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THE CO-INTEGRATING RELATIONSHIP BETWEEN FINANCIAL INCLUSION AND ECONOMIC GROWTH IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

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Abstract

This study examines the relationship between financial inclusion and economic growth in SADC. It uses panel data covering the period between 1995 to 2015 and employs the Autoregressive Distributed Lag (ARDL) Bounds and the Toda and Yamamoto and Dolado and Lutkepohl (TYDL) models to examine the co-integrating relationship and the direction of causality respectively. The impact of financial inclusion on economic growth, when measured by the mobile penetration rate and the number of bank branches, diminishes in the long run to an extent of having a negative relationship with economic growth. This implies possible thresholds beyond which a negative impact on economic growth is realized. The long-run influence of financial inclusion on economic growth is hinged on financial technologies, measured by fixed broadband internet services, which have great potential to foster unique financial inclusion and shift the economic paradigm, leading to a digitalized economy. Only financial inclusion initiatives that result in increased bank deposit accounts promote economic growth. SADC is encouraged to liberalize its information and communications technology sector in order to fully benefit from financial inclusion initiatives. In addition, SADC should consider embracing international financial monitoring standards so that it does not fall behind the inevitable integration of the financial sectors.

Keyword: Economic Growth, Financial Inclusion, Co-integration, ARDL, TYDL, SADC

JEL Classifications: B26, G18, G21

1. Introduction

The overarching objective of the South African Development Community (SADC), as stated in the SADC Treaty (1992), is to achieve sustainable economic growth, alleviate poverty, and enhance the standard and quality of living for all. Economic growth has been observed as the panacea towards poverty eradication and the attainment of prosperity (SADC, 1992; Jones and Manuelli, 2005). In its quest to develop diversified sources of economic growth, SADC developed the Protocol on Finance and Investment (SADC, 2006), thus embracing the fundamental role played by the financial sector in promoting economic growth.

The use of finance as one of the tools for speeding up economic prosperity in the SADC region has been studied before (Bara *et al.* 2017; Ariuna and Gibson, 2016; Akinboade and

Kinfack, 2015; South Africa Reserve Bank, 2014). Interestingly, contemporary views have ushered in the new notion that financial inclusion ought to be part of financial development. Financial development without the inclusion of the greater population of any given country is muffled. Economists have argued that the challenge faced by developing countries is that advancements in the financial sector have not managed to take aboard a significant proportion of their populace (Andrianaivo and Kpodar, 2011; Andrianaivo and Kpodar, 2012; Onaolapo, 2015; Singh and Stakic, 2020; Ratnawati, 2020). Consequently, another group of researchers has argued that financial development should also take financial inclusion into account if its analysis on economic growth is to be undisputed (Naceur *et al.* 2017; Lenka and Sharma, 2017).

Financial inclusion, in a broader sense, is defined as the process of ensuring the general population's access to appropriate financial products and services at an affordable cost and in a fair and transparent manner (Gregory and Laurence, 2011). It is a process of guaranteeing the availability, accessibility, and usability of formal financial systems to all economic agents in the economy (Sarma, 2008). The conception of financial inclusion depends on its economic objectives, which may either be poverty reduction, elimination of income inequality, or improved economic growth (Demirguc-Kunt and Levine, 2009).

Scholars have also attempted to distinguish between voluntary and involuntary financial exclusion (Williams *et al.* 2017). The World Bank (2014) defines the former as a situation where some of the economic agents opt not to utilize the formal financial system for religious or cultural reasons or because they lack significant need. The current study is solely concerned with the involuntary financial exclusion, which occurs due to factors that are beyond the control of the excluded population. Such factors usually include the high-risk profile and insufficient income levels of the excluded population or deliberate discrimination against particular economic agents due to market imperfections of the financial sector (Demirguc-Kunt and Klapper, 2013). Emphasis on involuntary financial exclusion is necessitated by the fact that the analysis of it will inform the crafting of appropriate national programs and policies that may correct market imperfection and ultimately lead to inclusive economic growth (Lenka and Sharma, 2017).

As the financial inclusion dimension is becoming a reality for an increasing number of developing countries, it is important to empirically examine how it affects economic growth as well as how domestic financial sector developments influence this process. Unlike previous studies in SADC countries such as Ariuna and Gibson (2016) and South Africa Reserve Bank (2014), the current study further investigates the causal relationship between financial inclusion and economic growth in SADC. It also contributes to the existing knowledge by identifying the inconsistency and inability of most empirical studies such as Asongu and Odhiambo (2020), Tchamyou *et al.* (2019), Ahmad *et al.* (2018), Naceur *et al.* (2017), and Batuo *et al.* (2018), which did not categorically differentiate between the effects of financial inclusion on macroeconomic variables based on the level of economic development. That is, the current study considers the income effect of financial inclusion on economic growth by adopting the segmentation approach based on the level of the economic performance of the SADC countries.

Previous studies have tended to concentrate on financial inclusion as a tool for poverty eradication and the elimination of income inequalities (Omar and Inaba, 2020; GPFI, 2012a; GPFI, 2012b; Tita, 2017). Although these crucial aspects of sustainable development are significant, it has been argued that any initiative that addresses economic growth has a possibility to address these aspects (Fosu, 2018; Thorbecke and Ouyang, 2018; Bhorat *et al.* 2016). Thus, the current research fills an important gap in literature; that of investigating the impact of financial inclusion on economic growth in the SADC region.

Though there has been recognition among policymakers of the significant role played by financial inclusion in sustaining employment, economic growth, and financial stability, not much attention has been given to empirical tests on the precise channels through which financial inclusion affects economic growth in SADC. Therefore, this study is crucial for a deeper understanding of the nature of financial inclusion that is suitable for fostering economic growth. The main objective of the current study is to ascertain whether financial inclusion is a fundamental ingredient in achieving greater economic growth in SADC. The specific objectives are to examine

the relationship between financial inclusion and economic growth as well as to explore the direction of causal effects between financial inclusion and economic growth.

The paper consists of six sections. Section 1 provides the background and the motivation for the study. Section 2 gives both a general and a country-specific financial inclusion review of the SADC experience. Section 3 covers a review of related literature. Section 4 outlines the econometric modeling and describes financial inclusion and economic growth. Section 5 presents the empirical findings and conducts an analysis of the results. Chapter 6 summarizes and concludes the main findings of the study. It further details the recommendations, policy implications, and suggestions for future research.

2. Financial inclusion trends in SADC

Financial inclusion encompasses a wide range of concepts that all point to the extent to which households and other economic agents participate formally in the financial sector. Tables 1 and 2 illustrate comparative statistics of some of the common financial inclusion variables that are randomly selected.

Seychelles, which is the only high-income economy in the SADC region (World Bank, 2017), shows the most financially inclusive environment followed by South Africa and Mauritius, as indicated in Table 1.

