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Working Paper 09/2017

May 2017

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THE CAUSAL RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND INVESTMENT IN BOTSWANA

Brian Muyambiri[1] and Nicholas M. Odhiambo

Abstract

In this paper, we examine the causal relationship between financial development and investment in Botswana between 1976 and 2014, using the autoregressive distributed-lag (ARDL) bounds testing approach. Unlike some previous studies, our study divides financial sector development into two segments, namely bank-based and market-based financial development. We also employ a trivariate Granger-causality model in order to address the omission-of-variable bias associated with a bivariate causality model. In order to capture the breadth and depth of the financial sector in the study country, we employ both bank- and market-based financial development indices. These indices are constructed from an array of bank- and market-based financial development indicators. Our results show that there is a bidirectional Granger-causal relationship between both bank-based and market-based financial development and investment in the short run. However, in the long run, a distinct causal flow is found to prevail only from investment to bank-based financial development.

Keywords: *Botswana, Investment, Bank-Based Financial Development, Market-Based Financial Development*

JEL Classification Code: *G10, G20, E22*

1. Introduction

There is no doubt that financial development has been investigated widely in economics, mostly as a significant contributor to economic growth. However, its relationship with

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investment has been assumed as relatively a positive one due to specific seminal studies that have given strong implications of such (see, among others, McKinnon, 1973; Shaw, 1973; Mathieson, 1979; Fry, 1978; Levine, 1997; 2005). The causal relationship between bank-based financial development and investment, and market-based financial development and investment has not been empirically ascertained substantively -- especially for a southern African country like Botswana[2]. This article makes a substantive contribution to existing literature by taking advantage of the use of composite indices of financial development, dividing financial development into bank-based and market-based financial development. It employs the ARDL bounds method in a trivariate setting to evaluate the causal relationship between financial development and investment.

The remainder of the paper is organised as follows: Section 2 discusses Botswana's financial development; Section 3 gives a review of the related literature; Section 4 presents the data sources, the empirical model specification and the estimation technique; Section 5 gives the empirical results; while Section 6 presents the conclusion to the study.

2. Financial Development and Investment Dynamics in Botswana

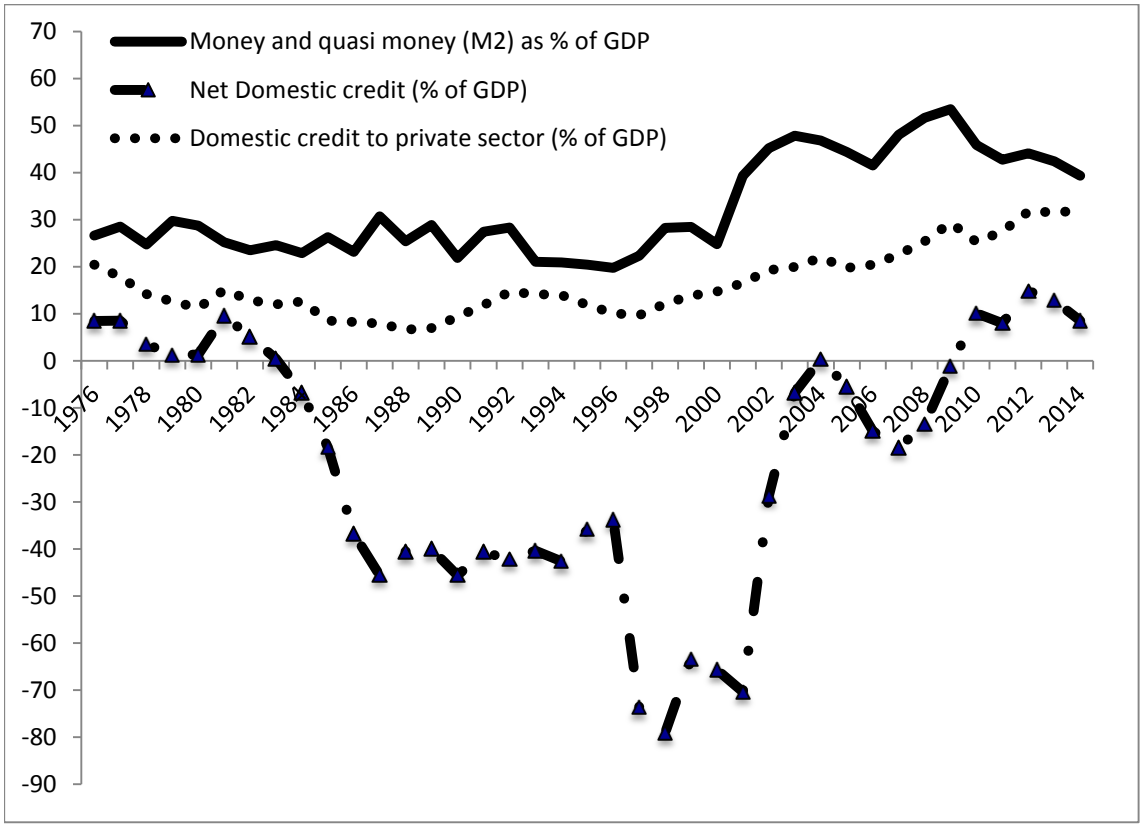
Botswana's financial system was first developed as an extension of the South African financial system in 1897. However, the independent national financial system was realised in 1976 when the Bank of Botswana was established (Muyambiri and Odhiambo, 2015). With the advent of the Bank of Botswana, a number of policies were put in place. Some of the

