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Financial development and economic growth in Botswana: New evidence from disaggregated data

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Abstract
In this study, the causal relationship between financial development and economic growth in Botswana is re-examined using disaggregated data from 1980 to 2020 on financial development. The importance of financial development and economic growth in achieving Sustainable Development Goals (SDGs) cannot be overemphasised. The study used the Autoregressive Distributed Lag (ARDL) approach to cointegration and the ECM-based Granger causality test to examine this linkage. Financial development is measured at an aggregate level by the Financial Development Index (FDI) and at a disaggregate level by the Financial Institution Index (FII) and Financial Market Index (FMI) from the International Monetary Fund (IMF) financial development index database. The study failed to find any causality between financial development and economic growth during the study period. The results apply, irrespective of proxy used to measure the level of financial development and the time frame. This finding points to the importance for Botswana to continue with the Vision 2036 and the National Development Plans that focus, among other goals, on economic growth, to realise an increase in gross fixed capital formation and financial development.

Keywords: autoregressive distributed lag, economic growth, financial development, South Africa.

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Introduction
The pioneering work of McKinnon (1973) and Shaw (1973) laid the foundation for a debate on the nature of the relationship between financial development and economic growth, with emphasis on the role of financial liberation; that leads to an increase in savings and hence investment. The McKinnon-Shaw school of thought

rests on the notion that government restrictions on the banking system, for example, interest, high reserve requirements, and interest-rate ceilings, hinder financial development, consequently affecting economic growth negatively (McKinnon, 1973; Shaw, 1973). On the other hand, Schumpeter (1911) pioneered the relationship between financial development and economic growth, while putting emphasis on supply-led growth. The debate on the nature of the relationship between economic growth and financial development has been raging for a long time due to the importance of these two variables in realising national development agendas and achieving the Sustainable Development Goals (SGDs). Two strands of literature have emerged: the supply-led growth hypothesis and the demand-led growth hypothesis. The relationship between these two variables is equally important to Botswana with the Vision 2036 – shared prosperity and the quest to a rebound from the negative impact of COVID-19 that has seen the country recording the biggest slump (8.5%) in 2020 since 1980 (World Bank, 2022).

Studies that have investigated the nature of the relationship between financial development and economic growth found varying results, based on the proxy for financial development, the methodology, the study period, and the study country. Some studies found a supply-led growth where financial development led to economic growth – in support of the Schumpeter (1911) school of thought (see Hsueh et al., 2013, Cizo et al., 2020); other studies confirmed a demand-led growth where economic growth led to demand for financial development to facilitate the financial requirements of the new level of economic growth (see, for example, Cizo et al., 2020); yet, some studies found no causal relationship between the two variables (see, Mhadhbi et al., 2020). The main objective of this study is to find out if Botswana follows a financial supply-led or demand -led hypothesis. This is important to policy formulation that influence the right variable first between economic growth and financial development to get the desired results.

This study takes a fresh look at the causality between economic growth and financial development, using new financial development indices developed by the International Monetary Fund (IMF, 2022) The study uses three indices of financial development, namely: the Financial Development Index, Financial Institution Index (a financial development index developed from bank-based measures) and the Financial Market Index (a financial development index developed from market-based measures). The new indices are expected to give insight into the causal flow between economic growth and financial development in Botswana. To overcome the shortcomings of a bivariate causality, such as the omission-of-variable bias, this study uses inflation, trade openness, gross fixed capital formation and education to form a multivariate causality framework. The study follows the Autoregressive Distributed Lag (ARDL) approach to cointegration and the ECM-based Granger causality test to explore the causality between economic growth and financial development in Botswana. The ARDL approach has been selected due to its numerous advantages over other approaches. For example, the approach is robust in small-sample studies and provides results in short-run and long-run time frames, which is more informative to a policy where time frame plays an important role in policy effectiveness.

Botswana was the most appropriate country to carry out this investigation given the history of the country in prudent macroeconomic management and maintaining economic growth at an average of 5% during the study period (World Bank, 2022). Moreover, Botswana has made strides in liberalisation of the financial market and started minimising unnecessary controls. This has been buttressed by legislation overhaul and review of the structures and operations of the financial authorities. A

level playing field has thus been created for all prospective investors in the financial sector (Bank of Botswana, 2022a). The country has managed to come up with a framework that increases efficiency and oversight by decentralisation of some financial market activities to different authorities, namely: Ministry of Finance and Development Planning, Botswana Stock Exchange, and Bank of Botswana. On the economic growth front, Botswana is one of the fast-growing economies that transformed from a poor country to a middle-income country through prudential resource management like diamonds. However, the vulnerability of the economic sector to international price volatility and the increasing demand for diversification to increase or maintain the high growth levels necessitate a relook of the role financial development can play.

The study is structured as follows: the next section deals with the dynamics of financial development in Botswana. This is followed by sections dealing with the empirical literature review, estimation techniques, empirical analysis, and the discussion of the results. The last section concludes the study.