Table 1. Selected financial inclusion indicators

	Bank branches (per 100.000 adult populations)		ATM (per 100000 adults)		Account at a financial institution (%age 15+)	Mobile cellular subscriptions (per 100 people)		Fixed broadband subscriptions (per 100 people)	
	2006-2010	2011-2015	2006-2010	2010-2015	2011-2015	2006-2010	2011-2015	2006-2010	2011-2015
Angola	5.50	6.63	7.27	18.45	34.26	34.76	61.49	0.07	0.25
Botswana	7.95	8.28	26.88	27.19	39.75	79.28	159.34	0.37	1.31
DRC	0.49	0.52	0.25	0.84	7.30	14.20	40.67	-	0.00
Lesotho	2.46	2.74	5.72	10.47	18.50	31.11	85.05	0.01	0.08
Madagascar	1.33	1.40	1.14	1.88	5.63	21.70	40.33	0.02	0.11
Malawi	2.06	2.09	2.07	4.57	16.34	12.16	31.70	0.01	0.03
Mauritius	19.91	20.51	38.47	44.64	81.17	81.89	124.15	4.61	12.86
Mozambique	2.61	2.90	4.21	7.96	-	19.96	51.79	0.04	0.13
Namibia	12.33	12.49	27.55	51.37	58.06	56.71	106.55	0.10	1.62
Seychelles	44.06	45.38	41.01	59.37	-	104.30	150.67	4.60	12.41
South Africa	8.17	8.77	42.28	62.31	61.21	89.00	142.62	0.94	2.55
Eswatini	5.75	5.82	17.39	27.45	28.57	43.87	69.12	0.17	0.43
Tanzania	1.63	1.81	3.21	5.40	18.15	30.30	61.34	0.01	0.13
Zambia	3.42	3.63	4.31	9.03	26.33	27.98	69.59	0.05	0.12
Zimbabwe	3.77	4.21	6.58	4.84	28.42	23.82	84.55	0.19	0.73

Source: World Bank and author's calculations

Seychelles has the highest mobile penetration rate as measured by the mobile cellular subscriptions per 100 people, followed by South Africa, with Malawi having the lowest rate. In terms of internet banking, proxied by fixed-broadband subscriptions, Mauritius recorded the highest rates and Malawi recorded the lowest rates. The fact that high-income countries have higher financial inclusion indicators than low-income countries may imply a positive relationship between the variables. Thus, the current study sheds more light on the relationship between financial inclusion and economic growth.

The upward trend in financial inclusion recorded by SADC between 2006 and 2015 was attained at very low levels and at a slower pace compared to other developing and developed countries, as can be seen in Table 2.

Table 2. Comparison of financial inclusion indicators for SADC and some selected regions

	Bank Branches (per 100.000 adult populations)		ATM (per 100000 adults)		Account at a Financial Institution (% age 15+)		Mobile Cellular Subscriptions (per 100 people)		Fixed Broadband Subscriptions (per 100 people)	
	2006-2010	2011-2015	2006-2010	2011-2015	2006-2010	2011-2015	2006-2010	2011-2015	2006-2010	2011-2015
SADC	8.1	8.48	16.07	22.39	-	32.40	44.74	85.26	0.83	2.24
EU	33.05	33.45	78.08	74.87	-	-	115.82	122.32	115.82	122.32
LAC	13.23	13.36	27.77	38.40	-	-	76.72	110.87	76.72	110.87
MENA	13.11	13.20	16.05	26.31	-	-	68.44	107.87	68.44	107.87
AUS	31.30	31.12	153.21	163.47	-	98.96	99.63	116.21	99.63	116.21
SSA	2.46	2.84	2.71	4.91	-	-	30.98	65.14	30.98	65.14
US	34.84	35.08	169.80	-	-	90.77	84.70	103.06	84.70	103.06

Notes: EU, LAC, AUS, MENA, SSA, and US represents European Union, Latin America and the Caribbean, Australia, Middle East and North Africa, Sub-Saharan Africa, and United States of America, respectively.
Source: World Bank and author's calculations

Despite SADC doing better than Sub-Saharan Africa, it is lagging in terms of more innovative and modern facets of financial inclusion, namely, ATM, mobile banking, and internet banking. Thus, compared to other regional blocks and countries like the EU, Latin America and the Caribbean, Middle East and North Africa, Australia and US, SADC have the lowest level of financial inclusion. This raises the question of whether financial inclusion spurs economic growth given the fact that richer countries in SADC have higher levels of financial inclusion and richer regional blocks compared to SADC also have higher levels of financial growth. This shows the relevance and the importance of the current study.

3. Literature review

Financial inclusion became topical in the 2000s upon the realization that poverty and income inequality were direct consequences of financial exclusion from financial products such as payments, savings, credit, risk management, insurance, and pensions (Jack and Tavneet, 2014; Joshi, 2011). Thus, financial inclusion through financial intermediation and other channels can contribute towards savings mobilization and also broaden productive investments in the presence of effective risk management and insurance vehicles (Thathsarani *et al.* 2021; Sahay *et al.* 2015; Rui and Melecky, 2013; Gardeva and Rhyne, 2011).

The hierarchy of consumer financial needs requires that full financial inclusion is achieved when all the categories are met or satisfied (MasterCard, 2014). These categories range from securing transaction accounts that receive and hold funds like salaries, remittances and benefits, electronic payments like bill payments, borrowing, investments or long-term savings, and finally securing insurance. Analyses suggest that people are always at different levels of the hierarchy of financial needs, resulting in the need to provide the right products for each category. Financial inclusion initiatives should not only focus on the rural areas but rather should also reach the urban areas given the heterogeneity of consumer financial needs (Demirguc-Kunt and Klapper, 2012a, 2012b).

Mobile money, which is defined as payment transactions through mobile communication networks, led to the advancement of financial intermediation in both breadth and depth (Masha, 2016). This development calls for enhanced supervision and monitoring by banks through the provision of mobile access to bank accounts, that is, mobile banking (Srouji, 2020; World Bank, 2013; World Bank, 2014). Central banks regulate mobile banking, though, in many instances, mobile money transactions rely on existing business and company laws since they are operated by mobile network operators (MNO) which are non-bank based (Masha, 2016).

In Africa, MNO-focused services are more robust compared to bank-based mobile facilities. MNO-focused services are mainly driven by people who have no other form of bank account, that is, the unbanked. In Sub-Saharan Africa, 16% of adults use mobile phones to pay bills or to send or receive money, which is 5% less compared to other regions in Africa (World Bank, 2014).

In 2004, South Africa became the first country to license a mobile money operating company in Africa, called MTN Mobile Money. Mobile money services are now very common, having begun in Kenya in 2007. Kenya's M-PESA had the most widespread use by 2014. Sub-Saharan Africa accounted for more than 53% of global live mobile money services by 2014 (Global System Mobile Authority [GSMA], 2017). Regional mobile payment is common and accounts for one-fifth of all remittances since it is on average 50% cheaper to send remittances using mobile money than using global money transfer operators (MTOs) (GSMA, 2017). Some MNO are now paying interest on store values or mobile wallets. SADC developed the SADC Mobile Money Guidelines in 2016 through its Protocol on Finance and Investment (FIP). Regional transfer of money through MNO is now possible, for example, from Orange Botswana to Econet and Ecocash in Zimbabwe. The developments explained above raise the question of whether the financial inclusion strides spur economic growth.

