The Efficacy of the Stock Market in the CARICOM sub-region: an Empirical Study

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Abstract

This paper examines the contribution of three stock exchanges of the CARICOM sub-region to economic growth. This is done within a VAR/VECM framework and the results ample provide evidence for the so-called 'supply-leading' hypothesis, since there is a strong, positive causal effect from stock market development to economic growth. On the other hand, it provides considerably less evidence for reverse causality, the so called demand-following hypothesis. Furthermore, the data do not support the hypothesis that funds from the banking sector in the form of private sector credit contribute to economic growth.

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1. Introduction

Since the seminal paper of Patrick (1966), there have been many studies – both theoretical and empirical – considering the relationship between finance and growth and asking, in particular, whether the relationship is supply-leading or demand-following[2] or both. See Levine (1997) and Levine and Zervos (1998) for a survey of some of the influential contributions under this heading. Stock Exchanges, and stock markets generally, are considered to be key elements of the financial system and their contribution to economic growth is getting wider and wider coverage in the literature (Atje and Jovanovic 1993, Demirgüç-Kunt and Levine 1995, Rousseau and Wachtel 2000 and Arestis et al. 2001). It is argued that their existence encourages investors to part with their savings to finance high-return, high-risk projects, especially since these investors can easily buy and sell their stake in the company and diversify risk in the case of internationally integrated stock markets (Bagehot 1873). Secondly, by encouraging investors to acquire information on firms and mitigating the principal–agent problem, stock markets can improve the quality of resource allocation.

Between 1982 and 1993, stock market capitalization worldwide grew at a rate of 15% per annum and a "disproportionate amount of this growth was in emerging stock markets, which rose from 3% of world stock market capitalization to 14% in the same period" (Demirgüç-Kunt and Levine 1995, p. 1). In the Caribbean, and in particular in the CARICOM sub-region, there is increasing focus on the development of stock markets as is evidenced by the recent establishment of the Guyana Stock Exchange, which opened for trading in 2003, as well as the establishment of the Eastern Caribbean Stock Exchange in 2001. These add to the older Exchanges that have been existence in Jamaica since 1969, in Trinidad & Tobago since 1981, and in Barbados since 1990. Further to this, agreement has been reached on the establishment of a CARICOM stock exchange, which will allow for the free trading across national frontiers.

The objective of this study is to investigate the efficacy of the stock exchange in the three countries, compared to the banking sector of these countries, in promoting economic growth. This is done within a VAR/VECM framework which allows for causality testing

[2] The stock exchange will be supply leading if it contributes to economic growth, and demand following if it is a consequence of economic growth.

as well as for the analysis of both the long-term and the short-term relationships among the variables of interest.

The rest of the paper is made up as follows: in the following section, we present some stylized facts about the structure and functioning of Stock Markets in the CARICOM sub-region, as well as on the proposed CARICOM stock exchange. This section also includes a summary of discussions held with some of the key players on these markets. In section 3, the data and methodology used in the paper are laid out and discussed. This section also contains a preliminary analysis of the data. Sections 4 contains the results and analysis of the estimation and testing of the models linking the stock market with growth. Section 5 concludes the paper.

2. Structure and functioning of Stock Markets in the CARICOM sub-region: some stylized facts

Trading of stocks takes place on formal exchanges located in the national jurisdictions that they serve. The Jamaica Stock Exchange (JSE), the oldest of the Exchanges in the CARICOM region, came into being in 1968. The Trinidad & Tobago Stock Exchange (TTSE) followed in 1981 and the Barbados Stock Exchange (BSE) in 1987. The newest kid on the block is the Guyana Stock Exchange, which was established in 2003. Three other exchanges exist in the CARICOM sub-region: the Eastern Caribbean Stock Exchange (ECSE, physically located in St. Kitts), the Bahamas Exchange and the Belize Stock Exchange.

The JSE was incorporated as a limited company in September 1968 and was opened for trading in February 1969. Prior to its establishment, trading in stocks and shares was carried out by a number of brokers on an informal basis. In fact, the Bank of Jamaica lists some twenty (20) publicly listed companies in 1964. By 1966, there were thirty-two (32) such companies and by 1969, when formal listing began, there were twenty-six (26). This later increased to thirty-four (34) by the end of 1969 and peaked at fifty-one (51) in 1995. The number of publicly listed companies currently stands at forty-three (43). As of January 2000, the JSE has been conducting trades using an automated trading platform. This benefits the market by allowing trading on all five (5) working days of the week.

Following the lead of Jamaica in 1968, the TTSE emerged in 1981 with the Securities Industry Act (SIA 1981). The TTSE replaced the Call Exchange and the Capital Issues Committees of the past. The securities market informally existed in Trinidad & Tobago for well over twenty (20) years prior to opening of the Stock Exchange. The change from this system was initiated in the early 1970s when the Government set out to localize the foreign owned commercial banking and manufacturing sectors of the economy. Alongside this development was the establishment of private institutions such as trust companies and stock broking firms to match the demands of investors in the market.

Faced with the need to harmonise the regulatory framework of the securities industry in Trinidad & Tobago, the SIA (1981) was repealed and replaced with the Securities Industry Act 1995 (SIA (1995)). This Act established the Trinidad & Tobago Securities and Exchange Commission (TTSEC) with its key function as regulator in the market. At

the end of 1981, the number of listed companies stood at thirty-two (32) and peaked at thirty-six (36) in 1984 and 1985. The number of listed companies currently stands at thirty-five (35). As of May 1993, a formal Bond market was established and in March 2005, the TTSE became the last of the regional exchanges to move to an electronic trading system which allows for five-day instead of the typical three day trading.

