# GOVERNMENT REVENUE-EXPENDITURE CAUSALITY AND CO-INTEGRATION:

# EVIDENCE FOR BARBADOS

*By*

R Craigwell
Central Bank of Barbados
Barbados

J Ferracho
ECCB
St Kitts

H Leon
SUNY
Old Westbury
NY 11568
and ECCB

August 1993

**GOVERNMENT REVENUE-EXPENDITURE CAUSALITY AND CO-INTEGRATION: EVIDENCE FOR BARBADOS.**

**Abstract:** This paper tests Barbadian data on government revenues and expenditures for Granger causality. The methodology employed is to test for cointegration before formulating the error correction models (augmented vector autoregression) used to test for causality. The results show that revenue and expenditure are cointegrated and that unidirectional causality exists from revenue to expenditure. A trivariate model that included inflation found evidence of a bi-directional causal relationship.

Keywords: cointegration, error correction model; Granger-causality.

## Introduction

This paper uses an error-correction model to test for causation between government revenues and expenditure in Barbados. It is argued that the Engle and Granger (1987) framework provides a more general test for causality than the standard Granger test [see Granger (1969), Guilkey and Salemi (1982) and Geweke, Meese and Dent (1983)], since the "standard test" equation is misspecified if the variables in the relationship of interest are cointegrated.[1] The approach adopted thus requires a test for cointegration prior to the formulation of the causality-testing equations. Our results indicate that, for the bivariate case, government revenues cause expenditure, and that in a trivariate system including inflation, there is evidence of feedback from expenditure to revenue.

There is no general theoretical consensus on the causal relation between expenditures and revenue. The debate dates back to Wagner's "Law of Expanding State Activity" which recognised the importance of revenue as a constraint on government expenditure, and the Peacock-Wiseman "displacement effect" which suggested that expenditures lead revenues. Friedman (1982) states that "increasing taxes would mean that you'd have just as large a deficit but at a higher level of government spending". Barro (1974), on the other hand argued, that increased taxes are the outcomes of higher levels of fiscal expenditures, so that causality runs from expenditure to revenue with no feedback.

This lack of a theoretical consensus has led to a number of empirical studies using both developed and developing countries data [see Ram (1988), Anderson, Wallace and Warner (1986), Miller and Russek (1991), Shibata and Kimura (1986)]. The philosophical foundations of Granger's definition of causality has also been questioned (see Zellner (1979), Geweke (1984), Jacobs, Leamer and Ward (1979), and Hoover (1990)), while issues relating to the sensitivity of the test results to lag length selection and detrending have been discussed (Thornton and Batten (1981), Nakhaeizadah (1987), Craigwell and Leon (1990)).

Causality between revenues and expenditure has potential implications for policies aimed at controlling the growth of the fiscal gap. In 1987 and 1988, the Barbadian fiscal authorities instituted a number of new taxation measures aimed at recovering 'lost' revenues to close a widening fiscal deficit (see Craigwell and Rock (1988), and Howard (1986)). An implicit assumption of that policy stance was that higher revenues would lead unambiguously to lower deficits, given a predetermined level of government spending. If revenues lead to higher expenditures, the anticipated reduction in the fiscal deficit may not be realised. If revenues are caused by spending and not vice versa, increasing revenues will not lead to higher expenditures, and could be seen as a potential strategy for reducing the fiscal deficit. If revenues and expenditures cause each other, a policy aimed at increasing revenues could have limited success in addressing the deficit if the concomitant increase in expenditures is ignored.

An empirically determined causal relation is examined for data covering the period 1946-1992. Section 2 outlines the tests of causality with and without cointegration, while the results are discussed in section 3. A concluding summary is provided in section 4.

## 2. Causality and Cointegration

A Granger causality test examines whether past changes in one variable (X) help to predict current changes in another variable (Y) after controlling for the effect of past changes in Y. To conduct the test, a relevant information set must be defined, variables need to be stationary and the number of past changes of X and Y need to be determined. Thus for two I(1) (non-stationary) variables, requiring first differencing to achieve stationarity, the Granger causal test is based on the regression:

$$\Delta Y_t = \alpha + \sum_{j=1}^{p}\beta_j \Delta Y_{t-j} + \sum_{j=1}^{r}\delta_j \Delta X_{t-j} + \epsilon_t \qquad (1)$$

X is said to not Granger-cause Y if the $\delta_j$s, based on the standard F-test, are jointly insignificant. For the same equation, but with $\Delta X_t$ on the left side, Y Granger-causes X if the $\beta_j$s are jointly significant. Therefore, by considering both regressions ($\Delta Y$ and $\Delta X$ as functions of lagged changes in $\Delta Y$ and $\Delta X$), it is possible to find that:

(a) Y causes X, but X does not cause Y;
(b) Y and X cause each other;
(c) X causes Y, but Y does not cause X; and
(d) X does not cause Y and Y does not cause X.