The South African Reserve Bank's (2014) report on SADC mentions the importance of financial inclusion and its access and usage dimensions. However, it does not incorporate the empirical evidence on the relevance of inclusion for the promotion of economic growth. This study plays a pivotal role in providing policy implications of financial inclusion on economic growth, amidst current efforts to promote financial development and financial integration in SADC.

The few existing studies in the relevant literature report a positive relationship between financial inclusion and economic growth, as well as mixed causality results on the linkages. Andrianaaivo and Kpodar (2011) conducted a cross-country study on 44 African countries using the dynamic panel systems GMM model with data covering the period 1988 to 2007. They measured financial inclusion by the mobile penetration rate, the number of deposits per head, and the number of loans per head. The results of their study showed a positive relationship between financial inclusion and economic growth and that financial inclusion brought about cost-effective financial services. The study furthermore established that the growth of mobile phone usage reinforces the relationship between financial inclusion and economic growth. However, in this study, the issue of causality could not be resolved due to the cross-country technique employed in the analysis. The current study, therefore, is justified because it sheds more light on the causal relationship between financial inclusion and economic growth.

Williams *et al.* (2017) used the ordinary least squares (OLS) method to conduct their study and their findings supported the findings of Andrianaaivo and Kpodar (2011). The former used data for three African countries over the period 2006-2015. Financial inclusion was proxied by the number of automated teller machines (ATM) and the commercial bank branches. Similar results about the link between financial inclusion and economic growth are also obtained from Onaolapo (2015), who used data for Nigeria covering the period 1982-2012. The study also uses the OLS model and measures financial inclusion by the number of commercial branches, bank loans to rural areas, demand deposits from rural areas, and central bank agricultural credit guarantee schemes. However, Demetriades and Law (2006) established that the positive relationship between financial inclusion and economic growth cannot be realized in economies with poor or non-existent financial regulation and with extremely high inflation environments.

Lenka and Sharma (2017), using the ARDL and the error correction model (ECM), observed both long-run and short-run positive impact of financial inclusion and economic growth. The research used data for India covering the period 1980-2014. Lenka and Sharma (2017) proxied financial inclusion by the number of savings bank account proportion to 1000 adults, the number of credit accounts per 1000 adults, the number of bank branches proportion to 1000 adults, the number of bank employees as a ratio of bank branches, the amount of deposits as a percentage of the GDP, and the amount of credits as the ratio of the GDP. Like the conclusions of Demetriades and Law (2006), the study ascertains that the efficiency of financial institutions stimulates financial inclusion, which later triggers economic growth.

4. Methodology

This study uses a panel regression method. Fisher $(\tilde{n}_ë)$ panel unit root test by Maddala and Wu (1999) was used to examine the null hypothesis of non-stationarity against the alternative hypothesis that the series was stationary. After the unit roots test in the series were examined,

the autoregressive distributed lag bounds testing approach were specified. The ARDL technique was used to test for both the long-run and short-run relationships.

4.1. ARDL bounds testing method

The study used the ARDL bounds test technique which was first introduced by Pesaran and Shin (1999) and was later extended by Pesaran *et al.* (2001) for undertaking a co-integration test. The ARDL bounds technique has numerous advantages over other co-integration techniques such as Johansen and Juselius (1992) and Engle and Granger (1987). The Johansen and Juselius (1992) co-integration technique is contingent on the strict supposition that all the variables in the test must be stationary after first differencing, that is, all the variables must be I(1) variables. The condition of the I(1) variables makes the estimate of the co-integration test subject to biases. The ARDL bounds testing approach is also relatively more efficient in either small or large sample sizes compared to other co-integration techniques. The ARDL bounds test technique also yields an unbiased result, even in the presence of endogeneity (Harris and Sollis, 2003).

The ARDL bounds testing for financial inclusion (FIC) and economic growth (Y) along with other variables (Z) is specified as in equations 1 and 2.

$$lnFIC_{it} = á_0 + á_1 lnFIC_{i,t-1} + á_2 lnY_{i,t-1} + á_3 lnZ_{i,t-1} + \sum_{j=1}^{p} â_{1j} \Delta lnFIC_{i,t-j} + \sum_{j=0}^{q_1} â_{2j} \Delta lnY_{i,t-j} + \sum_{j=0}^{q_2} â_{3j} \Delta lnZ_{i,t-j} + ð_{it} \qquad (1)$$

$$\Delta lnY_{it} = ó_0 + ó_1 lnY_{i,t-1} + ó_2 lnFIC_{i,t-1} + ó_3 lnZ_{i,t-1} + \sum_{j=1}^{p} ô_{1j} \Delta lnY_{i,t-j} + \sum_{j=0}^{q_1} ô_{2j} \Delta lnFIC_{i,t-j} + \sum_{j=0}^{q_2} ô_{3j} \Delta lnZ_{i,t-j} + \vartheta_{it} \qquad (2)$$

; where, $á_0$ and $ó_0$ are intercepts in equations 1 and 2, $ð_t$ and ϑ_t are the error terms for $á_1$, $á_2$, and $á_3$; $ó_1$, $ó_2$, and $ó_3$ are related to the long-run coefficients, and Δ is the first-difference operator and $p's$ and $q's$ are optimal lag lengths. It means that the models can either take the same or different lag length for the variables. The $Z's$ variables include other variables. The long-run ARDL coefficients are obtained by estimating equations 3 and 4.

$$lnFIC_{it} = á_0 + \sum_{j=1}^{p} á_{1j} lnFIC_{i,t-j} + \sum_{j=0}^{q_1} á_{2j} lnY_{i,t-j} + \sum_{j=0}^{q_2} á_{3j} lnZ_{i,t-j} + ð_{it} \qquad (3)$$

$$lnY_{it} = ó_0 + \sum_{j=1}^{p} ó_{1j} lnY_{i,t-j} + \sum_{j=0}^{q_1} ó_{2j} lnFIC_{i,t-j} + \sum_{j=0}^{q_2} ó_{3j} lnZ_{i,t-j} + \vartheta_{it} \qquad (4)$$

The short-run dynamic parameters are obtained by estimating the error-correction-models specified as in equations 5 and 6.

$$\Delta lnFIC_{it} = ð + \sum_{j=1}^{p} â_{1j} \Delta lnFIC_{i,t-j} + \sum_{j=0}^{q_1} â_{2j} \Delta lnY_{i,t-j} + \sum_{j=0}^{q_{2i}} â_{3j} \Delta lnZ_{i,t-j1} + ëECM_{i,t-1} + ð_{it} \quad (5)$$

$$\Delta lnY_{it} = ð + \sum_{j=1}^{p} ô_{1j} \Delta lnY_{i,t-j} + \sum_{j=0}^{q_1} ô_{2j} \Delta lnFIC_{i,t-j} + \sum_{j=0}^{q_{2i}} ô_{3j} \Delta lnZ_{i,t-j} + \partial ECM_{i,t-1} + ö_{it} \quad (6)$$

In equations 5 and 6, $â'_i s$ and $ô'_i s$ are short-run dynamic coefficients of the model and $ë$ and ∂ are associated with error-correction terms lagged once (ECM_{t-1}) for financial inclusion and economic growth models respectively.