The Securities Exchange of Barbados (SEB) was established in April 1987 under the Securities Exchange Act (1982) following government's mandate to stimulate growth of new ventures that would reduce the reliance on the banking system for long-term finance. The Act of 1982 was later repealed and replaced with the enactment of the Securities Act (2001). The BSE operates as a privately owned, non-profit organization administered by a Board of Directors. The number of listed companied is currently at twenty-three (23). In July 2001, the BSE introduced the electronic trading system, which replaced the open auction outcry method of trading.

The creation of a CARICOM Regional Stock Exchange (CRSE) was an initiative of the government of Jamaica in 1989. This led eventually to the Grand Anse Declaration which catered for the movement of capital across the region, starting with the three existing stock exchanges: the JSE, TTSE and BSE. Cross border trading in equity was recognized as an integral part to the deepening and widening of the integration process in CARICOM.

The objectives of the CRSE are to promote the movement of capital across the region; to increase the investment opportunities; to encourage optimum financing for CARICOM firms irrespective of where the entity resides and to increase the attractiveness of the region as an area for investment, both by regional and non-regional investors.

The CRSE is not an actual physical entity but an agreement of cooperation to facilitate the purchase and sale of cross border shares. It has been argued, however, that the exchange has been not performing up to mark as countries are faced with differing accounting standards and payments and settlements systems [3]. Complications also result from the different exchange control regimes, compounded by the lack of available hedging mechanisms or instruments.

[3] Wesley Gibbings, Trinidad Guardian, October 28, 2004

The CARICOM stock markets are, however, still quite underdeveloped and remain quite passive compared to those of the developed countries. They are small and characterized by few market players[4]. They are privately owned and run by boards consisting mainly of brokers and corporate players and, in some cases, of government or Central Bank representatives. Electronic trading is a relatively recent phenomenon. The JSE was the first to introduce it in January 2000. In July 2001, the Barbados Stock Exchange followed, and in March 2005, the TTSE became the last of the regional exchanges to move to an electronic trading system. Clearings are done electronically across the board by central depositories. The ECSE, where electronic trading has existed since its inception in 2001, is the only Exchange to have dematerialised its record-keeping altogether, so that even stock certificates have been replaced by electronic records. The slow process of harmonization of the CARICOM markets has often blamed on the manual trading system that prevailed until quite recently and which is still employed in some of the markets.

The CARICOM markets are hybrids of what are typically labelled broker and dealer markets. Brokers tend to act in two capacities, both to execute trade orders, and to trade based on their own inventory. Yet, none of the exchanges allows short sales, which is a key component of dealer trades in more sophisticated markets, especially in the trading of derivatives. Further, on all the exchanges in question trades must take place through registered brokers and these are few in each market. Jamaica has the highest tally with a mere ten (10) brokers. The reason for this seems intuitive – the size of the market, both on the supply and demand side, simply does not warrant larger numbers.

Actual trading is quite limited in that it is only on the JSE and the ECSE that trading is conducted on all five (5) weekdays. On the BSE and TTSE, trades are allowed on Tuesdays, Wednesdays and Fridays only. However, with the introduction of electronic trading it is anticipated that this will change and all exchanges will be open for business on the five weekdays. The volume of trading is most heavy on the TTSE and the JSE. The BSE regularly experiences low volumes of trade, as does the ECSE which currently

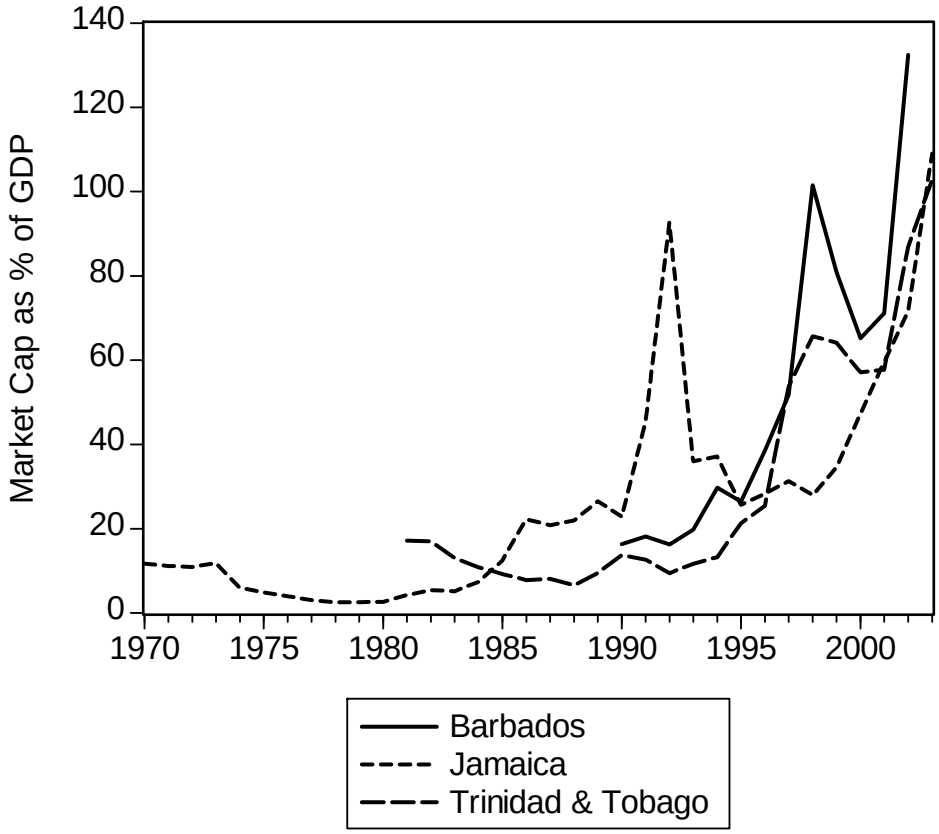
[4] See Bourne (1988) and Sergeant (1995) for studies of the Trinidad & Tobago Stock Exchange; Kitchen (1986) and Jackson (1986) for studies of the Jamaica Stock Exchange; Craigwell et al. (1996) for a study of the Barbados Stock Exchange.

only has (6) listed securities. It should also be noted that the BSE, JSE, and TTSE explicitly restrict price movements of shares, while the ECSE also reserves the right to stop trades that may adversely affect the market.

