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Working Paper 25/2019
August 2019

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Nicholas M. Odhiambo and Sheilla Nyasha[1]

Abstract

In this study, we examined the dynamic causality between financial development and economic growth in the Democratic Republic of the Congo (DRC), using time-series data from 1965 to 2015. Unlike some previous studies, the current study used three proxies to examine this linkage. These are liquid liabilities as a percentage of GDP (FD1), deposit money bank assets as a percentage of GDP (FD2), and bank deposits as a percentage of GDP (FD3). In addition, the study used savings and inflation as intermittent variables, thereby creating a multivariate Granger-causality model, and limiting the omission-of-variable bias, which has been found in some previous studies. Using the ARDL bounds testing approach, the study found that there is a short-run causal relationship between financial development and economic growth in the DRC, but the direction of causality is dependent on the proxy used to measure the level of financial development. When financial development was proxied by liquid liabilities as a percentage of GDP, unidirectional Granger-causality was found to prevail in the short run, running from economic growth to financial development. However, when deposit money bank assets as a percentage of GDP and bank deposits as a percentage of GDP were used as proxies, causality between financial development and economic growth was found to be bidirectional, but only in the short run. The study recommends that policy efforts in the DRC should be directed at developing both the financial sector and the real sector in the short run as both sectors have been found to be mutually beneficial to each other in the main, in this study.

Keywords: Financial Development; Economic Growth; Granger-Causality Test; Democratic Republic of Congo; DRC

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1. Introduction

The causal relationship between financial development and economic growth has been a subject of intense debate in recent decades and has attracted a plethora of empirical literature from both developed and developing countries. Currently, there exist four different views regarding the relationship between financial development and economic growth. The first view, which has been widely supported by studies such as McKinnon (1973) and Shaw (1973), is called the supply-leading response. This view posits that financial development leads to economic growth. The second view, which is known as the demand-following response, is the converse of the first view. It argues that it is economic growth that drives the development of the financial sector. The third view, however, argues that both financial development and economic growth Granger-cause each other, i.e., that there is bi-directional causality between financial development and economic growth. The fourth view, which is somewhat unpopular, is known as the neutrality view. It argues that financial development and economic growth are not causally related at all.

Although the relationship between financial development and economic growth has been examined extensively in the literature, the majority of the previous studies have concentrated mainly on the Asian and Latin American countries. While efforts have been made to include some African countries in the analysis in recent years, most of these African countries have been mainly middle-income countries. In particular, comprehensive studies on low-income countries such as the Democratic Republic of Congo (DRC) are almost non-existent. As a result, countries like the DRC have had to rely on empirical research done in other developing countries whose macroeconomic dynamics may not be comparable to its own. In some instances, such countries have had to rely on cross-country studies, which do not fully address country-specific issues. By lumping together countries that may be of different stages of financial and economic development, the traditional cross-sectional method cannot satisfactorily address the country-specific effects that underlie the relationship between financial development and economic growth in the studied countries (see, also, Odhiambo, 2009c; 2008a; Ghirmay, 2004; Casselli *et al*., 1996). Although the recent panel data analysis somewhat addresses some of the limitations of the cross-sectional analysis, it may still not address all the country-specific issues that inform policymaking in a country. Such issues can only be satisfactorily addressed by a time-series study with a specific focus on a single country. Apart from this weakness, previous studies on this subject also suffer from methodological

weaknesses. For example, some previous studies have relied on a bivariate causality model, which has been found to suffer from the omission-of-variable bias. This implies that introducing one or more additional variables in the bivariate model between financial development and economic growth may change the magnitude of the results as well as the direction of causality between these two variables.

In order to fill this lacuna, the current study aims to examine the causal relationship between bank-based financial development and economic growth in the Democratic Republic of Congo (DRC) by using the recently developed autoregressive distributed lag (ARDL) bounds testing approach to cointegration and the error-correction mechanism (ECM). To address the omission-of-variable bias, the study aims to use two intermittent variables, namely inflation and savings, which have an impact on both financial development and economic growth. This leads to a system of multivariate equations in a dynamic setting. Since previous studies have found that the causal relationship between financial development and economic growth may be sensitive to the proxy used to measure the level of financial development, the current study aims to use five proxies of bank-based financial development to examine this linkage.