The next section presents the Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) (hence, TYDL) test for causality.

4.2. Multivariate TYDL test for causality

Toda and Yamamoto (1995), Zapata and Rambaldi (1997) and Gujarati (1995) argued that the use of F-statistic for the causality test in vector error-correction model (VECM) and error-correction model (ECM) are not valid if variables were integrated and co-integrated. Due to the problems associated with VECM, ECM and VAR models, the current study adopted a more

flexible and efficient Granger causality test developed by Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996). The TYDL model is specified as in equations 7 and 8.

$$lnFIC_{it} = â_{10} + \sum_{j=1}^{k} â_{11,j} lnFIC_{i,t-j} + \sum_{j=1}^{k} â_{12,j} lnY_{i,t-j} + \sum_{j=1}^{k} â_{13,j} lnZ_{i,t-j} + \\ \sum_{j=k+1}^{k+dmax} â_{11,j} lnFIC_{i,t-j} + \sum_{j=k+1}^{k+dmax} â_{12,j} lnY_{i,t-j} + \sum_{j=k+1}^{k+dmax} â_{13,j} lnZ_{i,t-j} + ì_{1i,t}$$ (7)

$$lnY_{it} = â_{20} + \sum_{j=1}^{k} â_{21,j} lnY_{i,t-j} + \sum_{j=1}^{k} â_{22,j} lnFIC_{i,t-j} + \sum_{j=1}^{k} â_{23,j} lnZ_{i,t-j} + \sum_{j=k+1}^{k+dmax} â_{21,j} lnY_{i,t-j} + \\ \sum_{j=k+1}^{k+dmax} â_{22,j} lnFIC_{i,t-j} + \sum_{j=k+1}^{k+dmax} â_{23,j} lnZ_{i,t-j} + ì_{4i,t}$$ (8)

This TYDL technique uses a modified Wald statistic in testing for the significance of the parameters of a VAR model. The modified Wald statistic is valid regardless of whether the variables are I(0), I(1), fractional co-integrated, co-integrated or not-co-integrated.

4.3. Data and variable description

The study considered all the 15 SADC member states for the period from 1995 to 2015. The sample period is informed by the data availability.

Economic growth was proxied by real gross domestic product growth rate (RGDP) in order to control for inflation terms of the countries in the sample and obtain more superior estimations (Ariuna and Gibson, 2016; Altaee and Ai-Jafari, 2015; Arac and Ozcan, 2014).

Financial inclusion was proxied by both the banking and non-banking sectors variables to reflect the level of accessibility (supply side) and usage (demand side) of banking services. Supply-side indicators are the number of bank branches (NBB) measured by the number of bank branches per 100,000 adults and the number of automated teller machines (NATM) measured by the number of ATMs per 100,000 adults (Sharma, 2016; Lenka and Sharma, 2017; Tita, 2017; Babajide *et al.* 2015). Branchless banking services are proxied by the mobile penetration rate (MPR), which is measured by the mobile telephone subscribers per head, calculated as the number of mobile telephone subscribers divided by the total number of population and fixed broadband internet services (FBIS) measured by the number of fixed broadband internet subscribers per 100 people (Tchamyou *et al.* 2019; Andrianaivo and Kpodar, 2012). Demand-side indicators are the number of depositor accounts (NDA) measured by the number of depositor accounts per 1000 adults and the number of borrowers from regulated financial institutions (NBRFI), measured by the number of borrowers from regulated financial institutions per 1000 adults (Williams *et al.* 2017; Onaolapo, 2015; Andrianaivo and Kpodar, 2012).

A set of control variables, conventional variables in the endogenous models of economic growth, is included to account for other factors that are likely to influence economic growth. These include inflation (CPI), government spending (GEXP), gross fixed capital formation (GFCF), population growth (POPG), labor force participation rate (LFPR), and education level (EDU) (Akimov *et al.* 2009).

Data were obtained from the World Bank's World Development Indicators (WDI), the International Monetary Fund's International Financial Statistics (IFS), and The Financial Structure Database of the World Bank Financial Sector Development Indicators. The variables used in this paper are summarized in Table 3 in Appendix.

5. Empirical results and analysis
5.1. ADF-Fisher panel unit root test

The ADF-Fisher panel unit root test by Maddala and Wu (1999) is used to examine the null hypothesis of non-stationarity in levels against the alternative hypothesis that the series is stationary in levels. The result shows mixed order of integration, I(0) and I(1), for economic growth, financial inclusion, and control variables. The mixed order of integration justifies the use of the ARDL model.

The next section presents the ARDL test for co-integration to check for both the long-run and the short-run relationship between economic growth and financial inclusion variables.

5.2. **ARDL bounds test for co-integration approach**

The number of deposit accounts (NDA) is dropped since it was highly correlated with mobile penetration rate (MPR). The number of automated teller machines (ATM) and the number of borrowers from regulated financial institutions (NBFRFI) are both dropped since they are significantly correlated with the number of bank branches (NBB).

Table 4 gives the empirical results of the ARDL bounds test for co-integration whilst Table 5 gives the estimated short-run and long-run coefficients. The respective diagnostic tests are presented in both tables. There are two models estimated; Model 1 with economic growth measured by RGDP as the dependent variable and Model 2 with financial inclusion proxied by MPR as the dependent variables. Under both models, analysis is done for the three categories, namely, all SADC countries, SADC low-income countries, and SADC middle-income countries. These three categories help in ascertaining the significance of the income effect on the two models defined under this section.

The results indicate that the computed F-statistics, using the Wald test, are greater than the upper critical bound at the 1% level of significance for both models and all categories. These calculated values were compared with the critical values tabulated by Pesaran *et al.* (2001) at 1%, 5%, and 10% levels, which confirmed the existence of co-integration between the series over the study period. It then implies that the null hypothesis that there is no co-integration between economic development and financial inclusion along with selected macroeconomic variables is rejected. Thus, there is evidence of the existence of a long-run relationship between economic growth and financial inclusion along with some selected macroeconomic variables.

