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; Balamoune-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.

\[
\Delta\text{INV}_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta\text{INV}_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta\text{BFA}_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta\text{MFA}_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta\text{GDP}_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta\text{GDS}_{t-i} + \alpha_6 \text{INV}_{t-1} + \alpha_7 \text{BFA}_{t-1} + \alpha_8 \text{MFA}_{t-1} + \alpha_9 \text{GDP}_{t-1} + \alpha_{10} \text{GDS}_{t-1} + \epsilon_{1t}
\]

(1)

\[
\Delta\text{BFA}_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta\text{BFA}_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta\text{INV}_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta\text{MFA}_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta\text{GDP}_{t-i} + \sum_{i=0}^{n} \beta_{5i} \Delta\text{GDS}_{t-i} + \beta_6 \text{BFA}_{t-1} + \beta_7 \text{INV}_{t-1} + \beta_8 \text{MFA}_{t-1} + \beta_9 \text{GDP}_{t-1} + \beta_{10} \text{GDS}_{t-1} + \epsilon_{2t}
\]

(2)

\[
\Delta\text{GDS}_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta\text{GDS}_{t-i} + \sum_{i=0}^{n} \rho_{2i} \Delta\text{INV}_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta\text{BFA}_{t-i} + \sum_{i=0}^{n} \rho_{4i} \Delta\text{MFA}_{t-i} + \sum_{i=0}^{n} \rho_{5i} \Delta\text{GDP}_{t-i} + \rho_6 \text{GDS}_{t-1} + \rho_7 \text{BFA}_{t-1} + \rho_8 \text{MFA}_{t-1} + \rho_9 \text{INV}_{t-1} + \rho_{10} \text{GDP}_{t-1} + \epsilon_{3t}
\]

(3)

\[
\Delta\text{GDP}_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta\text{GDP}_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta\text{INV}_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta\text{BFA}_{t-i} + \sum_{i=0}^{n} \gamma_{4i} \Delta\text{MFA}_{t-i} + \sum_{i=0}^{n} \gamma_{5i} \Delta\text{GDS}_{t-i} + \gamma_6 \text{GDP}_{t-1} + \gamma_7 \text{BFA}_{t-1} + \gamma_8 \text{MFA}_{t-1} + \gamma_9 \text{INV}_{t-1} + \gamma_{10} \text{GDP}_{t-1} + \epsilon_{4t}
\]

(4)

\[
\Delta\text{MFA}_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta\text{MFA}_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta\text{INV}_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta\text{BFA}_{t-i} + \sum_{i=0}^{n} \delta_{4i} \Delta\text{GDP}_{t-i} + \sum_{i=0}^{n} \delta_{5i} \Delta\text{GDS}_{t-i} + \delta_6 \text{MFA}_{t-1} + \delta_7 \text{INV}_{t-1} + \delta_8 \text{MFA}_{t-1} + \delta_9 \text{GDP}_{t-1} + \delta_{10} \text{GDS}_{t-1} + \epsilon_{5t}
\]

(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:

