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The Finance – Growth Nexus in Botswana: A Multivariate Causal Linkage

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ABSTRACT

This paper evaluates the dynamic causal relationship between financial development, savings, investment and economic growth in Botswana from 1976-2014 by employing a multivariate causality model. Results reveal that it is chiefly investment that drives the bank-related and stock exchange-based financial sectors in the short run. Stock exchange-based financial development drives bank-related financial development and savings in both the short run and the long run. While, savings are found to Granger-cause investment. Economic growth Granger-causes investment and savings, both, in the short run and long run. Further, only bank-related financial development is found to Granger-cause economic growth in Botswana.

Keywords: financial development, economic growth, multivariate causality, Botswana

JEL Codes: E44, G21, O16

INTRODUCTION

There is an ongoing argument among scholars concerning the direction of causality between bank-related and stock exchange-based financial development and savings, investment and economic growth. As far as economic growth causality studies are concerned, a considerable number of empirical works have been conducted on a number of countries though with conflicting results (see Nyasha and Odhiambo, 2015; Rehman et al., 2015; Acaravci et al., 2009). There are four views that have been empirically proven to exist in literature, that is, the supply-leading hypothesis, demand-following hypothesis, bidirectional-causality view and the fourth view stipulating that financial development and economic growth have no causal relationship (Nyasha and Odhiambo, 2015). The supply leading hypothesis claims that financial development stimulates economic growth (see Bayar et al. 2014; Masoud, 2013; Nazir et al., 2010; Tachiwou, 2010; Nowbusting and Odit, 2009; Caporale et al., 2004; Boubakari and Jin, 2010), and the demand following hypothesis claims that growth instigates the demand for financial commodities (see Odo et al., 2016; Isu and Okpara, 2013; Carby et al., 2012; Paramati and Gupta, 2011; Baliamoune-Lutz, 2003; Onwumere et al., 2012). The bi-directional causality hypothesis stipulates that financial progression and economic growth are bi-directionally causal while the fourth view states that financial progression has no relationship with economic growth (see Nyasha and Odhiambo, 2015; Acaravci et al., 2009).

However, causality studies that focused on the additional variables used in this study have not been as numerous and as widely researched on as the finance-growth nexus. The relationship between financial development and investment is articulated as having four main conclusions by Muyambiri and Odhiambo (2017), that is:

a) Financial development Granger-causes investment (Xu, 2000; Caporale et al., 2005, Rousseau and Vuthipadadorn 2005; Chaudry, 2007; Carp, 2012; Hamdi et al., 2013; Asongu, 2014);
b) Investment Granger-causes financial development (Odhiambo, 2010);

c) There is a bidirectional causality between financial development and investment (Shan et al., 2001; Shan and Jianhong, 2006; Lu et al., 2007; Nazlioglu et al., 2009; Huang, 2011); and
d) No causal relationship exists between the two variables (Majid, 2008; Shan and Morris, 2002; Marques et al., 2013).

Conversely, most of the studies conducted to evaluate the causal relationship between either of the variables employed in this study, made use of mostly bank-related financial development indicators while ignoring the stock exchange-based side of the financial sector. In addition to the contradictory results that came from such studies, there has been no study to be best of our current knowledge that has sought to investigate the multivariate causal relationship between bank-related financial development, stock exchange-based financial development, savings and investment in one study especially for a country like Botswana[1]. Given these existing gaps, this study takes advantage of the multivariate causality analysis framework using the autoregressive distributed lag bounds testing approach to assess such a relationship.

METHODOLOGY

Shadowing Nyasha and Odhiambo (2015), the estimated ARDL model is given as follows.