Table 4. ARDL bound test results

Model 1 (dependent variable is LNRGDP)					
Regressor	LNNBB, LNMPR, LNFBIS, LNPOPG, LNCPI		LNNBB, LNMPR, LNFBIS, LNPOPG, LNCPI		LNNBB, LNMPR, LNFBIS, LNPOPG, LNCPI
Region	All SADC Countries		SADC Low-Income Countries (6 Countries)		SADC Middle-Income Countries (8+1)
Optimal lag Structure	(1,1,1,1,1,1)		(1,1,1,1,1,1)		(1,1,1,1,1,1)
F-statistics	14.79788***		8.214026***		8.376595***
Significance level	Pesaran *et al.* (2001, p. 300), critical values: intercept and no trend, k = 5.		Pesaran *et al.* (2001, p. 300), critical values: intercept and no trend, k = 5.		Pesaran *et al.* (2001, p. 300), critical values: intercept and no trend, k = 5.
	Lower bounds I(0)	Upper bounds I(1)	Lower bounds I(0)	Upper bounds I(1)	Lower bounds I(0)	Upper bounds I(1)
1% level	3.06	4.15	3.06	4.15	3.06	4.15
5% level	2.39	3.38	2.39	3.38	2.39	3.38
10% level	2.08	3.00	2.08	3.00	2.08	3.00
Model 2 (dependent variable is LNMPR)					
Regressor	LNNBB, LNRGDP, LNFBIS, LNPOPG, LNGFCF		LNNBB, LNRGDP, LNFBIS, LNPOPG, LNGFCF		LNNBB, LNRGDP, LNFBIS, LNPOPG, LNGFCF
Region	All SADC Countries		SADC Low-Income Countries (6 Countries)		SADC Middle-Income Countries (8+1)
Optimal lag Structure	(1,1,1,1,1,1)		(1,1,1,1,1,1)		(1,1,1,1,1,1)
F-statistics	26.32137**		12.98176***		17.32673***
Significance level	Pesaran *et al.* (2001, p. 300), critical values: intercept and no trend, k = 5.		Pesaran *et al.* (2001, p. 300), critical values: intercept and no trend, k = 5.		Pesaran *et al.* (2001, p. 300), critical values: intercept and no trend, k = 5.
	Lower bounds I(0)	Upper bounds I(1)	Lower bounds I(0)	Upper bounds I(1)	Lower bounds I(0)	Upper bounds I(1)
1% level	3.06	4.15	3.06	4.15	3.06	4.15
5% level	2.39	3.38	2.39	3.38	2.39	3.38
10% level	2.08	3.00	2.08	3.00	2.08	3.00

Note: The 1%, 5% and 10% significant levels are represented as ***, **, and *, respectively.

Table 5. Estimated long-run and short-run coefficients

Panel A: Long-run coefficients

Models	Model 1 (dependent variable is RGDP)			Model 2 (dependent variable is MPR)		
Regressor	All SADC Countries	SADC Lower Income Countries (6 Countries)	SADC Middle Income Countries (8+1)	All SADC Countries	SADC Lower Income Countries (6 Countries)	SADC Middle Income Countries (8+1)
Optimal lag Structure	ARDL(1,1,1,1,1,1) based on AIC	ARDL(1,1,1,1,1,1) based on AIC	ARDL(1,1,1,1,1,1) based on AIC	ARDL(1,1,1,1,1,1) based on AIC	ARDL(1,1,1,1,1,) based on AIC	ARDL(1,1,1,1,1,1,) based on AIC
LNNBB	-0.128787	-0.018848	-0.212570	0.047107***	-0.045865	0.019720
LNRGDP	-	-	-0.192790	0.048387**	0.093819**	0.047122*
LNMPR	-0.033220	-0.098510	-	-	-	-
LNFBIS	0.083206*	0.077803	0.195757**	-0.022380**	0.038418*	-0.041879**
LNPOPG	0.102101	2.211643*	0.191515	-0.042991*	-0.266018	-0.073539**
LNCPI	0.003669	-0.065691	0.084884	-	-	-
LNGFCF	-	-	-	0.199831***	0.176751***	0.143026**
Cons.	1.299337*	-0.696003	2.351259	0.336184**	0.768985**	0.236020

Panel B: Short-run coefficients

ΔLNNBB	0.614072**	0.609527*	0.629269	0.027225	0.092364	0.139219
ΔLNRGDP	-	-	-	-0.006359	-0.018194	-0.008205
ΔLNMPR	0.966504**	0.254984	1.462812**	-	-	-
ΔLNMPR(-1)	-	-	-	-	-	-
ΔLNFBIS	0.007913	-0.043967	0.059980	-0.009781	-0.058589**	0.012292
ΔLNPOPG	-0.169650	5.420653	-0.092517	0.035611	-0.992667	0.006073
ΔLNCPI	-0.154469	-0.074286	-0.113174	-	-	-
ΔLNGFCF	-	-	-	-0.065175	-0.073653	-0.159172
ECM(-1)	-0.716540***	-0.647611***	-0.935790***	-0.165025***	-0.242056***	-0.111721**
Diagnostic tests	**Statistics**			**Statistics**		
R-square	0.490092	0.697105	0.492333	0.624926	0.696424	0.696299
Adjusted R-square	0.420845	0.558278	0.368237	0.581312	0.598208	0.620373
F-statistics	7.077477***	5.021392***	3.967346***	14.44988***	7.090759***	8.444038***
DW Statistic	2.307609	2.328564	2.151360	1.770385	2.112315	1.862167

Note: The 1%, 5% and 10% significant levels are represented as ***, **, and *, respectively. Panel A shows the long-run results while Panel B gives the short-run results.

Model 1 shows that financial inclusion statistically positively affects economic growth in the short run when the MPR is measured in all SADC countries. The results corroborate with those of Masha (2016) who states that mobile payment systems enhance financial intermediation, both in breadth and depth, culminating in reduced transaction costs, smooth consumption, increased savings, and building working capital. The positive influence of the MPR diminishes in the long run to the extent of having a negative relationship with economic growth, though not statistically significant. This may suggest the existence of a threshold of the MPR beyond which the MPR will exert a negative impact on economic growth.

The results further show that the NBB has a positive relationship with economic growth in the short run. This result is in line with the findings of Williams *et al.* (2017), who considered three African countries. This shows that the NBB consolidates the impact of financial inclusion on economic growth. Like the MPR, the NBB's impact on economic growth diminishes in the long run to an extent of having a negative relationship with economic growth though also not statistically significant. This implies the existence of a possible NBB threshold, beyond which the NBB will exert a negative impact on economic growth. The result is in line with the findings of Demetriades and Law (2006), who ascertain that the positive growth impact from the financial inclusion does not hold in economies characterized by poor or nonexistent financial regulation and extremely high inflation environments. The findings suggest that in the long run, financial inclusion only boosts economic growth when measured by the FBIS. This possibly confirms the findings that the MPR and the FBIS are not complementary interventions of enhancing financial inclusion; rather they are substitutes (Andrianaivo and Kpodar, 2011).

For the estimated model, the coefficient of the error correction term (ECM(-1)) of 0.716540 is found to be negative and significant at a 1% level of significance as expected. Approximately 71.7% of shock or disequilibrium from the previous year converges back to the long-run equilibrium path in the current year for economic growth. The implication is that financial inclusion, together with some selected macroeconomic variables, is expected to Granger cause economic growth.