[2] See Muyambiri and Odhiambo (2015) for a fuller discussion of the chronological evolution of financial development in Botswana

policies followed by the Bank of Botswana include the banking regulation in 1977, the restrictive monetary policy, and then in 1989 – after help from the World Bank – various emancipative policy reforms were instituted.

The banking sector also expanded, as evidenced by the trends in the M2 to the GDP ratio. Starting from a mere 10% in 1975, the M2 to GDP ratio has maintained levels above 20% from the mid-1990s. It even doubled to above 40% by 2009. Due to the repressive policy that tended to restrict rather than promote financial sector investment and business initiatives, the trends before 1992 showed stagnation in the advancement of the financial sector. After the changes in policy through financial liberalisation, and following on a number of mergers, acquisitions and closures during the period 1992 to 1996, the financial sector began to improve in importance. Figure 1 shows the trends in the M2 to GDP ratio, the Net Domestic Credit to GDP ratio and the Domestic credit to private sector to GDP ratio for Botswana from 1976 to 2014.

Figure 1 – Trends in Selected Bank-based Financial development Indicators in Botswana (1976-2014)



Source: World Bank, World Development Indicators, 2016.

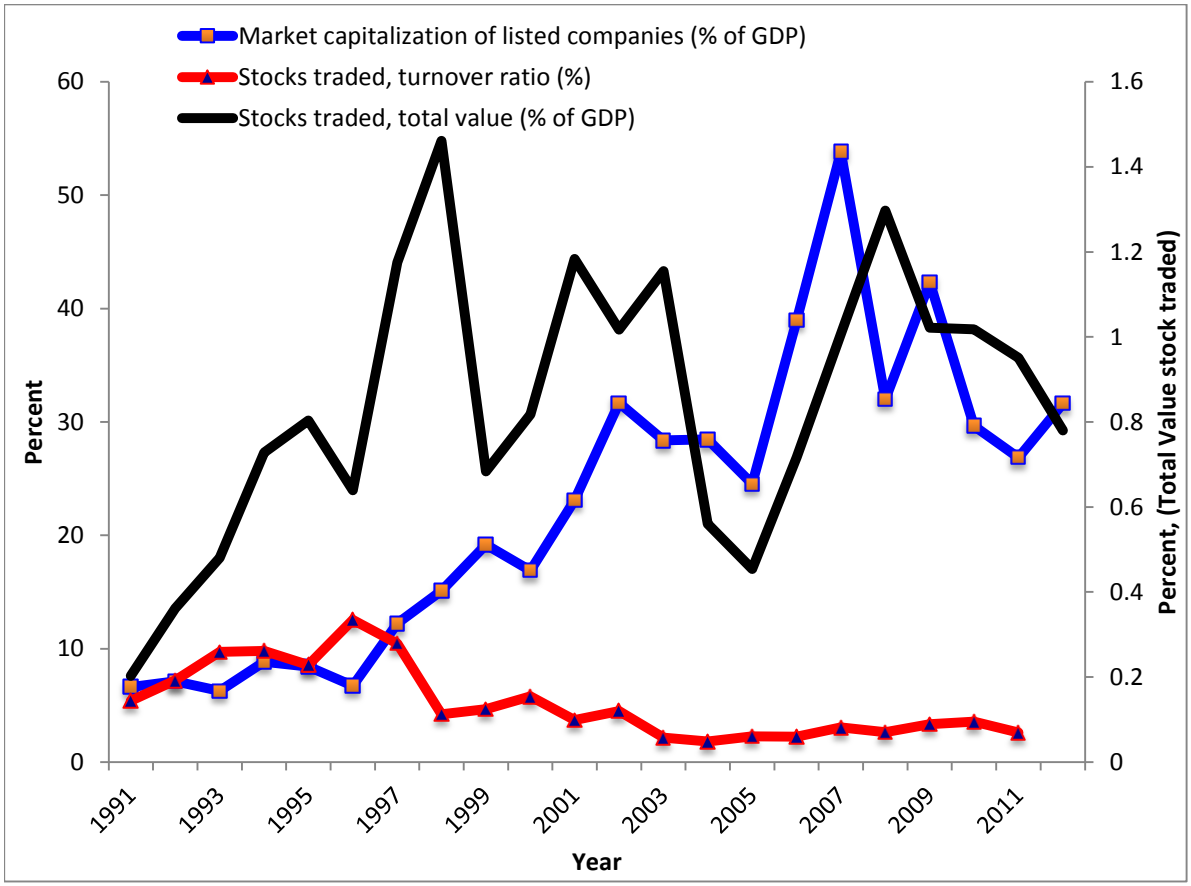
The M2 to GDP ratio shows that pursuant to the year 1997, the level of the money supply relative to the economy had been relatively stagnant. After 1997, the M2 to GDP ratio shows a sustained increment that points to the increased importance of the financial sector in Botswana. The resultant change in the M2 to GDP ratio was the result of the liberalisation policies of 1989, a number of bank mergers, acquisitions and closures during the period 1992 -1996 (Muyambiri and Odhiambo, 2015).