Literature review

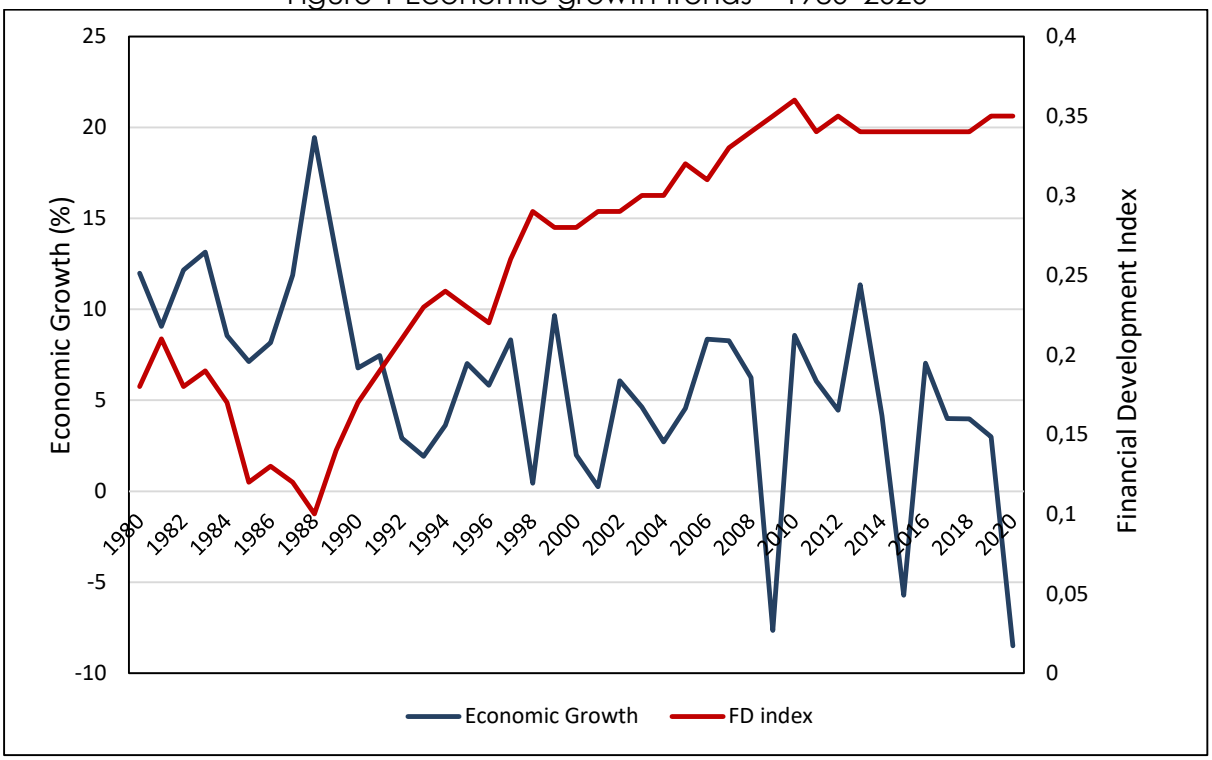
Economic growth dynamics in Botswana

The economy of Botswana is one of the fast-growing economies in Africa, anchored in prudent macroeconomic policies and good governance (United Nations, 2016). This is not to say that this impressive growth and transformation did not come with challenges (United Nations, 2016). Botswana's economy in the past years has been centred on diamonds and other minerals like gold, copper, nickel, iron, uranium and coal. Diamond mines at Damtshaa, Lerala, Letlhakane, Orapa and Jwaneng are the main source of revenue for the economy (United Nations, 2016). Copper-nickel operations were frozen in 2015 and 2016 due to a slump in copper prices (United Nations, 2016). The volatility in the international market negatively affected the main source of economic development financing. Now the economy is ready to diversify to other sectors to avoid reliance on minerals as a source of development finance. The impressive growth that was achieved by Botswana was guided by a series of National Development Plans from 1966 with the median policy: Botswana's Transnational Plan for Social and Economic Development (United Nations, 2016). The National Development Plan 11 was launched in 2016 and expires in 2023. The overarching economic policy blueprint is the Vision 2036 – achieving prosperity for all – that was launched in the same year as the NDP 11 theme on inclusive growth for the realisation of sustainable employment creation and poverty eradication. Vision 2036 provides an inclusive path that empowers Botswana and expands the economy. The National Development Plan 11 encapsulates the pillars in Vision 2036 and Sustainable Development Goals (SDGs) deliverables (Ministry of Finance and Economic Development, 2020). The NDP 11 and Vision 2036 consist of developing diversified sources of economic growth, developing human capital, strengthening national security, implementing an effective monitoring and evaluation system, and social development, and using natural resources sustainably (United Nations, 2016). To ensure that the goals set in the NDP11 are on track, mid-term policy reviews are carried out. This allows for the refinement of policies and strategies to remain on track to achieve the long-term goal: Vision 2036.

In response to economic policies implemented in Botswana, the growth of the economy has been largely positive. An average of 11% growth annually between 1980 and 1990 was recorded (World Bank, 2022). These years recorded economic growth of between 7% and 14,5% (World Bank, 2022). However, from 1991 to 2021,

the economy has not managed to break one-digit growth as experienced in the 1980s (World Bank, 2022). The highest economic growth rate recorded between 1991 and 2021 was 8,5% in 2010, a rebound from a slump of 7,6% growth registered in 2009 – a period during which a financial crisis was experienced (World Bank, 2022). Botswana was not spared from the negative impact of COVID-19, with a negative growth of 8,5% recorded in 2020 (World Bank, 2022). The economy is projected to grow by 7,5% in 2021, and 5,5% in 2022 due to a projected increase in domestic demand and improvements in diamond prices as economies reopen (African Development Bank Group [AFDB], 2022) and easing of restrictions on mobility and trade. The figure below reports economic growth figures and the financial development index for Botswana from 1980 to 2020.

Figure 1 Economic growth trends – 1980–2020



Source: World Bank (2022).