\[ \Delta IINV_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\Delta IINV_{t-i} + \sum_{i=1}^{n} \alpha_{2i}\Delta BFA_{t-i} + \sum_{i=1}^{n} \alpha_{3i}\Delta MFA_{t-i} + \sum_{i=1}^{n} \alpha_{4i}\Delta GDP_{t-i} \]
\[ + \sum_{i=1}^{n} \alpha_{5i}\Delta GDS_{t-i} + \alpha_6 ECT_{t-1} + \mu_{3t} \]
\[ \Delta BFA_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\Delta IINV_{t-i} + \sum_{i=1}^{n} \beta_{2i}\Delta BFA_{t-i} + \sum_{i=1}^{n} \beta_{3i}\Delta MFA_{t-i} + \sum_{i=1}^{n} \beta_{4i}\Delta GDP_{t-i} \]
\[ + \sum_{i=1}^{n} \beta_{5i}\Delta GDS_{t-i} + \beta_6 ECT_{t-1} + \mu_{2t} \]
\[ \Delta GDS_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i}\Delta IINV_{t-i} + \sum_{i=1}^{n} \rho_{2i}\Delta BFA_{t-i} + \sum_{i=1}^{n} \rho_{3i}\Delta MFA_{t-i} + \sum_{i=1}^{n} \rho_{4i}\Delta GDP_{t-i} \]
\[ + \sum_{i=1}^{n} \rho_{5i}\Delta GDS_{t-i} + \rho_6 ECT_{t-1} + \mu_{3t} \]
\[ \Delta GDP_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i}\Delta GDP_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\Delta IINV_{t-i} + \sum_{i=1}^{n} \gamma_{3i}\Delta BFA_{t-i} + \sum_{i=1}^{n} \gamma_{4i}\Delta MFA_{t-i} \]
\[ + \sum_{i=1}^{n} \gamma_{5i}\Delta GDS_{t-i} + \gamma_6 ECT_{t-1} + \mu_{4t} \]
\[ \Delta MFA_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i}\Delta MFA_{t-i} + \sum_{i=1}^{n} \delta_{2i}\Delta IINV_{t-i} + \sum_{i=1}^{n} \delta_{3i}\Delta BFA_{t-i} + \sum_{i=1}^{n} \delta_{4i}\Delta GDP_{t-i} \]
\[ + \sum_{i=1}^{n} \delta_{5i}\Delta GDS_{t-i} + \delta_6 ECT_{t-1} + \mu_{5t} \]

where

\( IINV = \) 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,

\( \alpha_0, \beta_0, \rho_0, \gamma_0 \) and \( \delta_0 \) = respective constants,

\( \alpha_{1i}, \ldots, \alpha_{10i}, \beta_{1i}, \ldots, \beta_{10i}, \rho_{1i}, \ldots, \rho_{10i}, \gamma_{1i}, \ldots, \gamma_{10i} \) and \( \delta_{1i}, \ldots, \delta_{10i} \) = respective coefficients,

\( \Delta = \) difference operator,

\( n = \) lag length,

\( \varepsilon = \) error term and \( \mu = \) 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
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
Botswana in the short run.

Similarly, for financial development Granger-causes economic growth only in the long run. The equations with a
cointegrated relationship are estimated, as expected, with the inclusion of an error correction term. Table 1
presents the results of the bounds F-test for co-integration.

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.

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term. Otherwise, no error correction term is included.

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 1. Stationarity Test Results

| Variable | Dickey-Fuller Generalised Least Square (DF-GLS) |
|----------|--------------------------------------------------|
|          | Stationarity in levels                          | Stationarity in differences |
|          | With intercept, no trend                        | With intercept and trend     |
| INV      | -2.7471*                                         | -2.7773                      |
| GDP      | -4.5213***                                       | -5.4507***                   |
| BFA      | -1.7833*                                         | -2.0434                      |
| MFA      | -0.0963**                                        | -0.9352***                   |
| GDS      | -2.1037**                                        | -2.5491                      |

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) | 5.162*** | Cointegrated |
| BFA                | F(BFA| GDP, INV, MFA, GDS) | 6.563*** | 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%

Perron (1997) PPURoot

Table 3. Granger-Causality Test Results

| Dependent Variable | F-statistics (probability) | ECTt [t-statistics] |
|--------------------|-----------------------------|---------------------|
| ΔINVt              | -1.0580 (0.387)             | -0.8347*** [-3.1077] |
| ΔBFAt              | 4.1163** (0.044)            | -0.19494* [-4.7746] |
| ΔMFAt              | 7.2592** (0.011)            | 0.53967            |
| ΔGDPt              | 2.4094 (0.190)              | 2.4408              |
| ΔGDSi              | 0.5629 (0.407)              | -0.88920*** [-4.2538] |

Note: *, ** and *** denote stationarity at the 10%, 5% and 1% significance levels respectively.
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. However, the same deduction is true for bank-related financial development in the 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.

