Finance and Growth Causality: A Test of the Patrick's Stage-of-Development Hypothesis

Yanique Carby
Summer Intern
Research and Economic Analysis Department
Central Bank of Barbados, BARBADOS
&
Postgraduate Student
University of the West Indies
St. Augustine Campus, TRINIDAD AND TOBAGO

Roland Craigwell
Professor of Economics
University of the West Indies
Cave Hill Campus, BARBADOS
&
Research Associate
Research and Economic Analysis Department
Central Bank of Barbados, BARBADOS

Allan Wright
Senior Economist
Research and Economic Analysis Department
Central Bank of Barbados, BARBADOS

Anthony Wood
Lecturer
University of the West Indies
Cave Hill Campus, BARBADOS

Abstract

This paper uses the financial system of Barbados over the period 1946 to 2011 to test the hypothesis of Patrick (1966) which states that the direction of causality between financial development and economic growth changes over the course of development. That is, at the early stage of development, the supply-leading impetus is evident but as real growth occurs in the economy, it will spark demand for financial services. The results from the Vector Error Correction Mechanism (VECM)/Vector Autoregression (VAR) models do not lend support for this thesis.

Keywords: Vector error correction process, vector autoregression process, financial development, economic growth, causality

JEL No: C51, E44, G00, O16

1. Introduction

In 1966 Patrick came up with the idea that the relationship between finance and growth could vary over time. In particular, at the initial stage, financial development will lead economic growth; however as real growth takes place in the economy, this link becomes of lesser importance and growth will induce the demand for greater financial services.

This hypothesis has proven difficult to test especially in developing countries since it requires a long data set to split the sample accordingly. The early studies by Stammer (1972) and Jung (1986) that tried to validate this theory suffered from this information deficiency. As such, Jung (1986) tested Patrick's hypothesis by looking at both developed and developing countries and observed the frequency of a particular financial development-growth relationship in one classification of countries as opposed to the other, rather than within the same country. Stammer's (1972) analysis was a case study on industrialized Hong Kong. This paper proposes to test the stage-of-development hypothesis of Patrick using data from the small open Caribbean economy of Barbados. Barbados is important not only because it is one of the few countries that has a long data series (1946-2011) but also as a result of its fairly well developed financial sector. Wood (2012), Bynoe-Mayers and Craigwell (2002) and Haynes (1995) noted that most economic transactions in Barbados are monetized and the financial system has proven to be a relatively efficient conduit of funds between savers and spenders. Thus, analyzing the causality which exists between finance and economic growth is very important since if it is established that financial sector development causes economic growth, the focus on financial development would then be well warranted and the country could continuously look to the financial sector as a source of its growth.

As with Stammer (1972) and Jung (1986), the two previous Caribbean studies that examined the Patrick's thesis (Wood, 1993 and Lorde and Iyare, 2004) would have been affected by data limitations. Wood (1993) used data from 1946 to 1990 while Lorde and Iyare (2004) information span was between the 1960s and 2000. In addition, both Caribbean articles, which found no support for Patrick hypothesis, applied a single-equation variant of the Granger causality method due to Hsiao (1979, 1981). The problem with this approach is that by treating the equations for finance and growth separately it runs the risk of having simultaneous equation bias which could make inferences invalid. This study improves on these two papers and the general literature by applying: (1) a simultaneous equation Vector Autoregression (VAR)/Vector Error Correcting Mechanism (VECM) methodology instead of the single equation Hsiao technique; and (2) an updated data set to 2011 to test the Patrick's stage-of-development hypothesis in the Barbadian economy.

The variables used are the ratios of M2 and credit to GDP respectively as measures of financial development and real GDP (1974 prices) as an indicator of economic growth. With the length of these series covering over six decades they are split into three periods: pre-independence (1946-1966), post-independence to pre-liberalization (1967-1990) and post-liberalization (1991-2011). Pre-independence can be classified as the time in which the country was controlled by the colonial power. Post-independence saw an independent financial system and an attempt to give the market the authority to determine who gets and grants credit, and at what price, that is, financial liberalization. In essence the latter process generally permits a greater degree of financial depth which translates into greater financial intermediation among savers and investors. This in turn increases the monetization of an economy, resulting in a more efficient flow of resources. Patrick's stage-of-development hypothesis posits that at the early stage of development (which would be pre-independence), finance leads economic growth; but as real growth occurs in the economy, it will spark financial development which changes the relationship. Therefore, the *prior* expectation if this hypothesis holds is to see a supply-leading relationship in the pre-independence period, then demand-following in subsequent periods.