Using the 1965-2015 dataset, the empirical results of this study show that the causal relationship between financial development and economic growth in the DRC varies widely depending on the variable used as a proxy for financial development.

The DRC has been undergoing civil war and unrest for decades. Its financial sector is less developed and not fully functional. A study on the causal relationship between financial development and economic growth in DRC could be what the study country needs at this moment as it rebuilds its economy. The Central Bank of the Congo is the highest authority in the country's financial sector – tasked with oversight of the financial sector. In DRC, banks are highly dollarised and largely dependent on sight deposit funding (Centre for Financial Regulation and Inclusion "Cenfri" *et al*., 2016). There are 18 commercial banks in DRC – five are the biggest, also referred to as the "top 5"; six are medium banks while seven are small banks. Of the 18 banks, five are domestic-owned, and 13 are foreign-owned (Cenfri *et al*., 2016).

The rest of the study is organised as follows: Section 2 reviews literature on the causal relationship between financial development and economic growth, while section 3 discusses the estimation techniques employed to examine the causality between financial development and economic growth in the study country. Section 4 presents and analyses the results of the study and Section 5 concludes.

2. Review of Literature

Empirically, the causality between financial development and economic growth has four possible outcomes – supply-leading response; demand-following response; feedback response; and neutrality. According to the supply-leading response, it is financial development that leads to economic growth, as the real sector responds to increased supply of financial resources. This outcome has been supported over the years by a number of studies (see among others, Omri *et al*., 2015; Osuala *et al*., 2013; Akinlo and Egbetunde, 2010; Odhiambo, 2009a; Majid, 2008; Christopoulos and Tsionas, 2004; Morris, 2002; Jalilian and Kirkpatrick, 2002; Shan and Morris, 2002; Graff, 2002; Beck *et al*., 2000; Ghali, 1999; Rousseau and Wachtel, 1998; Ahmed and Ansari, 1998; Odedokun, 1996a; Odedokun, 1996b; King and Levine, 1993; Jung, 1986).

The second possible outcome is the demand-following response, where Granger-causality flows unidirectionally from economic growth to financial development. This response is as a result of the financial sector's response to increasing demand from the real sector. A number of empirical studies are in support of this outcome (see Marques *et al*., 2013; Akinlo and Egbetunde, 2010; Odhiambo, 2009b; Odhiambo, 2009c; Odhiambo, 2008a; Odhiambo, 2008b; Güryay *et al*., 2007; Ang and McKibbin, 2007; Odhiambo, 2004; Shan and Morris, 2002; Shan *et al*., 2001).

The third possible outcome is the feedback hypothesis, also known as the bidirectional causality view. According to this outcome, financial development and economic growth Granger-cause one another. For empirical evidence on this outcome, see Jedidia *et al*. (2014), Cheng (2012), Akinlo and Egbetunde (2010), Abu-Bader and Abu-Qarn (2008), Shan and

Jianhong (2006), Luintel and Khan (1999), Shan *et al*. (2001), Fase and Abma (2003), Calderon and Liu (2003), Shan and Morris (2002), Sinha and Macri (2001), Akinboade (1998) and Wood (1993).

Then, there is the fourth but unpopular possible outcome, called the neutral view, also known as the independent view. In this view, financial development and economic growth are regarded as independent and have a neutral causal effect on each other – hence under this possible outcome, financial development and economic growth do not Granger-cause each other. Although unpopular, this neutrality view is not unusual (see Nyasha and Odhiambo, 2018a; 2015; Shan *et al*., 2001). Of the four possible outcomes, the most prominent one is the supply-leading hypothesis. Table 1 summaries the empirical studies on the Granger-causality between financial development and economic growth, organised according to the four possible outcomes alluded to.

