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FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: SOME CARIBBEAN EMPIRICAL EVIDENCE*

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The paper examines the role of financial development and economic growth in Barbados, Jamaica and Trinidad and Tobago. Causality tests conducted by using the stepwise Granger causality method, after addressing respective unknown exogenous structural changes, and using bounds testing approach to determine the level relationships between economic growth and each respective real financial development proxies, produced more robust results. Thus, economic growth drives real financial development in the short-run in all three countries, with Trinidad-Tobago's results being overwhelming. Long-run weak exogeneity tests from respective factor loadings indicate similar demand-following phenomenon in Jamaica, although results are mixed in Barbados and Trinidad-Tobago. Policymakers are therefore advised to make the overall economic growth of Jamaica their policy priority, and not favor its financial market with special policies over both near term and long-run. Similar policy is strongly recommended for both Trinidad-Tobago and Barbados. However, in Barbados and Trinidad-Tobago, mixed Granger causal relationship results suggest that extending resources as incentives to boost up both financial market development and economic growth will benefit them over the long-run.

Keywords: Financial Market, Stock Market, Economic Growth, Bounds Test, Granger Causality, Long-Run Weak Exogeneity
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1. INTRODUCTION

Patrick (1966) contends in his opening paragraph that the causal relationship between financial development (FD) and economic growth (EG) has not been well established both empirically and theoretically. However, ever since he proposed his

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hypothesis that a supply-leading phenomenon where financial development Granger causes economic growth supports the experience of lower and middle income or developing countries (DC), while a demand-following phenomenon where economic growth Granger causes financial development supports the experience of high income or highly developed countries (HDC), it has spawned several studies dating back from 1980s to unearth these causal relationships. See, (Jung, 1986; King and Levine, 1993; Demetriades and Hussein, 1996; Deidda and Fattouh, 2002; Calderón and Liu, 2003; Ang and McKibbin, 2007; Shen et al., 2011).

The supply-leading phenomenon argues that in countries where the capital markets are either under developed or have inefficient financial markets, the absence of adequate financial institutions, requisite arrays of financial assets and instruments, with poorly-developed financial services, experience stultified economic growth. Although this experience is common in countries at the early stages of their economic growth, they can also be experienced by low income countries that have under developed capital markets because of their poorly developed legal systems, which lack transparency and accountability, and are characterized by massive corruption, and extensive government regulations. Additionally, these countries have low real interest rates, high reserve requirement ratios, and controlled prices to the extent that their resources, assets, factors of production, goods and services are distributed largely by rationing.

The supply-leading phenomenon can also be associated with DC and state planned economies that experience financial repression, which results in their financial markets malfunctioning, by preventing their banking system from efficiently allocating loanable funds from savers with surplus funds, to investors with profitable business projects (see, Gurley and Shaw, 1967; Lewis, 1978; McKinnon, 1993). Thus, the resulting financial repression which is caused by a low interest rate ceiling below the market clearing value of marginal productivity of capital net of depreciation, results in low saving relative to their demand which translates into low investments, and low economic growth. Furthermore, improper official interference of the capital market results in suboptimal and inefficient marginal productivity of capital which also contribute to low economic growth.

To rectify a stunt economic growth, financial deepening where the money supply as a share of GDP increases as a result of expanding the number of banks and branches, and making more automatic teller machines and tellers easily accessible to depositors and borrowers across different parts of the country, and financial liberalization which frees government controlled and regulated markets, provide a sound basis for financial development to augment and promote economic growth (McKinnon, 1993; The World Bank, 1989; and Kitchen, 1993). Even in a situation of financial distress where real interest rates are negative and borrowers fail to honour their debt obligations, restructuring banks becomes important in allocating resources in the country. Additionally, financial restructuring which requires removing government controls and regulation on loans and saving, allows financial institutions to operate through the free market system, by mobilizing and efficiently allocating resources in the country to reduce risk, and increase the profitability of business investments and the productivity of factors of production such as capital and labour, to spur economic growth. Thus, financial development promotes economic growth (see Schumpeter, 1934; Gurley and Shaw, 1967; Goldsmith, 1969; Lewis, 1978; McKinnon, 1973; Pagano, 1993).

On the other hand, Patrick (1966) contends that the demand-following phenomenon, where economic growth drives financial development are generally experienced by HDC, and can be explained by the fact that their legal systems are sound, transparent and accountable. They also have low debt to GDP ratios and efficient functioning governments which do not crowd out private sector activities. Consequently, their financial developments respond to economic growth, as their financial markets widen and develop to provide increase opportunities for savers, businesses and investors to obtain loans at favourable yields and reduced risks. Thus, allowing their businesses to renovate their financial systems and build more financial institutions, produce more financial instruments and assets, and provide efficient financial services in response to the growth of their real economies. See Lewis (1978), Robinson (1979), Patrick (1966), Greenwood and Jovanovic (1990), Saint-Paul (1992) and Pagano (1993).

Early theoretical foundation of FD and EG relationships can be found in Goldsmith (1969), McKinnon (1973) and Shaw (1973), to name three. Goldsmith (1969) argues that financial intermediaries drive economic growth by raising the efficiency of investments, while McKinnon (1973) and Shaw (1973) view financial development as an enhancement to economic growth, by increasing the level of saving to boost investment in response to increase in real rates, which result from financial deepening and expansive use of intermediary services. But according to Pagano (1993) these early theories lack a sound analytical basis.

Bencivenga and Smith (1991) show that financial intermediaries such as banks encourage savings, which are funnelled to encourage and promote capital accumulation and investments to augment economic growth. Furthermore, by employing an endogenous growth model with overlapping generations within the framework of general equilibrium analysis, they showed that activities of financial intermediaries promote higher steady state growth independent of saving rates. They also showed that financial intermediaries like banks, direct funds from depositors to fund illiquid and high-yield technological projects, while reducing losses associated with investing in liquid assets; thus augmenting investments employed in production and increasing economic growth.

Financial intermediaries reduce idiosyncratic risk and avert informational frictions, by allocating loanable funds to investors with profitable projects and higher productivity of capital to augment steady state growth. See Greenwood and Jovanovic (1990). They facilitate more resources saved to be allocated to investment to augment production and economic growth, by reducing the variance between lending and borrowing rates, fees, commissions and other charges of securities brokers and dealers (Roubini and Sala-i-Martin, 1991).

Financial intermediaries such as stock markets or exchanges facilitate more funds to be raised by (i) first reducing idiosyncratic shocks which are associated with withdrawing bank savings to fund investments, and (ii) secondly reducing risk associated with rate of return shocks, by diversifying portfolios risks to enable firms to invest in illiquid projects that are more productive in generating economic growth (see, Greenwood and Jovanovic, 1990; Levine, 1991; Pagano, 1993).

Stock markets protect shareholders from idiosyncratic liquidity shocks by allowing them to raise funds by selling stocks instead of withdrawing money from their bank accounts. This insurance benefit which shareholders enjoy allows listed companies to invest their funds in illiquid and more productive project to augment production and promote economic growth. The stock market also provides an avenue for more funds to be moved and liquidated quickly to enable households to share liquidity risk. The stock market allows listed companies to share risk associated with sectoral demand which results from specialization. This privilege then encourages companies to specialize even more, and the resulting increased specialization augments production and promotes economic growth. See (Levine, 1991; Saint-Paul, 1992).

Pagano (1993) using an AK model, demonstrates that financial development drives economic growth through three avenues, which are by increasing (i) the fraction of saving invested in firms, (ii) the social marginal product of capital, and (iii) the rate of private saving; although the effect of saving on economic growth in the model is ambiguous. This is because when financial development increases saving, it also increases investments which then augment economic growth. If, however, financial intermediation operating through insurance companies, banks and the stock exchange allows investors to share risks to reduce saving, then the resulting saving may also reduce investments, and hence economic growth. See Pagano (1993) and Greenwood and Jovanovic (1990). The effect of financial development on economic growth is therefore dependent on whether or not the country in question derives more saving from activities of financial intermediaries. As a result, the causal effect of financial development on economic growth or its reverse effect or feed-back effect or independence is better determined empirically for each country. It is this task that this study has undertaken for the three Caribbean countries, namely: Barbados, Jamaica and Trinidad-Tobago.