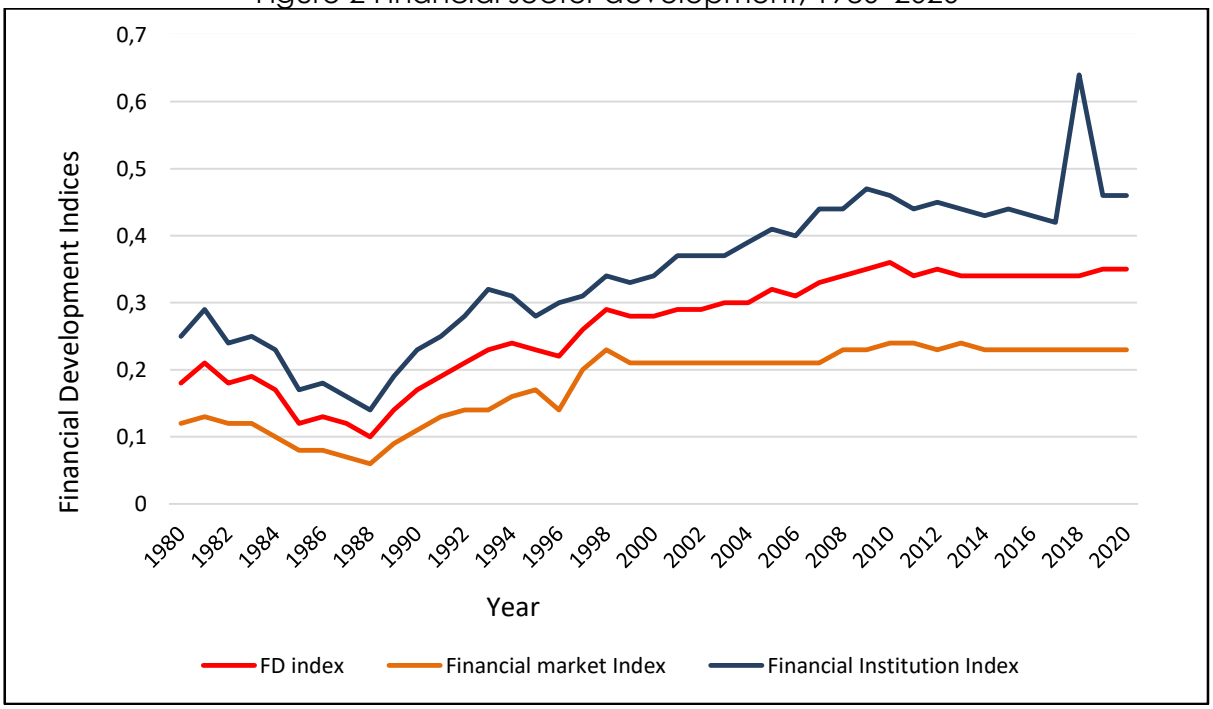
Figure 1 reports economic growth trends since 1980 and financial development, measured by the financial development index – an index that combines market-based measures and bank-based measures. Economic growth remained positive in most of the years, apart from 2009, 2015, and 2020 (World Bank, 2022). On the other hand, financial development shows a sustainable increase from 1996 (World Bank, 2022). Interestingly, in the same year, a slump in financial development was recorded, and economic growth was at its highest. What remains uncertain is which variable causes the other, which will be explored in this study.

Financial development dynamics in Botswana

The Bank of Botswana was established in 1975 when the Bank of Botswana and Financial Institutions bills were passed to establish the bank and the framework to govern financial institutions that were under the bank's supervision, respectively (Bank of Botswana, 2022a). The Bank of Botswana Act 1996 provides for the establishment of the bank of Botswana, the constitution, objectives and powers

(Bank of Botswana, 2022b). The central bank stands at the apex of the financial system, supervising three commercial banks and one finance company then (World Bank, 1989). The central bank is responsible for maintaining monetary and financial stability in Botswana (Bank of Botswana, 2022a). The central bank is expected to monitor the activities of non-bank financial institutions that accept deposits from the public (World Bank, 1989). A battery of reforms has been implemented to liberalise the financial system, including the removal of control on interest rates and exchange control and liberalisation of commercial bank licensing, among other reforms (Sekakela, 2018). By the end of 2008, the number of commercial banks had grown (Moffat, 2009). In 1976 the national currency, the Pula, was launched to replace the rand (Bank of Botswana, 2022a). Botswana has since never looked back – transforming the financial system that buttressed the transition of the economy from the poorest country to a middle-income country. As the bank's responsibilities continued to evolve, the central bank has gone through reviews to ensure success in its mandate. Now the financial system is market-oriented and free from unnecessary controls. All exchange controls were removed by 1999 (Bank of Botswana, 2022a). Entry into the financial sector is not restricted if set requirements by the regulatory body are met. The supervisory and regulatory functions in the financial sector are split between the Ministry of Finance and Development Planning, the Botswana Stock Exchange, and the Bank of Botswana (Moffat, 2009). The Banking Supervision Department in the Bank of Botswana is responsible for regulating all banking operations. Thus, the legislative and regulatory framework has worked to build a modern, resilient and efficient financial system.

Figure 2 Financial sector development, 1980–2020



Source: IMF (2022).

The number of commercial bank branches per 100 adults increased from only six in 2005 to nine in 2020 (World Bank, 2022). The domestic credit to the private sector by banks as a percentage of GDP improved from an average of 11,4% between 1980 and 2000, to 27,9% between 2001 and 2020 – more than double compared to the growth from 1980 until 2000 (World Bank, 2022). The development of the financial system is evident from the financial development index, which has maintained an

upward trend since 1988 (World Bank, 2022). The financial institution and financial market indices also reflect an upward trend, showing general growth in the bank-based and market-based measures of financial development (World Bank, 2022). Figure 2 reflects the growth in the financial development, financial institution, and financial market indices over the study period.

