-2.60		[4,2]	3.74*	-2.084	0.112	-2.036
	[2,3]	0.878	-2.559	0.043	-2.534		[4,3]	2.51**	-2.060	0.112	-1.999
	[2,4]	1.166	-2.596	0.074	-2.567		[4,4]	1.85	-2.034	0.112	-1.961
[RPI, MIC]	[2,1]	0.959	-2.662	0.049	-2.647	[RPI, MIC]	[4,1]	2.26	-2.043	0.120	-2.006
	[2,2]	0.450	-2.545	0.049	-2.525		[4,2]	1.693	-2.032	0.118	-1.983
	[2,3]	0.467	-2.471	0.047	-2.446		[4,3]	1.129	-2.007	0.118	-1.946
	[2,4]	0.774	-2.491	0.082	-2.461		[4,4]	0.943	-1.986	0.117	-1.913
[RPI, M2]	[2,1]	0.029	-2.598	0.052	-2.583	[RPI, M2]	[4,1]	0.061	-2.013	0.124	-1.977
	[2,2]	0.71	-2.582	0.047	-2.563		[4,2]	0.116	-1.99	0.123	-1.941
	[2,3]	2.28	-2.812	0.033	-2.787		[4,3]	0.261	-1.971	0.122	-1.911
	[2,4]	2.122	-2.815	0.059	-2.785		[4,4]	0.194	-1.946	0.122	-1.872
[MO, RPI]	[1,1]	0.148	-1.726	0.125	-1.712	[MO, RPI]	[4,1]	2.94**	0.102	1.025	0.139
	[1,2]	2.422	-1.915	0.092	-1.895		[4,2]	2.53**	0.100	0.996	0.149
	[1,3]	2.46	-1.960	0.078	-1.936		[4,3]	1.66	0.126	0.996	0.187
	[1,4]	2.50**	-2.010	0.132	-1.981		[4,4]	1.69	0.128	0.973	0.201
[MIA, RPI]	[2,1]	1.83	-1.907	0.104	-1.892	[MIA, RPI]	[4,1]	2.30	-0.771	0.428	-0.734
	[2,2]	1.03	-1.814	0.102	-1.794		[4,2]	1.50	-0.754	0.424	-0.706
	[2,3]	0.83	-1.737	0.098	-1.713		[4,3]	0.99	-0.729	0.424	-0.668
	[2,4]	0.593	-1.626	0.194	-1.597		[4,4]	0.80	-0.706	0.422	-0.633
[MIC, RPI]	[3,1]	2.65	-3.471	0.022	-3.457	[MIC, RPI]	[4,1]	3.87*	-2.115	0.112	-2.079
	[3,2]	1.55	-3.394	0.021	-3.375		[4,2]	3.27*	-2.124	0.108	-2.075
	[3,3]	0.96	-3.278	0.021	-3.253		[4,3]	2.28**	-2.103	0.107	-2.042
	[3,4]	0.67	-3.163	0.042	-3.133		[4,4]	1.73	-2.079	0.107	-2.006
[M2, RPI]	[2,1]	2.73	-3.646	0.018	-3.631	[M2, RPI]	[4,1]	1.75	-0.816	0.409	-0.779
	[2,2]	6.64*	-4.054	0.011	-4.035		[4,2]	2.11	-0.822	+0.396	-0.744
	[2,3]	4.13*	-3.941	0.011	-3.917		[4,3]	1.39	-0.797	0.396	-0.736
	[2,4]	3.06**	-3.864	0.021	-3.835		[4,4]	1.039	-0.771	0.396	-0.698