The question is which of these two phenomena -- supply-leading and demand-following -- described by Patrick (1966) empirically apply to the three Caribbean countries: Barbados, Jamaica and Trinidad-Tobago? The gross national income (GNI) using the World Bank's threshold of high income of July 2010 and 2013 were US$12,275 and US$12,745, respectively. This means that in 2013 both Barbados and Trinidad-Tobago which have GNI per capita of US$15,173 and US$20,622, respectively, are high-income countries, whereas the GNI per capita of Jamaica of US$5,100 during that period is classified as an upper-middle income country. Considering that although all three Caribbean countries generally have the same level of industrialization, their different income levels based on their GNI per capita classifications, will suggest that they exhibit varying demand-following and supplying-leading phenomena. It is therefore important to empirically verify whether financial development drives economic growth or vice versa as suggested by Patrick (1966) in these three Caribbean countries, noting that each finding entails different policy implications. Hopefully, policy implications from the study can also be applied in other countries that share their unique behavioural characteristics.

Thus, this is the only recent study on financial development (FD) and economic growth (EG) which employs six different FD proxies to capture their respective effect on EG in three Caribbean countries. Unlike previous studies which treated several countries as a homogenous group in panel studies within the framework of growth models, this study employs temporal and long-run Granger causality to adequately address dynamic effect of the variables. It is also the first time series study that uses both bounds tests and traditional unit roots test rather than relying solely on the latter to determine stationarity properties of each variable in a causality test. Unlike the few Granger causality studies that impose structural change periods a priori, we relied on the model to determine the structural break dates by using the Quandt and Andrews' (QA) method. It is the only study that provides robust results for three Caribbean countries and recommends policies to address their respective short-term and long-run development.

Following the introductory section, the rest of the study is organized into four sections. Section 2 contains a review of the literature. It is followed by the model and data employed in the study in Section 3. The empirical results are discussed in Section 4. The study is culminated with the summary of the findings and policy recommendations in Section 5.

2. LITERATURE REVIEW

Early empirical studies employed correlation to examine the relationships between financial development and economic growth. Among these early studies are Goldsmith (1969), McKinnon (1973) and Shaw (1973). They found a positive correlation between FD and EG. But finding the driver of causation between FD and EG cannot be determined from a positive correlation between them. This means that Patrick's (1966) supply-leading and demand-following phenomena cannot be determined from these early studies. There is, in fact, a need to conduct a Granger non causality test to unravel whether FD causes EG by enhancing the efficiency of investments (A) or by raising the rate of saving (s) or the proportion of saving rate that is invested (φ) (cf. Pagano, 1993).

The supply leading phenomenon observed was proposed by Goldsmith (1969) who argued that FD raises the efficiency of investment (A), whereas McKinnon (1973, 1993) explained the same outcome by arguing that FD increases the level of saving (s) and/or investment (φ). See also Pagano's (1993) analytical foundation of the Goldsmith and McKinnon-Shaw's analysis.

One of the pioneering causality studies between FD and EG, was Jung's (1986) paper which examined the behavioural causal relationships between FD and EG for 56 countries comprising of both DC and HDC (see also Fritz, 1984). He used annual data ranging from 1948 to 1981. His variables included currency outside the banking system (C), narrow money (M1) which comprised of C and demand deposits, broad money supply (M2), gross domestic product (GDP), and per capita real GDP (y). Although he recognized the significance of structural changes in a short sample period, he did not address it in his study (see Jung, 1986, 335-336). He employed currency ratio (C/M1) to capture qualitative financial development or financial structure which decreased when there were increased diversification of financial assets and liabilities, and extensive transactions were conducted in other forms of medium of exchange without using currency; and M2/GDP ratio as a monetization variable which captured substitution from real assets to financial assets. The latter variable also served as a financial intermediation variable, which measured quantitative financial development. Jung's quantitative study, which generally employed an annual sample of 15 years, found moderate support for supply-leading in DC, although in most of these findings, the dominant financial development proxy was defined by the currency ratio.

King and Levine (1993) studied whether FD regressor was significant in a cross-country growth model, to determine the importance of financial development in driving economic growth. They also employed correlation to determine the role of FD to EG by using initial income level, schooling, monetary, fiscal and trade variables as control variables. Their cross sectional study included 80 DC and HDC which span 1960-1989. They used four proxies for FD and defended their choice by the fact that since each financial indicator was defective using all four FD proxies provided better means to capture financial development functions, than relying on a single FD proxy. They also dismissed the idea of using a single FD composite variable by arguing that it would require weights which could not be easily constructed and defended. Their FD proxies were (a) liquid liability/GDP ratio which was a traditional measure of financial depth, with liquid liabilities capturing the size of financial intermediary system, and (b) BANK variable which was the ratio of deposit money bank assets to the sum of deposit money bank assets and domestic assets of a central bank. Thus, institutions providing financial intermediation services were differentiated by using credit allocated to deposit banks, as opposed to those allocated to a central bank. They also employed two variables to capture the distribution of assets by the financial system, although they were not precise on recipients of bank credit. These other two FD proxies were (c) PRIVATE which was the credit issued to nonfinancial private firms as a ratio of total credit net of banks' credit, and finally (d) PRIVY which was the same credit issued to nonfinancial private firms to GDP ratio.

They also employed three variables to capture economic growth. These were real per capita GDP, physical capital accumulation which was captured by investment to GDP ratio, and a Solow's residual variable or total factor product which was used to capture improvement in economic efficiency.

The problem between stock and flow issues that arise when liquid liability (LL), which is a stock variable that is measured usually by either M2 or M3, was resolved by converting the LL to a flow variable by using the average of $\overline{LL} = (LL_{t-1} + LL_t)/2$. Thus the $\overline{LL}/GDP$ ratio resolved the stock and flow difficulties. They computed their partial correlations with the average level of FD and average level of EG over the sample period. They split their countries into very fast growing, fast growing, slow growing and very slow growing. Their findings based on contemporaneous and lagged correlations between EG and FD proxies, and estimates of growth model where the FD proxies were included among the regressors of the EG regressands equations, after controlling for initial GDP, schooling, other core variables, to name a few, indicated that financial services stimulated economic growth, by increasing capital accumulation and improving the efficiency of capital usage in countries.

Calderón and Liu (2003) argued that their panel data used long time series of 35 years and more countries compared to King and Levine (1993). Their 109 countries also comprised of both DC and HDC. Their data included M2/GDP ratio, which was used to measure financial intermediaries; and credit provided by financial intermediaries, which was captured by bank credit to private sector as a ratio of GDP. They used the latter ratio to measure financial services which they termed as an aspect of financial intermediary development. Their general findings were that a long sample period revealed that FD causes EG. As a result, they concluded that the longer the sample period the larger the effect of FD causing EG.

Finally, they claimed that the literature existing before their study did not allow one to test for both FD causing EG and EG causing FD until their study. This was not because the causal technique did not exist, but rather that the literature they considered might have ignored to conduct such a causal test. Unfortunately, this claim cannot be true since Calderón and Liu's (2003) study was long preceded by Jung's (1986) study, which tested both Patrick's (1966) supply-leading and demand-following phenomena (see also Fritz, 1984; Demetriades and Hussein, 1996).

Christopoulos and Tsionas (2004) provided a panel study for 10 DC. They argued that unlike previous studies, their panel study employed vector autoregression model to deal with long-run and structural relationships between FD and EG, by accounting for thresholds. Results of their study did not show any threshold effects. Finally, they claimed that using a fully modified OLS estimator resolved the endogeneity problem which commonly plagued such panel studies. They found that generally FD causes EG in the long-run, although their panel study results could not be attributed to any specific countries.

In examining the roles banks and private credits play in resolving information asymmetries and transaction costs problems, King and Levine (1993) ignored the fact that the stock market resolves similar difficulties to spur economic growth. Levine and Zervos (1998) rectified this omission, by relying on the roles of both banks and stock market activities to ameliorate information asymmetries and reduce transaction costs problem to generate economic growth. However, their study suffered from both lack of consistency which emanated from using initial values of stock market and banking development variables, and loss of information which resulted from using average values. Additionally, their ordinary least squares (OLS) estimates were hampered by simultaneity bias, reverse causation bias, and absence of control variables problems. See Beck and Levine (2004).

According to Beck and Levine (2004), they rectified the econometrics shortcomings of Levine and Zervos' (1998) study by controlling for simultaneity bias, addressing excluded variable bias, and controlling for other growth determinants. They addressed business cycle shortcomings emanating from using annual or quarterly data, by using a five-year averaged interval data over the entire study sample, 1976-1998. They corrected the OLS estimation problem, by not only using a newly constructed panel system estimator which removes biases associated with difference panel estimator, but by also using several variants of system panel estimator such as the one-step panel estimator, two-step panel estimator, and a novel panel estimator to assess the diagnostics of their results.

Their main findings were that bank credit did not correlate with economic growth, even though economic growth correlated significantly with the turnover ratio, and the turnover ratio correlated with bank development. Their one step system estimator showed that both bank development and stock market development proxies, independently and simultaneously influenced economic growth significantly, although their effect on economic growth varied.