Figure 2 reports on financial development measures: the financial development index, a combination of financial institution and financial market indices (bank-based and market-based measure). The financial indices started on a downward trajectory from 1980 to 1988, before taking an upward turn that has been maintained during the study period. This shows a general growth in the financial market and confirms the importance of the banking sector in Botswana during the study period. Financial institutions remained resilient above financial market and financial development indices, showing the overall importance of bank-based financial development in Botswana. The slow growth in market-based financial development has pulled the overall financial development index down – where it has maintained an average range between the two measures of financial development.

Review of related literature

The theoretical link between economic growth and financial development dates to the work by Schumpeter (1911), McKinnon (1973 and Shaw (1973), among other pioneering studies. Schumpeter (1911) highlighted the relationship between economic growth and financial growth as supply-led growth where financial development leads to economic development. This is related to several roles financial institutions play in economic growth through the intermediation process. Apart from supply-led growth, demand-led growth is another strand of literature that has found empirical support. In this instance, economic growth necessitates the development of the financial sector to accommodate the financial needs of the expanding economy. Financial development can be market-based or bank-based, depending on which sector plays a vital role in the economy.

Given the variability in the relationship between financial development and economic growth, depending on the country under study, the methodology, and the period under study, a relook at the causal flow between economic growth and financial development in Botswana will shed more light to determine whether the economy follows supply-led or demand-led growth. This is most needed in the current period of recovery from the impact of COVID-19 on the economic growth impetus that the country had built prior to the pandemic. The empirical literature review focuses on studies that have explored the impact of financial development on economic growth as well as those that have examined the impact of economic growth on financial development and ends by reviewing studies that have explored the causal relationship between the two variables.

Impact of financial development on economic growth

Nguyen and Pham (2021) analysed the role of financial development on economic growth in transnational economies with newly established financial systems. For the period 1990–2020, the study investigated 29 transnational economies and five Asian developing economies. Employing the Generalised Method of Moments (GMM) and three financial sector measures, financial sector development was found to be an important determinant of economic growth across all the measures of financial development. Afonso and Blanco-Arana (2018) investigated the relationship between economic growth and financial development in The Organisation for

Economic Co-operation and Development (OECD) countries, using data from 1990–2016. By using a random effect model, the study found that an increase in domestic credit through market capitalisation and turnover ratio of domestic shares led to a positive per capita GDP. Education expenditure, inflation, and unemployment were also found to be highly significant. Likewise, Bist (2018) examined the relationship between financial development and economic growth in 16 low-income countries based on panel data from 1995–2014. Using fully modified and dynamic OLS techniques, the study found financial development to have a positive and significant impact on economic growth in nine countries. The results were consistent when time series analysis was done on a single-country basis. However, FMOLS also discovered a negative impact of financial development on economic growth in three countries: The Central African Republic, Madagascar, and Mozambique. Durusu-Ciftci et al. (2016) studied the long-run relationship between financial development and economic growth using panel data from 40 countries between 1989 and 2011. Based on credit markets, employing Augmented Mean Group (AMG) and Common-Correlated Effects (CCE), the study found the two channels to have a positive effect on GDP per capita, with the contribution of credit markets being greater.

Iheanacho (2016) studied the relationship between financial intermediary development and economic growth in Nigeria using data from 1981–2011. The study used four measures of financial development: domestic credit to the private sector as a percentage of GDP, liquid liabilities to GDP, deposit money bank assets to GDP, and bank deposits to GDP. Three composite measures of financial sector intermediary development were constructed using the principal component analysis. Employing the ARDL approach, the results confirmed a negative and significant relationship between the two in the short run only; no relationship was confirmed in the long run. Nkoro and Uko (2013) found the same results as Afonso and Blanco-Arana (2018) and Bist (2018). In the study, Nkoro and Uko (2013) examined the financial sector development-economic growth nexus for Nigeria using annual data from 1980–2009 and the error correction mechanism (ECM). Broad money stock to GDP, market capitalisation to GDP, bank deposit liability to GDP, prime interest rate and private sector credit to GDP were used as proxies for financial development. The study found financial development to have a positive effect on economic growth. The study found financial depth and credit to the private sector to be ineffective in supporting economic growth.

In the same spirit, Anwar and Nguyen (2011) examined the link between financial development and economic growth in Vietnam using endogenous growth theory; in a panel data set of 61 provinces of Vietnam over the period 1997-2006. The growth rate of real gross province product per capita and financial development proxied by the ratio of savings to GPP, the ratio of credit to GPP, and the ratio of M2 to GDP were used. The study found that financial development contributed to economic growth. De Gregorio and Guidotti (1995) studied the impact of financial development on economic growth in 98 countries using cross-country data from 1960 to 1985: and 12 Latin-American countries using data from 1950 to 1985. Financial development was found to have a positive correlation with growth in a large cross-country data set. However, a negative relationship was confirmed for panel data for Latin America, attributed to unregulated financial liberalisation and expectation of government bailouts.