TABLE 1: Studies on the Granger-Causality Between Financial Development and economic Growth

Author(s)	**Methodology**	**Direction of Causality**
Panel 1: Studies in Favour of Unidirectional Causality from Financial Development to Economic Growth		
Omri *et al*. (2015)	Panel	FD $\rightarrow$ Y
Osuala *et al*. (2013)	Time-series	FD $\rightarrow$ Y (causality only from total number of deals ratio to economic growth)
Akinlo and Egbetunde (2010)	Time-series	FD $\rightarrow$ Y (Central African Republic, Congo Republic, Gabon, and Nigeria)
Odhiambo (2009a)	Time-series	FD $\rightarrow$ Y
Majid (2008)	Time-series	FD $\rightarrow$ Y
Christopoulos and Tsionas (2004)	Panel	FD $\rightarrow$ Y
Graff (2002)	Cross-section	FD $\rightarrow$ Y (but unstable)

Author(s)	**Methodology**	**Direction of Causality**
Shan and Morris (2002)	Time-series	FD → Y (for one country)
Jalilian and Kirkpatrick (2002)	Panel	FD → Y
Beck *et al.* (2000)	Cross-section and panel	FD → Y
Ghali (1999)	Time-series	FD → Y
Ahmed and Ansari (1998)	Cross-section	FD → Y
Rousseau and Wachtel (1998)	Time-series	FD → Y
Odedokun (1996a)	Time-series	FD → Y (evidence of supply-leading response is found in 85% of the sample countries; the impact of financial development is found to be higher on low income LDCs than in high income LDCs)
Odedokun (1996b)	Cross-section	FD → Y
King and Levine (1993)	Cross-section	FD → Y
Jung (1986)	Cross-section	FD → Y (supply-leading pattern occurs more often than demand-following pattern in LDCs)
PANEL 2: Studies in Favour of Unidirectional Causality from Economic Growth to Financial Development		
Marques *et al*. (2013)	Time-series	y → FD
Akinlo and Egbetunde (2010)	Time-series	Y → Finance (for Zambia)
Odhiambo (2009b)	Time-series	Y → FD
Odhiambo (2009c)	Time-series	Y → FD
Odhiambo (2008a)	Time-series	Y → FD
Odhiambo (2008b)	Time-series	Y → FD
Güryay *et al*. (2007)	Time-series	Y → FD
Ang and McKibbin (2007)	Time-series	Y → FD

Author(s)	Methodology	Direction of Causality
Odhiambo (2004)	Time-series	Y → FD
Shan and Morris (2002)	Time-series	Y → FD (for 5 countries)
Shan *et al*. (2001)	Time-series	Y → FD (for three countries)
PANEL 3: Studies in Favour of Bidirectional Causality between Financial Development and Economic Growth		
Jedidia *et al*. (2014)	Time-series	FD ↔ Y
Cheng (2012)	Time-series	FD ↔ Y
Akinlo and Egbetunde (2010)	Time-series	FD ↔ Y (for Chad, South Africa, Kenya, Sierra Leone and Swaziland)
Abu-Bader and Abu-Qarn (2008)	Time-series	FD ↔ Y
Shan and Jianhong (2006)	Time-series	FD ↔ Y
Calderon and Liu (2003)	Pooled data	FD ↔ Y
Fase and Abma (2003)	Time-series	FD ↔ Y
Shan and Morris (2002)	Time-series	FD ↔ Y (for 4 countries)
Shan *et al*. (2001)	Time-series	FD ↔ Y (for five countries)
Sinha and Macri (2001)	Time-series	FD ↔ Y
Luintel and Khan (1999)	Time-series	FD ↔ Y
Akinboade (1998)	Time-series	FD ↔ Y
Wood (1993)	Time-series	FD ↔ Y
PANEL 4: Studies in Favour of Neutrality between Financial Development and Economic Growth		
Nyasha and Odhiambo (2018a)	Time-series	FD ≠ Y (for some countries)
Nyasha and Odhiambo (2015)	Time-series	FD ≠ Y

Author(s)	Methodology	Direction of Causality
		(between bank-based financial development and economic y)
Shan *et al.* (2001)	Time-series	FD ≠ Y (for two countries)

Note: FD = Financial Development; Y = Economic Growth

3. Estimation Techniques

The ARDL-bounds-testing approach to cointegration

Following the earlier work by Pesaran and Shin (1999), which was later extended by Pesaran *et al*. (2001), this study employs the ARDL-bounds testing approach to examine the long-run relationship between financial development and economic growth in DRC. The choice of the approach was based on the numerous advantages the ARDL has over the traditional cointegration approaches such as the residual-based technique and the Full-Maximum Likelihood (FML) test (see Odhiambo, 2008a; Nyasha and Odhiambo, 2018b). Among the numerous advantages of the ARDL approach is its ability to give unbiased long-run estimates and valid t-statistics even when some of the regressors are endogenous (Odhiambo, 2008a).