$$\Delta INV_t = \propto_0 + \sum_{i=1}^{n} \propto_{1i} \Delta INV_{t-i} + \sum_{i=0}^{n} \propto_{2i} \Delta BFA_{t-i} + \sum_{i=0}^{n} \propto_{3i} \Delta MFA_{t-i} + \sum_{i=0}^{n} \propto_{4i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \propto_{5i} \Delta GDS_{t-i} + \alpha_6 INV_{t-1} + \alpha_7 BFA_{t-1} + \alpha_8 MFA_{t-1} + \alpha_9 GDP_{t-1} + \alpha_{10} GDS_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta BFA_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta BFA_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta INV_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta MFA_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \beta_{5i} \Delta GDS_{t-i} + \beta_6 BFA_{t-1} + \beta_7 INV_{t-1} + \beta_8 MFA_{t-1} + \beta_9 GDP_{t-1} + \beta_{10} GDS_{t-1} + \varepsilon_{2t} \quad (2)$$

$$\Delta GDS_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta GDS_{t-i} + \sum_{i=0}^{n} \rho_{2i} \Delta INV_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta BFA_{t-i} + \sum_{i=0}^{n} \rho_{4i} \Delta MFA_{t-i} + \sum_{i=0}^{n} \rho_{5i} \Delta GDP_{t-i} + \rho_6 GDS_{t-1} + \rho_7 BFA_{t-1} + \rho_8 MFA_{t-1} + \rho_9 INV_{t-1} + \rho_{10} GDP_{t-1} + \varepsilon_{3t} \quad (3)$$

$$\Delta GDP_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta INV_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta BFA_{t-i} + \sum_{i=0}^{n} \gamma_{4i} \Delta MFA_{t-i} + \sum_{i=0}^{n} \gamma_{5i} \Delta GDS_{t-i} + \gamma_6 GDP_{t-1} + \gamma_7 BFA_{t-1} + \gamma_8 MFA_{t-1} + \gamma_9 INV_{t-1} + \gamma_{10} GDP_{t-1} + \varepsilon_{4t} \quad (4)$$

$$\Delta MFA_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta MFA_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta INV_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta BFA_{t-i} + \sum_{i=0}^{n} \delta_{4i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \delta_{5i} \Delta GDS_{t-i} + \delta_6 BFA_{t-1} + \delta_7 INV_{t-1} + \delta_8 MFA_{t-1} + \delta_9 GDP_{t-1} + \delta_{10} GDS_{t-1} + \varepsilon_{5t} \quad (5)$$

[1] See Muyambiri and Odhiambo (2015) for a fuller examination of the sequential development of the finance sector in Botswana

The multivariate causality model is then presented as follows:

$$\Delta INV_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta INV_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta BFA_{t-i} + \sum_{i=1}^{n} \alpha_{3i} \Delta MFA_{t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \alpha_{5i} \Delta GDS_{t-i} + \alpha_6 ECT_{t-1} + \mu_{1t} \quad (6)$$

$$\Delta BFA_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta INV_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta BFA_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta MFA_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \beta_{5i} \Delta GDS_{t-i} + \beta_6 ECT_{t-1} + \mu_{2t} \quad (7)$$

$$\Delta GDS_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta INV_{t-i} + \sum_{i=1}^{n} \rho_{2i} \Delta BFA_{t-i} + \sum_{i=1}^{n} \rho_{3i} \Delta MFA_{t-i} + \sum_{i=1}^{n} \rho_{4i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \rho_{5i} \Delta GDS_{t-i} + \rho_6 ECT_{t-1} + \mu_{3t} \quad (8)$$

$$\Delta GDP_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta INV_{t-i} + \sum_{i=1}^{n} \gamma_{3i} \Delta BFA_{t-i} + \sum_{i=1}^{n} \gamma_{4i} \Delta MFA_{t-i} + \sum_{i=1}^{n} \gamma_{5i} \Delta GDS_{t-i} + \gamma_6 ECT_{t-1} + \mu_{4t} \quad (9)$$

$$\Delta MFA_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta MFA_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta INV_{t-i} + \sum_{i=1}^{n} \delta_{3i} \Delta BFA_{t-i} + \sum_{i=1}^{n} \delta_{4i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \delta_{5i} \Delta GDS_{t-i} + \delta_6 ECT_{t-1} + \mu_{5t} \quad (10)$$

where

INV = investment to GDP ratio.

BFA = accelerator-augmented index of bank-related financial development index, calculated as the means-removed average (of M3 to GDP, domestic credit to private sector to GDP ratio, and total domestic credit to GDP ratio) multiplied by the growth rate of GDP per capita.