Apart from studies that found financial development to have a positive impact on economic growth, there is a strand of empirical literature that confirm a negative impact of financial development on economic growth. Wen et al. (2021) examined

the impact of financial development on economic aggregates: economic growth, inflation and employment, for 120 countries using data from 1997–2017. The study used liquid liabilities, money, quasi money and bank credit as proxies for financial development. It was found that financial development has a negative impact on economic growth across all proxies of economic growth used in the study. This finding contrasted with the traditional supply-lending hypothesis. Ouyang and Li (2018) found the same results in a study on the relationship between energy consumption, financial development and economic growth in China. The study used the GMM panel VAR approach for 30 provinces in China based on quarterly data from 1996–2015. Financial development was proxied by M2, credit, the revenue of the insurance industry, and stock market value. The study found that when financial development was measured by a comprehensive measure developed from principal component analysis, a negative impact on economic growth was confirmed. In a similar vein, Narayan and Narayan (2013) analysed the impact of financial systems on economic growth for a panel of 65 developing countries. In a full panel of 65 countries, the study found financial sector growth, while bank credit was found to have a negative impact on economic growth. In Asia, the role of financial sector development was found to be present but weak; countries in the Middle East presented strong evidence that bank credit has a negative effect on economic growth. Although the studies reviewed confirm supply-led growth, there is evidence of financial development having no significant effect or a negative effect on economic growth, according to findings by Nkoro and Uko (2013) and Bist (2018).

Causality studies between financial development and economic growth

Cizo et al. (2020) examined the causal relationship in European Union (EU) countries using data from 1995 to 2017. The study used a financial development index to investigate the causality between financial development and economic growth. The direction of causality was found to be sensitive to the period under study and the groups of countries considered. In some groups of EU countries, a unidirectional causal flow was established from financial development to economic growth, supporting the financial supply hypothesis; in other groups, a unidirectional causal flow from economic growth to financial development was confirmed to be consistent with the financial demand hypothesis; and in some of the groups, a bi-directional causality between the two was established. Thus, the causal relationship between financial development and economic growth cannot be generalised from one study to the other. These results from the same study are consistent with the results where the impact of financial development on economic growth is inconclusive. Qamruzzaman and Jianguo (2018) investigated the relationship between financial innovation and economic growth in Bangladesh, Pakistan and Sri Lanka using data from 1975–2016. The study used the Autoregressive Distributed Lag approach and found that financial innovation stimulates economic growth. The Granger causality test also found a bidirectional causality between financial innovations and economic growth across all the countries studied.

Mhadhbi et al. (2020) examined the causal relationship between banking sector development and economic growth in 40 developing countries using data from 1970–2012. The study used two banking sector indices. Using bootstrapping and Granger causality testing, the study found limited evidence of supply-leading, demand-following, or complementary hypotheses. Unidirectional causality was confirmed from financial development to economic growth in 23 countries. No causality was found between economic growth and financial sector development

in 16 sample countries. Similarly, Osuji (2015) examined the causal relationship between financial development and economic growth in Nigeria using time series data from 1960–2014. The study used the Vector Error Correction Model (VECM). Four measures of financial development were used. The study found a positive long-run relationship between financial development and economic growth. The causality between the two was found to be sensitive to the financial development proxy used. When private sector credit and bank deposit liabilities were used as proxies, a unidirectional causal flow from financial development to economic growth was confirmed, while a unidirectional causal flow from economic growth to financial development was confirmed when money-to-income ratio and domestic credit ratios were used as financial development proxies.

Hsueh et al. (2013) examined the causality between financial development and economic growth in OECD countries using panel data from 1980–2007. Using bootstrap panel Granger causality, the study found a unidirectional causal flow from financial development to economic growth from M1 to economic growth in Taiwan and China; M2 to economic growth in Malaysia, Singapore and China; and from domestic claims in economic growth in Malaysia, Indonesia, Singapore, Thailand, Taiwan and China. In a separate study, Wadud (2009) examined the causal relationship between financial development and economic growth in South Asian countries, namely, India, Pakistan and Bangladesh, using data from 1976–2008. The study used the vector autoregressive model to assess the long-run relationship between the two. The findings of the study confirmed a unidirectional causal flow from financial development to economic growth.

The causal relationship between financial development and economic growth is sensitive to the methodology used, the country under study and the financial development proxy used, making generalisation of results inappropriate. A relook at the relationship between these two variables, using disaggregated financial development data will give more insight on the causality between the two.

Estimation techniques

This study uses the ARDL approach and ECM-based Granger causality test to investigate the causality between financial development and economic growth in Botswana. The ARDL approach was developed by Pesaran and Shin (1999) and modified by Pesaran et al. (2001). This approach was selected because of its numerous advantages over other methods. For example, the approach can be used in models with variables integrated of different orders; the approach is robust in small samples, and the results can be given in long-run and short-run timeframes that are more informative to policy makers.

Variable definition

Variables of interest are economic growth (EG) and financial development (FD). Financial development is measured using three financial development indices created by the International Monetary Fund (IMF). The indices consider multi-dimensional aspects of financial development, including financial market depth (size and liquidity); access – the ability of individuals and companies to access financial services; and efficiency – the capability of financial service providers to provide services at low cost (IMF, 2022). The Financial Development Index (FDI) is an aggregate measure of market-based (Financial Market Index – FMI) and bank-based (Financial Institution Index – FII) measures. The disaggregated measures of financial development used in this study are the financial market index and the

financial institution index. The study is divided into three models. Model 1 captures financial development measured by the aggregate measure (FDI), model 2 measures financial development using FII and model 3 captures financial development using FMI. Table 1 gives a summary of variables.

Table 1 Variable definition

Variable	Notation	Variable definition	Source
Economic growth	EG	Rate of change of GDP	WDI
Financial development measure (FDI, FII, FMI)	FD	An aggregate of Financial Market Index and Financial Institution Index	IMF database
Financial Market Index	FMI	An aggregate of Financial Market Depth Index, Financial Market Access Index and Financial Market Efficiency Index	IMF database
Financial Institution Index	FII	An aggregate of Financial Institutions' Institution Depth Index, Financial Access Index and Financial Institution Efficiency Index	IMF database
Trade openness	TOP	Exports and imports as a percentage of GDP	WDI
Education	EDU	Gross primary school enrolment	WDI
Gross fixed capital formation	GFE	GFC as a percentage of GDP	WDI
Inflation	INFL	Rate of change of the Consumer Index (CPI)	WDI

Note: WDI – World Development Index; IMF – International Monetary Fund Financial Development Database.
Source: Authors'.