In addressing the omission-of-variable bias associated with bivariate Granger-causality model, this study has utilised two intermittent variables – savings and inflation – thereby creating a multivariate Granger-causality model, whose function is expressed as:

Y/N = f (BBFD, SAV, INF)…….(1)

Where Y/N is economic growth; BBFD is financial development based on bank-based proxies; SAV is savings; INF is inflation.

To enhance the depth of the finance-growth causality study in the study country, three proxies of financial development were used – taking turns to enter into the causality model. Thus, the finance-growth causal relationship in the DRC was assessed using three models. In Model 1, financial development (BBFD1) is proxied by liquid liabilities as a percentage of GDP. In

Model 2, financial development (BBFD2) is proxied by Deposit money bank assets as a percentage of GDP; while in Model 3, financial development (BBFD3) is proxied by bank deposits as a percentage of GDP.

Before causality testing, there is need to test for cointegration. Following Pesaran *et al*. (2001) the generic cointegration model for this study is expressed in the form of a set of four cointegration equations as follows:

$$\Delta Y/N_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\Delta Y/N_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\Delta BBFD_{t-i} + \sum_{i=0}^{n} \alpha_{3i}\Delta SAV_{t-i} + \sum_{i=0}^{n} \alpha_{4i}\Delta INF_{t-i} + \alpha_4 Y/N_{t-1} + \alpha_5 BBFD_{t-1} + \alpha_6 SAV_{t-1} + \alpha_7 INF_{t-1} + \mu_{1t} \quad \ldots\ldots\ldots\ldots (2)$$

$$\Delta BBFD_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\Delta BBFD_{t-i} + \sum_{i=0}^{n} \beta_{2i}\Delta Y/N_{t-i} + \sum_{i=0}^{n} \beta_{3i}\Delta SAV_{t-i} + \sum_{i=0}^{n} \beta_{4i}\Delta INF_{t-i} + \beta_5 BBFD_{t-1} + \beta_6 Y/N_{t-1} + \beta_7 SAV_{t-1} + \beta_8 INF_{t-1} + \mu_{2t} \quad \ldots\ldots\ldots\ldots (3)$$

$$\Delta SAV_t = \pi_0 + \sum_{i=1}^{n} \pi_{1i}\Delta SAV_{t-i} + \sum_{i=0}^{n} \pi_{2i}\Delta Y/N_{t-i} + \sum_{i=0}^{n} \pi_{3i}\Delta BBFD_{t-i} + \sum_{i=0}^{n} \pi_{4i}\Delta INF_{t-i} + \pi_5 SAV_{t-1} + \pi_6 Y/N_{t-1} + \pi_7 BBFD_{t-1} + \pi_8 INF_{t-1} + \mu_{3t} \quad \ldots\ldots\ldots\ldots (4)$$

$$\Delta INF_t = \Omega_0 + \sum_{i=1}^{n} \Omega_{1i}\Delta INF_{t-i} + \sum_{i=0}^{n} \Omega_{2i}\Delta Y/N_{t-i} + \sum_{i=0}^{n} \Omega_{3i}\Delta BBFD_{t-i} + \sum_{i=0}^{n} \Omega_{4i}\Delta SAV_{t-i} + \Omega_5 INF_{t-1} + \Omega_6 Y/N_{t-1} + \Omega_7 BBFD_{t-1} + \Omega_8 SAV_{t-1} + \mu_{4t} \quad \ldots\ldots\ldots\ldots (5)$$

Where:

Y/N = Economic growth= real GDP per capita

BBFD = Bank-Based Financial development

Model 1: BBFD = BBFD1 = Liquid liabilities to GDP (%)

Model 2: BBFD = BBFD2 = Deposit money bank assets to GDP (%)

Model 3: BBFD = BBFD3 = Bank deposits to GDP (%)

SAV = Savings = gross domestic savings to GDP (%)

INF = Inflation

a_0, β_0, π_0 and Ω_0 = respective constants;

$a_1 - a_4$, $\beta_1 - \beta_4$, $\pi_1 - \pi_4$, and $\Omega_1 - \Omega_4$ = respective short-run coefficients;

$a_5 - a_8$, $\beta_5 - \beta_8$, $\pi_5 - \pi_8$, and $\Omega_5 - \Omega_8$ = respective long-run coefficients

Δ = difference operator;

n = lag length;

t = time period; and

μ_{it} = white-noise error terms.