Engle and Granger (1987) showed that when a set of variables are cointegrated there must be causation in at least one direction, and an Error Correction Representation exists with current changes in each variable explained by lagged changes in all the variables and the lagged equilibrium relationships among the variables. For the bivariate case, we have

$$\Delta Y_t = \alpha + \sum_{j=1}^{k-1}\theta_j \Delta Y_{t-j} + \sum_{j=1}^{k-1}\gamma_j \Delta X_{t-j} - \phi U_{t-k} \qquad (2)$$

where $U_t = Y_t - \beta X_t$ is the equilibrium relationship between $Y_t$ and $X_t$.

Therefore, when two series are cointegrated, the standard causal test equation (Eqn 1) is misspecified in that it omits the variable $U_{t-k}$. In particular, a significant $\phi$ will now imply a Granger causal effect from X to Y, even if the $\gamma_j$s are insignificantly different from zero. Further, X does not cause Y, and Y does not cause X, is not a feasible possibility if X and Y are cointegrated.

## 3. Empirical Results

Our analysis employed annual data for the period 1946-1992 using government revenues and expenditures in Barbados.[2] All variables are in logarithms and have been deflated by the price index. Before conducting the causal tests, each variable is tested for non-stationarity. Cointegration tests are then performed for the relevant variables of interest. We consider both bivariate and trivariate information sets and fix the number of lagged changes considered in the regression.[3] In examining the temporal properties of the data, correlograms and regression based "Dickey-Fuller" tests [Dickey and Fuller (1979, 1981)] were used to determine whether each series is stationary. A rejection of stationarity of the series in level form requires the first difference of that series to be tested for stationarity. If the first difference is stationary it is said to be I(0) and this implies that the level series is integrated of order one, I(1). The Dickey-Fuller tests are performed within the regression framework

$$\Delta Y_t = \alpha + \psi T + \rho Y_{t-1} + \sum_{j=1}^{m}\beta_j \Delta Y_{t-j} + \epsilon_t \qquad (3)$$

The tests for stationarity is based on the significance of $\rho$, where the hypothesis $\rho=0$ implies that Y is non-stationary and $\rho<0$ implies Y is stationary. Zero restrictions on $\alpha$ and $\beta$ depend on whether the process posited to be generating the data has a non-zero mean or a time trend. The m lagged dependent variables are included to ensure the residuals are not auto-correlated; m=0 defines the Dickey-fuller test while m≠0 is called the Augmented Dickey-Fuller test.

Table 1 below reports the results for the variables of interest.

**[Table 1 here]**

The results show that the logarithm of the level of each series is non-stationary [I(1)], but that the change in the logarithms are stationary [I(0)].

The existence of a long run relationship is based on the principle of cointegration. A linear combination of non-stationary variables will, in general, be non-stationary. If a particular linear combination of these non-stationary variables is stationary the set of variables is said to be cointegrated. The cointegrating vector describes the tendency of the set of variables to move towards an equilibrium. For example, in the two variable case, the cointegrated variables do not diverge from other, (they tend to move together). In the bivariate case, the test for cointegration is conducted by testing the residuals from the static regression

$$Y_t = \alpha + \delta X_t + \epsilon_t \qquad (4)$$

for stationarity.

The testing procedure is the Dickey-Fuller test outlined above, but with different critical values to account for the fact that the residuals have to be estimated.

Table 2
Static Regressions

| Dependent Variable | Coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Constant | LRCX | LRTX | LRGR | $R^2$ | DW | DF | ADF(2) |
| LRCX | -0.11 | | | 1.026 | .987 | 1.18 | -4.77* | -4.25* |
| LRGR | 0.11 | 0.962 | | | .987 | 1.17 | -4.66* | -4.27* |
| LRTX | 0.07 | | | 1.067 | .975 | 0.81 | -4.21* | -3.27 |
| LRGR | -0.05 | | .914 | | .975 | 0.80 | -3.95* | -3.06 |

NOTE: The estimated regressions are $Y = \alpha + \delta X + \epsilon$ and $X = \gamma + \beta Y + U$ for $Y = \{LRCX, LRTX\}$ and $X = \{LRGR\}$.