Table 1 reports the variables used in the study, definition of the variables and the sources of the data used.

Model specification

The ARDL model specification for the multicausality model can be expressed as follows:

$$\begin{aligned}\Delta Y_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1i}\, \Delta Y_{t-i} + \sum_{i=0}^{n} \varphi_{2i} \Delta X1_{t-i} + \sum_{i=0}^{n} \varphi_{3i}\, \Delta X2_{t-i} + \sum_{i=0}^{n} \varphi_{4i}\, \Delta X3_{t-i} \\ + \sum_{i=0}^{n} \varphi_{5i}\, \Delta X4_{t-i} + \sum_{i=0}^{n} \varphi_{6i}\, \Delta X5_{t-i} + \beta_1 Y_{t-1} + \beta_2 X1_{t-1} + \beta_3 X2_{t-1} \\ + \beta_4 EX3_{t-1} + \beta_5 X4_{t-1} + \beta_6 X5_{t-1} + \mu_{1t}\end{aligned} \quad (1)$$

where Y is financial development proxies measured by Financial Development Index (FDI), Financial Institution Index (FII) and Financial Market Index (FMI) in Model 1, Model 2, and Model 3, respectively. These financial development indices enter the equation one at a time, while other variables remain the same; $X1$ is education measured by gross primary school enrolment (EDU); $X2$ is economic growth (EG); $X3$ is trade openness (TOP); $X4$ is inflation (INFL); $X5$ is gross fixed capital formation (GFC); φ_0 is a constant; $\varphi_1 - \varphi_6$ and $\beta_1 - \beta_6$ are coefficients; and μ_1 is the error term.

The Granger-causality models for Equation 1 are specified in Equations 2:

$$(1-L)\begin{bmatrix} EG_t \\ FD_t \\ TOP_t \\ EDU_t \\ INFL_t \\ GFC_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \\ \alpha_6 \end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix} \beta_{11i}\beta_{12i}\beta_{13i} \\ \beta_{21i}\beta_{22i}\beta_{23i} \\ \beta_{31i}\beta_{32i}\beta_{33i} \\ \beta_{41i}\beta_{42i}\beta_{43i} \\ \beta_{51i}\beta_{52i}\beta_{53i} \\ \beta_{61i}\beta_{62i}\beta_{63i} \end{bmatrix} x \begin{bmatrix} EG_{t-1} \\ FD_{t-1} \\ TOP_{t-1} \\ EDU_{t-1} \\ INFL_{t-1} \\ GFC_{t-1} \end{bmatrix} + \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \\ \gamma_6 \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (2)$$

where FD is financial development proxies measured by Financial Development Index (FDI), Financial Institution Index (FII) and Financial Market Index (FMI), where each index enters the equation one at a time, while the remaining variables stay the same; ECM is error correction term ; $\gamma_1 - \gamma_6$ are ECM coefficients; and the remaining variables are as defined previously.

Data sources

This study investigates the causal relationship between financial development and economic growth using annual time series data from 1980–2020. Data on economic growth (EG), trade openness (TOP), education (EDU), inflation (INFL) and gross fixed capital formation as a percentage of GDP (GFC) was retrieved from the World Development Indicators database. Data on financial development indices, namely the financial development index (FDI), financial institution index (FII) and financial market index (FMI) was extracted from the IMF financial development database.

Empirical results

Unit root test

Although the ARDL approach does not require that the variables be integrated of the same order, a unit root test was done in this study to ascertain that all variables are integrated of order 0 or order 1. When the order of integration is greater than 1, the ARDL falls away. The study uses the Augmented Dickey-Fuller GLS and Phillip and Perron (PP) tests to examine this linkage. The results of the unit root test are presented in table 2.

Results reported in table 2 confirm that all the variables in the study are integrated of order 1, implying that data analysis can be done using the selected ARDL test.

Before examining the causality between economic growth and financial development, the cointegration test was carried out to determine if a long-run relationship exists between the variables in model 1, model 2, and model 3 functions. The ARDL approach to cointegration uses upper-bound and lower-bound critical values. The F-statistics from each function are compared to the upper-bound and the lower-bound critical values. The decision rule is to reject the presence of cointegration if the F-statistic is below the lower bound. In the case where the F-statistic is above the upper bound, cointegration is confirmed. However, if the F-statistic falls between the lower and the upper bounds, the results are inconclusive. Results reported in table 3 confirm cointegration in some of the functions in models 1, 2 and 3. To proceed with the analysis, for those functions where a long-run relationship was confirmed, causality was estimated in the short run and the long run, while for those functions where no cointegration was confirmed, short-run causality was tested. Table 3 presents cointegration results for models 1, 2 and 3.