The generic ECM-based Granger-causality model specification is given as:

$$\Delta Y/N_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta Y/N_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta BBFD_{t-i} + \sum_{i=1}^{n} \alpha_{3i} \Delta SAV_{t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta INF_{t-i} + \alpha_9 ECM_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$\Delta BBFD_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta BBFD_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta \frac{Y}{N_{t-i}} + \sum_{i=0}^{n} \beta_{3i} \Delta SAV_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta INF_{t-i} + \beta_9 ECM_{t-1} + \mu_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$\Delta SAV_t = \pi_0 + \sum_{i=1}^{n} \pi_{1i} \Delta SAV_{t-i} + \sum_{i=0}^{n} \pi_{2i} \Delta Y/N_{t-i} + \sum_{i=0}^{n} \pi_{3i} \Delta BBFD_{t-i} + \sum_{i=0}^{n} \pi_{4i} \Delta INF_{t-i} + + \pi_9 ECM_{t-1} + \mu_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$\Delta INF_t = \Omega_0 + \sum_{i=1}^{n} \Omega_{1i} \Delta INF_{t-i} + \sum_{i=0}^{n} \Omega_{2i} \Delta Y/N_{t-i} + \sum_{i=0}^{n} \Omega_{3i} \Delta BBFD_{t-i} + \sum_{i=0}^{n} \Omega_{4i} \Delta SAV_{t-i} + \Omega_9 ECM_{t-1} + \mu_{4t} \dots\dots\dots\dots (9)$$

Where:

ECM = error-correction term;

a_9, β_9, π_9 and Ω_9 = respective coefficients for the error-correction terms;

μ_{it} = mutually uncorrelated white-noise residuals; and all other variables and characters are as described in equations 2-5.

Data Source

Annual time-series data from 1965 to 2015 is utilised in this study. The data as sources from various sources, including the World Bank's World Databank and from the World Bank's Financial Development and Structure Dataset (World Bank, 2017).

Results

4. Results

Unit Root Tests

Although the ARDL method does not require all variables to be of the same order of integration, it cannot be applied when the variables are integrated of order two [I(2)] or higher. Consequently, it is recommended to conduct unit root test to check whether all the variables are integrated of order one [I(1)] and/or below. In this study, Dickey-Fuller generalised least squares (DF-GLS) and the Phillips-Perron (PP) unit root tests were employed, and the results are summarised in Table 2, Panels A and B, respectively.

Table 2: ***Results of Unit Root Tests***

Panel A: Dickey-Fuller generalised least squares (DF-GLS)				
Variable	**Stationarity of all Variables in Levels**		**Stationarity of all Variables in First Difference**	
	Without Trend	With Trend	Without Trend	With Trend
Y/N	-1.960**	-3.049*	-	-
BBFD1	-2.122**	-3.225**	-	-
BBFD2	-1.952**	-3.192**	-	-
BBFD3	-1.698*	-2.925*	-	-
INF	-6.189***	-6.272***	-	-
SAV	-4.304***	-5.311***	-	-
Panel B: Phillips-Perron (PP)				
Variable	**Stationarity of all Variables in Levels**		**Stationarity of all Variables in First Difference**	
	Without Trend	With Trend	Without Trend	With Trend
Y/N	-1.943	-1.954	-8.227***	-8.741***
BBFD1	-3.220**	-5.800***	-	-
BBFD2	-2.655*	-4.479***	-	-
BBFD3	-2.946**	-4.552***	-	-
INF	-6.253***	-6.175***	-	-
SAV	-5.089***	-5.038***	-	-

Note: ***, ** and * denote stationarity at 1%, 5% and 10% significance level

The results of the unit root tests reported in Table 2 show that all the variables are integrated of order one or order zero – thereby confirming the validity and suitability of using the ARDL approach.

Cointegration Tests

The results of the cointegration test carried out in this study are summarised in Table 3.