Thus, the aforementioned literature reviews convincingly show that the idea of finding the causal effect between financial development and economic growth, the primary objective of this study, is very important. Nonetheless, most of these studies reviewed that have concluded that financial development is an important driver to economic growth, based their findings on (endogenous) growth models, where financial development proxies were found to be significant regressors in economic growth equations. See (Bencivenga and Smith, 1991; King and Levine, 1993; Levine and Zervos, 1998; Beck and Levine, 2004). These studies have also found that the contribution of financial development to economic growth varied in DC and HDC.

These developments in the financial development and economic growth literature, have led some recent studies to seek a justification in modelling non-linear relationship(s) between financial development and economic growth. Unfortunately, these studies also fail to establish empirically which of the two variables drive the other. See (Shen et al., 2011; Rioja and Valev, 2004; Khan and Senhadji, 2003; Deidda and Fattouh, 2002; Greenwood and Jovanovic, 1990).

For instance, Deidda and Fattouh (2002) using King and Levine (1993) data, employed an endogenous growth (or a growth regression) model, where liquid liability/GDP ratio was used as a FD proxy, and economic growth was defined by the real per capita GDP, to study the relationship between FD and EG. They used a threshold model to express the non-linear relationships between FD and EG by splitting their data into low and high income countries. They found that low income countries (or DC) exhibit insignificant relationship between FD and EG, whereas the relationship between FD and EG is positive and significant for high income countries (or HDC). See also (Xu, 2000; Demetriades and Hussein, 1996).

Shen et al. (2011) employed a flexible non-linear growth model which comprised of linear and non-linear random field estimation parts[1] to study the relationships between FD and EG, over the period 1976-2005.They argued that it was best to allow the model to determine the nature of the non-linearity than to impose an a priori restrictions or non-linear relationship between the variables in such studies (see Hamilton, 2001; Huang and Lin, 2007). They used both stock market and bank development as proxies for FD. They captured bank development with liquid liability/GDP ratio and bank lending/GDP ratio, and stock market development with market capitalization/GDP ratio, stock transaction (or traded) to GDP ratio, and turnover ratio (which is also a stock market value traded to market capitalization ratio).

They found that banking-growth relationship was inverted U-shaped, while the stock market-growth relationship is asymmetric square root (√)-shaped. See also (Rioja and Valev, 2004; Khan and Senhadji, 2003; Deidda and Fattouh, 2002; and Xu, 2000). These findings were supported by an earlier study by Khan and Senhadji (2003) who obtained inverted √-shaped relationship between FD and EG. Other non-linear relationship between FD and EG studies which employed threshold models, found that the effect of FD on EG was uncertain in low income countries or DC, mild in high income countries or HDC, and strongest in middle income countries.

A shortcoming of Shen et al. (2011) and most non-linear models studies is the absence of structural form variables. As a result, their reduced form models failed to capture dynamics between or among bank and stock market development on economic growth, and their associated reverse dynamics or effects. Additionally, like most endogenous or growth regression models, they cannot determine the direction of causation, although endogeneity test can be used to rule out the endogeneity property of the regressors.

In our attempt to add to the literature without using endogenous growth models and their non-linear variant models, and to properly account for dynamics between FD and EG, and address reverse causation in previous studies, we have employed Granger causality technique to identify the direction of causation in both short-term and long-run, and to rectify the lack of dynamics between and among stock market and banking development proxies on economic growth for the three Caribbean countries in our study. We have employed bounds testing relationships developed by Pesaran et al. (2001) which does not require any pretesting of stationarity properties of the variables included in the study and performs well in under-sized samples in a time series analysis. See also Pesaran and Shin (1999). We have also addressed the absence of structural changes in most of the previous studies as recommended by Patrick (1966) and Jung (1986), and

[1] The non-linear random field estimation part, which does not require any a priori assumptions on the conditional mean of the model's random variables, capture non-linear relationship and curvature. See Hamilton (2001).

the unique characteristics of each country.

3. THE MODEL AND DATA

The basic m-vector time series Zt is expressed as the kth order vector autoregressive (VAR) model as

$$\Phi(L)Z_t = v_t,\ t = 1, \cdots, T, \tag{1}$$

where v_t is Gaussian i.i.d. errors with zero mean and variance-covariance matrix of $\Omega_v > 0$. L is the lag operator such that $L^i Z_t = Z_{t-i}$, and $\Phi(L)$ is the matrix of lag polynomial such that $\Phi(L) = I_k - \Sigma\Phi_i L^i$. $Z_t = [y_t, fd_t]'$ is 2×1 column vector of variables: y_t is the logarithmic form of per capita real GDP, and fd_t is a column vector of logarithmic form of real per capita financial development proxy variables which include credit claims on the private sector (cpsn), domestic credit (dcpn), liquid liabilities (llpn), market capitalization per GDP ratio (macpn), market turnover ratio (mtvpn), broad money (mpn), and quasi money (qmpn).

Equation (1) can have some unit roots but it cannot be explosive or have seasonal unit roots. The lag polynomial matrix, $\Phi(L)$, has a full column rank, r, where $0 \leq r < k - 1$, and m is the sample size. The elements of Z_t can be I(1), I(0) or mutually cointegrated. The optimum lag length of $\Phi(L)$ is k and it does not have any deterministic components. The $k \times k$ lag polynomial matrix $\Phi(L)$ can be factorized into vector error correction model (VECM) form as

$$\Phi(L) = \Delta\Phi * (L) + \Phi(1)L,$$

where $\Delta\Phi * (L) = \Phi(L) - \Phi(1)L$. The long-run multiplier matrix is $\Phi(1) = -\Pi$, and the short-term response lag polynomial matrix is $\Pi(L) - \Pi(1)L = \Gamma(L)$.

The VECM expression which addresses structural change dummy variables can be specified as

$$\Phi(L)Z_t = \Pi z_{t-1} + \Gamma\Delta Z_{t-i} + \mu D_t + v_t,\ i = 1, \cdots, k - 1, \tag{2}$$

D is structural change dummy variables which are determined for each model from Quandt (1960) and Andrews (1993) (QA) tests for unknown break points. The resulting structural change dummy $D \in \{D68, D69, D70, D71, D77, D81, D85, D86, D92, D95, D97, D01, D04\}$. Thus, for instance $D68 = \{1, 1968 - 2014;\ 0, otherwise\}$, $D69 = \{1, 1969 - 2014;\ 0, otherwise\}$ and $D04 = \{1, 2004 - 2014;\ 0, otherwise\}$.

Estimated parameters of Equation (1) in a bivariate model indicate that in the short-run fd uni-directionally Granger-causes y, if and only if, the null hypothesis (H_0): $\Phi_{21,j} = 0,\ \forall j \in 1, 2, \cdots, k$ (where $\Phi_{21,j}$'s are the coefficients of the manipulated variables) is rejected as judged by either Wald (W) test or modified W test or log-likelihood ratio (LR) test or Lagrange multiplier (LM) test (Granger, 1991; Mosconi and Giannini, 1992; Ghartey, 1993; Zapata and Rambaldi, 1997; Harvey, 1999; Juselius, 2006).[2] We have used F-test and W test. The W test is specified as

$$Wald\,Test \;=\; ((N-K)/q)((RSS_R - RSS_{UR})/SS_{UR}),$$

where N is the number of sample observations, K is the number of estimated parameters in unrestricted (UR) equation which includes the intercept and dummy variables, and q is the number of restricted (R) parameters, RSS is the residual sum of squares. W-test is a goodness of fit test which is used to test the significant levels of the zero restricted coefficients to validate causal direction (see Harvey, 1999).

Equation 2 can be rewritten in terms of the controlled variable y_t and the forcing or manipulated variable fd_t for time t as

$$\Delta y_t = \delta y_{t-1} + \mu' fd_{t-1} + \Sigma\gamma_i \Delta y_{t-i} + \Sigma\varphi_j \Delta fd_{t-j} + \xi_t, \quad (3)$$
$$i = 1,\cdots,k-1,\; j = 0,\cdots,k-1.$$

Equation (3) can be extended to include both intercept and trend. In the long-run, if we add a set of dummy variables and invoke a steady-state condition, then given that $\delta \neq 0$, and $\mu \neq 0$, Equation (3) can be expressed in cointegrated form as

$$\mathrm{y_t} = \theta' fd_t + \alpha' D_t + u_t, \quad (4)$$

where, θ and α are the long-run response parameters and u_t is iid with zero mean and white noise innovations. If we assume that $-1 \leq \delta < 0$, an indication that the long-run relations are stable, then equation 4 can be re-written in error-correction form as

$$\Delta y_t = \delta(y_{t-1} - \theta' fd_{t-1} - \alpha' D_{t-1}) + \Sigma\gamma_i \Delta y_{t-i} + \Sigma\varphi_j \Delta fd_{t-j} + \xi_t, \quad (5)$$
$$i = 1,\cdots,k-1,\; j = 0,\cdots,k-1.$$

There is no cointegration between y_t and fd_t if $\delta = 0$. Additionally, if $\delta \neq 0$ but $\theta = 0$, the long-run relationship between the variables y_t and fd_t will degenerate to render y_t non existing. Thus, Equation (5) is an ADL model in y_t and fd_t with k as lag orders and D_t as dummy variables which capture structural changes (see Pesaran et al., 2001). The asymptotic distribution of the test statistics are not changed by using different lag lengths for the manipulated variables of y_t and fd_t.