Table 2 Unit root test

Dickey-Fuller Generalised Least Square (DF-GLS)				
Variable	Stationarity of all variables in levels		Stationarity of all variables in First Difference	
	Without trend	With trend	Without trend	With trend
EG	-2.757	-0.455	-7.908***	-8.592***
FDI	-0.161	-1.777	-4.771***	-3.123*
FII	-0.533	-3.781	-4.622***	-5.252***
FMI	-0.546	-1.781	-5.935***	-6.043***
TOP	-1.079	-1.923	-5.662***	-5.062***
EDU	-0.252	-1.976	-6,181***	-6.004***
INFL	-0.989	-3,464	-2.125**	-8.309***
GFC	-0.453	-3,462	-7.411***	-8.005***
Phillip and Perron (PP) Unit root test				
EG	-2.148	-5.383	-3.949***	-8.691***
FDI	-0.674	-2.005	-6.016***	-5.916***
FII	-0.246	-2.561	-9.400***	-9.230***
FMI	-0.951	-2.051	-6.031***	-5.951***
TOP	-1.712	-2.161	-5.648***	-5.574***
EDU	0.009	-2.132	-6.256***	-6.304***
INFL	-1.904	-2.421	-9.252***	-9.106***
GFC	-2.601	-3.019	-8.013***	-8.040***

Source: Author calculation.

Table 3 Cointegration test results

Dependent variable	Function	F-statistic	Cointegration status
Panel A: Model 1			
EG	F(EG|FDI, TOP, EDU, INFL,GFC)	5.2803***	Cointegrated
FDI	F(FDI|EG, TOP, EDU, INFL, GFC)	2.7727	Not cointegrated
TOP	F(TOP|FDI, EG, EDU, INFL, GFC)	2.6111**	Cointegrated
EDU	F(EDU|FDI, EG, TOP, INFL, GFC)	2.1358	Not cointegrated
INFL	F(INFL|FDI, TOP, EDU, GFC, EG)	3.7206*	Cointegrated
GFC	F(GFC|FDI, TOP, EDU, INFL, EG)	6.9448***	Cointegrated
Panel B: Model 2			
EG	F(EG|FII, TOP, EDU, INFL,GFC)	4.7018**	Cointegrated
FII	F(FII|EG, TOP, EDU, INFL, GFC)	3.6348*	Cointegrated
TOP	F(TOP|FII, EG, EDU, INFL, GFC)	2.9482	Not cointegrated
EDU	F(EDU|FII, EG, TOP, INFL, GFC)	2.1662	Not cointegrated
INFL	F(INFL|FII, TOP, EDU, GFC, EG)	5.5000***	Cointegrated
GFC	F(GFC|FII, TOP, EDU, INFL, EG)	5.2457***	Cointegrated
Panel C: Model 3			
EG	F(EG|FMI, TOP, EDU, INFL,GFC)	5.2809***	Cointegrated
FMI	F(FMI|EG, TOP, EDU, INFL, GFC)	1.3325	Not cointegrated
TOP	F(TOP|FMI, EG, EDU, INFL, GFC)	2.7257	Not cointegrated
EDU	F(EDU|FMI, EG, TOP, INFL, GFC)	1.8594	Not cointegrated
INFL	F(INFL|FMI, TOP, EDU, GFC, EG)	3.4764*	Cointegrated
GFC	F(GFC|FMI, TOP, EDU, INFL, EG)	7.5199***	Cointegrated
Asymptotic critical values (unrestricted intercept and no trend)			
Critical values	1%	5%	10%
	I (0) I (1)	I (0) I (1)	I (0) I (1)
	3.41 54.68	2.62 3.79	2.26 3.35

Source: Author calculation.

Analysis and discussion of results

Table 4 presents the causality results of i) model 1, where the aggregate index (FDI) was used to measure financial development; ii) model 2, where financial institution (FII) was used as a disaggregated measure of financial development focusing on

bank-based measures; and iii) model 3, where the financial market index (FMI) was used as a disaggregated measure of financial development capturing market-based financial development measures.

Table 4 Granger causality results for models 1, 2 and 3

Panel A	Model 1: Financial Development Index (FDI)						
Dependent variable	F-statistic [Probability value]						ECM
	ΔEG	ΔFDI	ΔTOP	ΔEDU	ΔINFL	ΔGFC	t-statistics
ΔEG	-	0.245 [0.624]	6.274*** [0.005]	3.158* [0.056]	0.989 [0.328]	0.508 [0.481]	-0.922*** [-6.067]
ΔFDI	0.392 [0.536]	-	2.805* [0.075]	3.184* [0.084]	0.372 [0.546]	4.626** [0.039]	-
ΔTOP	9.573*** [0.003]	0.091 [0.765]	-	0.236 [0.630]	1.979 [0.155]	0.351 [0.558]	-
ΔEDU	4.402** [0.035]	4.407** [0.044]	3.275* [0.008]	-	0.399 [0.532]	0.399 [0.532]	-
ΔINFL	3.980* [0.056]	1.827 [0.180]	5.503** [0.026]	2.169 [0.133]	-	2.162 [0.115]	-0.758*** [-5.992]
ΔGFC	4.380** [0.011]	8.981*** [0.005]	0.506 [0.483]	0.870 [0.359]	1.300 [0.263]	-	-0.826*** [-6.972]
Panel B	Model 2: Financial Institution Index (FII)						
	ΔEG	ΔFII	ΔTOP	ΔEDU	ΔINFL	ΔGFC	
ΔEG	-	0.448 [0.508]	9.021*** [0.002]	3.609** [0.039]	1.179 [0.286	1.020 [0.320]	-0.970*** [-7.082]
ΔFII	0.096 [0.758]	-	8.339*** [0.001]	4.234** [0.02]	0.006 [0.941]	3.127* [0.087]	-0.781*** [-6.387]
ΔTOP	9.434*** [0.003]	0.517 [0.477]	-	0.004 [0.946]	1.942 [0.160]	0.205 [0.654]	-
ΔEDU	4.342* [0.086]	9.519*** [0.003]	3.150* [0.086]	-	1.454 [0.237]	0.845 [0.365]	
ΔINFL	1.286 [0.265]	3.030** [0.047]	3.286* [0.037]	0.572 [0.456]	-	3.476* [0.030]	-0.580*** [-5.123]
ΔGFC	1.973 [0.156]	3.774* [0.061	0.029 [0.866]	0.281 [0.600]	1.850 [0.830]	-	-0.677** [-5.346]
Panel C	Model 3: Financial Market Index (FMI)						
	ΔEG	ΔFMI	ΔTOP	ΔEDU	ΔINFL	ΔGFC	
ΔEG	-	0.247 [0.623]	6.639*** [0.004]	3.301* [0.050]	0.831 [0.369]	0.543 [0.467	-0.922*** [-6.066]
ΔFMI	0.355 [0.556]	-	2.898* [0.070]	1.373 [0.250]	0.205 [0.654]	3.273* [0.051]	-
ΔTOP	9.949*** [0.002]	0.554 [0.462]	-	0.191 [0.665]	2.133 [0.135]		-
ΔEDU	5.008*** [0.006]	6.563** [0.016]	0.645 [0.428]	-	2.401 [0.132]	1.496 [0.231]	-
ΔINFL	1.165 [0.288]	0.655 [0.424]	1.542 [0.223]	3.019* [0.092]	-	5.629** [0.023]	-0.542** [-5.135]
ΔGFC	5.377*** [0.005]	9.117*** [0.001]	1.028 [0.319]	0.856 [0.435]	3.116* [0.088]	-	-0.607*** [-4.951]