The rest of paper is divided into four sections: Section 2 gives a review of the relevant literature; Section 3 explores the methodology employed as well as the description of the data used. The empirical tests follow in Section 4 accompanied by their interpretation; and a conclusion is then made in the final section.

2. Literature Review

Patrick's stage-of-development hypothesis involves both a "supply-leading" and a "demand-following" phenomenon. The "supply-leading thesis" postulates that the development of the financial system will lead to economic growth while the "demand-following hypothesis" posits that as real growth takes place in the economy, it will spark the demand for financial services. Furthermore, researchers assert that a feedback relationship may exist between financial development and economic growth. This literature review begins by discussing the relationship between financial development and economic growth at the theoretical level. The studies which have sought to test these theories are then surveyed. Given that this latter evidence is quite voluminous, the concentration here will be on developing countries, especially the Caribbean. The final part of this section will look at the paucity of empirical work that assessed the Patrick's hypothesis.

2.1 Theory

Economists have been interested in the finance-growth link for a long time. Yet, there seems to be no consensus on the matter. Dating back to Schumpeter (1911), the importance of financial services in promoting economic growth had been emphasized. McKinnon (1973) and Shaw (1973) also suggested the critical role that financial intermediation has for stimulating economic growth. Others (Adams, 1819; Robinson, 1952; Hicks, 1969; Demetriades and Hussein, 1996) are not convinced that finance strengthens economic growth and note that financial development follows economic growth. Robinson (1952) notes that "where enterprise leads finance follows" (p. 86). As such, this school of thought which purports that growth leads finance is based on the premise that financial development is as a result of the demand for financial services which comes about as the economy develops.

Demetriades and Hussein (1996) point out that support for this demand-following hypothesis can also be found in the work on money demand by Friedman and Schwartz (1963). They rationalize this view by realizing that a regular measure of financial development (the ratio of the broad money stock to nominal GDP) is the inverse of the velocity of circulation of the broad money stock, and viewing the services rendered by money balances as a luxury, then any positive association between financial development and real gross domestic product (GDP) per capita may simply reflect an income elasticity which is greater than unity. As such, the direction of causation would run from real GDP to financial development, through the demand for money (p. 2-3).

The stronger arguments though seem to be in favour of the fact that finance is important in facilitating economic growth as evident in the theories put forward in the various growth models - the classical, the neo-classical and the endogenous theory. For example, the Harrod-Domar (1946) classical growth model for a closed economy puts forth that the ratios of national savings and national capital-output stimulate the growth rate of gross national product (GNP). As such, the expansion of new capital stock through investment takes place only when these economies save a portion of their national income. This new investment generated through savings will lead to economic growth. The Harrod-Domar growth model was extended to open economies by Kennedy (1966), with savings having similar implications. Another popular classical work is that of Schumpeter (1911) which purports that financial intermediaries, in carrying out their financial services - such as mobilizing savings, evaluating projects, managing risks, monitoring managers and facilitating transactions - are essential for technological innovation and economic growth.

The second category of growth theories is that of the neo-classical which by considering productivity, capital accumulation, population growth and technological progress, sought to explain long-run economic growth. In Solow's (1956) growth model, the importance of savings and capital investment in promoting economic growth is emphasized. His premise was that the capacity of the economy can be expanded if society saved part of their resources and used it to build into the future. Another contribution to the neo-classical growth theory is Goldsmith (1969) who focused on how to transform short-term financial instruments into long-term ones and how long-term financing can result in economic growth. The approach in this regard builds on the Harrod-Domar model. Goldsmith (1969) noted that liquidity can be generated in the financial system if there are surplus savers (persons who save more than they invest) and borrowers (who want to invest more than they save) so that the surplus is transferred to investors through financial instruments. Goldsmith alluded that the creation of liquidity is critical to the process of economic development.