* Significant at 5 per cent level

Table 2 reports ordinary least squares estimates of the cointegrating regressions for both total and current expenditures and revenue. The hypothesis that real current expenditure and real revenue are cointegrated cannot be rejected. The evidence for real total expenditure is tenuous: the hypothesis of no rejection is not rejected for the ADF statistic.[4] Since our interest relates to the implications of cointegration in causality tests, the results below focus on the relationship between current expenditure and revenue.

Table 3
Results of the Causality Tests

| Regressors | Dependent Variable | | | | | |
|---|---|---|---|---|---|---|
| | DLRCX | | | DLRGR | | |
| Constant | .03 (1.49) | .05 (2.42) | .04 (2.27) | .03 (1.94) | .03 (1.78) | .03 (1.75) |
| DLRCX(-1) | -.22 (1.25) | -.64 (3.20) | -.60 (2.98) | -.09 (0.66) | -.05 (.28) | -.03 (.14) |
| DLRCX(-2) | -.04 (0.24) | -.57 (2.59) | -.52 (2.35) | .22 (1.60) | .28 (1.40) | .31 (1.59) |
| DLRGR(-1) | .25 (1.12) | .57 (2.59) | .55 (2.47) | .11 (0.62) | .08 (.39) | .05 (.28) |
| DLRGR(-2) | .29 (1.29) | .65 (2.91) | .63 (2.75) | .03 (0.18) | -.07 (.03) | -.03 (.15) |
| ECM(-3) | | -.83 (3.41) | | | .08 (.39) | |
| RECM(-3) | | | .78 (3.13) | | | -.14 (.63) |
| | F(2,39)=1.49 | F(2,38)=6.39* | F(2,38)=5.72* | F(2,39)=1.63 | F(2,38)=1.59 | F(2,38)=1.78 |
| $R^2$ | .08 | .30 | .27 | .10 | .10 | .11 |
| SE | .95 | .085 | .086 | .075 | .076 | .07 |

NOTE: ECM is the residual from the static regression of expenditure on revenue and RECM is the residual of the reverse regression of revenue on expenditure.

* Significant at 5 per cent level

Table 3 displays the results of the causality tests for the logarithm of real current expenditure (LRCX) and real revenue (LRGR). The results show the need to exercise caution in interpreting causality tests when the variables are cointegrated. Without the cointegrating residual, neither variable causes each other. When the standard testing equation includes the error correction term, revenue is found to Granger cause current expenditure; current expenditure does not cause Granger -cause revenue at the 5 percent level.

The above exclusion F - tests examine the dynamic response between real current expenditure and revenue but exclude the long-run causal relationship implied by the cointegrating vector. Alexander (1993) argues that the inclusion of the cointegrating vector in the exclusion test could distort the results because of the significance of the error correction term. Taylor and Tonks (1989) include the long-run relationship by estimating unrestricted auto-regressions:

$$\Delta Z_t = \alpha + \sum_{j=1}^{k-1}\theta_j \Delta Y_{t-j} + \sum_{j=1}^{k-1}\gamma_j \Delta X_{t-j} + \beta_1 Y_{t-k} + \beta_2 X_{t-k} + \epsilon_t \text{ for } Z = \{Y_t, X_t\} \qquad (5)$$

The test for Granger causality from X to Y involved testing the joint significance for $\beta_2$ and the $\gamma_j$s (i.e, the significance of lagged x and lagged changes in x). This formulation (Eqn (5)) has an I(o) left hand side variable and two right hand side levels ($Y_{t-k}$ and $X_{t-k}$) that are I(1)s. Unless ($\beta_1 Y_{t-k} + \beta_2 X_{t-k}$) is I(o), $\epsilon_t$ will be I(1). Further, the implicit long-run relationship recovered from Eqn. (5) may not be the same as that estimated from the static long-run regression (Eqn. (4)). The crux of the problem is that the parameters of interest include $\beta_2$, and $\beta_2$ can be written as a co-efficient on a stationary variable only if Y and X are cointegrated. If not, non-standard distribution theory applies. (See Stock and Watson (1988)).