MFA = accelerator-augmented index of stock exchange-based financial development index, calculated as the means-removed average (of stocks traded, total value to GDP ratio, market capitalisation to GDP ratio, and the turnover ratio) multiplied by the growth rate of GDP per capita.

GDP = real GDP growth rate.

GDS = gross domestic savings.

ECT = error-correction term,

$\propto_0, \beta_0, \rho_0, \gamma_0$ and δ_0= respective constants,

$\propto_1, \dots, \propto_{10}, \beta_1, \dots, \beta_{10}, \rho_1, \dots, \rho_{10}, \gamma_1, \dots, \gamma_{10}$ and $\delta_1, \dots, \delta_{10}$=respective coefficients,

Δ = difference operator,

n = lag length,

ε = error term and μ = white-noise error-term.

EMPRICAL RESULTS

Stationarity tests are employed to ensure that all variables are integrated of maximum order 1. Otherwise, the ARDL bounds test methodology will break down if there are variables integrated of an order greater than 1. The Perron (1997) PPURoot unit root and the Augmented Dickey-Fuller Generalised Least Square tests unit root tests

Table 1. Stationarity Test Results

DICKEY-FULLER GENERALISED LEAST SQUARE (DF-GLS)				
Variable	**Stationarity in levels**		**Stationarity in differences**	
	With intercept, no trend	**With intercept and trend**	**With intercept, no trend**	**With intercept and trend**
INV	-2.7471*	-2.7773	-6.2222***	-6.2291***
GDP	-4.5213 ***	-5.4507 ***	-	-
BFA	-1.7833*	-2.0434	-9.9352***	-11.0932***
MFA	-4.0963**	-4.9413*	-	-
GDS	-2.1037**	-2.5491	-5.5152***	-5.5653***
Perron (1997) PPURoot				
Variable	**Stationarity in levels**		**Stationarity in differences**	
INV	-6.3488***	-6.6408***	-	-
GDP	-6.3130***	-6.2841***	-	-
BFA	-6.4923***	-7.0091**	-	-
MFA	-5.6991*	-5.1882	-6.7414***	-6.4492***
GDS	-4.0141	-4.3253	-6.3954***	-6.2451***

Note: *, ** and *** denote stationarity at the 10%, 5% and 1% significance levels respectively

Table 2. Bounds F-Test for Cointegration Results

Dependent Variable	**Function**		**F-statistic**		**Cointegration Status**	
INV	F(INV| GDP, BFA, MFA, GDS)		5.1612***		Cointegrated	
BFA	F(BFA| GDP, INV, MFA, GDS)		6.5637***		Cointegrated	
MFA	F(MFA| GDP, BFA, INV, GDS)		1.0799		Not cointegrated	
GDP	F(GDP| INV, BFA, MFA, GDS)		3.3418		Not cointegrated	
GDS	F(GDS| GDP, BFA, MFA, INV)		3.8044*		Cointegrated	
Asymptotic Critical						
	1%		5%		10%	
Pesaran et al. (2001:301)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Table CI(iii) Case III	3.74	5.06	2.86	4.01	2.45	3.52

Note: *, ** and *** denotes significance at the 10%, 5% and 1% significance levels respectively

Table 3. Granger-Causality Test Results

Investment (I), Bank-related Financial Development (BG), and Savings (S)						
Dependent Variable	**F-statistics (probability)**					$\boldsymbol{ECT_t}$ **[t-statistics]**
	ΔINV_t	ΔBFA_t	ΔMFA_t	ΔGDP_t	ΔGDS_t	
ΔINV_t	-	1.0580	1.7160	4.6903**	4.1479*	-0.83473**
		(0.387)	(0.234)	(0.040)	(0.053)	[-3.1077]
ΔBFA_t	4.1163**	-	9.4632**	0.61525	0.0060698	-0.19494*
	(0.044)		(0.010)	(0.557)	(0.939)	[-1.7746]
ΔMFA_t	7.2592**	0.15822		0.96271	0.55967	
	(0.011)	(0.856)		(0.415)	(0.588)	
ΔGDP_t	2.0094	3.4138*	1.2810		2.4408	
	(0.190)	(0.066)	(0.324)		(0.131)	
ΔGDS_t	0.75629	1.6111	3.8186*	6.3678**	-	-0.88920***
	(0.407)	(0.251)	(0.082)	(0.019)		[-4.2538]

Note: *, ** and *** denotes significance at the 10%, 5% and 1% significance levels, respectively

were employed to check the order of integration. The results for the test of stationarity of the variables are presented in **Table 1**.