Note: *,**,*** indicate significance at 10%, 5% and 1% level of significance.
Source: Author calculation.

The results presented in table 4, panels A, B and C confirm no causality between financial development and economic growth, regardless of the financial development measure used. These results are not unique to Botswana. In a study on 40 developing countries, Mhadhbi et al. (2020) found no causality between financial

development and economic growth in 16 countries. This study failed to support a distinct financial demand or supply-led hypothesis.

Other results presented in table 4, panel A confirm: i) bidirectional causality between education and economic growth in the short run and a unidirectional causal flow from education to economic growth, ii) unidirectional causal flow from economic growth to inflation in the short run and the long run; iii) bidirectional causal flow from economic growth to TOP in the short run and a unidirectional causal flow from TOP to economic growth in the long run; iv) unidirectional causal flow from TOP to FDI in the short run; v) no causality between FDI and inflation in the short run and the long run; vi) bidirectional causality between education and FDI; vii) unidirectional causal flow from TOP to education in the short run; viii) no causality between education and inflation; education and GFC; TOP and GFC; and inflation and GFC in the long run and the short run; and viii) unidirectional causal flow from TOP to inflation in the short run and in the long run.

Other results presented in table 4, panel B confirm: i) bidirectional causality between education and economic growth in the short run and a unidirectional causal flow from education to economic growth in the long run; ii) no causality between inflation and economic growth; iii) bidirectional causality between TOP and economic growth in the short run and a unidirectional causal flow from TOP to economic growth in the long run; iv) unidirectional causal flow from TOP to FII in the short run and in the long run; v) unidirectional causal flow from FII to inflation in the short run and the long run; vi) bidirectional causality between education and FII in the short run and a unidirectional causal flow from education to FII in the long run; vii) unidirectional causal flow from TOP to education in the short run; viii) unidirectional causal flow from TOP to inflation in the short run and the long run; and ix) unidirectional causal flow from GFC to inflation in the short run and the long run; and no causality between INFL and education; GFC and education; and GFC and TOP in the short run and the long run.

Other results presented in table 4, panel C confirm: i) bidirectional causality between economic growth and education in the short run and a unidirectional causal flow from education to economic growth in the long run, ii) no causality between economic growth and inflation in the short run and in the long run, iii) bidirectional causality between economic growth and TOP in the short run and unidirectional causality from TOP to economic growth in the long run, iv) unidirectional causal flow from FMI to education in the short run; v) unidirectional causality from FMI to inflation in the short run and in the long run; vi) a unidirectional causal flow from FMI to education in the short run; vii) no causality between education and TOP in the short run, viii) unidirectional causal flow from education to inflation in the long and short run, ix) no causality was confirmed between education and GFC; TOP and inflation; and TOP and GFC; and x) bidirectional causality between GFC and inflation in the short run and in the long run.

The results presented in panels A, B and C confirm that there is no direct causal relationship between financial development and economic growth, regardless of whether financial development is measured at an aggregate level or using disaggregated data. This is consistent with findings by Mhadhbi et al. (2020) in a study on 40 developing countries. Education and TOP play an important role in economic growth and financial development. Findings from all the models confirm the importance of financial development on inflation, with the causal flow being from financial development to inflation.

Conclusion

This study investigated the causal relationship between economic growth and financial sector development in Botswana, using data from 1980 to 2020. Financial development was measured using the financial development indices produced by the IMF. Aggregated financial sector development was captured by the financial sector development index (FDI); market-based financial development was measured and captured by the financial market index (FMI), and bank-based financial development was measured and captured by the financial institution index (FII). To fully specify the model, intermittent variables were added, namely, education, trade openness, inflation and gross fixed capital formation. Using the ARDL approach to cointegration and the ECM-based Granger causality analysis, the study found no causality between economic growth and financial development – regardless of the financial development index used. Based on these findings, it can be recommended that Botswana continues with policies, such as the Vision 2036 and the National Development Plans, aimed at strengthening economic growth. The policies should be implemented to increase the gross fixed capital formation, which will positively impact Botswana's financial development and thus reinforce high growth levels. Further research can benefit from examining the relationship between financial development and economic growth using disaggregated data on financial institution index and financial market index that captures financial depth, access and efficiency.

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