The most recent addition to the growth literature is the endogenous growth models in which investments in research and development, and in physical and human capital are major determinants of economic growth. It contrasts to the neo-classical economics which contends that technological progress and other external factors are the main sources of economic growth. This model posits that financial intermediaries can affect the growth-creation process, as innovation and knowledge are achieved through costly research and development activities, which are usually only possible when external funding is available through the financial system.

Valverde et al (2007), in their endogenous growth framework explained how the efficient operation of financial institutions leads to economic growth. The new growth model by Greenwood and Jovanovic (1990) shows that improved capital allocation can foster faster economic growth. As firms and entrepreneurs seek capital, financial intermediaries can obtain valuable information in the process, thus reducing the cost involved in verifying and monitoring these firms. This access to capital fosters growth.

In addition, Diamond (1984) concurs that financial intermediaries have means to efficiently monitor their borrowers, and hold diversified portfolios so as to maintain the safety of their depositors' funds. This result in information asymmetries and transaction costs being reduced, which in the end will allow for increased and more efficient investment. Stiglitz (2001) does not downplay the success in acquiring information; however, he notes that there will still exist some information imperfection which could lead to adverse selection and moral hazard in the markets.

2.2 Empirical Evidence

As mentioned earlier, there exists a large body of empirical work on the finance-growth nexus, especially on developed countries (see Gupta, 1984; Jung 1986; King and Levine, 1993; Demetriades and Hussein, 1996; Levine, 1997; Arestis and Demetriades, 1997). In fact, Lucas (1988) concludes that the debate on the relationship between financial and economic development is "over-stressed". However, research on the Caribbean has not been that plentiful so this section provides a brief review of this rather sparse literature. A survey of the empirical studies within the Caribbean reveals mixed findings on the direction of causality between finance and economic growth. These results range from a unidirectional to a feedback relationship, and intermediate linkages that are not so clear. The evidence also differs according to the methodology and data employed, the span of the period of study as well as how financial development is measured.

The Granger's (1969) causality technique was used by Ganga (2001), Byron (1997) and Modeste (1993). Ganga (2001) employed annual data for Guyana over the period 1985-2000 with the ratio of domestic credit to the private sector to GDP as a proxy for financial development, and real GDP as a measure of economic growth. However, Byron (1997) utilized three different ratios indicative of financial development (financial intermediation, monetization and finance ratios) in addition to GNP and GDP per capita as measures of economic development. She employed annual data for the period 1972-1995 for 13 CARICOM countries (The Bahamas, Barbados, Belize, Guyana, Jamaica, Trinidad and Tobago and the OECS). Modeste (1993), on the other hand, used the real interest rate, government savings and foreign savings respectively, as a proportion of income as indicators of financial development and the growth in exports and real GDP as measures of economic growth. However, the data set was based on pooled annual data for Barbados (1981-1991), Guyana (1978-1990), Jamaica (1978-1989), and Trinidad and Tobago (1981-1991). All three studies found a bi-directional relationship between finance and growth.

More advanced econometric techniques (Vector Autoregressions (VARs) and Vector Error Correction models (VECMs)) were used by Ramlal and Watson (2005), Craigwell et al (2001) and Iyare and Moore (2011). Ramlal and Watson (2005) formed a VECM with quarterly data for the period 1970-2002 for Barbados, Jamaica, and Trinidad and Tobago. Financial development was measured as the ratio of broad money (M2) to GDP and the ratio of domestic credit to the private sector to GDP. Per capita growth in real GDP is utilized to represent economic growth. In the case of Jamaica, the private sector credit variable was found to be insignificant in interacting with the other variables; however, there was evidence of unidirectional causality from the money variable to economic growth. There was support for bidirectional causality between money and growth for Barbados and Trinidad and Tobago. Though some evidence of bidirectional causality is observed, the results indicate some perverse relations as financial development may lead to lower growth rates.

Craigwell et al (2001) on the other hand found unidirectional causality from financial development to economic growth for Barbados. The study used data covering the period 1974 to 1998 for real interest rate, real capital per capita and the ratio of total commercial bank deposits to nominal GDP at market prices as proxies for financial development. However, the time span was limited and may not adequately capture long-run effects. Many of the studies highlighted above would have suffered from omitted variables bias, so a different approach was taken from the traditional examination of the finance-growth causality in a recent study by Iyare and Moore (2011). They established a Vector Error Correction Model (VECM) to investigate the relationship between real GDP per capita and financial development and included exogenous variables - savings, investment, trade openness and real interest rate - for the economies of Barbados, Jamaica, Singapore, and Trinidad and Tobago for the period 1960-2003. The results show that in all four countries, there is a positive association between financial development and growth. However, the finance-growth nexus varies in the long run across countries and highlighted the fact that despite similarities amongst economies (in terms of size and openness), there can be differences in the level of importance of the link.