**Table 4 - Results of the Unrestricted Auto-regressions**

| Regressors | Dependent Variables DLRCX | | DLRGR | |
|---|---|---|---|---|
| Constant | -.03 | (0.90) | .06 | (2.07) |
| DLRCX (-1) | -.65 | (3.25) | -.06 | (0.36) |
| DLRCX (-2) | -.60 | (2.69) | .25 | (1.26) |
| DLRGR (-1) | .55 | (2.49) | .05 | (0.26) |
| DLRGR (-2) | .64 | (2.88) | -.02 | (0.08) |
| LRCX (-3) | -.84 | (3.47) | .07 | (0.30) |
| LRGR (-3) | .84 | (3.39) | -.09 | (0.42) |
| $R^2$ | .316 | | .152 | |
| SE | .084 | | .074 | |
| F(3,37) | 4.98* | | 1.00 | |

* Significant at 5 per cent

The result for the expenditure equation [DLRCX] recovers the restricted ECM estimates of Table 3. Revenue Granger causes expenditure and expenditure does not cause revenue. All "error correction" equations satisfy serial independence, homoscedasticity, normality and correct functional form assumptions. However, the percentage of the variation in the dependent variable that is explained is low in each case, indicating the need possibly to extend the information set.

For a trivariate system, we consider potential inflation effects on real expenditure and revenue. The inflation variable could be justified as a "money illusion" effect if government perceives an increase in nominal revenue as an increase in real revenue. This may be due to the different short-run effects of inflation on the components of revenue and expenditure. Alternatively, if inflation is unanticipated, real expenditure may fall through involuntary saving (Deaton (1977)). Since inflation is I(o), there will be only one cointegrating vector. The results for this trivariate system,[5] shown in Table 5, indicate that expenditure is caused by both revenue and inflation, revenue is caused by both inflation and expenditure, and inflation in not caused by revenue but is caused by expenditure.[6] The significance of the second lag of expenditure in the revenue equation and that of the first lag of expenditure in the inflation equation suggest that expenditure causes inflation which in turn causes revenue. This causal link may help explain why in the bivariate system expenditure has, at best, a weak causal influence on revenue.[7]

The above findings do not therefore provide unambiguous support for increasing revenues to reduce the deficit. The result that revenues cause expenditures with possible weak feedback suggests that increased taxation is unlikely to reduce the deficit. Expenditure restraint or reform seems to be a more successful strategy.

## 4. Conclusion

This paper investigates the causal relationship between real revenues and real expenditure for Barbados during the period 1946-1992. It argues that it is necessary to test for cointegration before employing the vector autoregression test for causation since the vector autoregression is misspecified if the variables are cointegrated. The results show that real current expenditure and revenues are cointegrated and that revenues Granger cause expenditure. A trivariate system that included inflation shows causation from inflation and revenues to expenditure, from expenditure to inflation, and from inflation and expenditure to revenue.

The bivariate results indicate that revenue increasing measures are unlikely to reduce the deficit. Even in the trivariate system, where some evidence of feedback from expenditure to revenue exists, the dominant causal relationship seems to be from revenue to expenditure. An implication of this result is that expenditure control may be a more successful strategy for reducing the fiscal deficit.

Table 1: Testing for Stationarity

| Variable | Test | No trend | With Trend |
|---|---|---|---|
| LRTX | DF<br>ADF(1) | -2.15<br>-1.76 | -1.55<br>-1.14 |
| DLRTX | DF<br>ADF(1) | -6.77*<br>-4.19* | -7.05*<br>-4.52* |
| LRCX | DF<br>ADF(1) | -1.55<br>-1.13 | -1.64<br>-1.26 |
| DLRCX | DF<br>ADF(1) | -7.41*<br>-4.47* | -7.44*<br>-4.53* |
| LRGR | DF<br>ADF(1) | -1.16<br>-1.17 | -1.09<br>-1.06 |
| DLRGR | DF<br>ADF(1) | -6.37*<br>-3.89* | -6.42*<br>-4.07* |
| LRY | DF<br>ADF(1) | -2.07<br>-2.15 | -2.10<br>-2.36 |
| DLRY | DF<br>ADF(1) | -6.27*<br>-5.14* | -6.55*<br>-5.62* |
| LRP | DF<br>ADF(1) | 1.05<br>0.41 | -1.14<br>-2.11 |
| DLRP | DF<br>ADF(1)<br>ADF(2) | -3.28*<br>-3.66*<br>-2.16 | -3.43<br>-3.72*<br>-2.13 |
| D2LRP | DF<br>ADF(1) | -6.44*<br>-7.83* | -6.36*<br>-7.75* |

* Significant at 5 per cent level

RTX is Real Total Expenditure, when total expenditure is current expenditure plus capital expenditure and net lending.