For SADC Low-Income Countries, in the short run, financial inclusion, when proxied by NBB, statistically and positively affects economic growth, 0.609527. The result is the same for All SADC Countries. In the long run, financial inclusion does not statistically and significantly affect economic growth in the SADC Low-Income Countries. The challenge faced by developing countries could be that advancements in the financial sector have not managed to take aboard a significant proportion of their populace. The result tends to confirm the general findings of Andrianaivo and Kpodar (2011, 2012) and Onaolapo (2015). However, though not statistically significant, FBIS has a positive effect on economic growth whilst MPR has a negative effect on economic growth. Notably, population growth (POPG) supports economic growth in the long run. The rest of the variables are found to be statistically insignificant in the short run and/or long run. In SADC Middle-Income Countries, just like All SADC Countries, the positive influence of MPR diminishes in the long run to the extent of having a negative relationship with economic growth, though not statistically significant. Thus, MPR spurs economic growth only in the short run. In other words, in the short run, financial inclusion supports economic growth. The effect of FBIS on economic growth, similarly to the case of All SADC Countries, is positive and statistically significant. The rest of the variables are statistically insignificant both in the short run and long run.

For the estimated model, the coefficient of the error correction term (ECM(-1)) is also found to be negative and significant. The negative and statistically significant estimate of the lagged error correction term (ECM(−1)) validates an established long-run relationship between all the variables in the estimated model for SADC Middle-Income Countries.

Model 2 shows that in All SADC Countries, economic growth has a positive and statistically significant effect on financial inclusion (MPR) only in the long run. NBB effect on financial inclusion is positive and statistically significant in the long run. FBIS negatively affects financial inclusion in the long run, possibly confirming the substitutability of FBIS and MPR. Government investment, GFCF, propels financial inclusion in the long run. SADC countries may

consider GFCF to influence FBIS which positively affects economic growth in the long run. In the long run, POPG negatively and statistically affects financial inclusion.

In SADC Low-Income Countries, FBIS relationship with financial inclusion is negative and statistically significant in the short run. In the long run, economic growth statistically positively supports financial inclusion, 0.093819. FBIS, unlike for All SADC Countries, statistically and significantly supports financial inclusion in the long run. The effect of GFCF on financial inclusion is positive and statistically significant. The rest of the variables are statistically insignificant both in the short run and the long run.

In SADC Middle-Income Countries, there is no statistically significant effect in the short run for the variable considered in the model on financial inclusion. In the long run, the effect of economic growth on financial inclusion is positive and statistically significant. FBIS, like under All SADC Countries, statistically and negatively affect financial inclusion. The effect of POPG on financial inclusion is negative and statistically significant. Like other categories, GFCF supports financial inclusion.

The regression for the underlying ARDL models for all categories fits well, as indicated by the statistically significant F-statistics at a 1% level of significance. The fact that the overall fit of the models is significant implies that the models can be used for meaningful inferences. The Durbin-Watson test shows that the variables in the models are free of autocorrelation; that is the values of the Durbin-Watson statistic are within 1.5-2.4.

The next section tests causality between economic growth and financial inclusion.

5.3. The direction of causality: TYDL Granger causality approach

Before presenting the results, this study undertakes some tests to avert presenting a biased result. These tests included the lag length selection criteria test. This test was conducted in order to include the appropriate lag length in the TYDL Granger causality test. The other diagnostic test was conducted in order to make sure that the model does not suffer from serial correlation. Finally, VAR stability test was conducted. The stability of the VAR model means that the TYDL model presented in Table 6 is not biased. Further, Table 6 shows direct and indirect causalities between financial inclusion and economic growth, including some control variables. The results are for all SADC countries, SADC Low-Income Countries, and SADC Middle-Income Countries.

Figures 1, 2, and 3 in the Appendix present the pictorial view of results in Table 6. As can be seen from Figure 1, which represents the findings for All SADC Countries, the results show that there is bidirectional causality between economic growth and NDA. The only direct causality between financial inclusion and economic growth is through NDA. There is bidirectional causality between NDA and NBB. There is unidirectional causality from GFCF to MPR and also from NDA to NBFRI. MPR, FBIS, and GFCF Granger cause NDA independently. It can be observed that MPR, FBIS, and GFCF cause economic growth indirectly via NDA. GFCF indirectly Granger causes economic growth through MPR which Granger causes NDA and eventually NDA Granger causes economic growth. Thus, financial inclusion Granger causes economic growth only through NDA. The result corroborates those of William *et al.* (2017). This means that financial inclusion initiatives that influence NDA should be pursued.

Figure 2, which represents the SADC Low-Income Countries, shows that the only direct relationship between financial inclusion and economic growth is through NDA. Like under All SADC Countries, MPR, FBIS, and GFCF independently Granger cause NDA. A unidirectional causality from NBB to NDA is realized. There is also unidirectional causality from GFCF to MPR and from NDA to NBFRI. Like for All SADC Countries, it can be observed that MPR, FBIS, and GFCF Granger cause economic growth indirectly through NDA. GFCF indirectly Granger causes economic growth through MPR, which Granger causes NDA, and eventually, NDA Granger causes economic growth.

As can be seen from Figure 3, which represents SADC Middle-Income Countries, like for all SADC countries, there is bidirectional causality between economic growth and NDA. The only direct causality between financial inclusion and economic growth is through NDA. Furthermore, there is a unidirectional causality from MPR to NDA. It can be observed that MPR Granger causes

economic growth through NDA. The unidirectional causality between NDA and economic growth is consistent with empirical findings reported by Sharma (2016).