The extent to which bank-based financial sector was financing private entities is measured by the domestic credit to the private sector to GDP ratio. The domestic credit to private sector to GDP ratio shows a maintained downward trend from 21% to 7% from 1976 to 1989. From 1990 onwards (after the institution of liberalisation policies), the domestic credit to private sector to GDP ratio shows a continuous upsurge that climaxed to 32% by 2014. Therefore, the opening up of the financial sector through liberal policy managed to increase private sector borrowing, and to decrease disintermediation in the banking sector.

The other bank financial development indicator employed in this study is the net domestic credit to GDP ratio. The net domestic credit to GDP ratio gives a summative picture of the net claims of the public sector and the private sector relative to GDP. The net domestic credit to GDP ratio confirms the notion that, despite positive credit provision to the private sector, the public sector has been rather a net saver (provider of credit to the financial sector) than a borrower in the period under review.

The exceptions are the period from 1976 to 1983, where it ranged between 10% to 0% and 2010 to 2014, where it ranged from 8% to 10%. As far as the public sector is concerned, the financial sector has only recently started to be a credit provider, since 2010; otherwise, from 1983 to 2009, it was a net borrower. The trends in market-based financial development are presented in Figure 2.

Figure 2 – Trends in Selected Market-based Financial development Indicators in Botswana (1992-2014)