The general ADL(p,q)[3] model of Pesaran and Shin (1999) with dummy variables is

[2] F-test is our default joint test of zero restrictions.

[3] P and q denote optimal lag-lengths of the controlled and manipulated variables, respectively.

specified as

$$y_t = \theta f d_t + \tau' D_t + \Sigma\gamma_i y_{t-i} + \Sigma\varphi_j f d_{t-j} + \xi_t, \quad (6)$$
$$i = 1, \cdots, p;\ j = 0, \cdots, q;\ q \leq p.$$

The ADL (p,0) model with dummy variables is expressed as

$$y_t = \theta' f d_t + \tau' D_t + \Sigma\gamma_i y_{t-i} + \xi_t,\ \forall i = 1, \cdots, p. \quad (7)$$

The error-correction model of ADL (p, q) with dummy variables is expressed as

$$\Delta y_t = \delta(y_{t-1} - \theta' f d_{t-1} - \tau' D_{t-1}) + \Sigma\gamma_i \Delta y_{t-i} + \Sigma\varphi_j \Delta f d_{t-j} + \xi_t, \quad (8)$$
$$i = 1, \cdots, p;\ j = 0, \cdots, q.$$

Lag lengths p and q of the ADL model are chosen by using both Schwarz-Bayesian information criterion (SBC) and Akaike information criterion (AIC). Considering the under-sized sample nature of our data, we have imposed the assumption $p = 1$ and $q = 1$ to produce the ADL (1,1) model.

According to Pesaran and Shin (1999), the ADL is not amenable to structural changes and it is suitable for Granger causality test in level form. It does not require any detail information about the integration and cointegration properties of the variables. In fact the ADL model does not require the usual pretesting and differencing to ensure that the time series observations are stationary, as a precondition for Granger causality analysis. The ADL approach to cointegration is comparable to Phillips and Hansen's (1990) procedure, and performs better in under-sized samples.

A novel contribution of this paper to the literature on Granger causality analysis is the use of bounds testing relationships, instead of the traditional unit roots tests, to determine the level relationships among the set of regressors and regressands. See Pesaran et al. (2001, 289-290). The set of regressors and regressands are specified in level form for the Granger causality tests, if the calculated values of F- and W-statistics lie outside below the bounds of F-tests and W-tests critical values. The ADL model is specified in first difference form for the Granger causality tests, if both calculated values of F- and W-statistics lie beyond the bounds of both calculated F-tests and W-tests critical values; and finally, it is specified in error-correction form if the calculated values of F- and W-statistics lie within the critical values of the bounds. Thus, having employed the ADL bounds testing to determine the level relationships among the regressors and regressands, we then used the Hsiao's (1979) stepwise Granger causality test technique to determine the direction of the temporal causality, and validated the ensuing results with a goodness of fit test by using the W-test.

3.1 Data and Sources

In the literature on financial development and economic growth, although researchers stressed on stock and flow measurement differences, they often maintained the same variables as proxies for financial development. In light of the above, the financial development variables employed in our study are those commonly used as proxies for capturing financial development in most of the literature (see Jung, 1986; King and Levine, 1993; Demetriades and Hussein, 1996; Calderón and Liu, 2003).

Consequently, considering that most of our financial development proxy variables are stocks while most of our macroeconomic variables are flows, we have designed our stock variables data to capture the general flow concept, by using average stock variables from period t-1 to t to convert our stock variables into flow variables.[4] This means stock variables such as: liquid liabilities, broad money supply, quasi money, the values of stock traded, and market capitalization or the total values of listed shares in domestic stock markets are converted into flow variables by using averages discussed above. Hence, our set of financial development proxies include: broad money supply (M), quasi money (QM), liquid liabilities (LL), and stock market development proxies such as market capitalization (MCAP), and market turnover ratio (MTV). Thus, all of our stock variables are converted into flows to resolve the dichotomy between stock and flow concepts commonly found in such studies.

Economic growth is captured by gross domestic product (GDP). Both GDP and a set of financial development proxies are accounted for inflation and population growth. So all variables included in the study are expressed in real per capita terms, by deflating each variable by prices and population. The set of logarithmic form of real per capita financial development proxy variables are cpspn, dcpn, llpn, mcapn, mtvpn, and qmpn; and logarithmic form of real per capita GDP is ypn.

Structural changes, which are common features that may influence the outcomes of such studies, are addressed by using the QA test which allows the model to identify unknown structural break points are then used to address structural changes for each model of the three countries in the study. The dummy variables employed to capture these unknown structural changes, for each model of each country, are as follows: D68, D69, D70, D71, D77, D81, D85, D86, D92, D95, D97, D01, and D04; where for instance $D68 = \{1, 1968 - 2014;\ 0, otherwise\}$, and $D01 = \{1, 2001 - 2014;\ 0, otherwise\}$.

Sources of data employed in the study are mainly various issues of International Financial Statistics (IFS) published by the International Monetary Fund (IMF). It has the benefit of yielding the same concept of measurement for each of the countries considered in the study. Additionally, if even there were to be an error in measurement, the fact that the IMF is our common source of data will mean that any error will affect all the countries in the study equally. Furthermore, data from stock exchanges, which are compiled each day from open markets in each of the three countries, are also credible

[4] The under-sized sample nature of our data precludes the use of five-year averaged interval data to address business cycle shortcomings (cf. Beck and Levine, 2004).

and can be relied on to provide inference for the three countries under study, to inform policy.

Financial development and economic growth annual data is sourced from the website of the IMF's IFS, and stock market development data is sourced from Annual Reports of Barbados Stock Exchanges, Trinidad-Tobago Stock Exchanges, Bank of Jamaica, and websites of Bank of Trinidad-Tobago and The World Federation Exchanges. Although GDP and CPI data start from 1960 in all three countries, generally Barbados data covers 1966-2011, and both Jamaica and Trinidad-Tobago data covers 1960-2013. However, stock markets in these countries are relatively young. They were developed much later after their independence, so their data cover 1989-2009 in Barbados, 1969-2010 in Jamaica and 1980-2010 in Trinidad-Tobago.

4. DISCUSSION OF EMPIRICAL RESULTS

In Table 1, we have reported break dates of the unknown exogenous structural changes which were determined by the QA test for each model employed in the study for all three countries: Barbados, Jamaica and Trinidad-Tobago.[5] There were at least 14, 25 and 20 structural breaks compared for the stock market and economic growth models, and at most 30, 34 and 37 structural breaks compared for the rest of financial development and economic growth models in choosing the structural break dates for Barbados, Jamaica and Trinidad-Tobago models, respectively. According to Hansen's (1997) p-values all the structural break dates chosen are significant at 0.01 levels.

Following the tradition of Granger causality test, we determined the stationarity process of all variables employed in the study by conducting unit roots tests with both augmented Dickey-Fuller (ADF, 1979) test and Kwiatkowski, Phillips, Schmidt and Shin (KPSS, 1992) test. See results in Table 2. Results of the ADF test indicated that all the variables are stationary at degree unity for all three countries. However, stationarity results of the KPSS test are mixed for all three countries. Thus, according to the KPSS test results, mcapn is stationary at the level form for Barbados, capspn, llpn, and ypn are stationary at the level form for Jamaica, while dcpn, mcapn and ypn are stationary at the level form for Trinidad-Tobago. The rest of the variables are stationary in their first difference forms in all three countries. Thus, the KPSS test results indicate that all variables are not integrated at the same order for all three countries, even though the ADF test results indicate that they are all integrated at degree unity, and stationary in their first difference forms. We have therefore found it necessary to estimate the ADL model and use its associated bounds test to determine the level relationships between economic growth and respective financial development proxies in each model, since unlike the traditional unit roots test, the ADL estimates are more amenable to undersized

[5] A summary statistics of per capita economic growth and financial development variables are reported in the Appendix.

sample problem (see Pesaran et al., 2001).