Table 6. TYDL Granger causality between economic growth and financial inclusion

All SADC Countries (k=1)		SADC Low-Income Countries (k=2)		SADC Middle-Income Countries (k=2)	
Variables	Wald-statistic	Variables	Wald-statistic	Variables	Wald-statistic
LNNBB ↛LNRGDP	0.127587	LNNBB ↛LNRGDP	0.013999	LNNBB ↛LNRGDP	0.460469
LNRGDP ↛LNNBB	0.072287	LNRGDP ↛LNNBB	1.082687	LNRGDP ↛LNNBB	0.164388
LNMPR ↛ LNRGDP	1.157384	LNMPR ↛ LNRGDP	0.357922	LNMPR ↛ LNRGDP	1.889618
LNRGDP ↛ LNMPR	0.091372	LNRGDP ↛ LNMPR	0.080536	LNRGDP ↛ LNMPR	0.372951
LNFBIS ↛ LNRGDP	0.125786	LNFBIS ↛ LNRGDP	0.268857	LNFBIS ↛ LNRGDP	0.566639
LNRGDP ↛ LNFBIS	2.360158	LNRGDP ↛ LNFBIS	0.687080	LNRGDP ↛ LNFBIS	1.098972
LNNDA → LNRGDP	4.251544*	LNNDA ↛ LNRGDP	0.053931	LNNDA → LNRGDP	3.705100*
LNRGDP →LNNDA	23.74059***	LNRGDP →LNNDA	11.70395***	LNRGDP →LNNDA	3.935875**
LNNBRFI ↛ LNRGDP	0.724791	LNNBRFI ↛ LNRGDP	0.000634	-	-
LNGDP ↛ LNNBRFI	0.901667	LNGDP ↛ LNNBRFI	2.103427	-	-
LNGFCF ↛LNRGDP	0.317028	LNGFCF ↛LNRGDP	3.484908	LNGFCF ↛LNRGDP	0.069429
LNRGDP ↛ LNGFCF	1.216274	LNRGDP ↛ LNGFCF	0.746444	LNRGDP ↛ LNGFCF	2.338925
LNMPR ↛ LNNBB	0.437103	LNMPR ↛ LNNBB	0.394760	LNMPR ↛ LNNBB	0.000108
LNNBB ↛ LNMPR	0.060849	LNNBB ↛ LNMPR	0.013755	LNNBB ↛ LNMPR	0.357276
LNFBIS ↛LNNBB	0.976197	LNFBIS ↛LNNBB	0.372803	LNFBIS ↛LNNBB	0.512925
LNNBB ↛LNFBIS	1.622616	LNNBB ↛LNFBIS	0.043466	LNNBB ↛LNFBIS	1.215049
LNNDA → LNNBB	3.537215*	LNNDA ↛ LNNBB	0.265907	LNNDA ↛ LNNBB	0.975128
LNNBB →LNNDA	4.402923**	LNNBB →LNNDA	10.32053***	LNNBB ↛LNNDA	0.120086
LNNBRFI ↛ LNNBB	1.141537	LNNBRFI ↛ LNNBB	0.611055	-	-
LNNBB ↛LNBRFI	0.227414	LNNBB ↛LNBRFI	0.533717	-	-
LNGFCF ↛LNNBB	0.056805	LNGFCF ↛LNNBB	0.059305	LNGFCF ↛LNNBB	0.710016
LNNBB ↛ LNGFCF	0.501116	LNNBB ↛ LNGFCF	1.764723	LNNBB ↛ LNGFCF	0.193061
LNFBIS ↛LNMPR	1.358250	LNFBIS ↛LNMPR	0.686595	LNFBIS ↛LNMPR	2.173700
LNMPR ↛LNFBIS	0.111836	LNMPR ↛LNFBIS	0.833410	LNMPR ↛LNFBIS	2.096379
LNNDA ↛ LNMPR	0.010309	LNNDA ↛ LNMPR	0.018586	LNNDA ↛ LNMPR	0.437735
LNMPR →LNNDA	15.46780***	LNMPR →LNNDA	8.654456***	LNMPR →LNNDA	6.524787***
LNNBRFI ↛LNMPR	0.148377	LNNBRFI ↛LNMPR	0.560299	-	-
LNMPR ↛LNNBRFI	0.460256	LNMPR ↛LNNBRFI	0.034651	-	-
LNGFCF →LNMPR	10.76929***	LNGFCF →LNMPR	3.895821**	LNGFCF ↛LNMPR	1.517059
LNMPR ↛ LNGFCF	0.004959	LNMPR ↛ LNGFCF	0.085188	LNMPR → LNGFCF	5.078746**
LNNDA ↛ LNFBIS	0.127176	LNNDA ↛ LNFBIS	0.642088	LNNDA ↛ LNFBIS	0.004184
LNFBIS → LNNDA	4.936617**	LNFBIS → LNNDA	5.732296**	LNFBIS ↛ LNNDA	0.310918
LNNBRFI ↛ LNFBIS	0.790767	LNNBRFI ↛ LNFBIS	0.138459	-	-
LNFBIS ↛LNNBRFI	0.015839	LNFBIS ↛LNNBRFI	1.231575	-	-
LNGFCF ↛LNFBIS	0.644897	LNGFCF ↛LNFBIS	0.334175	LNGFCF ↛LNFBIS	0.026179
LNFBIS ↛ LNGFCF	0.059026	LNFBIS ↛ LNGFCF	0.238358	LNFBIS ↛ LNGFCF	1.701545
LNNBRFI ↛ LNNDA	0.063108	LNNBRFI ↛ LNNDA	2.382615	-	-
LNNDA →LNNBRFI	5.476177**	LNNDA →LNNBRFI	3.369253*	-	-
LNGFCF → LNNDA	4.912574**	LNGFCF → LNNDA	19.54601***	LNGFCF ↛ LNNDA	0.121697
LNNDA ↛ LNGFCF	0.173977	LNNDA ↛ LNGFCF	0.038862	LNNDA ↛ LNGFCF	0.994314
LNGFCF ↛ LNNBRFI	0.164939	LNGFCF ↛ LNNBRFI	0.400441	-	-
LNNBRFI ↛ LNGFCF	0.110433	LNNBRFI ↛ LNGFCF	0.202182	-	-

Note: The 1%, 5%, and 10% significant are represented as ***, ** and * respectively. Sign → indicates direction of causality.

6. Conclusion and policy implications

The ARDL results for financial inclusion and economic growth are mixed across the three categories. This confirms that there might be inter-country differences that define the relationship between financial inclusion and economic growth in SADC. The number of bank branches had a significant positive short-run relationship with economic growth for All SADC Countries and SADC Low-Income Countries. Mobile penetration rate promoted economic growth in the short run for the three categories though it was statistically insignificant for SADC Low-Income Countries. In the short run, there was substitutability effect between mobile penetration rate and bank branches penetration. The results could be suggesting that mobile financial services have a possibility of reducing the financial infrastructure gap in SADC. That is, mobile phone diffusion may increase financial inclusion to the poor and non-poor in SADC countries through the provision of cost-effective financial services where bank coverage is low. Thus, SADC countries are advised to take into consideration the mobile phone and bank branches substitutability effect as they expand bank branches in this era of high mobile phone penetration rate.

Unlike other studies like Lenka and Sharma (2017) and Williams *et al.* (2017), this study unearthed the conclusion, namely that the fixed broadband internet investment in SADC is the long-run gateway to meaningful financial inclusion. This is evidenced by the fixed broadband internet subscriber's variable having a significant positive long-run relationship with economic growth. Other policy initiatives like having more bank branches and improving mobile banking, a common trend in SADC, only have a short-term significant influence on economic growth. This can be evidenced by some bank branches now shutting down in some locations in SADC countries. Though some central banks in SADC countries have structured financial inclusion divisions within their establishments - for example, the Bank of Botswana's Financial Inclusion Roadmap and Strategy 2015-2021 -, they need to review their policies, strategies, and plans and embrace financial technologies (Fintech), which has a great potential in fostering unique financial inclusion and in shifting economic paradigm, leading to a digitalized economy. This includes attracting both internal and external investments in the information and communication (ICT) sector in order to improve financial inclusion, which ultimately leads to financial stability and economic growth. Thus, the liberalization of the ICT sector is advocated for. The increased competition, through the liberalization of the ICT sector, may reduce communication costs in SADC, which are relatively high compared to other regions like East Africa. This strategic shift, informed by the results of this study, has the potential to stimulate the diffusion of ICT and financial inclusion and promote economic growth.