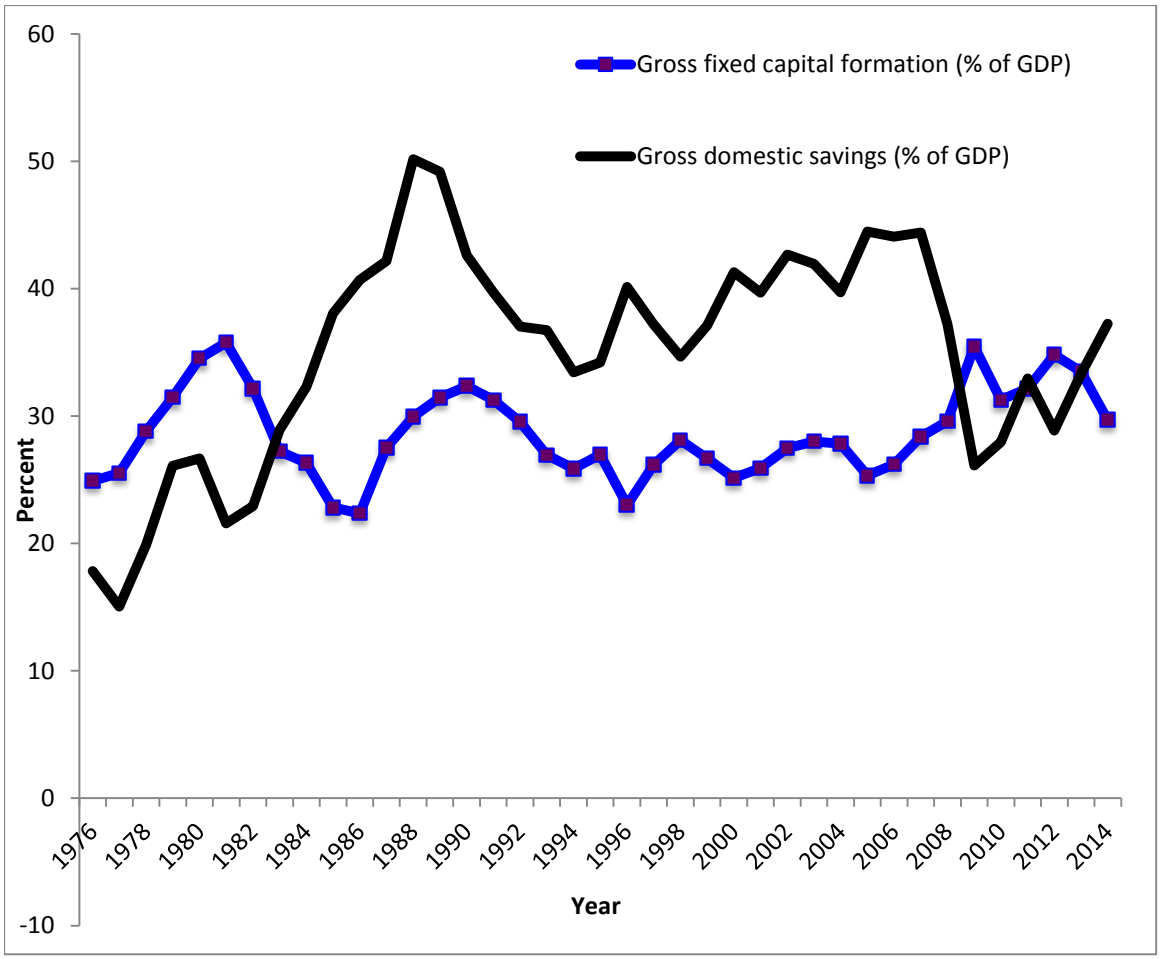


Source: Financial Structure Database - Beck *et al.* (2000, 2010); Čihák, *et al.* (2012).

The Botswana Share market was established in 1989. It was later formally established by an Act of Parliament (the Botswana Stock Exchange Act) in 1994. The trends in the market capitalisation to GDP and stocks traded, as well as the total value to GDP show the increased importance of the market-based sector to the economy. However, the turnover ratio of stocks traded has been maintained below 0.4% levels.

The trends in investment (proxied by the gross fixed-capital formation to GDP ratio) and savings (proxied by gross domestic savings) are shown in Figure 3.

Figure 3 – Trends in Investment and Savings in Botswana (1976 - 2014)



Source: World Bank, World Development Indicators, 2016.

The trends in investment show intermittent changes that kept the range between 22% and 36% from 1976 to 2014. Otherwise, gross domestic savings trends show three distinctive periods. The period from 1977 to 1988 showed a sustained increase in savings from 15% of GDP to 50% of GDP. Most of these savings were from the public sector (Muyambiri and Odhiambo, 2015). From 1988 to 2007, savings averaged 41%. After 2007, the savings to GDP ratio decreased to below 40% levels, that is, decreasing to 27% in 2008 (may be due to the global financial crisis) and surging again to 37% by 2014.

Despite the huge public sector domestic savings, financial development trends for Botswana for the period 1976 to 2014 showed an increase in financial depth and development.

3. Literature Review

Although a number of studies have been conducted on the relationship between financial development and economic growth, very few studies have examined the causal relationship between both bank-based financial development and market-based financial development, and investment.

Marques *et al.* (2013), together with Majid (2008) and Shan and Morris (2002), for example, found no causal relationship between financial development and investment. Interestingly, Lu *et al.* (2007) and Nazlioglu *et al.* (2009) are in agreement with Huang (2011) as their results point to bidirectional causality between finance and investment. Lu *et al.* (2007) used

a neoclassical Cobb-Douglas production function with constant returns to scale, cointegration testing, and Granger causality testing on data from China to obtain their result. Nazlioglu *et al.* (2009) used the bounds (ARDL) testing approach to cointegration for measuring the relationship between financial development and investment in Turkey. Nazlioglu *et al.* (2009), in assessing the limitations of their study, advocated for the use of other time-series techniques that do not only use financial development indicators as explanatory variables but also use other non-finance control variables to assess the finance--investment relationship. Their notion (Nazlioglu *et al.*, 2009) is addressed in this current study. On the other hand, Odhiambo (2010) found an investment-led finance result in South Africa using the bounds (ARDL) testing approach.