* significance at 5% level

** significance at 10% level

TABLE A.VI

TRINIDAD AND TOBAGO:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1973 - 1980						1981 - 1989					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ	VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
[RPI, M0]	[2,1]	2.047	-5.492	0.003	-5.463	[RPI, M0]	[4,1]	6.24*	-4.924	0.006	-4.879
	[2,2]	1.41	-5.441	0.003	-5.402		[4,2]	3.02**	-4.862	0.006	-4.802
	[2,3]	0.93	-5.349	0.003	-5.301		[4,3]	2.21	-4.824	0.006	-4.749
	[24]	0.692	-5.259	0.003	-5.201		[4,4]	1.62	-4.765	0.006	-4.674
[RPI, M1A]	[2,1]	0.0843	-5.383	0.003	-5.354	[RPI, M1A]	[4,1]	0.402	-4.743	.007	-4.698
	[2,2]	0.456	-5.334	0.003	-5.295		[4,2]	0.280	-4.687	0.007	-4.626
	[2,3]	0.285	-5.234	0.003	-5.185		[4,3]	1.08	-4.718	0.007	-4.642
	[24]	0.292	-5.159	0.003	-5.100		[4,4]	2.14**	-4.827	.006	-4.736
[RPI, M1C]	[2,1]	1.08	-5.440	0.003	-5.411	[RPI, M1C]	[4,1]	.094	-4.733	.007	-4.687
	[2,2]	0.511	-5.341	0.003	-5.302		[4,2]	0.343	-4.691	0.007	-4.630
	[2,3]	0.566	-5.286	0.003	-5.237		[4,3]	0.515	-4.660	0.007	-4.584
	[24]	0.717	-5.265	0.003	-5.207		[4,4]	1.79	-4.785	0.006	-4.694
[RPI, M2]	[2,1]	1.172	-5.445	0.003	-5.416	[RPI, M2]	[4,1]	1.01	-4.764	0.007	-4.718
	[2,2]	0.646	-5.356	0.003	-5.317		[4,2]	0.563	-4.706	.007	-4.646
	[2,3]	0.402	-5.257	0.003	-5.208		[4,3]	2.17	-4.821	.006	-4.745
	[24]	0.415	-5.191	0.003	-5.132		[4,4]	2.13**	-4.825	.006	-4.734
[M0, RPI]	[1,1]	0.173	-0.571	-.419	-.542	[M0, RPI]	[1,1]	0.242	-1.268	0.233	-1.223
	[1,2]	2.79**	-.760	-.313	-.721		[1,2]	.231	-1.214	.231	-1.153
	[1,3]	1.74	-.660	.313	-.612		[1,3]	.316	-1.170	.227	-1.094
	[1,4]	1.242	-.565	.312	-.506		[1,4]	.236	-1.108	.227	-1.017
[M1A, RPI]	[2,1]	.143	-2.407	.067	-2.378	[M1A, RPI]	[2,1]	.298	-2.00	.112	-1.954
	[2,2]	.069	-2.308	0.067	-2.269		[2,2]	.147	-1.938	.112	-1.877
	[2,3]	.178	-2.234	0.065	-2.185		[2,3]	.106	-1.876	.112	-1.800
	[24]	.131	-2.136	0.065	-2.077		[24]	.145	-1.824	.111	-1.733
[M1C, RPI]	[3,1]	0.49	-1.226	.217	-1.197	[M1C, RPI]	[3,1]	.067	-2.823	.049	-2.777
	[3,2]	0.496	-1.158	.211	-1.119		[3,2]	.176	-2.2770	.049	-2.710
	[3,3]	0.31	-1.059	.210	-1.010		[3,3]	.147	-2.712	.049	-2.636
	[3,4]	0.40	-1.007	.200	-.949		[3,4]	.138	-2.654	.048	-2.563
[M2, RPI]	[4,1]	.355	-2.157	.086	-2.128	[M2, RPI]	[4,1]	.825	-2.934	.044	-2.889
	[4,2]	.175	-2.058	0.086	-2.019		[4,2]	.399	-2.872	.044	-2.811
	[4,3]	.181	-1.972	0.084	-1.923		[4,3]	.263	-2.810	.044	-2.734
	[4,4]	.303	-1.919	.081	-1.861		[4,4]	.304	-2.764	.043	-2.673

* significance at 5% level

** significance at 10% level

TABLE A.VI (Cont'd)