Table 1. Determination of Unknown Structural Break Points

Model (ypn, fd): $ypn = \beta fd + c$	Slope Coefficients (β)	No. of breaks compared	Max LR/W F-Stats	Period Chosen
Barbados				
(ypn, cpspn)	1.041[0.00]*	30	66.757[0.00]*	2001(D01)
(ypn, dcpn)	3.899[0.00]*	29	48.769[0.00]*	1986(D86)
(ypn, llpn)	3.896[0.00]*	29	107.259[0.00]*	1995(D95)
(ypn, mcapn)	3.610[0.00]*	14	94.682[0.00]*	1997(D97)
(ypn, mpn)	1.025[0.00]*	30	112.017[0.00]*	2001(D01)
(ypn, qmpn)	1.044[0.00]*	30	127.017[0.00]*	1992(D92)
Jamaica				
(ypn, cpspn)	1.221[0.00]*	34	33.889[0.00]*	1969(D69)
(ypn, dcpn)	1.122[0.00]*	34	71.589[0.00]*	1971(D71)
(ypn, llpn)	1.108[0.00]*	25	47.522[0.00]*	1981(D81)
(ypn, mcapn)	0.892[0.00]*	28	177.99[0.00]*	1985(D85)
(ypn, mpn)	1.119[0.00]*	34	99.797[0.00]*	1969(D69)
(ypn, qmpn)	1.194[0.00]*	34	94.184[0.00]*	1968(D68)
Trinidad-Tobago				
(ypn, cpspn)	1.270[0.00]*	37	177.98[0.00]*	1969(D69)
(ypn, dcpn)	1.144[0.00]*	31	9.159[0.00]*	2004(D04)
(ypn, llpn)	1.153[0.00]*	35	153.652[0.00]*	1977(D77)
(ypn, mcapn)	1.201[0.00]*	20	125.974[0.00]*	1997(D97)
(ypn, mpn)	1.179[0.00]*	35	115.110[0.00]*	1977(D77)
(ypn, qmpn)	1.263[0.00]*	35	158.916[0.00]*	1970(D70)

Notes: Hansen's (1997) method is used to calculate the probability (p)-values reported in square brackets; * denotes significance at 0.01 levels. Both maximum LR F-statistics and W F-statistics produced similar results. Real per capita variables notations include: real per capita GDP (ypn), credit claims on the private sector (cpspn), domestic credits (dcpn), liquid liabilities (llpn), market capitalization per GDP ratio (mcapn), market turnover ratio (mtvpn), broad money supply (mpn), and quasi money (qmpn). All variables are expressed in logarithmic forms.

Consequently, we employed bounds tests obtained from the ADL estimates, after accounting for unknown exogenous structural changes for each model in Table 3, to determine the level relationship between respective financial development proxy variables and economic growth for each country in the study. Results of bounds testing in Table 3 showed that in Barbados, calculated F-statistics and W-statistics fell below their respective F-tests and W-tests bounds for models: (ypn, cpspn), (ypn, dcpn), (ypn, llpn), (ypn, mcapn) and (ypn, qmpn). Both calculated F-statistics and W-statistics fell within their respective bounds for only model (ypn, mpn). This suggests that whereas all the models in Barbados, with the exception of model (ypn, mpn), have level relationships, model (ypn, mpn) has inconclusive relationship. The traditional unit roots test results reported in Table 2 are therefore used to determine the stationarity properties of both ypn and mpn for the temporal Granger causality test in the study. See Table 5.

In Jamaica, the ADL estimates in Table 3 produced calculated F-statistics and W-statistics for models (ypn, cpspn), (ypn, dcpn) and (ypn, mcapn) which fell below their respective bounds, while those of models (ypn, llpn), (ypn, mpn) and (ypn, qmpn) fell above their respective bounds.

Therefore, for the temporal Granger causality test, we have specified variables included in models (ypn, cpspn), (ypn, dcpn) and (ypn, mcapn) in their level form. However, according to the bounds testing relationships approach because the paired variables in models (ypn, llpn), (ypn, mpn) and (ypn, qmpn) are integrated at degree unity, we have re-specified them in their first difference forms for the said test.

Table 2. Stationarity Properties of Real per Capita Income and Financial Development Proxy Variables

Variables	Level Form ADF(k=1)			First Difference Form ADF(k=1)		
	Barbados	Jamaica	Trinidad-Tobago	Barbados	Jamaica	Trinidad-Tobago
cpspn	1.663[0.97]	0.834[0.89]	1.266[0.94]	-4.002[0.00]*	-6.058[0.00]*	-3.911[0.00]*
dcpn	0.532[0.83]	1.999[0.99]	-0.385[0.54]	-10.412[0.00]*	-6.704[0.00]*	-3.247[0.00]*
llpn	2.828[0.99]	0.706[0.86]	1.543[0.97]	-4.422[0.00]*	-5.399[0.00]*	-3.586[0.00]*
mcapn	1.252[0.94]	3.036[0.99]	0.125[0.71]	-3.301[0.00]*	-4.036[0.00]*	-3.396[0.00]*
mpn	3.515[0.99]	1.503[0.96]	1.754[0.98]	-4.215[0.00]*	-6.266[0.00]*	-3.757[0.00]*
qmpn	3.390[0.99]	1.378[0.95]	1.880[0.98]	-4.488[0.00]*	-4.602[0.00]*	-2.254[0.02]**
ypn	1.882[0.98]	0.556[0.83]	0.858[0.89]	-4.606[0.00]*	-4.005[0.00]*	-5.596[0.00]*
	Level Form KPSS LM-Stat			First Difference Form KPSS LM-Stat		
cpspn	0.773	0.475	0.667	0.081	0.085	0.326
dcpn	0.791	0.672	0.206	0.500	0.397	0.362
llpn	0.761	0.571	0.683	0.168	0.182	0.143
mcapn	0.580	0.749	0.499	0.107	0.178	0.223
mpn	0.777	0.792	0.659	0.121	0.241	0.138
qmpn	0.806	0.812	0.680	0.077	0.275	0.205
ypn	0.802	0.570	0.331	0.223	0.087	0.090

Notes: Probability (p)-values are reported in square brackets and k denotes lag lengths. One-sided p-values from MacKinnon (1991) are used as critical values of the ADF tests. The KPSS tests: at 0.01, 0.05 and 0.10 significance levels have the following critical values: 0.739, 0.463 and 0.347, respectively, for the case of an intercept; and 0.216, 0.146 and 0.119, respectively, for the case of an intercept and trend. All variables are expressed in logarithmic forms. See also Tables 1.

Table 3. Bounds Tests of Long-run ADL Estimates of Real per Capita Income and Financial Development Proxy Variables after Accounting for Unknown Structural Changes

Regressands	Barbados	Jamaica	Trinidad-Tobago
cpspn	1.052 [0.00]*	1.342 [0.00]*	-2.932 [0.99]
D2001	-0.723[0.00]*		
D1969		-0.828 [0.01]*	29.996 [0.99]
F-Stats	2.529	1.275	0.040
Bounds	[[3.781, 5.031]]	[[10.007, 11.345]]	[[5.052, 5.797]]
W-Stats	5.058	2.551	0.081
Bounds	[[7.561, 10.063]]	[[10.007, 11.345]]	[[10.104, 11.593]]
N	42	48	51
ADL(j,k)	(1,1)	(1,0)	(1,1)
dcpn	4.883[0.00]*	0.963[0.00]*	-5.569[0.95]
D1986	-4.099[0.13]		
D2001		0.525[0.85]	
D2004			
F-Stats	1.327	1.049	10.140
Bounds	[[4.543, 5.538]]	[[3.733, 4.885]]	[[3.779, 4.882]]
W-Stats	2.654	2.097	20.280
Bounds	[[9.086, 11.077]]	[[7.467, 9.771]]	[[7.560, 9.764]]
N	39	48	14
ADL(j,k)	(1,0)	(1,0)	(1, 0)
llpn	3.911[0.00]*	0.946[0.92]	1.362[0.00]*
D1995	-3.196[0.05]**		
D1981		20.726[0.82]	
D1977			-1.460[0.12]
F-Stats	1.128	5.625	1.136
Bounds	[[4.121, 5.357]]	[[4.839, 5.610]]	[[4.702, 5.459]]
W-Stats	2.256	11.250	2.273
Bounds	[[8.242, 10.714]]	[[9.677, 11.219]]	[[9.403, 10.918]]
N	41	35	49
ADL(j,k)	(1,1)	(1,0)	(1,0)
mcapn	4.285[0.00]*	4.222[0.44]	1.397[0.00]*
D1997	1.266[0.96]		-1.947[0.00]*
D1985		-45.603[0.54]	
F-Stats	0.072	2.348	1.981
Bounds	[[4.692, 5.876]]	[[4.622, 5.510]]	[[4.410, 5.591]]
W-Stats	0.144	4.696	3.962
Bounds	[[9.384, 11.753]]	[[9.243, 11.020]]	[[8.820, 11.182]]
N	20	40	28
ADL(j,k)	(1,0)	(1, 0)	(1,0)
mpn	1.038[0.00]*	1.240[0.00]*	1.363[0.00]*
D2001	-0.752[0.00]*		
D1969		-0.976[0.00]*	
D1977			-1.244[0.12]
F-Stats	4.684	8.553	1.255
Bounds	[[3.781, 5.031]]	[[5.003, 5.672]]	[[4.702, 5.459]]
W-Stats	9.367	17.105	2.510
Bounds	[[7.561, 10.063]]	[[10.007, 11.345]]	[[9.403, 10.918]]
N	42	48	49
ADL(j,k)	(1,0)	(1, 0)	(1,0)