Nevertheless, from the limited empirical studies that have been performed, four main conclusions have materialised: i) Financial development Granger-causes investment (see, among others, Xu, 2000, Caporale *et al.*, 2005, Rousseau and Vuthipadadorn 2005, Chaudry, 2007, Carp, 2012, Hamdi *et al.*, 2013, and Asongu, 2014); ii) investment Granger-causes financial development (see Odhiambo, 2010); iii) 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, and Huang, 2011); and iv) no causal relationship exists between the two variables (Majid, 2008, Shan and Morris, 2002, and Marques *et al.*, 2013). Table 1 gives a summary of the previous studies, which have been conducted on the causal relationship between financial development and investment.

Table 1: Related Literature on Causality between Financial Development and Investment

Author(s)	Region/Country	Variables	Direction of Causality
Studies in Favour of Unidirectional Causality from Financial Development to Investment			
Caporale *et al.*, 2004	7 countries	- Ratio of gross fixed capital formation to nominal GDP - Ratio of the real change of GDP to the real level of total investment - Market capitalisation ratio - Value traded ratio	Stock market development → investment
Caporale *et al.*, 2005	4 countries	- Ratio of gross fixed capital formation to nominal GDP - Ratio of the real change of GDP to the real level of total investment - Market capitalisation ratio - Value traded ratio	Stock market development → investment
Carp, 2012	Romania	- Annual percentage growth rate of GDP at market prices - Local currency market capitalization of listed companies as a percentage of GDP - Turnover ratio (%) - Capitalization for the period stock value traded (% of GDP) - Total investment as a percentage of GDP	Stock market development → investment
Rousseau, 1999	Japan	- Non-intermediary holdings of corporate stocks and bonds - Per capita GNP - Gross domestic fixed investment - Private domestic fixed investment - Currency in circulation - Mid-year population - Assets of insurance companies - Loan agricultural cooperatives - Assets of savings institutions	Financial development → investment

		- Assets of special banks - Assets of commercial banks		
Xu, 2000	41 countries	- Real GDP - Real domestic investment - Index of financial development - Liquid liabilities/GDP - total bank deposits/GDP	Financial development investment	→
Rousseau & Vuthipadadorn, 2005	10 Asian countries	- Difference between broadly defined and narrow money (M2-M1) - Credit allocated to the private sector - Gross domestic product - Gross domestic fixed investment	Financial development investment	→
Chaudhry, 2007	Pakistan	- Economic Growth - Investment - Broad money - Private sector credit - Stock market capitalization - Foreign direct investment - Trade openness	Financial development investment	→
Hamdi *et al.*, 2013	Tunisia	- Banking deposit liabilities to GDP ratio - M3 to GDP - Private sector credit to GDP - Real GDP to total population - Investment to GDP	Financial development investment	→
Asongu, 2014	16 countries	- Deposit money bank assets/(deposit money + central bank assets) - Liquid liabilities/GDP - Central bank assets/GDP - Deposit money bank assets/GDP - Private credit by deposit money banks/GDP - Bank deposits/GDP - Financial system deposit/GDP	Financial development investment	→

		- Bank credit/bank deposits - Private credit by deposit money banks and other financial institutions/GDP - Foreign direct investment/GDP - Private capital flows/GDP - Remittance - Net development assistance/GDP - Gross private investment/GDP - Gross public investment/ GDP - Gross fixed capital formation/GDP - Gross domestic investment/GDP - Net long-term borrowing - Portfolio investment/GDP - Portfolio equity flows/GDP - Budgetary investment/GDP - Net foreign investment/GDP - Total gross domestic savings		
Studies in Favour of Unidirectional Causality from Investment to Financial Development				
Odhiambo, 2010	South Africa	- Liquid liabilities/GDP - Private credit/GDP - M2/GDP - Investment - Economic growth	Investment financial development	→
Studies in Favour of Bidirectional Causality between Financial Development and Investment				
Shan *et al.*, 2001	9 countries	- Real per capita GDP - Ratio of loans made to the private sector by commercial banks and other deposit-taking banks to GDP - Total factor productivity - Ratio of the sum of imports and exports to GDP - Investment as a percentage of GDP - Consumer price index	Investment financial development in China	↔

		- Stock market price index		
Lu *et al.*, 2007	China	- M2 - Bank deposit liabilities to GDP - Bank domestic credit to GDP - Real GDP per capita - Real per capita investment - Real physical capital per capita	Investment financial development	↔
Huang, 2011	43 countries	- Nominal private investment to nominal GDP - Financial intermediary development index - Liquid liabilities over GDP - Private credit to GDP - Commercial bank assets to the sum of commercial bank and central bank assets	Investment financial development	↔
Shan & Jianhong, 2006	China	- Real GDP - Total credit to the economy - Labour force - Net investment - Total trade as a % of GDP	Investment financial development	↔
Nazlioglu *et al.*, 2009	Turkey	- Gross fixed capital formation to nominal GDP - Government investment to nominal GDP - Private investment to nominal GDP - Money to income - Banking deposit liabilities to income - Domestic credit to income - Private sector credit to income - Share of private sector credit in domestic credit - Liquid liabilities to income	Investment financial development	↔
Studies in Favour of No Causal Relationship between Financial Development and Investment				