Table 1 confirms that the ARDL bounds testing procedure is appropriate for the data and it is therefore employed. **Table 2** reports the results of the bounds F-test for co-integration.

The results from the bounds cointegration test indicate that three out of the five equations have a long run relationship. Consequently, the multivariate Granger causality test is run and the results are reported in **Table 3**. The equations with a cointegrated relationship are estimated, as expected, with the inclusion of an error correction term. Otherwise, no error correction term is included.

The empirical results of the multivariate Granger causality test are reported in **Table 3**.

The results in **Table 3** reveal that they are only unidirectional causal relationships amongst a number of the variables under discussion. Economic growth is found to Granger-cause investment and savings both in the short-run and long run. Only bank-related financial development is found to Granger-cause economic growth in Botswana in the short run.

Inherently, investment, according to the results, precedes financial development. However, there is only a short-run unidirectional causal relationship from investment to stock exchange-based financial development. The same unidirectional relationship in both the short run and the long run is found from investment to bank-related financial development. Therefore, consistent with Odhiambo (2010), the results show that it is chiefly investment that drives

Table 4. Summary of Granger-causality test results

DEPENDENT VARIABLE	DIRECTION OF CAUSALITY AND SIGNIFICANT VARIABLES	PERIOD OF CAUSALITY	
		Short Run	Long Run
GDP	⇒INV, GDS	✓	✓
INV	⇒BFA	✓	✓
	⇒MFA	✓	-
MFA	⇒BFA	✓	✓
	⇒GDS	✓	✓
BFA	⇒GDP	✓	-
GDS	⇒INV	✓	✓

NB: GDP=Economic growth, GDS=Savings, INV=investment; BFA=bank-related financial development; MFA=stock exchange-based financial development, ⇒indicates direction of causality, ✓indicates presence of causality in respective period.

the bank-related and stock exchange-based financial sectors. To induce financial sector development, there is need to put in place policies that encourage increased investment. Nevertheless, investment is found to be Granger-caused by economic growth and savings in both the long run and the short run in Botswana.

Notwithstanding that stock exchange-based financial development is Granger-caused by only investment, it precedes both bank-related financial development and savings in both the short run and the long run.

As already noted, investment and stock exchange-based financial development Granger-cause bank-related financial development in the short run and long run. The only variable that is Granger-caused by bank-related financial development is economic growth and this is only in the short run. This finding tends to confirm the findings of Bayar et al., 2014; Masoud, 2013; Nazir et al., 2010; Tachiwou, 2010; Nowbusting and Odit, 2009; Caporale et al., 2004; and Boubakari and Jin, 2010.

Savings Granger-cause investment in both the long run and the short run. Stock exchange-based financial development and economic growth Granger-cause savings in both the short run and the long run.

Table 4 summarises the results of the Granger-causality tests.

CONCLUSION

In this paper, the causal relationship between financial development, split into bank-related and stock exchange-based financial development, savings, and investment and economic growth has been empirically examined for the period of 1976 to 2014 for Botswana with the aid of a multivariate Granger-causality model. The study results show that it is chiefly investment that drives the bank-related and stock exchange-based financial sectors in the short run. However, the same deduction is true for bank-related financial development in the long run. Inherently, results also show that stock exchange-based financial development drives bank-related financial development and savings in both the short run and the long run. While, savings are found to Granger-cause investment. Economic growth is found to Granger-cause investment and savings both in the short-run and long run. Only bank-related financial development is found to Granger-cause economic growth in Botswana.

Therefore, to induce financial sector development in the short run, there is need to put in place policies that encourage increased investment. These must focus on the economic growth and savings that have been found to precede investment as per the results of this study.

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