Table 3. Bounds Tests of Long-run ADL Estimates of Real per Capita Income and Financial Development Proxy Variables after Accounting for Unknown Structural Changes (Con't)

Regressands	Barbados	Jamaica	Trinidad-Tobago
qmpn	1.070[0.00]*	1.359[0.00]*	1.440[0.00]*
D1992	-0.752[0.00]*		
D1968		-1.251[0.00]*	
D1970			-1.377[0.06]***
F-Stats	1.691	9.211	1.086
Bounds	[[4.304, 5.428]]	[[5.049, 5.666]]	[[4.898, 5.577]]
W-Stats	3.383	18.421	2.172
Bounds	[[8.608, 10.857]]	[[10.098, 11.331]]	[[9.796, 11.154]]
N	42	48	49
ADL(j,k)	(1,0)	(1,1)	(1,0)

Notes: J is the lag length of endogenous variables, and k is the lag length of exogenous variables. Absolute p-values are reported in square brackets, and bounds critical values are reported in double square brackets. *, ** and *** denote significance at 0.01, 0.05 and 0.10 levels, respectively. See also Table 1.

Table 4. Determination of Level Relationships between Real per Capita Income and Real per Capita Financial Development Proxies from ADL Bounds Testing Relationships after Accounting for Structural Changes

Model	Barbados	Jamaica	Trinidad-Tobago
(ypn, cpspn)	Level	Level	Level
(ypn, dcpn)	Level	Level	First difference
(ypn, llpn)	Level	First difference	Level
(ypn, mcapn)	Level	Level	Level
(ypn, mpn)	Error correction model	First difference	Level
(ypn, qmpn)	level	First difference	Level

Notes: These relationships are determined from the results in Table 3. See also Table 1.

Table 5. Temporal Granger Causal Relationship between Real per Capita Economic Growth (EG) and Financial Development Proxies (FD) after Accounting for Unknown Structural Changes

Manipulated Variables	Controlled Variables	Exogenous Variables	Information Criteria AIC	SBC	Goodness of Fit Tests χ^2 Wald test for H0: zero restrictions	Causal Direction
Barbados						
ypnt-1	cpspn t-1	D2001	-2.160	-2.035	0.345[0.56]	FD ⇏ EG
ypnt-1		D2001	-2.211	-2.130		
cpspn t-1	ypn t-1	D2001	-1.671	-1.547	2.021[0.16]	EG ⇏ FD
cpspn t-1		D2001	-1.668	-1.585		
ypn t-1	dcpn t-1	D1986	-2.112	-1.984	0.134[0.71]	FD ⇏ EG
ypn t-1		D1986	-2.183	-2.101		
dcpn t-1	ypn t-1	D1986	0.894	1.022	43.924*[0.00]	EG ⇒ FD
dcpn t-1		D1986	1.640	1.725		
ypn t-1	llpn t-1	D1995	-2.224	-2.099	2.076[0.16]	FD ⇏ EG
ypn t-1		D1995	-2.163	-2.082		
llpn t-1	ypn t-1	D1995	-1.968	-1.843	2.276[0.14]	EG ⇏ FD
llpn t-1		D1995	-1.959	-1.875		
ypn t-1	mcapn t-1	D1997	=2.151	-2.002	0.069[0.80]	FD ⇏ EG

Table 5. Temporal Granger Causal Relationship between Real per Capita Economic Growth (EG) and Financial Development Proxies (FD) after Accounting for Unknown Structural Changes (Con't)

Manipulated Variables	Controlled Variables	Exogenous Variables	Information Criteria AIC	SBC	Goodness of Fit Tests χ^2 Wald test for H0: zero	Causal Direction
Barbados						
ypn t-1		D1997	-2.166	-2.085		
mcapn t-1	ypn t-1	D1997	0.684	0.833	6.545**[0.02]	EG ⇒ FD
mcapn t-1		D1997	0.909	1.009		
Δypn t-1	Δmpn t-1	D2001	-2.281	-2.155	6.995[0.00]	FD ⇒ EG
Δypn t-1		D2001	-2.186	-2.104		
Δmpn t-1	Δypn t-1	D2001	-1.999	-1.874	0.551[0.46]	EG ⇏ FD
Δmpn t-1		D2001	-2.034	-1.950		
ypn t-1	qmpn t-1	D1992	-2.138	-2.014	0.168[0.68]	FD ⇏ EG
ypn t-1		D1992	-2.171	-2.091		
qmpn t-1	ypn t-1	D1992	-1.810	-1.686	3.563**[0.05]	EG ⇒ FD
qmpn t-1		D1992	-1.770	-1.687		
Jamaica						
ypnt-1	cpspn t-1	D1969	-2.888	-2.771	0.539[0.47]	FD ⇏ EG
ypnt-1		D1969	-2.994	-2.919		
cpspn t-1	ypn t-1	D1969	-0.648	-0.531	6.964*[0.01]	EG ⇒ FD
cpspn t-1		D1969	-0.545	-0.467		
ypn t-1	dcpn t-1	D1971	-2.877	-2.760	0.021[0.88]	FD ⇏ EG
ypn t-1		D1971	-2.995	-2.921		
dcpn t-1	ypn t-1	D1971	-1.163	-1.046	10.670*[0.00]	EG ⇒ FD
dcpn t-1		D1971	-0.992	-0.914		
Δypn t-1	Δllpn t-1	D1981	-3.159	-3.041	0.237[0.63]	FD ⇏ EG
Δypn t-1		D1981	-3.278	-3.203		
Δllpn t-1	Δypn t-1	D1981	-3.052	-2.918	1.121[0.29]	EG ⇏ FD
Δllpn t-1		D1981	-1.877	-1.787		
ypn t-1	mcapn t-1	D1985	-2.849	-2.722	0.108[0.74]	FD ⇏ EG
ypn t-1		D1985	-2.998	-2.924		
mcapn t-1	ypn t-1	D1985	0.533	0.660	11.237*[0.00]	EG ⇒ FD
mcapn t-1		D1985	0.749	0.833		
Δypn t-1	Δmpn t-1	D1969	-3.159	-3.041	2.164[0.14]	FD ⇏ EG
Δypn t-1		D1969	-3.249	-3.174		
Δmpn t-1	Δypn t-1	D1969	-1.410	-1.292	0.237[0.63]	EG ⇏ FD
Δmpn t-1		D1969	-1.447	-1.368		
Δypn t-1	Δqmpn t-1	D1968	-3.160	-3.043	0.360[0.55]	FD ⇏ EG
Δypn t-1		D1968	-3.249	-3.174		
Δqmpn t-1	Δypn t-1	D1968	-1.399	-1.281	2.202[0.14]	EG ⇏ FD
Δqmpn t-1		D1968	-1.434	-1.355		
Trinidad-Tobago						
ypnt-1	cpspn t-1	D1969	-1.564	-1.451	1.782[0.19]	FD ⇏ EG
ypnt-1		D1969	-1.585	-1.510		
cpspn t-1	ypn t-1	D1969	-2.012	-1.899	29.476*[0.00]	EG ⇒ FD
cpspn t-1		D1969	-1.573	-1.497		
Δypn t-1	Δdcpn t-1	D2004	-1.515	--1.389	0.680[0.19]	FD ⇏ EG
Δypn t-1		D2004	-1.615	-1.540		
Δdcpn t-1	Δypn t-1	D2004	3.572	3.699	37.609[0.00]	EG ⇒ FD
Δdcpn t-1		D2004	4.224	4.308		
ypn t-1	llpn t-1	D1977	-1.387	-1.263	0.034[0.85]	FD ⇏ EG
ypn t-1		D1977	-1.616	-1.542		
llpn t-1	ypn t-1	D1977	-1.525	-1.409	7.266*[0.00]	EG ⇒ FD
llpn t-1		D1977	-2.172	-2.095		