Majid, 2008	Malaysia	- The ratio of total bank deposits liabilities to nominal GDP - Share of gross fixed capital formation to nominal GDP - Growth rate of real gross domestic product (GDP) - Changes in the consumer price index	No causal relationship between financial development and investment
Shan and Morris, 2002	19 OECD countries and China	- Real GDP - Ratio of total credit to GDP - Spread of borrowing and lending interest rates - Productivity - Ratio of gross investment to GDP - Ratio of total trade to GDP - Consumer price index - Official interest rate - Stock market price index	No clear causal relationship between financial development and investment
Marques *et al.*, 2013	Portugal	- Real gross domestic product - Stock market capitalization/GDP - Total domestic credit ratio/GDP - Investment ratio logarithm/GDP - Consumer price index	No causal relationship between financial development and investment

NB: → indicates direction of causality.

As shown by the number of studies reviewed, there has not been much emphasis on evaluating the causal relationship between financial development and investment. Nevertheless, the findings of previous studies suggest that this relationship is relatively ambiguous, and there is much scope for further empirical investigation.

4. Data and Methodology

The study used data for the period of 1976 to 2014. The main data source was the World Development Indicators (World Bank, 2016). All the series data were obtained from this source.

The ARDL model used in this study can be expressed as follows:

Model A: Investment and bank-based financial development

$$\Delta I_t = \propto_0 + \sum_{i=1}^{n} \propto_{1i} \Delta I_{t-i} + \sum_{i=0}^{n} \propto_{2i} \Delta BG_{t-i} + \sum_{i=0}^{n} \propto_{3i} \Delta S_{t-i} + \alpha_4 BG_{t-1} + \alpha_5 S_{t-1} + \alpha_6 I_{t-1} + \varepsilon_{1t} \ldots\ldots\ldots\ldots 1$$

$$\Delta BG_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta BG_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta I_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta S_{t-i} + \beta_4 BG_{t-1} + \beta_5 S_{t-1} + \beta_6 I_{t-1} + \varepsilon_{2t} \ldots\ldots\ldots\ldots 2$$

$$\Delta S_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta S_{t-i} + \sum_{i=0}^{n} \rho_{2i} \Delta I_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta BG_{t-i} + \rho_4 BG_{t-1} + \rho_5 S_{t-1} + \rho_6 I_{t-1} + \varepsilon_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

Model B: Investment and market-based financial development

$$\Delta I_t = \omega_0 + \sum_{i=1}^{n} \omega_{1i} \Delta I_{t-i} + \sum_{i=0}^{n} \omega_{2i} \Delta MG_{t-i} + \sum_{i=0}^{n} \omega_{3i} \Delta S_{t-i} + \omega_4 MG_{t-1} + \omega_5 S_{t-1} + \omega_6 I_{t-1} + \varepsilon_{4t} \ldots\ldots\ldots 4$$

$$\Delta MG_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1i} \Delta MG_{t-i} + \sum_{i=0}^{n} \varphi_{2i} \Delta S_{t-i} + \sum_{i=0}^{n} \varphi_{3i} \Delta I_{t-i} + \varphi_4 MG_{t-1} + \varphi_5 S_{t-1} + \varphi_6 I_{t-1} + \varepsilon_{5t} \ldots\ldots\ldots 5$$

$$\Delta S_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta S_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta MG_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta I_{t-i} + \gamma_4 MG_{t-1} + \gamma_5 S_{t-1} + \gamma_6 I_{t-1} + \varepsilon_{6t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 6$$

Where I is the annual growth rate of the gross fixed capital formation (a proxy for the level of domestic investment), BG is the bank-based financial development index, MG is the market-based financial development index, S is the gross domestic savings, and ε is the error term. Three bank-based financial development indicators are used to calculate the bank-based financial development indicator (BG) – namely, liquid liabilities as a ratio of GDP (M3), domestic credit to private sector as a ratio of GDP, and domestic credit provided by financial sector (% of GDP) as a ratio of GDP. The resultant index is multiplied by the GDP per capita growth rate to get the accelerator-augmented index, BG. Three market-based financial development indicators are used

to calculate the market-based financial development indicator, MG – stocks traded, total value as a percentage of GDP, market capitalisation of listed companies as a ratio of GDP, and the turnover ratio. The resultant index is multiplied by the GDP per capita growth rate to get the accelerator-augmented index, MG.