Availability of information is fairly good, considering the actual structures of the markets. Information on past prices and volumes is available from the respective exchanges for at least the past 5 years. Current bid data is available from the JSE only, and in that case, only at the exchange's public gallery or to subscribers to their online service. The system of trade on the other exchanges does not lend to an automatic posting of prices while trades are being negotiated. These prices are only posted after trading is complete.

The stock exchanges of Barbados, Jamaica and Trinidad & Tobago have all been characterized as inefficient, performing disappointingly and still in an underdeveloped state (Kitchen 1986, Jackson 1986, Bourne 1988, Sargeant 1995 and Craigwell et al. 1996). Notwithstanding this, since their appearance in the CARICOM sub-region, market capitalization has grown phenomenally, especially since the 1990s, as an inspection of Figure 1 below reveals:

Figure 1
Evolution of Market Capitalization as a percentage of GDP



In the case of the JSE, market capitalization as a percentage of GDP stood at 12% at the end of 1969 and was 109% by the end of 2003. At the TTSE, the value of stock market capitalization grew from 17% of GDP in 1981 to 103% in 2003. In the case of the BSE, the value of stock market capitalization increased from 16% of GDP in 1990 to 132% in 2002.

The opinion on the role of the stock market in the economic developmental process was sought from some key market players. It was the general consensus of these key players that the stock exchange can, and does, play a major role in promoting economic growth and development in an economy. However, they viewed as major impediments to this process the lack of new issues coming onto the market[5]; the lack of confidence in the market with regards to issues relating to the accounting standards used, disclosure of firm

[5] One major market player pointed to the popularity of that the rights issues in Trinidad & Tobago which required no SEC approvals involved and were not as costly as issuing new shares.

activity and the system of trading at the stock exchange; the reluctance of Companies to divulge information[6] and the perception of firms that it is much easier to borrow from banks rather than raise funds through equity financing. Craigwell and Murray (1998) note that, with the formation of the SEB, the pool of resources available for investment increased tremendously, and opine that "the formation of the exchange had a dramatic impact on the leverage level of firms". Studies of the TTSE by Bourne (1988) and Sargeant (1995) both recognize the potential of the market in the development of the economy. Sargeant (1995) also suggests capital market innovations such as credit creating services, liquidity enhancing services, equity generating services, price risk covering services and debt-equity hybrid services. Similar comments on the JSE are made by Kitchen (1986).

3. Data and Methodology

The basic relationship to be examined for the study of the stock exchange-growth nexus is:

$$F(C, M, Y, u) = 0 \qquad (2)$$

C is the ratio of domestic private sector credit to GDP (current values) and is a measure of the development of the banking sector. It is introduced since bank borrowing may be viewed as an alternative to equity capital as a source of finance to firms. M is the ratio of market capitalization to GDP and is an indicator of the development of the stock exchange. Y is per capita real GDP, a measure of economic activity; changes in this variable may be used to measure growth in the economy. u is a vector of error terms.

Annual data for private sector credit, market capitalization and GDP (current and constant values) are collected from the IFS online statistical data base. The population data, needed for the calculation of Y, are obtained from the publications of the statistical agencies of the three countries. The data set for Barbados covers the period 1991 to 2002, for Jamaica the period 1970 to 2003, and for Trinidad & Tobago 1981 to 2003[7]. In the analysis that follows, C, M and Y will be treated in logarithmic form and will be denoted, respectively, c, m and y. These variables will be referred to, respectively, as the

[6] Reasons advanced for this included fear of taxation laws, kidnapping and the competitor being able to gain access to 'trade secrets'.

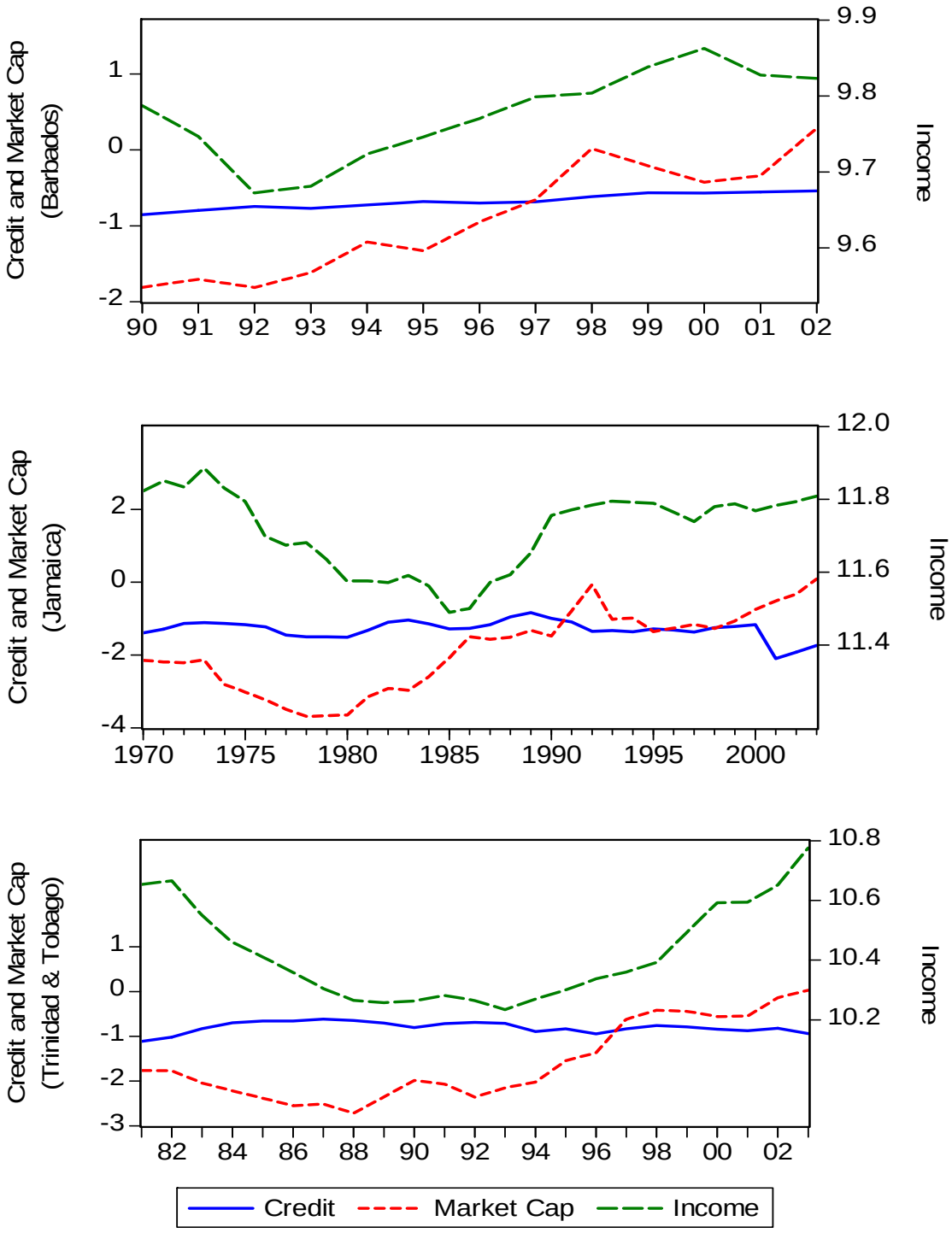
[7] These were the longest periods for which a coherent data set was available for each country.