The results also suggested that a cross-country approach to investigating the relationship between financial development and economic growth may overestimate this linkage.

To complete this review studies that concentrate on the Patrick's stage-of-development hypothesis should be assessed. Wood (1993) is the first study on the Caribbean. He indicates that for the entire period under study, there existed a bi-directional causal relationship between the two variables. Wood used a version of Granger causality owing to Hsiao (1979, 1981) to test the causal relationship between financial development and economic growth for Barbados for the period 1946-1990 and then for sub-periods 1946-1968 and 1969-1990 to test the stage-of-development hypothesis. He utilised the ratio of M2 to GDP as a measure of financial development. For the first sub-sample (1946-1968), it was found that causality ran in one direction from economic growth to financial development (demand-following); while for the second sub-sample (1969-1900), the study showed a supply-leading relationship where financial development induced economic growth. The results therefore run counter to what is proposed by Patrick's stage-of development hypothesis.

Patrick's stage-of-development hypothesis was also not supported in a similar study by Lorde and Iyare (2004) which used the ratio of M2 to GDP as well as the ratio of credit provided by financial intermediaries to the private sector to GDP as indicators of financial development for Barbados (1966-2000), Jamaica (1960-2000), and Trinidad and Tobago (1960-2000). Applying Hsiao's (1979, 1981) stepwise Granger causality technique, the results showed supply-leading for Barbados and Trinidad and Tobago and a bi-directional causality in all cases, indicating that a demand-following response exists in all countries, at least in the short run. While Lorde and Iyare (2004) checked for stationarity and long-run relationships between the variables, they did not explicitly test the stage-of-development hypothesis over particular periods but rather on a short-run/long-run basis. There is no evidence that Modeste (1993) and Wood (1993) did checks for stationarity, and along with Byron (1997), did not test for long-run relationships between finance and growth. Therefore, the results are not valid unless the variables are co-integrated. Wood acknowledged that the results may suffer from missing-variable bias and that the test is limited in detecting the effect of contemporaneous innovations in financial development and economic growth.

The survey of the literature highlighted the following limitations: (a) the limited time span over which the studies were done; (b) failing to carry out proper checks for stationarity; (c) inability to take into account the long-run relationship between the variables used; (d) not investigating structural changes in the relationship between finance and growth; and (e) possible omitted variables bias. What this paper sets out to do is investigate Patrick's stage-of-development hypothesis in Barbados by: (a) looking at a data set for an extensive period of time; (b) undertaking checks for stationarity on this data set; (c) investigating long-run relationships between the variables; and (d) examining if there is a change in the relationship between finance and growth over the period of study.

3. Methodology and Data

3.1 Methodology

The meaning of causality in a statistical sense was developed by Granger (1969) when he explained that an economic time series Y_t causes another, X_t, if its inclusion leads to a better prediction of X_t than if it was excluded. Causality can be unidirectional (Y_t causes X_t or X_t causes Y_t), or bidirectional/feedback when X_t is causing Y_t and Y_t is also causing X_t. The most common way to test for a causal relationship is to use the Granger (1969) methods which "see how much of the current *Y* can be explained by past values of *Y* and then to see whether adding lagged values of *X* can improve the explanation" (Eviews 7 User Guide, p.428). *Y* is said to be Granger-caused by *X* if it helps in the prediction of *Y*, or equivalently if the coefficients on the lagged values of *X* are statistically significant

Granger causality can be estimated using single equation methods as proposed by Granger (1969), Sims (1972), Hsiao (1979, 1981) and others, as well as simultaneous equations procedures as in a VAR/VECM system of Johansen (1988, 1995). This paper uses the latter approach to examine the Patrick's stage-of-development hypothesis which avoids simultaneous equation bias in the estimates and makes inferences valid. The general form of the VECM process is given as:

$$\Delta Y_t = \eta + \sum_{i=1}^{p-1} \Phi_i \Delta Y_{t-i} + \Pi \zeta_{t-1} + \rho Xt + \varepsilon_t$$

where Δ is the first difference operator, Y_t is a *n×1* vector of variables consisting of real GDP and the ratio of M2 to GDP (the ratio of credit to GDP), X is a set of control variables, η is a *n×1* vector of deterministic variables, and Φ is a *n×n* coefficient matrix. The rank of $\prod$ determines the number of co-integrating relationships, ζ is the correcting term and ε is a *n×1* vector of disturbances with normal properties.