Table 5. Temporal Granger Causal Relationship between Real per Capita Economic Growth (EG) and Financial Development Proxies (FD) after Accounting for Unknown Structural Changes (Con't)

Manipulated Variables	Controlled Variables	Exogenous Variables	Information Criteria AIC	SBC	Goodness of Fit Tests χ^2 Wald test for H0: zero	Causal Direction
Trinidad-Tobago						
ypn t-1	mcapn t-1	D1997	-1.265	-1.123	0.732[0.40]	FD ⇏ EG
ypn t-1		D1997	-1.591	-1.517		
mcapn t-1	ypn t-1	D1997	0.337	0.479	13.302[0.00]*	EG ⇒ FD
mcapn t-1		D1997	0.692	0.787		
ypn t-1	mpn t-1	D1977	-1.530	-1.414	0.261[0.61]	FD ⇏ EG
ypn t-1		D1977	-1.616	-1.542		
mpn t-1	ypn t-1	D1977	-2.079	-1.963	3.820*[0.05]	EG ⇒ D
mpn t-1		D1977	-2.039	-1.962		
ypn t-1	qmpn t-1	D1970	-1.541	-1.425	2.176[0.14]	FD ⇏ EG
ypn t-1		D1970	-1.585	-1.510		
qmpn t-1	ypn t-1	D1970	-2.269	-2.153	18.225*[0.00]	EG ⇒ FD
qmpn t-1		D1970	-1.892	-1.815		

Notes: P-values are reported in square brackets; *, ** and *** denote significance at 0.01, 0.05 and 0.10 levels, respectively. Notation ⇒ denotes Granger causality, and ⇏ denotes non Granger causality. Thus, EG ⇒ FD means EG Granger causes FD, and FD ⇏ EG means FD does not Granger causes EG, where EG is economic growth and FD is financial development.

In Trinidad-Tobago, with the exception of model (ypn, dcpn), both variables included in each model have their calculated F-statistics and W-statistics falling below their respective bounds. Only calculated F-statistics and W-statistics of model (ypn, dcpn) fell above its bounds. Thus, with the exception of the paired variables in model (ypn, dcpn) which are integrated at degree unity and are therefore specified in their first difference form for the temporal Granger causality test, the paired variables in the rest of the bivariate models have level relationships so their temporal Granger causality test is conducted in their level form. Summary results of the level relationships between economic growth and respective financial development proxy variables in each model determined from Pesaran et al. (2001) bounds testing relationships have been reported in Table 4. Those results are used to specify the paired variables in each model for the temporal Granger causality tests in Table 5.

Information criteria from both AIC and SBC have been employed to determine the direction of the temporal Granger causality tests for both manipulated and controlled variables in each model, after accounting for unknown exogenous structural changes in Table 5. We have assumed an optimal lag length of unity for the entire study because of our under-sized sample data. Both AIC and SBC results from univariate and bivariate models are compared as suggested in Hsiao's stepwise Granger causality test method to ascertain the causal direction between each of the financial development proxies and economic growth. Subsequently, the H0 of zero restrictions imposed on manipulated variables from ensuing results are then validated by the goodness of fit tests by using Wald's statistics (χ^2 Wald) in Table 5. See Ghartey (1993).

Results of temporal Granger causality test in Table 5 show that in Barbados financial development proxy variables defined by either cpspn or llpn are unrelated to ypn. However, ypn uni-directionally Granger causes financial development proxy variables defined by either dcpn or mcapn or mpn or qmpn. Thus, Barbados experiences demand-following phenomenon in the short-term. See (Calderón and Liu, 2003; Patrick, 1966; Pagano, 1993) for similar empirical findings and theoretical reasons.

In Jamaica, economic growth and financial development are independent when the latter proxy is defined by either llpn or mpn or qmpn. However, we find that ypn uni-directionally Granger causes financial development defined by either cpspn or dcpn or mcapn. Thus, Jamaica experiences the same demand-following in the short-term just as Barbados.

In Trinidad-Tobago, results are more robust judging by either the size of coefficients or significance levels of the p-values of Wald tests. Results in Table 5 indicate that ypn uni-directionally Granger causes financial development proxies defined by either cpspn or dcpn or llpn or mcapn or mpn or qmpn.

Thus, in the short-run all three Caribbean countries demonstrate Patrick's (1966) demand-following phenomenon, with results being overwhelming in Trinidad-Tobago, although there is a hint on supply-leading phenomenon from a single case of financial development proxy defined by mpn in Barbados. Similar results are observed by Calderón and Liu (2003), Saint Paul (1992) and the reasons behind such findings can also be found in Lewis (1978), Robinson (1979) to name two.

Long-run weak exogeneity results reported in Table 6 for all three countries are inferred from the significance of their respective error-correction terms or factor loadings. Over the long-run, with the exception of a single case where ypn uni-directionally Granger causes financial development proxy defined by cpspn in Barbados; financial development proxy defined by either llpn or mcapn or mpn or qmpn uni-directionally Granger causes ypn. Only financial development proxy defined by dcpn is unrelated to ypn as its error-correction term is explosive even though it has the correct sign.

Thus, the supply-leading phenomenon is predominant over the long-run in the country. It is consistent with what was observed by Calderón and Liu (2003), who explained the supply-leading phenomenon by the fact that it takes longer for financial development to impact economic growth. It should be noted that their sample covered 1960-1994. Christopoulos and Tsionas (2004) study which did not find any short-term causal relationship between financial development and economic growth, also observed similar supply-leading phenomenon finding in developing countries over the long-run by using error-correction model, although their sample covered 1970-2000.

In Jamaica, the significance of respective error-correction terms show that over the long-run, ypn uni-directionally Granger causes financial development proxies defined by either cpspn or dcpn or llpn or mcapn or qmpn. Only financial development proxy defined by mpn and ypn are independent. Thus, there is a strong evidence of demand-following phenomenon in both short-term and long-run in the country; a characteristic which Patrick (1966) attributes to be the expected experience of most HDC. See Greenwood and Jovanovich (1990).

Table 6. Long-Run Weak Exogeneity Tests after Accounting for an Unknown Exogenous Structural Change

Manipulated Variables	Controlled Variables	Exogenous Variables	EC Terms	Causal Direction
Barbados				
cpspn	ypn	D2001	-0.245[2.158]*	EG ⇒ FD
ypn	cpspn	D2001	0.001[0.016]	FD ⇏ EG
dcpn	ypn	D1986	-1.453[5.293]	EG ⇏ FD
ypn	dcpn	D1986	-0.055[1.003]	FD ⇏ EG
llpn	ypn	D1995	0.017[0.495]	EG ⇏ FD
ypn	llpn	D1995	-0.256[3.371]*	FD ⇒ EG
mcapn	ypn	D1997	-0.105[0.460]	EG ⇏ FD
ypn	mcapn	D1997	-0.609[3.395]*	FD ⇒ EG
mpn	ypn	D2001	-0.054[0.643]	EG ⇏ FD
ypn	mpn	D2001	-0.287[2.654]*	FD ⇒ EG
qmpn	ypn	D1992	-0.160[1.460]	EG ⇏ FD
ypn	qmpn	D1992	-0.367[2.690]*	FD ⇒ EG
Jamaica				
cpspn	ypn	D1969	-0.546[3.927]*	EG ⇒ FD
ypn	cpspn	D1969	0.010[0.450]	FD ⇏ EG
dcpn	ypn	D1971	-0.107[2.082]*	EG ⇒ FD
ypn	dcpn	D1971	-0.018[0.689]	FD ⇏ EG
llpn	ypn	D1981	-0.478[2.830]*	EG ⇒ FD
ypn	llpn	D1981	-0.062[0.797]	FD ⇏ EG
mcapn	ypn	D1985	0.083[2.640]*	EG ⇒ FD
ypn	mcapn	D1985	-0.114[1.933]	FD ⇏ EG
mpn	ypn	D1969	-0.142[1.509]	EG ⇏ FD
ypn	mpn	D1969	-0.043[1.656]	FD ⇏ EG
qmpn	ypn	D1968	-0.150[1.967]*	EG ⇒ FD
ypn	qmpn	D1968	-0.035[1.267]	FD ⇏ EG
Trinidad-Tobago				
cpspn	ypn	D1969	-0.225[4.234]*	EG ⇒ FD
ypn	cpspn	D1969	-0.005[0.068]	FD ⇏ EG
dcpn	ypn	D2004	-0.734[2.862]*	EG ⇒ FD
ypn	dcpn	D2004	-0.330[3.082]*	FD ⇒ EG
llpn	ypn	D1977	-0.062[1.701]	EG ⇏ FD
ypn	llpn	D1977	-0.181[1.993]*	FD ⇒ EG
mcapn	ypn	D1997	-0.288[1.265]	EG ⇏ FD
ypn	mcapn	D1997	-0.350[3.006]*	FD ⇒ EG
mpn	ypn	D1977	-0.076[1.726]	EG ⇏ FD
ypn	mpn	D1977	-0.200[2.105]*	FD ⇒ EG
qmpn	ypn	D1970	-0.173[2.815]*	EG ⇒ FD
ypn	qmpn	D1970	-0.046[0.518]	FD ⇏ EG

Notes: T-ratios are reported in square brackets. Causal direction is denoted by ⇒, and ⇏ denotes no causation. Thus EG ⇒ FD means EG causes FD, where EG is economic growth and FD is financial development, and FD ⇏ EG means FD does not cause EG. *, ** and *** denote significance at 0.01, 0.05 and 0.10 levels, respectively.