credit variable, the market capitalization variable and the income variable.

The evolution of the three variables for the 3 countries is shown in Figure 2 below.

Figure 2

Evolution of Credit, Market Capitalization and Income Variables



The market capitalization and income variables show some evidence of moving in tandem in all cases, but the same certainly cannot be said of the credit and income variables. It is interesting to complement this basic observation with an analysis of the simple correlations among the variables, which are shown in table 2 below:

Table 2
Simple Correlation Coefficients (%)

Variables	Barbados	Jamaica	Trinidad & Tobago
c and m	91.0	-19.6	-47.0
c and y	22.0	-17.7	-62.0
m and y	32.0	40.0	62.0

There is, in all cases, a reasonably strong positive correlation between m and y, especially in the Trinidad & Tobago case. In addition, there is a very strong positive relationship between c and m in the Barbados case (more is said about this below). Unexpected negative coefficient values between c and m, and c and y, appear for both Jamaica and Trinidad and Tobago, and the values for Trinidad & Tobago (-47% and -62%) are quite high. We will say more on this when we discuss the results of block causality tests below.

The methodology to be employed requires, in a first step, the establishment of a Vector Autoregression (VAR) model. Once this is determined, it is used to conduct block causality tests[8]. These tests will be complemented by an analysis of the impulse responses and variance decompositions of the forecast errors. Using the chosen VAR, cointegration tests are carried out to determine the existence of long-run relationships between the variables and a Vector Error Correction Model derived if such cointegration is verified. This will be used to shed further light on the relationship between stock market development and economic growth and, in particular, to determine the direction of causality.

[8] These are used in preference to classic Granger causality tests since conclusions drawn from the latter are likely to be based on biased results. This is because they assume only a bivariate specification while the models used in this paper involve three variables.

4. Stock Markets and Growth: results and analysis

As a preliminary step in the econometric exercises, all variables used are tested for unit roots using the ADF and the KPSS tests. The null hypothesis, in the case of the ADF, is that the process is non stationary while in the KPSS case, the null is that the process is stationary. Because of the very small sample sizes, we are being very cautious in the interpretation of results of these tests. Our a priori feeling is that they are all admit exactly one unit root, or are I(1), and we will reject this hypothesis only if we have very strong evidence to the contrary. For this reason, we have added to these two tests a simple inspection of the correlogram of the variables in levels and first differences. As is well known, the Autocorrelation Function displays high and slowly declining positive values for a non stationary series. If the series is I(1), the correlogram of the variable will display such a pattern in level but not in first differences. The Box-Ljung statistic may be used to test whether the series (in levels and in first difference) is white noise, which is an extreme form of stationarity.

The results obtained are displayed in Table 5 below, which also shows the conclusions drawn.

Table 5
Unit Root Tests

Variable	ADF	KPSS	Correlogram	Decision
Barbados				
y • Level • 1st diff	 -4.388[b] -4.540[a]	 0.147[b] 0.256	 Dubious. White noise.	I(1) (largely because of KPSS test).
c • Level • 1st diff	 -4.164[b] -5.380[a]	 0.500[a] 0.425[c]	No clear evidence.	I(1) (largely because of KPSS test).
m • Level • 1st diff.	 -2.802 -3.374[a]	 0.1133[c] 0.4306[c]	 I(1). White noise.	I(1) (largely because of ADF and Correlogram).
Jamaica				
y • Level • 1st diff)	 -3.116 -3.920[a]	 0.163[b] 0.246	 I(1). White noise.	I(1)
c • Level • 1st diff	 -2.461 -5.483[a]	 0.158[b] 0.329	 Dubious. White noise.	I(1)
m				I(1)

• Level • 1st diff	-2.022 -4.750[a]	0.100 0.2263	I(1). White noise.	
Trinidad & Tobago				
y • Level • 1st diff)	 -0.7398 -0.592	 0.186[b] 0.750[a]	 Appearance of stationarity	Possibly I(0), but assumed to be I(1).
c • Level • 1st diff	 -3.277[c] -3.731[a]	 0.138[b] 0.378[c]	 Dubious. White noise	Arguably I(1)
m • Level • 1st diff	 -1.943 -3.179[b]	 0.166[b] 0.367[c]	 I(1). White noise.	I(1)

a: sig at 1%. b: sig at 5%. c: sig at 10%. Otherwise, not significant.
Tests at levels include constant and trend terms. Tests in 1st diff include constant only.