The VECM is used only when the variables are co-integrated, that is, there exist a long-run relationship between the non-stationary variables in Y_t. The error correction mechanism (ECM), ζ_t presupposes that some variable *y* has an equilibrium path. In the short-run, there are adjustments to deviations from the long-run path which are defined by ζ_t. Long-run causality is determined by ζ . Short-run causality is ascertained by a test on the joint significance of the lagged explanatory variables, Φ_i, using the F-test or Wald test.

With no co-integration, the variables that are stationary in levels imply a VAR in levels. If the variables require first differencing to be stationary, that is, they are I(1), the VAR in changes is employed. The general form of the VAR model is given as:

$$Y_t = \eta + \sum_{i=1}^{p} \Phi_i Y_{t-i} + \varepsilon_t$$

where the variables are defined as above. In this framework only short-run causality can be assessed. As before, this is undertaken utilizing the F-test or Wald test on Φ_i.

There are three main concerns when conducting Granger causality tests: (1) the variables must be stationary; (2) the lag length should be appropriate; and (3) the problem of omitted variables must be addressed. With this in mind, the following procedure is outlined below. The variables are first tested for stationarity by using informal time series plots of the raw data and correlograms, as well as the formal checks of the Augmented Dickey Fuller (ADF) and the Phillips-Perron and KPSS unit root statistics. If the variables are found to have a unit root (non-stationary), the Johansen (1988) procedure can then be applied to test for co-integration to identify the number of co-integrating vectors. Next, the VECM can be formed and long-run and short-run causality determined. If the variables are stationary, co-integration tests are not necessary and the VAR in levels or changes is carried out, depending on whether they are I(0) or I(1). What then follow are short-run Granger causality tests.

3.2 Data

Testing Patrick's hypothesis requires a fairly long dataset since Granger causality must be done for various periods. Barbados has data on money, credit and GDP from 1946-2011 making it ideal to test this hypothesis. With data covering more than six decades it is adequate to examine the long run relationship between finance and growth as well as to enable the full period to be decomposed into three periods: pre-independence (1946-1966), post-independence to pre-liberalization (1967-1990) and post-liberalization (1991-2011). It is expected that if the Patrick's stage-of-development thesis is to hold a supply-leading relationship in the pre-independence period should exist, then demand-following in subsequent periods.

For the purpose of this study, the financial development variables selected are the ratio of M2 to GDP and the ratio of total credit to GDP. Real GDP (1974 prices) is used as an indicator of economic growth and the retail price index (inflation), due to unavailability of other data, represents the only control variable. The ratio of M2[1] to GDP is a monetization ratio that is suggestive of the liquid form of monetary aggregates which are related to the ability of the financial system to provide liquidity or act as a medium of exchange. That is, it is able to capture the size and depth of financial markets. However, this monetization measure may only capture liquidity and not how well this liquidity is being channelled to other sectors in the economy. As such, the total credit (loans and advances to both private and the public sectors) to GDP variable indicates the role of the financial intermediaries in transferring funds to the various sectors of the economy. Inflation is the typical measure of the increase in the general price level and was selected as a control variable since it could impact money, credit as well as GDP. These variables were chosen due to their availability and the fact that they are widely used in other studies investigating similar causal relationships (see Ganga, 2001; Wood, 1993; Lorde and Iyare, 2004). All data were obtained from the Central Bank of Barbados.

[1] M2 is M1 (which is currency with the public plus demand deposits) plus quasi money (time deposits and savings deposits).