RCX is Real Current Expenditure

RGR is Real Government Revenue

RY is Real Income

RP is the Consumer Price Index

The prefix L signifies the natural logarithm of the variable

D means the first difference

D2LRP is the change in inflation

Table 5

Results for Trivariate System

| | DLRCX | DLRCX | DLRGR | DLRGR | D2LRP | D2LRP |
|---|---|---|---|---|---|---|
| ONE | .02 (1.28) | -.05 (1.78) | .06 (2.25) | .01 (.85) | -.01 (.85) | -.02 (1.46) |
| DLRCX(-1) | -.67 (3.93) | -.67 (3.88) | -.06 (.34) | -.06 (.33) | .25 (2.13) | .25 (2.15) |
| DLRCX(-2) | -.36 (1.79) | -.37 (1.77) | .52 (2.42) | .53 (2.43) | .10 (.70) | .10 (.70) |
| DLRGR(-1) | .64 (3.72) | .64 (3.60) | -.01 (0.3) | .04 (.19) | .14 (1.14) | .13 (1.10) |
| DLRGR(-2) | .83 (4.69) | .83 (4.60) | .08 (.44) | .11 (.55) | -.13 (1.05) | -.13 (1.10) |
| D2LRP(-1) | -.87 (3.70) | -.87 (3.65) | -.78 (3.15) | -.79 (3.13) | .17 (1.07) | .18 (1.09) |
| D2LRP(-2) | .27 (1.29) | .27 (1.28) | .15 (.66) | .14 (.61) | -.31 (2.14) | -.31 (2.16) |
| ECM(-3) | -.62 (3.19) | | | .24 (1.15) | | .13 (.94) |
| LRCX(-3) | | -.63 (3.15) | .23 (1.08) | | .13 (.95) | |
| LRGR(-3) | | .64 (3.14) | -.26 (1.20) | | -.13 (.92) | |
| $R^2$ | .58 | .58 | .33 | .29 | .45 | .45 |
| Se | .064 | .065 | .068 | .069 | .045 | .044 |
| GR → | F(2,35)=15.09* | F(3,34)=9.52* | | | F(3,34)=1.42 | F(2,35)=1.51 |
| RP → | F(2,35)=7.13* | F(2,34)=6.93* | F(2,34)=4.98* | F(2,35)=4.90* | | |
| CX → | | | F(3,34)=3.20* | F(2,35)=4.79* | F(3,34)=1.60 | F(2,35)=2.45 |

* Significant at 5 per cent

## END NOTES

1. Cointegration is a technique that allows estimation and inference to be possible when economic variables display non-constancy in their mean and variance.

2. Data are from the Central Bank of Barbados. GDP is in constant 1974 dollars.

3. The alternative of a flexible lag structure is explained in Hsaio (1981).

4. This result is supported by the Johansen (1988) test which indicated one cointegrated vector for LRCX and LRGR but could not reject the null of zero cointegrating vectors for LRTX and LRGR. The estimated co-efficient vector for the cointegrating regression is almost identical to the OLS estimates.

5. The reported results are for a trivariate system with one cointegrating vector relating expenditure to revenue. The alternative of treating inflation as an exogenous variable in a generalised vector autoregression yields the same causal relationship above. The essential difference is that inflation rather than changes in inflation enter the bivariate generalised vector autoregression.

6. The second lag on expenditure is significant, indicating a weak feedback effect from expenditure to revenue.

7. The trivariate system with real expenditure, real revenues and real income yielded one cointegrating vector (using the Johansen procedure) with a co-efficient on real income that could not be rejected as equal to zero. The trivariate error correction models yielded similar results to the bivariate case. Real income does not Granger cause either expenditure [F(2,36) = 0.06], or revenue [F(2,36) = 0.03]. In fact, the bivariate systems of expenditure-income and revenue-income are not cointegrated.

## REFERENCES


Alexander, C.O., (1993) **"Changing Relationship Between Production, Wages and Unemployment in the U.K."**, *Oxford Bulletin of Economics and Statistics*, Vol 55 No.1 (1993), pp.87-102

Anderson, W., M.S. Wallace and J.T. Warner (1986) **"Government Spending and Taxation: What causes What?"**, *Southern Economic Journal*, Vol.52, No.3, pp 630-39.