The evidence is somewhat mixed, but not sufficient, in our view, to lead to the rejection of the hypothesis that all the variables are I(1). Henceforth, we will assume that they are.

The first step in the process is to choose the optimal lag length of the 3-variable VAR model for each of the countries. Various selection criteria are available, including the sequential modified Likelihood Ratio (LR) criterion, the Final Prediction Error (FPE) criterion, the Akaike Information Criterion (AIC), the Schwarz Bayesian Criterion (SIC) and the Hannan-Quinn Information (HQC) criterion. There is no unanimity among practionners about the best criterion (or set of criteria) to use, but Ivanov and Kilian (2005) establish on the basis of experimental evidence that "for quarterly VAR models, the Hannan-Quinn Criterion (HQC) appears to be the most accurate criterion with the exception of sample sizes smaller than 120, for which the Schwarz Information Criterion (SIC) is more accurate" and, furthermore, that "sequential Lagrange-multiplier and likelihood ratio tests cannot be recommended". In a very influential paper, Hamilton and Herrera (2004) argue strongly in favour of the sequential testing procedure, especially when there is some a priori knowledge (based on previous studies) about the lag length. We have no a priori knowledge of lag length so we will not use the LR criterion. We have annual, and not quarterly data, and the number of observations we have is considerably less than 120. We propose, in the case of Barbados, to impose a maximum lag length of 1, and for the other two countries to limit our lag length to a maximum of two, given the small data sets and the possibility that "short-run" adjustments are hardly like to take more than two years. We will use the SIC criterion to choose between lags of

length 1 and 2. The criteria used resulted in a choice of a lag of order 1 for Jamaica and a lag length of 2 for Trinidad & Tobago.[9].

Block causality tests are now carried out on the systems as established. The results obtained are summarized in Table 6 below[10]:

[9] The VAR for Jamaica includes and constant and a trend term. The other two include a constant term only

.

[10] Blocks of one and two variables were tested. There was only one case where a block containing two variables was significant while no individual variable in that block was, and that is the only two variable block shown here.

Table 6
Results of Block Causality Tests

Country		c	m	y
Barbados	c causes: m causes: y causes:	●●●		●●
Jamaica	c causes: m causes: y causes:	●		●●●
Trinidad & Tobago	c causes: m causes: y causes: m and y cause:	●	●●●	●●● ●●●

●●● Significant at 1% or lower. ●● Significant between 1% and 5%. ● Significant between 5% and 10%.

In all three cases, there is convincing evidence the m causes y and in no case is there evidence of bi-directional causality. In fact, m seems to be exogenous to y in all three systems. c has no causal effect whatsoever (on m and on y) in Barbados and Jamaica, but has a very strong effect on both m and y in Trinidad & Tobago. In fact, in the case of Jamaica, c seems to be almost irrelevant to the system. In the case of Barbados, there is relatively strong evidence that m causes c but not the other way around. It is of some interest to note that, although neither m nor y cause c in Trinidad and Tobago, taken together there is some mild evidence of one way causation.

What might all this signify, especially when taken in conjunction with the results of the correlation analysis of the previous section? These results provide strong *prima facie* evidence that stock market development will impact positively on growth in all three countries, and in no case will causality also run in the other direction. Furthermore, and perhaps more importantly, there is no evidence from these results that development of the banking sector causes economic growth. Perhaps this is just as well in the cases of Jamaica and Trinidad & Tobago since, given the negative correlation, the impact of banking sector growth on overall economic growth would be negative. In Barbados, stock market growth will also result in growth in the banking sector.

The negative correlations, though surprising, are not of such great concern in Jamaica as may appear at first blush since c has no causal effect in Jamaica on either y or m. In the case of Trinidad & Tobago, however, c has strong direct causal effect on both m and y. One possible explanation for these negative correlations between m and c is that in

Trinidad and Tobago, and to a lesser extent in Jamaica, the banking sector and the stock market are substitute sources of funds (Beck and Levine, 2002). A possible explanation for the negative relationship between c and y may be that private sector credit from the banks may be used to finance non domestic activity (consumption and investment), and such leakages from the system have a negative effect on economic growth.

The very high correlation between c and m in the case of Barbados is cause for some concern. Any data analysis, such as those involving a VAR, may result in inefficient estimates because of this high correlation, especially given the very small sample size in the Barbadian case[11]. In addition, it can at best add precious little information which m is not already contributing and, furthermore, we have already seen that c is non causal to both m and y in the Barbados case. Henceforth, it shall be removed from the Barbados system, leaving us, especially given the very small data, with a much more manageable 2-variable VAR for Barbados. The optimum lag length in this case was found to be 2[12].