4. Empirical Results[2]

4.1 Stationarity Tests

Weak stationarity requires that the mean (first moment) and variance/covariance (second moments) are independent of time. As such, a natural starting point in identifying stationarity is an inspection of the economic series against time. The plots for the full period 1946-2011 (see Figure 1) show that there is an upward trend in both the ratios of M2 and credit to GDP as well as the real GDP series which means that over time, the mean is changing and the series are growing in a fairly systematic manner, indicating that all three variables are non-stationary. The pattern for the control price variable is not as clear cut. When these indicators are first differenced however, they seem to fluctuate around a fixed mean with a tendency to return quickly to this mean which would point to one unit root in the four variables.

To confirm these informal checks, formal unit root tests are applied. Due to space consideration only the ADF statistic is presented. The results in Table 1 imply that money, credit, real GDP and the price series all admit to at least one unit root. The ADF tests reveal that after first differencing these series do not disclose a unit root which would indicate that the variables are integrated of order one. With regards to the sub-periods, the money and real GDP variables both acknowledge one unit root. For the credit and price variables for the sub-period 1946-1966, the notion of one unit root was rejected at 10% level of significance. Overall however, the conclusion is that these variables appear to be integrated of order one at the 10% level of significance in each sub-period.

4.2 Co-integration Test

The Johansen (1988) test is used to check for co-integration. Two important aspects of this procedure are the selection of the correct lag length and the most appropriate data trend. The results point to a linear deterministic trend for the entire sample and the sub-periods. Long lag lengths consume degrees of freedom and too small ones will lead to misspecification. According to the Schwarz Bayesian criterion, which is preferred for relatively small samples, the optimal lag length is one. However, checks for autocorrelation, normality and homoskedasticity should be undertaken to make sure that the errors are white noise. Due to the breakdown of some of these assumptions, a lag length of 2 was chosen for the entire sample as well as the sub-samples that involve testing the money variable; on the other hand, a lag length of 1 proved appropriate when using the credit variable.

With these selections, the Johansen co-integration test indicates that the money ratio and the real GDP variables are co-integrated and has one co-integrating vector over the full sample and sub-samples (see Table 2). However, for the credit ratio and real GDP, the results yield no co-integration for both the entire sample and sub-periods (see Table 3).

4.3 Results for the VECM Model: Money and Real GDP

As the full sample and sub-samples for the money and real GDP variables suggest a unique co-integrating vector, the VECM can be estimated. The diagnostics tests in Table 4 show that there seems to be no problem with serial correlation, normality or homoskedasticity both in the overall sample and sub-samples.

An initial indication that the VECM represents an economically meaningful long-run relationship is that the adjustment coefficients are negative and significant. This is the case with our model (see Table 5). The speed of adjustment to long-run equilibrium when money is the dependent variable is 3.93% for real GDP and 13.40% for money. When real GDP is the dependent variable, it is 64% for money and 19.78% for real GDP. This indicates that it takes a longer time to adjust to long-run equilibrium from a shock from the real GDP variable in both cases.

For the sub-samples, all adjustment coefficients are negative and significant with the exception of the coefficient of the money variable in the sub-period 1946-1966.

4.4 Results for the VAR Model: Credit and Real GDP

The credit ratio and real GDP model indicated no co-integration. They were however I(1). As such, the VAR was run in first difference form. The results proved to be insignificant.

[2] The estimations were carried out using Eviews version 7.

4.5 Granger Causality Results

The VECM allows one to comment on long-run and short-run causality. Table 6 gives a summary of the results. Over the entire period, the findings indicate a bidirectional causal relationship between financial development (as measured by the money ratio) and economic growth in the long-run and a unidirectional causal relationship from economic growth to financial development in the short-run.