Table 3: Results of *Bounds F-test for Cointegration*

Dependent Variable	Function	F-statistic			
Model 1					
Y/N	F(Y/N|BBFD1, INF, SAV)	1.40			
BBFD1	F(BBFD1|Y/N, INF, SAV)	0.46			
INF	F(INF|Y/N, BBFD1, SAV)	3.27			
SAV	F(SAV|Y/N, BBFD1, INF)	7.11***			
Model 2					
Y/N	F(Y/N|BBFD2, INF, SAV)	1.20			
BBFD2	F(BBFD2|Y/N, INF, SAV)	0.11			
INF	F(INF|Y/N, BBFD2, SAV)	3.72			
SAV	F(SAV|Y/N, BBFD2, INF)	9.04***			
Model 3					
Y/N	F(Y/N|BBFD3, INF, SAV)	1.34			
BBFD3	F(BBFD3|Y/N, INF, SAV)	0.31			
INF	F(INF|Y/N, BBFD3, SAV)	3.24			
SAV	F(SAV|Y/N, BBFD3, INF)	9.04***			
Asymptotic Critical Values					
Pesaran *et al*. (2001), p.300 Table CI(iii) Case III	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	4.29	5.61	3.23	4.35	2.72	3.77

Note: *** denotes statistical significance at 1% level

The cointegration results displayed in Table 3 confirm the presence of cointegration in each model, as there is at least one cointegration vector in each model. Following the establishment of a long-run equilibrium relationship in the three models, the study proceeds with Granger-causality estimation using Wald Test or Variable Deletion Test for the short-run causality and

the and error-correction test for the long-run causality. However, the long-run causality is only estimated for the functions that tested positive for cointegration (Nyasha *et al*., 2017).

ECM-Based Granger-Causality Test

The ECM-based Granger causality results for all the models used in this study are summarised in Table 4.

Table 4: ***Results of Granger-Causality Test***

Table 4a) Model 1

Dependent Variable	**F-statistics [probability]**				ECT_{t-1} **[t-statistics]**
	$\Delta Y/N_t$	$\Delta BBFD1_t$	ΔINF_t	ΔSAV_t	
$\Delta Y/N_t$	-	1.013 [0.320]	0.228 [0.636]	5.069** [0.030]	-
$\Delta BBFD1_t$	3.611* [0.064]	-	0.003 [0.959]	0.450 [0.506]	-
ΔINF_t	1.172 [0.286]	1.290 [0.264]	-	3.979** [0.015]	-
ΔSAV_t	0.934 [0.339]	0.296 [0.590]	8.637*** [0.005]	-	-0.593*** [-3.993]

As revealed in Table 4a, the empirical results for Model 1 show that there is unidirectional Granger-causality from economic growth (Y/N) to financial development (BBFD1) in the DRC when financial development is measured by liquid liabilities as a percentage of GDP – lending support to the demand-following hypothesis. However, these results hold only in the short run. Consistent with these results are previous studies by Marques *et al*. (2013), Akinlo and Egbetunde (2010) and Odhiambo (2009b; 2009c), among others.

Further, Model 1 results show that there is: (i) short-run unidirectional Granger-causality from savings to economic growth; (ii) short-run bidirectional Granger-causality between inflation and savings; (iii) long-run unidirectional Granger-causality from inflation to savings; (iv) no causality between financial development (BBFD1) and inflation, financial development (BBFD1) and savings, and between inflation and economic growth.

Table 4b) Model 2

Dependent Variable	F-statistics [probability]				ECT_{t-1} [t-statistics]
	$\Delta Y/N_t$	$\Delta BBFD2_t$	ΔINF_t	ΔSAV_t	
$\Delta Y/N_t$	-	4.052* [0.051]	0.257 [0.615]	6.386** [0.015]	-
$\Delta BBFD2_t$	8.696*** [0.006]	-	0.124 [0.727]	0.262 [0.853]	-
ΔINF_t	3.478* [0.070]	1.476 [0.232]	-	2.674 [0.111]	-
ΔSAV_t	1.009 [0.321]	0.201 [0.656]	8.792*** [0.005]	-	-0.565*** [-3.658]

For Model 2, the results show that there is bidirectional Granger-causality between financial development (BBFD2) and economic growth (Y/N) when financial development is proxied by deposit money bank assets as a percentage of GDP. However, these results apply only in the short run. These results support the feedback hypothesis where financial development and economic growth cause each other; and are consistent with results of some previous studies (see Cheng, 2012; Jedidia *et al*., 2014).