**REFERENCES**

Acaravci, S. K., Ozturk, I. and Acaravci, A. (2009). Financial development and economic growth: Literature survey and empirical evidence from Sub-Saharan African countries. *South African Journal of Economic and Management Sciences*, 12(1), 11-27. https://doi.org/10.4102/sajems.v12i1.258

Baliamoune-Lutz, M. (2003). Financial liberalization and economic growth in Morocco: a test of the supply-leading hypothesis. *Journal of Business in Developing Nations*, 7, 31-50.

Bayar, Y., Kaya, A. and Yildirim, M. (2014). Effects of stock market development on economic growth: Evidence from Turkey. *International Journal of Financial Research*, 5(1), 93-100. https://doi.org/10.5430/ijfr.v5n1p93

Boubakari, A. and Jin, D. (2010). The role of Stock Market Development in Economic Growth: Evidence from some Euronext Countries, *International Journal of Financial Research*, 1(1), 14-20. https://doi.org/10.5430/ijfr.v1n1p14

Caporale, G. M., Howells, P. G. and Soliman, A. M. (2004). Stock market development and economic growth: the causal linkage. *Journal of economic development*, 29(1), 33-50.
Carby, Y., Craigwell, R., Wright, A. and Wood, A. (2012). Finance and growth causality: A test of the Patrick's stage-of-development hypothesis. *International Journal of Business and Social Science*, 3(21), 129-139.

Isu, H. O. and Okpara, G. C. (2013). Does Financial Deepening Follow Supply Leading on Demand Following Hypothesis? A look at the Nigerian Evidence. *Asian Journal of Science and Technology*, 5(1), 10-15.

Masoud, N. M. (2013). The impact of stock market performance upon economic growth. *International Journal of Economics and Financial Issues*, 3(4), 788-798.

Muyambiri, B and Odhiambo, M. N. (2017). The casual relationship between financial development and investment in Botswana. *UNISA Economic Research Working Paper Series*, Working Paper 09/2017, 1-31.

Muyambiri, B. and Odhiambo, N. M. (2015). The evolution of the financial system in Botswana. *African Journal of Business and Economic Research*, 10(2-3), 87-113.

Nazir, M. S., Nawaz, M. M. and Gilani, U. J. (2010). Relationship between economic growth and stock market development. *African Journal of Business Management*, 4(16), 3473-3479.

Nowbusting, B. M. and Odit, M. P. (2009). Stock market development and economic growth: The case of Mauritius. *International Business & Economics Research Journal (IBER)*, 8(2), 77-88.

Nyasha, S. and Odhiambo, N. M. (2015). Banks, stock market development and economic growth in South Africa: a multivariate causal linkage. *Applied Economics Letters*, 22(18), 1480-1485. https://doi.org/10.1080/13504851.2015.1042132

Odo, S. I., Oghonna, B.C., Agbi, P. E. and Anoke, C. I. (2016). Investigating the causal relationship between Financial Development and Economic Growth in Nigeria and South Africa. *Journal of Economics and Finance*, 7(2), 75-81.

Onwumere, J. U. J., Ibe, I. G., Okafor, R. G. and Uche, U. B. (2012). Stock Market and Economic Growth in Nigeria: Evidence from the Demand-Following Hypothesis. *European Journal of Business and Management*, 4(19), 1-9.

Paramati, S. R., and Gupta, R. (2011). An empirical analysis of stock market performance and economic growth: evidence from India, *International Research Journal of Finance and Economics*, 73, 133-149.

Perron, P. (1997). Further evidence on breaking trend functions in macroeconomic variables. *Journal of econometrics*, 80(2), 355-385. https://doi.org/10.1016/S0304-4076(97)00049-3

Pesaran, M. H., Shin, Y. and Smith, R. (2001). Bound testing approaches to the analysis of level relationship. *Journal of Applied Econometrics*, 16(3), 289-326. https://doi.org/10.1002/jae.616

Rehman, M. Z., Ali, N. and Nasir, N. M. (2015). Linkage between Financial Development, Trade Openness and Economic Growth: Evidence from Saudi Arabia. *Journal of Applied Finance & Banking*, 5(6), 127-141.

Tachiwou, A. M. (2010). Stock market development and economic growth: the case of West African monetary union. *International Journal of Economics and Finance*, 2(3), 97-103. https://doi.org/10.5539/ijef.v2n3p97