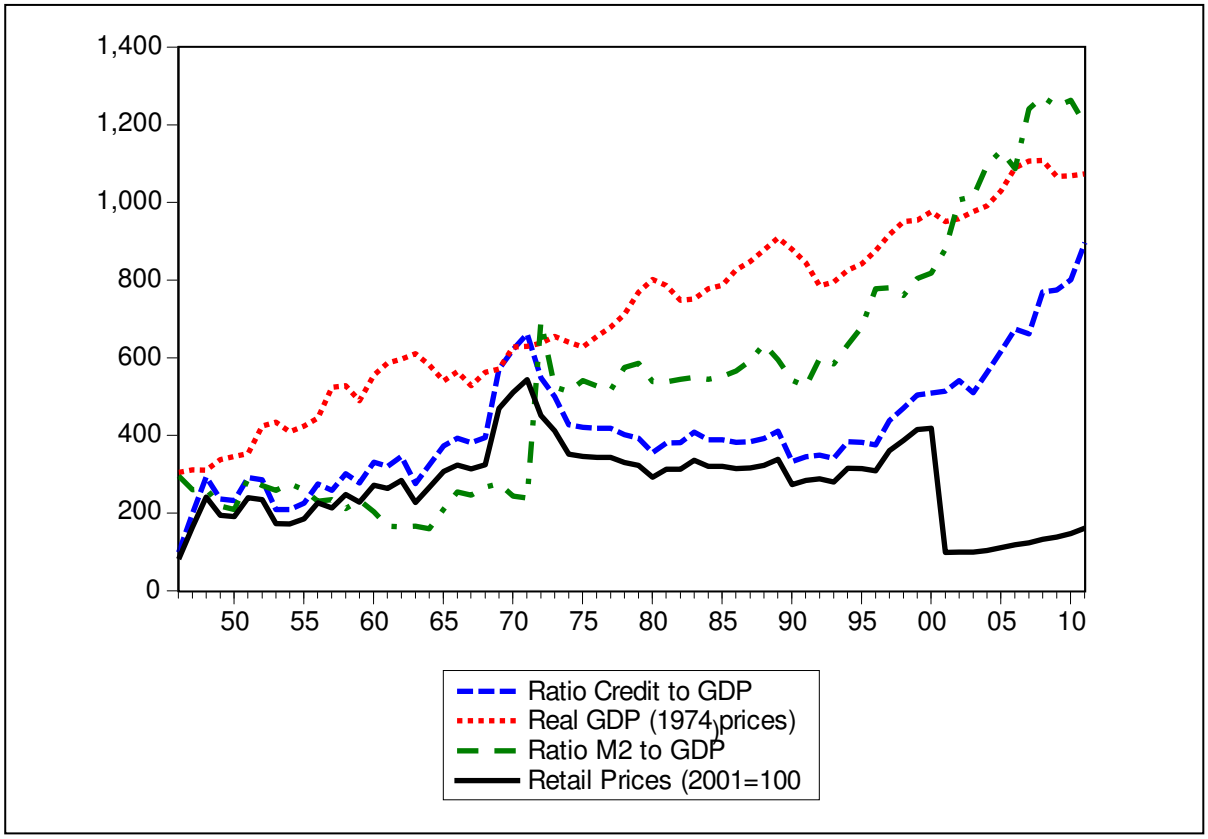
The results for the sub-period 1946-1966 showed unidirectional causality from economic growth to financial development in both the short and long-run, and for 1967-1990 financial development leads economic growth in the short-run and bidirectional in the long-run. The short-run findings for these two sub-periods were the same as those found by Wood (1993), and therefore yielded a similar conclusion to Wood of no support for Patrick's stage-of-development hypothesis. For the other sub-period 1991-2011, causality ran from financial development to economic growth in the short-run and there was a bidirectional relationship in the long-run.

The VARs results provide the analysis for the credit measure and real GDP. These findings allow one to comment on short-run causality. There was no indication of a causal relationship between financial development and economic growth both in the overall sample and sub-samples. It is to be noted that the credit measure used here includes both loans and advances to the private and public sectors, while what is required is the credit extended to the private sector. Hence, the measure employed in this paper may not be the most appropriate one.

5. Conclusion

This study undertook the task of testing Patrick's stage-of-development hypothesis in the Barbadian economy through the use of Granger (1969) causality tests utilizing co-integration and VECM and VAR analyses. The results showed that causality ran unidirectional from economic growth to financial development in the short run and bi-directional in the long run throughout the entire period using a money variable. Also, tests on the subsamples provide no support for the hypothesis. These findings are indicative rather than conclusive since the paper was constrained by the lack of data on other measures of financial development and economic growth.