On the other hand, unlike Barbados and Jamaica, long-run results of Trinidad-Tobago show a feed-back relationship between ypn and financial development proxy defined by dcpn. There are three cases of supply-leading phenomena, where financial development proxies defined by either llpn or mcapn or mpn uni-directionally Granger causes ypn; and two cases of demand-following phenomena where ypn uni-directionally Granger causes financial development proxies defined by either cpspn or qmpn over the period.

Thus, the long-run weak exogeneity test results in Table 6 also indicate to a larger extent that the demand-following phenomenon is satisfied in all three Caribbean countries. Although the finding is predominant in Jamaica, it is weakest in Barbados where there is only a single case of demand-following phenomenon, and four cases of supply-leading phenomena. However, these long-run results are nearly mixed in Trinidad-Tobago where there is a single case of feed-back relationship, three cases of supply-leading phenomena and two cases of demand-following phenomena.

5. CONCLUSION

The paper examines the role of financial development and economic growth in Barbados, Jamaica and Trinidad and Tobago. Structural break points are determined by using the Quandt-Andrews method for all financial development proxies and economic growth. Pairing each of the financial development proxies with economic growth resulted in each model picking different periods as structural break points. This means that it is important to address structural changes in such studies as suggested by Patrick (1966) and Jung (1986). Additionally, we find that it is inappropriate to pick structural break date(s) a priori to address structural change(s) in such studies. This is evident from the fact that different models picked different structural break dates.

Temporal Granger causality tests conducted by using the stepwise Granger causality method, addressing respective unknown exogenous structural changes for each model, determining the optimal lag-length from an a priori imposed maximum lag-length of four, and using the traditional unit roots tests to determine the stationarity properties of all variables, failed to produce any significant results in determining the causal direction between economic growth and financial development in all three countries. However, by using bounds testing approach to determine the level relationships between economic growth and each respective real financial development proxies, after accounting for respective unknown exogenous structural changes in each model, show that to a larger extent, economic growth drives real financial development in the short-run in all three countries, with Trinidad-Tobago's results being more robust and overwhelming.

In particular, over the short-term, we observe a single case where financial development Granger causes economic growth, three cases where economic growth Granger causes financial development, and two cases where economic growth and financial development are unrelated in Barbados. In Jamaica, over the same period, there were three cases of economic growth Granger causing financial development and three cases where both variables are unrelated; whereas in Trinidad-Tobago, economic growth Granger causes all six financial development proxies. Thus, the demand-following phenomenon holds in the short-term in all three countries, but is more dominant in Trinidad-Tobago; a finding which according to Patrick is consistent with the expected behavior of HDC.

Long-run weak exogeneity tests from respective factor loadings indicate four cases of supply-leading phenomena, one case of demand-following phenomenon, and one case of independence in Barbados. However, in Jamaica there are five cases of demand-following phenomena, and a single case of independence. In Trinidad-Tobago, the results are nearly mixed. There is a single case of feedback causal relationship, two cases of demand-following phenomena and three cases of supply-leading phenomena.

Policy implications are the same for all three countries in the short-term, as they exhibit predominantly demand-following phenomena which suggest that their governments should direct national resources to provide policy incentives to enhance their broader economic growth, and not favor their financial market development with special incentives. Similar policy is recommended for Jamaica in the long-run. However, in Barbados the predominant supply-leading phenomenon finding suggests that the country could benefit if national resources are used to provide incentives to enhance its financial market development. In Trinidad-Tobago, the long-run mixed results from both supply-leading and demand-following phenomena suggest that national resources can be used to provide incentives to enhance their overall growth, and also to boost their financial market development.

Additionally, considering that stock market in all three countries are relatively young, and more so for Barbados and Trinidad where the stock market proxy for financial development drives the long-run economic growth, providing special incentives to assist their stock market development will benefit both countries over the long-run.

APPENDIX

Table A1. Summary Statistics

Barbados	CPSPN	DCPN	LLPN	MCAPN	MPN	QMPN	YPN
Barbados							
Mean	1.21E+08	1.21E+08	149.7784	292.5859	1.70E+08	1.21E+08	2.48E+08
Median	97313898	97313898	129.1608	226.3750	1.39E+08	99401859	2.35E+08
Maximum	2.77E+08	2.77E+08	361.2279	920.6219	4.54E+08	3.29E+08	3.88E+08
Minimum	45278049	45278049	72.36342	33.31187	61026936	34620398	1.15E+08
Std. Dev.	63394998	63394998	72.22371	261.7208	1.08E+08	77563188	75010480
Skewness	1.270555	1.270555	1.184811	0.922685	1.363795	1.245331	0.343276
Kurtosis	3.597977	3.597977	3.567616	2.974758	3.626332	3.431038	2.105794
Jarque-Bera	12.20988	12.20988	10.39027	2.980276	14.03240	11.44730	2.383043
Probability	0.002232	0.002232	0.005543	0.225342	0.000897	0.003268	0.303759
Sum	5.19E+09	5.19E+09	6290.693	6144.305	7.31E+09	5.22E+09	1.11E+10
Sum Sq. Dev.	1.69E+17	1.69E+17	213866.9	1369955.	4.86E+17	2.53E+17	2.48E+17
Observations	43	43	42	21	43	43	45
Jamaica							
Mean	844.1472	1598.466	1699.261	0.001469	1588.434	1019.700	3698.999
Median	868.8980	1698.014	1731.543	0.000837	1514.295	984.5047	3747.138
Maximum	1366.667	3049.109	2340.297	0.006935	2457.581	1804.095	4922.179
Minimum	362.3516	258.7043	931.8917	6.28E-05	477.7168	237.0427	2346.202
Std. Dev.	259.8812	697.5494	409.8222	0.001725	579.1181	428.3133	767.7127
Skewness	0.026751	-4.48E-05	-0.062083	1.591281	-0.232416	0.125953	-0.167650
Kurtosis	2.124498	2.271718	1.918281	4.708944	1.810900	2.237582	1.810493
Jarque-Bera	1.570790	1.082889	1.778301	22.29238	3.327972	1.316341	3.436543
Probability	0.455940	0.581907	0.411005	0.000014	0.189383	0.517798	0.179376
Sum	41363.21	78324.82	61173.38	0.060212	77833.29	49965.31	199745.9
SumSq. Dev.	3241835.	23355607	5878399.	0.000119	16098135	8805709.	31237290
Observations	49	49	36	41	49	49	54
Trinidad-Tobago							
Mean	206.5196	153.3235	341.6193	0.000388	297.9503	208.0526	806.1990
Median	204.8372	191.0115	345.9976	0.000215	290.9669	222.0908	702.0905
Maximum	402.6580	337.8387	680.5091	0.001380	676.8100	454.0047	1574.565
Minimum	39.39524	-136.1338	108.7759	3.58E-05	102.0544	49.05178	471.1742
Std. Dev.	100.1614	131.1364	155.7866	0.000401	134.4764	96.81947	279.5409
Skewness	-0.032626	-0.667248	0.097842	1.115884	0.469114	0.094700	0.756535
Kurtosis	2.122879	2.446234	2.122284	3.104882	2.906014	2.540410	2.588365
Jarque-Bera	1.676132	4.436018	1.684744	6.031744	1.852304	0.514783	5.532358
Probability	0.432546	0.108826	0.430688	0.049003	0.396075	0.773066	0.062902
Sum	10739.02	7819.500	17080.97	0.011266	14897.51	10402.63	43534.74
Sum Sq. Dev.	511647.5	859838.3	1189203.	4.49E-06	886111.8	459326.5	4141585.
Observations	52	51	50	29	50	50	54

Notes: Real per capita credit claims on the private sector (CPSPN), domestic credit (DCPN), liquid liabilities (LLPN), market capitalization per GDP ratio (MCAPN), broad money (MPN), quasi money (QMPN), and real per capita GDP (YPN).

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