Furthermore, Model 2 results show that there is: (i) short-run unidirectional Granger-causality economic growth to inflation; and from savings to economic growth (ii) short-run unidirectional Granger-causality from economic growth to savings; (iii) long-run and short-run unidirectional Granger-causality from inflation to savings; and (iv) no causality between financial development (BBFD2) and inflation; and between financial development (BBFD2) and savings.

Table 4c) Model 3

Note: ***, ** and * denote stationarity at 1%, 5% and 10% significance level

Dependent Variable	F-statistics [probability]				ECT_{t-1} [t-statistics]
	$\Delta Y/N_t$	$\Delta BBFD3_t$	ΔINF_t	ΔSAV_t	
$\Delta Y/N_t$	-	8.282*** [0.006]	0.254 [0.617]	7.647*** [0.008	-
$\Delta BBFD3_t$	7.737*** [0.008]	-	0.003 [0.958]	0.357 [0.554]	-
ΔINF_t	0.601 [0.443]	1.248 [0.271]	-	6.483** [0.014]	-
ΔSAV_t	0.921 [0.343]	0.163 [0.688]	8.661*** [0.005]	-	-0.576*** [-3.718]

In the case of Model 3, the results show that there is short-run bidirectional Granger-causality between financial development (BBFD3) and economic growth when bank deposits as a percentage of GDP are used to proxy financial development. These results have also been supported by previous studies, such as Cheng (2012) and Jedidia *et al*. (2014), amongst others.

The results for Model 3 further show that there is: (i) short-run unidirectional Granger-causality from savings to economic growth; (ii) short-run bidirectional causality between inflation and savings; (iii) long-run unidirectional Granger-causality from inflation to savings; and (iv) no Granger-causality between economic growth and inflation; inflation and financial development (BBFD3); and between savings and financial development (BBFD3).

Overall, the study findings show that in the DRC, the causality between financial development and economic growth is not as obvious as normally anticipated. It has been found to be time- and proxy-variant. When using liquid liabilities as a percentage of GDP (BBFD1 – Model 1), causality was found to be unidirectional from economic growth to financial development; and only in the short run. However, when using deposit money bank assets as a percentage of GDP (BBFD2) and bank deposits as a percentage of GDP (BBFD3), causality was found to be bidirectional but only in the short run. In the main, short-run bidirectional causality between financial development and economic growth was found to be predominant.

5. Conclusion

The study has examined the Granger-causality between financial development and economic growth in the DRC using data for the period stretching from 1965 to 2015. The study was

motivated by the need to ascertain the causal relationship between financial development and economic growth in the DRC as the country embarks on re-building the nation following decades of civil war and unrest. The findings could assist policy makers in catalytic growth policies. To address the variable-omission-bias, savings and inflation were added as two intermittent variables, thereby creating a multivariate Granger-causality model. To enhance the rigour and comprehensiveness of the finance-growth causal nexus in the study country, three proxies of financial development were employed. These were liquid liabilities as a percentage of GDP (BBFD1), deposit money bank assets as a percentage of GDP (BBFD2), and bank deposits as a percentage of GDP (BBFD3). Using the ARDL bounds testing approach, the findings of the study showed that the direction of causality between financial development and economic growth in the DRC only prevails in the short run. In addition, the direction of causality was found to be dependent on the proxy used to measure the level of financial development. When financial development is proxied by liquid liabilities as a percentage of GDP (BBFD1 – Model 1), Granger-causality was found to be unidirectional from economic growth to financial development. However, when deposit money bank assets as a percentage of GDP (BBFD2 – Model 2) and bank deposits as a percentage of GDP (BBFD3 – Model 3) were used as proxies of financial development, causality between financial development and economic growth was found to be bidirectional. Thus, in the main, the bidirectional causality was found to predominate. The study recommends that policy makers in the DRC should target appropriate proxies of financial development when drafting short-term pro-financial development and pro-economic growth related policies, as policy implementation outcome may vary depending on the targeted financial development proxy. Overall, short-term policy efforts could be directed at developing both the financial sector and the real sector as the two sectors have been found to be mutually beneficial to each other in the main in this study.

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