Figure 1: Plot of Variables



Tables 1(a) and (b): Augmented Dickey Fuller (ADF) Tests

	LEVEL			
Periods	**Money**	**Credit**	**Real GDP**	**Price**
1946 – 2011	0.076	-0.154	-0.892	-2.442
1946 – 1966	-2.141	-2.745*	-1.159	-2.745*
1967 – 1990	-2.332	-1.907	-0.411	-1.907
1991 – 2011	-0.863	1.485	-1.079	-1.415
	FIRST DIFFERENCE			
Periods	**Money**	**Credit**	**Real GDP**	**Price**
1946 – 2011	-9.972***	-7.213***	-6.584***	-7.624***
1946 – 1966	-4.046***	-2.922*	-4.417***	-2.922*
1967 – 1990	-6.581***	-3.438**	-4.151***	-3.438**
1991 – 2011	-4.999***	-5.462***	-2.722*	-4.461***

Notes: *** is significance at 1 percent level;
** is significance at 5 percent level;
* is significance at 10 percent level

Table 2: Tests for Co-integration Rank: Money and Real GDP

	Hypotheses					
	H_0 : r = 0 **H_1 : r ≥ 1**				**H_0 : r = 1** **H_1 : r ≥ 2**	
Periods	**Trace Statistics**	**Decision**	**Max Eigenvalue Statistics**	**Decision**	**Statistics**	**Decision**
1946 – 2011	29.896	Reject H_0	21.852	Reject H_0	8.044	Do not Reject H_0
1946 – 1966	25.553	Do not Reject H_0	20.220	Reject H_0	5.333	Do not Reject H_0
1967 – 1990	34.476	Reject H_0	28.737	Reject H_0	5.739	Do not Reject H_0
1991 – 2011	27.445	Reject H_0	20.021	Reject H_0	7.425	Do not Reject H_0

Notes: The 95% critical values are as follows: 25.872 for trace statistics for first hypothesis; 19.387 for maximum eigenvalues statistics for first hypothesis; 12.518 for statistics for second hypothesis (both tests).

Table 3: Tests for Co-integration Rank: Credit and Real GDP

	Hypotheses					
	H_0 : r = 0 **H_1 : r ≥ 1**				**H_0 : r = 1** **H_1 : r ≥ 2**	
Periods	**Trace Statistics**	**Decision**	**Max Eigenvalue Statistics**	**Decision**	**Statistics**	**Decision**
1946 – 2011	17.648	Do not Reject H_0	15.410	Do not Reject H_0	2.238	Do not Reject H_0
1946 – 1966	19.834	Do not Reject H_0	12.642	Do not Reject H_0	7.19	Do not Reject H_0
1967 – 1990	22.876	Do not Reject H_0	13.255	Do not Reject H_0	9.621	Do not Reject H_0
1991 – 2011	22.425	Do not Reject H_0	15.783	Do not Reject H_0	6.642	Do not Reject H_0

Notes: The 95% critical values are as follows: 25.872 for trace statistics for first hypothesis; 19.387 for maximum eigenvalues statistics for first hypothesis; 12.518 for statistics for second hypothesis (both tests).

Table 4: Diagnostics Tests

Periods	Autocorrelation LM Test	Residual Normality Test (Jarque-Bera)	Residual Heteroskedasticity Test
1946 – 2011	No serial correlation up to 12 lags	8.935328 (0.0627)	26.62306 (0.9341)
1946 – 1966	No serial correlation up to 12 lags	5.385962 (0.2499)	32.38027 (0.6415)
1967 – 1990	No serial correlation up to 12 lags (except at 1)	1.231419 (0.8729)	30.37329 (0.8371)
1991 – 2011	No serial correlation up to 12 lags	0.311797 (0.9890)	43.28936 (0.1882)

Notes: Probability values in parentheses.

Table 5: Test for Significance of Adjustment Coefficients

Periods	ΔGDP_t	$\Delta Money_t$
1946 – 2011	-5.653***	-2.081**
1946 – 1966	-3.440***	-0.642
1967 – 1990	-5.750***	-2.022*
1991 – 2011	-2.774**	-2.398**

Notes: *** is significance at 1 percent level;
** is significance at 5 percent level;
* is significance at 10 percent level

Table 6: Granger Causality Tests

Periods	Direction of Causality: Long run	Direction of Causality: Short run
1946 – 2011	Financial development ←→ Economic growth	Economic growth → Financial development
1946 – 1966	Economic growth → Financial development	Economic growth → Financial development
1967 - 1990	Financial development ←→ Economic growth	Financial development → Economic growth
1991 - 2011	Financial development ←→ Economic growth	Financial development → Economic growth

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