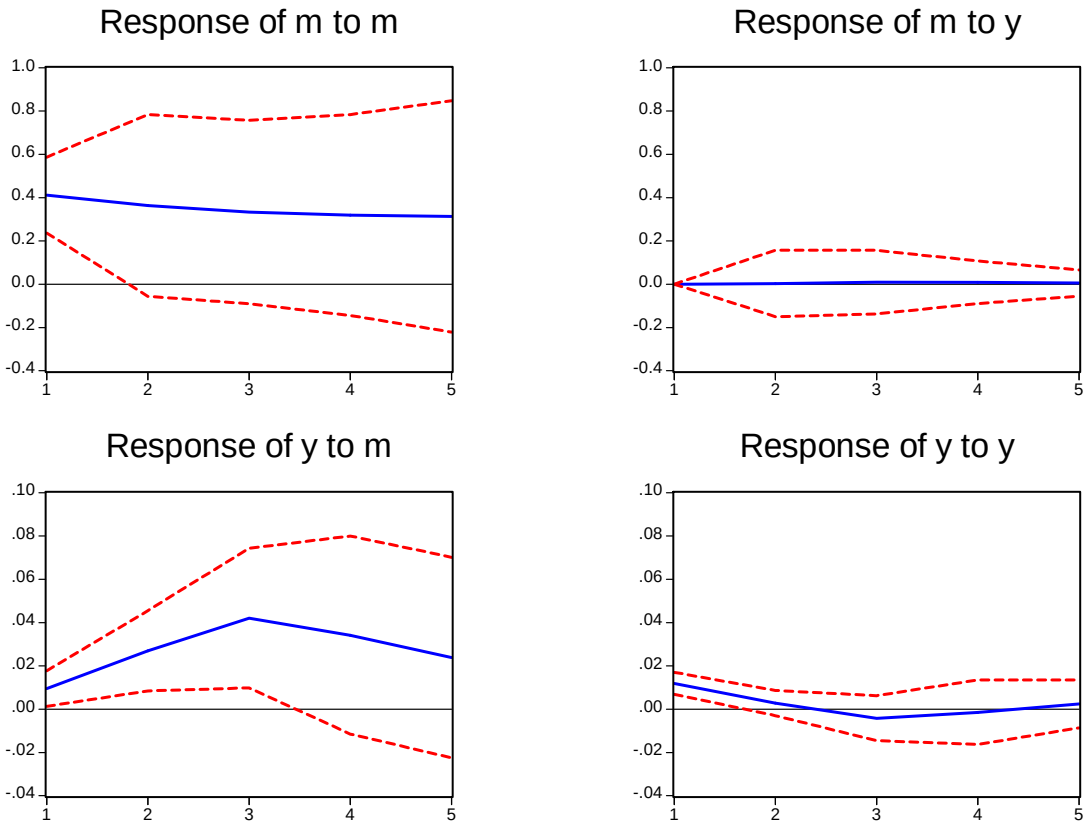
The impulse responses[13] shown in Figure 3 below for a period of five years shed further light on the relationship between the variables:

[11] This is the classic problem of multicollinearity.
[12] Once again, the VAR had a constant but no trend term.
[13] The Choleski ordering used is c, m and y. Changing the order does not alter the general conclusions drawn.