TRINIDAD AND TOBAGO:
RESULTS OF GRANGER CAUSAL INFERENCE AND LAG LENGTH SELECTION

1990 - 1995						1973 - 1995					
VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ	VARIABLES [D. VAR, ID. VAR.]	LAGS [i , j]	F	AIC	FPE	HQ
[RPI, M0]	[2,1]	.473	-5.053	.005	-5.032	[RPI, M0]	[4,1]	2.23	-4.0	0.17	-39.64
	[2,2]	.224	-4.942	.005	-4.915		[4,2]	2.206	-4.003	0.016	-3.955
	[2,3]	0.400	-4.888	.004	-4.854		[4,3]	1.58	-3.983	0.016	-3.922
	[2,4]	0.564	-4.861	.008	-4.820		[4,4]	1.34	-3.966	0.016	-3.893
[RPI, M1A]	[2,1]	.150	-5.032	.005	-5.011	[RPI, M1A]	[4,1]	0.474	-3.977	0.017	-3.941
	[2,2]	.089	-4.92	.005	-4.896		[4,2]	0.6788	-3.963	0.017	-3.915
	[2,3]	.249	-4.855	.004	-4.821		[4,3]	0.764	-3.950	0.017	-3.890
	[2,4]	.534	-4.852	.008	-4.811		[4,4]	2.645*	-4.031	0.015	-3.98
[RPI, M1C]	[2,1]	.0061	-5.022	.005	-5.002	[RPI, M1C]	[4,1]	.0827	-3.972	0.017	-3.936
	[2,2]	.733	-5.010	.004	-4.983		[4,2]	0.598	-3.961	0.017	-3.913
	[2,3]	.465	4.901	.004	-4.867		[4,3]	0.435	-3.937	0.017	-3.877
	[2,4]	.713	-4.901	.008	-4.860		[4,4]	1.482	-3.973	0.016	-3.900
[RPI, M2]	[2,1]	.464	-5.052	.005	-5.032	[RPI, M2]	[4,1]	.0426	-3.971	0.017	-3.935
	[2,2]	.322	-4.955	.005	-4.928		[4,2]	0.713	-3.964	0.017	-3.916
	[2,3]	.327	-4.872	.004	-4.838		[4,3]	0.619	-3.945	0.017	-3.884
	[2,4]	.535	-4.852	.008	-4.811		[4,4]	1.600	-3.979	0.016	-3.907
[M0, RPI]	[1,1]	1.48	-2.417	0.064	-2.397	[M0, RPI]	[1,1]	0.275	-0.008	0.919	0.028
	[1,2]	-1.57	-2.415	0.057	-2.388		[1,2]	1.27	-0.012	0.892	0.036
	[1,3]	0.975	-2.304	0.057	-2.270		[1,3]	.9468	.009	.888	0.069
	[1,4]	0.796	-2.225	0.111	-2.184		[1,4]	.8407	0.027	0.881	0.100
[M1A, RPI]	[1,1]	.535	-2.419	0.064	-2.398	[M1A, RPI]	[3,1]	0.919	-1.53	0.292	-1.117
	[1,2]	.395	-2.327	0.063	-2.300		[3,2]	0.761	-1.135	0.290	-1.087
	[1,3]	0.631	-2.297	0.058	-2.263		[3,3]	0.978	-1.129	0.284	-1.068
	[1,4]	0.57	-2.224	.111	-2.183		[3,4]	0.7280	-1.103	0.284	-1.031
[M1C, RPI]	[1,1]	.0413	-1.67	.067	-2.823	[M1C, RPI]	[4,1]	0.898	-0.681	0.469	-0.644
	[1,2]	.032	-1.562	.134	-1.535		[4,2]	0.792	-0.664	0.465	-0.616
	[1,3]	.226	-1.498	.128	-1.463		[4,3]	0.779	-0.649	0.460	-0.588
	[1,4]	.255	-1.417	.249	-1.376		[4,4]	0.577	-0.623	0.460	-0.551
[M2, RPI]	[1,1]	.1658	-3.158	.030	-3.137	[M2, RPI]	[4,1]	2.09	-1.545	0.197	-1.509
	[1,2]	.096	-3.049	.030	-3.022		[4,2]	1.452	-1.531	0.195	-1.482
	[1,3]	.314	-2.995	.029	-2.960		[4,3]	1.285	-1.518	0.193	-1.458
	[1,4]	.554	-2.983	0.052	-2.942		[4,4]	1.100	-1.500	0.191	-1.428

* significance at 5% level

** significance at 10% level