Barro, R.J., (1974) **"Are Government Bonds Net Wealth?"** *Journal of Political Economy*, Vol. 82, No.6, 1974, pp.1095-1117

Craigwell R., and Leon H., (1990) **"Causality Testing and Sensitivity to Detrending: The Money-Income Relationship Revisited"**, *North American Review of Economics and Finance*, 1, 117-35.

Craigwell R., and Rock L.L., (1984), **"Tax Then Spend, or Spend Then Tax? Evidence for Barbados"**, Central Bank of Barbados Research Papers, September 1988.

Deaton, A.S., (1977) **"Involuntary Saving Through Unanticipated Inflation"**, *American Economic Review*, 67, pp.899-910.

Dickey D.A., and Fuller, W.A., (1981), **"The Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root"**, *Econometrica*, Vol 49, 991057-72.

Dickey D.A., and Fuller, W.A., (1979), **"Distribution of the Estimates for Autoregressive Time Series with a Unit Root"**, *Journal of the American Statistical Association*, 74, 427-31.

Engle, R.F. and Granger, C. (1987), **"Cointegration and Error Correction: Representation, Estimation and Testing"**, *Econometrica*, 55:251-276.

Friedman, M., (1982), Interview with the Washington Times, June 2 and 3, 1982.

Geweke, J., (1984), **"Inference and Causality in Economic Times"**, Series Model in Z Griliches and M Intriligator, (eds), *Handbook of Econometrics*, North Holland, Amsterdam, 1101-1144.

Geweke, J., Meese, R., and Dent, W.T., (1983), **"Comparing Alternative Tests of Causality in Temporal Systems: Analytical Results and Experimental Evidence"**, *Journal of Econometrics*, Vol 21, 161-194.

Granger, C.W.J., (1969), **"Investigating Causal Relationships by Econometric Models and Cross-Spectral Methods"**, *Econometrica*, Vol 37, No.3, 1969, pp.424-438.

Guilkey, D. and Salemi, M., (1982), **"Small Sample Properties of Three Tests for Granger-Causal Ordering in a Bivariate Stochastic System"**, *Review of Economics and Statistics*, 64, 668-681.

Hoover, K., (1990), **"The Logic of Causal Inference: Econometrics and the Conditional Analysis of Causality"**, *Economics and Philosophy*, 6, 207-34.

Howard, M., **"Income Tax Reform: An Analysis of Two Barbados Budgets 1986"**, University of the West Indies, Cave Hill Campus, Barbados, mimeo, December, 1986

Hsaio, C., (1982), **"Autoregressive Modelling and Causal Ordering of Economic Variables"**, *Journal of Economic Dynamics and Control*, Vol.4, pp.243-59.

Jacobs, R., Leamer, E., Ward, M., (1979), **"Difficulties with Testing for Causation"**, *Economic Inquiry*, 17, 60-75.

Johansen, S., (1988), **"Statistical Analysis of Cointegration Vectors"**, *Journal of Economic Dynamics and Control*, 12, pp.231-254.

Miller, S.M. and Russek, F.S. (1991), **"Cointegration and Error Correction Models: The Temporal Causality Between Government Taxes and Spending"**, *Southern Economic Journal*, 57, 221-29.

Nakhaeizadah, G., (1987), **"The Causality Direction in Consumption-Income Process and Sensitivity of Lag Structure"**, *Applied Economics*, 19, 829-838.

Shibata, H. and Kimura, Y., (1986), **"Are Budget Deficits the Cause of Growth in Government Expenditures?"**, in B.P. Herber (ed), *Public Finance and Public Debt (Detroit: Wayne State University Press)*.

Stock J.H, and Watson , M.W. (1988), **"Variable Trends in Economic Time Series"**, *Journal of Economic Prospectives*, Vol 2, No 3, Summer 1988, pp.147-174

Taylor, M.P. and Tonks, I. (1988), **"The Internationalisation of Stock Markets and the Abolition of the U.K. Exchange Control"**, *Review of Economics and Statistics*, Vol 71, pp.332-336.

Thornton, D., and Batten, D. (1985), **"Lag-Length Selection and Tests of Granger Causality between Money an Income"**, *Journal of Money, Credit and Banking*, 17, 164-178.

Zellner, A., (1979), **"Causality and Econometrics"**, in K Brunner and H Meltzer, (eds), Three Aspects of Policy and Policymaking: Knowledge, Data and Institutions, North Holland, Amsterdam.