After confirmation of cointegration between financial development and investment, the causal relationship between investment and either bank-based financial development or market-based financial development is investigated with the aid of the VECM Granger-causality approach. Following Nyasha and Odhiambo (2015) and Odhiambo (2010), the trivariate causality model is estimated as follows:

Model A: Investment and bank-based financial development

$$\Delta I_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta I_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta BG_{t-i} + \sum_{i=1}^{n} \alpha_{3i} \Delta S_{t-i} + \alpha_4 ECT_{t-1} + \mu_{1t} \quad \ldots\ldots 7$$

$$\Delta BG_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta I_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta BG_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta S_{t-i} + \beta_4 ECT_{t-1} + \mu_{2t} \quad \ldots\ldots 8$$

$$\Delta S_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta I_{t-i} + \sum_{i=1}^{n} \rho_{2i} \Delta BG_{t-i} + \sum_{i=1}^{n} \rho_{3i} \Delta S_{t-i} + \rho_4 ECT_{t-1} + \mu_{3t} \quad \ldots\ldots 9$$

Model B: Investment and market-based financial development

$$\Delta I_t = \omega_0 + \sum_{i=1}^{n} \omega_{1i} \Delta I_{t-i} + \sum_{i=1}^{n} \omega_{2i} \Delta MG_{t-i} + \sum_{i=1}^{n} \omega_{3i} \Delta S_{t-i} + \omega_4 ECT_{t-1} + \mu_{4t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 10$$

$$\Delta MG_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1i} \Delta I_{t-i} + \sum_{i=1}^{n} \varphi_{2i} \Delta MG_{t-i} + \sum_{i=1}^{n} \varphi_{3i} \Delta S_{t-i} + \varphi_4 ECT_{t-1} + \mu_{5t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 11$$

$$\Delta S_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta I_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta MG_{t-i} + \sum_{i=1}^{n} \gamma_{3i} \Delta S_{t-i} + \gamma_4 ECT_{t-1} + \mu_{6t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 12$$

Where

$\alpha_0, \beta_0, \rho_0, \ \omega_0, \varphi_0$ and γ_0 are respective constants; Δ is the difference operator; $\alpha_1 - \alpha_4, \beta_1 - \beta_6, \rho_1 - \rho_6, \omega_1 - \omega_6, \varphi_1 - \varphi_6, \gamma_1 - \gamma_6$ are the respective coefficients; and $\varepsilon_{1t} - \varepsilon_{6t}, \mu_{1t} - \mu_{6t}$- are the error terms.

The statistical significance of the lagged error term, that is, ECT_{t-1} validates the long-run relationship between the variables. However, the coefficient of the error correction term (ECT_{t-1}) should be negative to guarantee the convergence of the estimated system of variables in the models. Nevertheless, only in situations where there is cointegration amongst the variables was the error correction term included in the above-illustrated regression. The t-statistic for the coefficient of the lagged error

correction term is used to assess the significance of the long-run causal relationship among the variables. Short-run causality is gauged with the help of the given differenced variables by using the F-statistic to assess the significance of the relationship.

5. Empirical Results

Since the ARDL bounds test works only with variables integrated to a maximum order of 1, the augmented Dickey-Fuller generalised least square and the Perron (1997) PPURoot unit root tests were employed. Unit Root test results are reported in Table 2.

Table 2: Unit Root Test Results

DICKEY-FULLER GENERALISED LEAST SQUARE (DF-GLS)					**PERRON (1997) UNIT ROOT TEST (PPUROOT)**			
Variable	**Levels – I(0)**		**Differences – I(1)**		**Levels – I(0)**		**DifferenZces – I(1)**	
	No trend	**With trend**	**No trend**	**With trend**	**No trend**	**With trend**	**No trend**	**With trend**
I	-2.747*	-2.777	-6.222***	-6.23***	-6.35***	-6.641***	-	-
BG	-1.783*	-2.043	-9.935***	-11.09***	-6.492***	-7.009***	-	-
MG	-4.096***	-4.941***	-	-	-5.699**	-5.188	-6.741***	-6.45***
S	-2.104**	-2.549	-5.515***	-5.57***	-4.014	-4.325	-6.395***	-6.25***

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

All the variables under consideration are at most integrated of order 1. Therefore, given the confirmation of the order of integration to be at most 1, the next step is to test the possibility of cointegration among the variables using the ARDL bounds testing procedure. To establish if there is cointegration in the variables under study, the bounds F-test is employed. If there is cointegration, the estimated causality model would contain the error correction term as one of the regressors, and the opposite would also be true (i.e., no cointegration, no error correction term in the estimated model). The empirical results of the ARDL bounds F-test for both bank-based financial development (Model A) and market-based financial development (Model B) are given in Table 3.