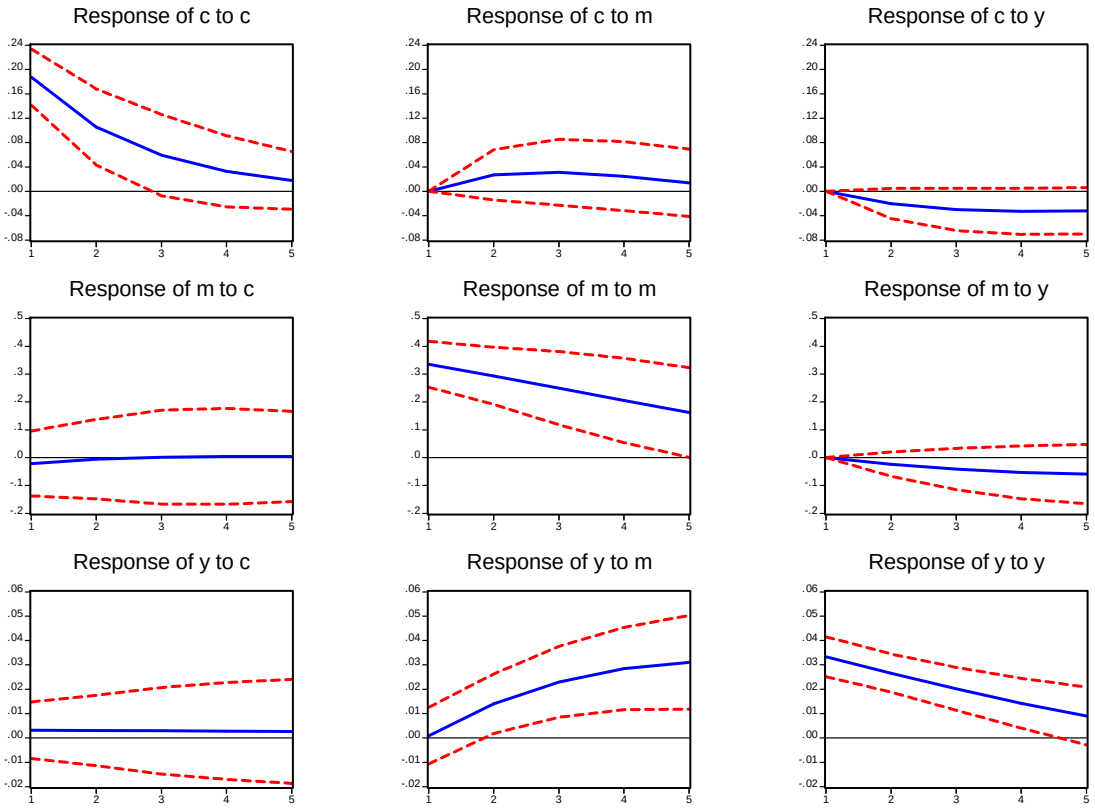
Figure 3

Impulse Responses

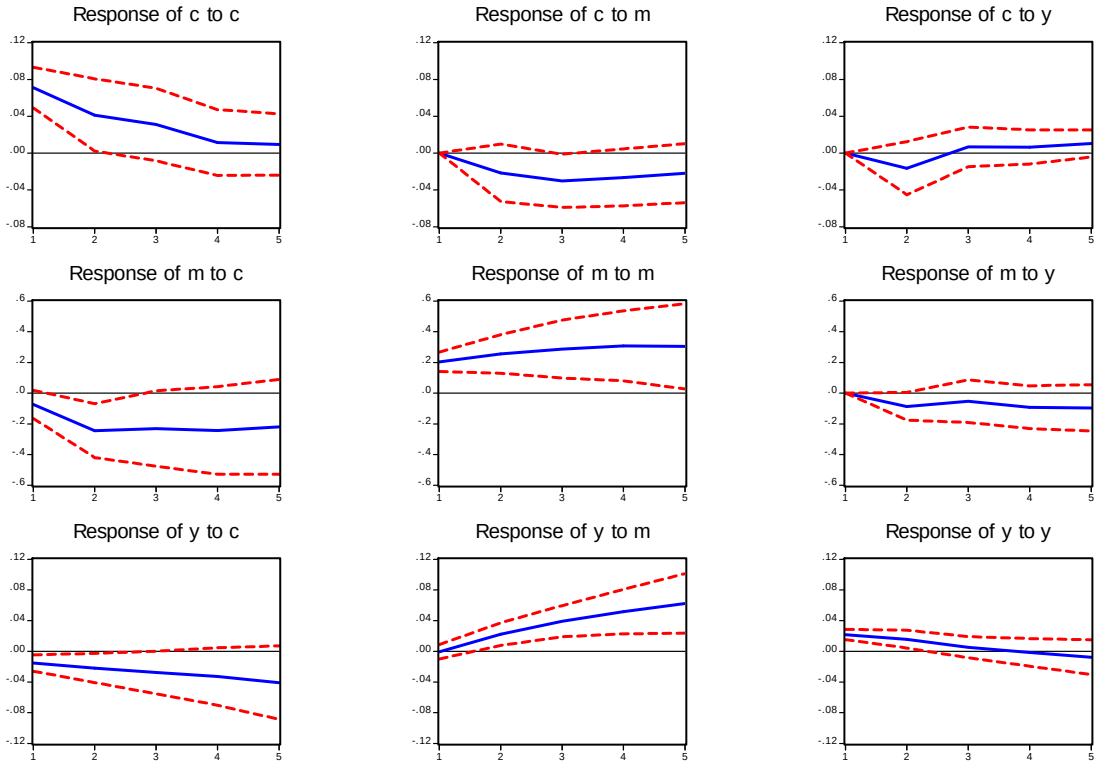
(a) Barbados



(b) Jamaica


Response of c to c
Response of c to m
Response of c to y
Response of m to c
Response of m to m
Response of m to y
Response of y to c
Response of y to m
Response of y to y

(c) Trinidad & Tobago



There is further evidence in the case of all three countries that a shock to the stock market variable, m, impacts positively on growth in the economy, even when we allow for the variation shown by the confidence bands. A shock to c has a decidedly negative effect on y in the case of Trinidad and Tobago while, in the case of Jamaica, its effect is negligible. It may be argued that, in the case of Trinidad & Tobago, the negative response of the credit variable to the shock in the stock exchange variable adds even greater impetus to the growth variable given the established negative relationship between the two. The response of the credit variable to the stock exchange variable, in both the cases of Jamaica and Trinidad and Tobago, is further evidence in these two countries that funds from the banking sector and the stock exchange are substitutes for each other. It is interesting to note as well that there is no evidence that lends credence to the competing so-called "demand-following" hypothesis (Patrick, 1966) that economic growth leads financial development. If anything, its response to shocks in income is insignificant (Barbados) or negative (Jamaica and Trinidad & Tobago).

Examination of the variance decomposition of the forecast errors sheds further light on these matters. The contribution of each variable to each other variable, after 5 years, is shown in Table 7 below:

Table 7
Forecast Variance Decomposition of Forecast Errors After 5 years (%)

Country	After 5 years, % of Decomposition due to → Variance decomposition of ↓	c	m	y
Barbados	m	NA	100	0
	y	NA	96	4
Jamaica	c	90	4	6
	m	0	97	3
	y	1	49	50
Trinidad & Tobago	c	73	23	4
	m	36	60	4
	y	31	63	6

m explains 96% of the variation in y in Barbados, 63% in Trinidad & Tobago and 49% in the case of Jamaica. The corresponding figures for c are 31% for Trinidad & Tobago and 1% for Jamaica. This is very convincing evidence that the stock exchange contributes much more to economic growth than the banking system. There is also little support for the "demand-following" hypothesis since y contributes nothing to stock market growth in Barbados, and only 3% and 4% respectively in the case of Jamaica and Trinidad & Tobago.

In summary, the preceding analysis provides strong evidence for causality from stock market development to economic growth in all cases. The banking sector contributes insignificantly in comparison. There is precious little evidence for the "demand-following" hypothesis that economic growth causes growth in the stock market.

The final pieces of evidence will be provided by cointegration analysis, which requires the construction and testing of VECM models based on the VAR models established and analyzed above. The Johansen method is applied to the Jamaica and Trinidad and Tobago data, while the Engle-Granger 2-step procedure is applied to the Barbados data[14].

[14] This is because there are only 2 variables in the Barbados VAR and also because of the possible gain in efficiency through use of the Engle-Granger procedure applied to the very short Barbados data set. It is also known that OLS estimation of the long-run relationship is superconsistent in the 2-variable case that we have here (Stock, 1987).