Table 3: Bounds F-Test for Cointegration

BOTSWANA							
Model A: Investment (I), Bank-Based Financial Development (BG), and Savings (S)				**Model B: Investment (I), Market-Based Financial Development (MG), and Savings (S)**			
Dependent Variable	**Function**	**F-statistic**	**Cointegration Status**	**Dependent Variable**	**Function**	**F-statistic**	**Cointegration Status**
I	F(I|BG, S)	1.774	Not Cointegrated	I	F(I|MG, S)	0.849	Not Cointegrated
BG	F(BG|I, S)	7.336***	Cointegrated	MG	F(MG|I, S)	1.465	Not Cointegrated
S	F(S|I, BG)	5.262***	Cointegrated	S	F(S|I, MG)	10.809***	Cointegrated
Asymptotic Critical Values							
Pesaran et al 2001:300 Table CI(iii) Case III		1%		5%		10%	

I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
5.15	6.36	3.79	4.85	3.17	4.14

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

Results from Table 3 show that three of the six equations estimated have cointegrated variables. This is confirmed by the respective F-statistics for each function vis-à-vis the asymptotic critical values.

Therefore, the direction of causality between investment and financial development – both bank- and market-based -- is investigated. Table 4 gives the results of the trivariate Granger-causality models employed in this study.

Table 4: Granger-Causality Test Results

Model A: Investment (I), Bank-Based Financial Development (BG), and Savings (S)					**Model B: Investment (I), Market-Based Financial Development (MG), and Savings (S)**				
Dependent Variable	**F-statistics (probability)**			ECT_t **[t-statistics]**	**Dependent Variable**	**F-statistics (probability)**			ECT_t **[t-statistics]**
	ΔI_t	ΔBG_t	ΔS_t			ΔI_t	ΔMG_t	ΔS_t	
ΔI_t	-	3.366** (0.048)	1.970 (0.157)	-	ΔI_t	-	5.952** (0.013)	1.624 (0.232)	-
ΔBG_t	4.436** (0.021)	-	0.252 0.779	- 0.90476*** [-4.6878]	ΔMG_t	5.146** (0.021)	-	0.493 (0.621)	-
ΔS_t	2.852** (0.041)	4.980*** (0.004)	-	-0.930** [-2.197]	ΔS_t	2.028 (0.171)	5.907** (0.015)	-	-0.490* [-1.825]

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

The results of the Granger-causality test reported in Table 4 for Model A show that for Botswana, there is short-run bidirectional causality between bank-based financial development and investment. This is confirmed by the F-statistics of ΔBG and ΔI in the ΔI and ΔBG equations, respectively, which are 3.366 and 4.436, respectively. In addition, there is long-run unidirectional causality from investment to bank-based financial development. The long-run causal flow is supported by the coefficient of the error-correction term in the bank-based financial development function, which is negative and statistically significant, as expected. Another deduction from the results of Model A for Botswana is that there is both long-run and short-run unidirectional causality from investment to savings and from bank-based financial development to savings.

The empirical results reported in Table 3, Model B show that for the case of Botswana, there is short-run bidirectional causality between market-based financial development and investment. In addition, there is unidirectional causality from market-based financial development to savings, irrespective of whether the causality is estimated in the short run or in the long run.

In summary, the reported results reveal that there is a bidirectional Granger-causal relationship between bank-based financial development and investment and between market-based financial development and investment in Botswana in the short run. The short-run results are consistent with Lu *et al.* (2007), Huang (2011), and Nazlioglu *et al.* (2009). However, in the long run, it is investment that Granger-causes bank-based financial development. These results are consistent with Odhiambo, (2010).

5. Conclusion

The causal effect of financial development, split into bank-based and market-based financial development, on investment has been empirically examined for the period of 1976 to 2014. The causal relationship between financial development and investment was examined using a trivariate Granger-causality models. The savings ratio was included as an intermitting variable in order to address the problem of omission-of-variable bias. The study found that there is a bidirectional Granger-causal relationship between both bank-based and market-based financial development and investment in the short run. However, in the long run, a distinct causal flow was found to prevail only from investment to bank-based financial development. This implies that policies that enhance both bank-based financial development and investment should be employed in the short run. However, in the long run, more effort should be put into enhancing investment in order to stimulate bank-based financial development. Given the short-run bidirectional causal relationship between market-based financial development and investment in Botswana, policies that enhance both investment and market-based financial development should be employed in the short run.

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