The results of the Johansen tests for the existence of cointegrating equations are summarized in Table 8 below[15]:

TABLE 8

Tests for Cointegration Rank

Country	r=	0	1	2
Jamaica	Eigenvalue	0.4096	0.2287	0.0274
Trend assumption: Linear deterministic trend (restricted)	Trace Statistic	26.87	9.486	0.9162
	95% Quantile	29.80	15.49	3.841
	p-value*	0.1048	0.3233	0.3385
	Max Eig Statistic	17.39	8.570	0.9162
	95% Quantile	21.13	14.26	3.841
	p-value*	0.1545	0.3237	0.3385
Trinidad & Tobago	Eigenvalue	0.756	0.655	0.123
Trend assumption: No deterministic trend (restricted constant)	Trace Statistic	54.75	25.09	2.762
	95% Quantile	35.19	20.26	9.164
	p-value*	0.0001	0.0100	0.6241
	Max Eig Statistic	29.66	22.33	2.762
	95% Quantile	22.30	15.89	9.164
	p-value*	0.0039	0.0042	0.6241

* MacKinnon et al. (1999) p-values

There is strong evidence for two cointegrating equations in the case of Trinidad & Tobago, and relatively mild evidence of one cointegrating equation in the Jamaica case (corresponding trace statistic is significant at 10% level). There was also evidence of a cointegrating relationship among the two variables in the Barbadian case, and this is shown in Table 9 below. Also appearing in Table 6 are the normalized cointegrating equations, containing the error correction terms for each country, as well as the corresponding VECM.

[15] r is the cointegration rank associated with the null hypothesis of the test.

Table 9

Cointegrating Equations and VECM Models

BARBADOS:

$$\text{(OLS estimation) } y = 9.832 + 0.0632\ m + \varepsilon_B$$
$$(4.144)$$
$$\bar{R}^2 = 0.57,\ DW = 1.03$$

$$\Delta m = -0.1922 - 0.0651\Delta m_{-1} - 0.7977\ \Delta y_{-1} - 0.0090\varepsilon_{B-1}$$
$$(0.1305) \qquad (0.2288) \qquad (0.0021)$$
$$\Delta y = 0.0042 - 0.0189\Delta m_{-1} + 0.5385\ \Delta y_{-1} - 0.8694\varepsilon_{B-1}$$
$$(0.6605) \qquad (2.698) \qquad (3.462)$$

JAMAICA:

$$y = -11.94 + 0.1186\ m + \varepsilon_J$$
$$(4.184)$$
$$\Delta c = -0.0105 - 0.0339\varepsilon_{J-1}$$
$$(0.1218)$$
$$\Delta m = 0.0676 - 0.7251\varepsilon_{J-1}$$
$$(1.550)$$
$$\Delta y = -0.0004 - 0.1804\varepsilon_{J-1}$$
$$(3.929)$$

TRINIDAD & TOBAGO:

$$m = -9.809 - 10.69\ c + \varepsilon_{TT,1}$$
$$(6.002)$$
$$y = 11.22 + 0.4623\ m + \varepsilon_{TT,2}$$
$$(9.673)$$
$$\Delta c = 0.1212\Delta c_{-1} - 0.1243\Delta m_{-1} - 0.5422\ \Delta y_{-1} - 0.0723\varepsilon_{TT,1-1} - 0.1454\varepsilon_{TT,2-1}$$
$$(0.5888) \quad (1.781) \quad (1.031) \quad (4.230) \quad (1.508)$$
$$\Delta m = 2.300\Delta c_{-1} + 0.1024\Delta m_{-1} - 3.653\ \Delta y_{-1} - 0.0865\varepsilon_{TT,1-1} - 0.6867\varepsilon_{TT,2-1}$$
$$(3.561) \quad (0.4465) \quad (2.213) \quad (1.613) \quad (2.268)$$
$$\Delta y = -0.2386\Delta c_{-1} + 0.0318\Delta m_{-1} - 0.1443\ \Delta y_{-1} + 0.0186\varepsilon_{TT,1-1} - 0.1364\varepsilon_{TT,2-1}$$
$$(3.175) \quad (1.247) \quad (0.7518) \quad (2.984) \quad (3.873)$$

ε_B and ε_J are the error correction terms for, respectively, Barbados and Jamaica. $\varepsilon_{TT,1}$ and $\varepsilon_{TT,2}$ are the two error correction terms for Trinidad & Tobago. T-values are shown in parentheses.

The cointegrating equations are well established. Each error correction term is highly significant and correctly signed in at least one equation in the VECM corresponding to it, which is further evidence of the cointegrability of the variables in the system. In the Barbados case, evidence of the existence of the cointegrating relationship is based, in the first instance, on the cointegrating regression Durbin-Watson statistic (Engle and Granger, 1987). The adjustment coefficient associated with this term in the Δy equation is correctly signed and highly significant. The fact that the adjustment coefficient is not

significant in the Δm equation is further evidence that there is no reverse causality from y to m. The private sector credit variable was not significant in cointegrating equation in the Jamaica case and was dropped[16]. The error correction term is highly significant and correctly signed in the Δy equation in the Jamaica system, but not in the other two short-run equations. This is further evidence of lack of reverse causality from the growth variable to the banking sector and stock market variables in the case of Jamaica.

The Trinidad & Tobago case threw up two cointegrating equations, and they are shown in Table 6. The first is a long run stock exchange equation and the second a long run growth equation. The first is highly significant in the Δc and Δy equations, providing some evidence here of causality from m to c and m to y. It is barely significant at 10% in the Δm equation but is correctly signed here. The second is highly significant in the Δm and Δy equations (where it is correctly signed), providing some evidence here of feedback causality from y to m and bi-directional causality between the two variables.

6. Conclusion

This paper represents a very first attempt to investigate the relationship between stock market development and economic growth in the CARICOM sub-region. The data provides evidence of a strong and positive causal effect from stock market development to economic growth, but considerably less evidence for reverse causality, the so called demand-following hypothesis. Furthermore, it does not support the hypothesis that funds from the banking sector in the form of private sector credit contribute to economic growth.

Further research is required to corroborate these results and, in particular, to examine the reason for apparent lack of causality from banking sector development to economic growth. Such research should also examine the contribution of the bond market.

[16] This "restriction" was tested and verified as correct: the corresponding χ^2 statistic was associated with a p-value of 0.266.

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