The causality results show that financial inclusion only benefits the economy when it leads to an increased number of bank deposit accounts. The current study, unlike previous studies like Asongu and Odhiambo (2020), reveals that financial inclusion interventions like increasing number of bank branches, mobile banking, fixed broadband internet services, as well as gross fixed capital formation have impact on or cause economic growth through influencing the number of deposit accounts. Interestingly, this applies to both SADC Middle-Income and SADC-Low Income Countries. Thus, policies for formal banking and non-formal banking supervision authorities in SADC should be reviewed to allow financial inclusion to have an impact on the number of deposit accounts. The possible challenges posed by financial inclusion like security concerns and anti-money laundering may be reduced through the introduction of policies that promote the infusion of ICT in financial sectors. Most countries in both Eastern and Southern Africa regions like Botswana are currently under the observation of the Financial Action Task Force (FATF) of the International Cooperation Review Group (ICRG). One of the six action items of the ICRG action plan calls for the development of risk-based supervisory manuals as well as robust implementation plans. In order to benefit from these financial innovation products coming through financial inclusion, SADC countries should consider these international monitoring standards so that they do not fall behind the inevitable integration of the financial sectors.

Furthermore, SADC governments should prioritize the development of legal and governance frameworks that include adherence to the rule of law and good public sector management in order to benefit from financial innovation as well as financial liberalization and

integration. To augment this policy recommendation, SADC countries should also prioritize investment in human capital, especially quality education, and health, as it has the potential of enhancing the productivity of both physical and financial capital with a capability of spurring economic growth.

Sectorial transformation or approach, which entails modeling of a broader definition of growth, including economic development components like unemployment and components of output, is topical in most SADC countries, for example, Botswana. This may provide recommendations for SADC countries to concentrate on improving the efficiency of financial systems to realize long-term economic growth.

The current study is limited to the banking sector-related variables to capture financial inclusion, due to data availability. A study that includes non-banking institutions like micro-financing institutions, self-help groups, and post office savings banks may shed more light or validate findings of the current study, given that these institutions have robust penetration to the unbanked agents, including those in rural areas. In addition, cross-specific and cross-country studies are encouraged for more targeted policy implications.

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Appendix

Table 3. Variable description and expected signs

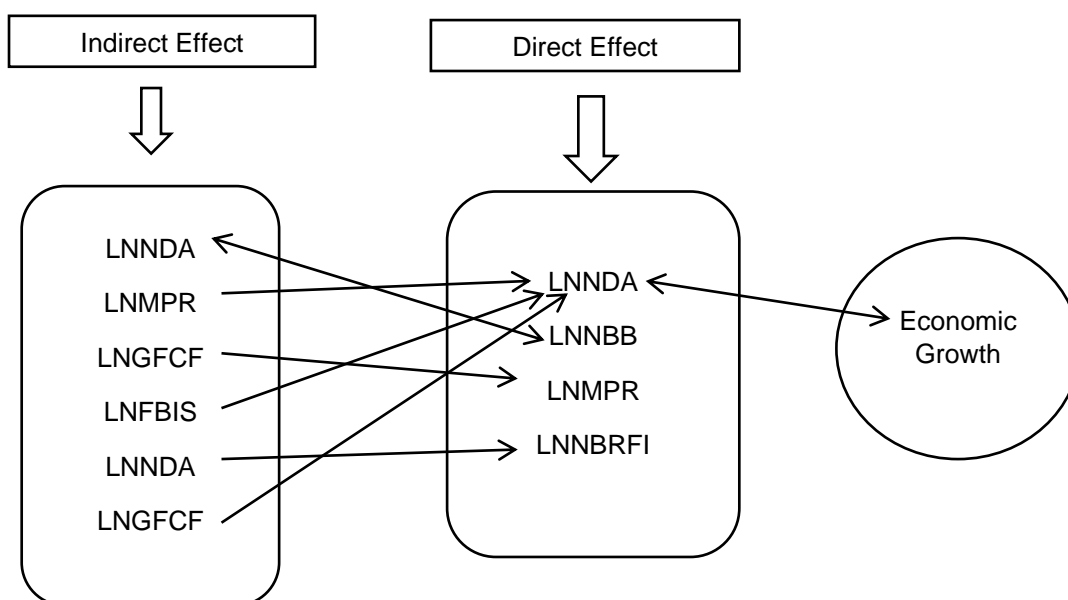| Variable	Variable description	Variable symbol
Economic growth	Real gross domestic product growth rate	RGDP
Supply side indicators (accessibility)		
Number of bank branches	Number of bank branches per 100000 adults	NBB
Number of ATM	Number of ATM per 100000 adults	NATM
Demand side indicators (usage)		
Number of depositor accounts	Number of depositor accounts per 1000 adults	NDA
Number of borrowers from regulated financial institutions	Number of borrowers from regulated financial institutions per 1000 adults	NBRFI
Branchless indicators		
Mobile penetration rate	Mobile phone subscribers per 100 people	MPR
Fixed broad band internet services	Fixed broadband internet subscribers per 100 people	FBIS
Control variables		
Inflation	Consumer price index	CPI
Gross fixed capital formation	Gross fixed capital formation (% of GDP)	GFCF
Government expenditure	Government expenditure (%of GDP)	GEXP
Population growth	Population growth (annual %)	POPG
Labour force participation rate	Labor force participation rate, total (% of total population ages 15-64)	LFPR
Education level	School enrollment, tertiary (% gross)	EDU

Figure 1. TYDL Granger causality between economic growth and financial Inclusion: All SADC Countries
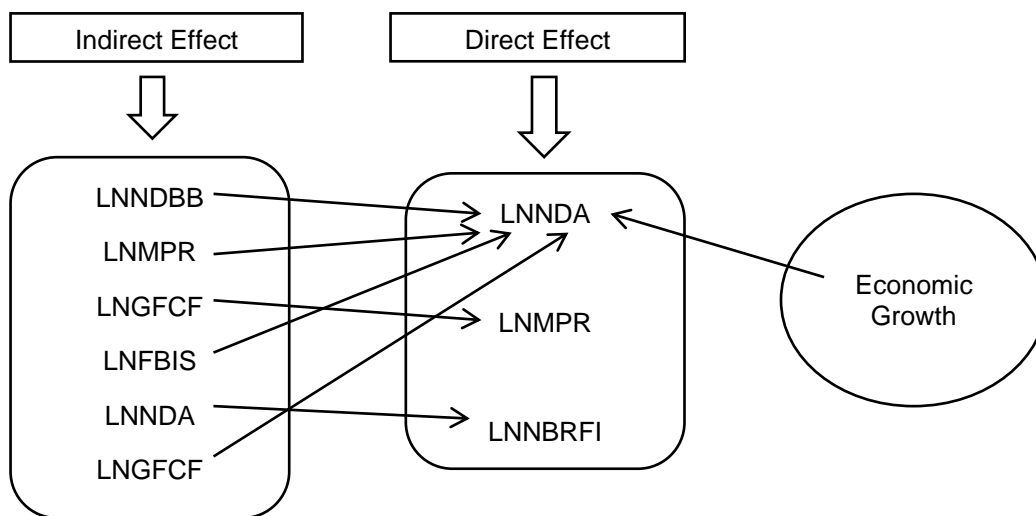
**Figure 2. TYDL Granger causality between economic growth and financial inclusion:
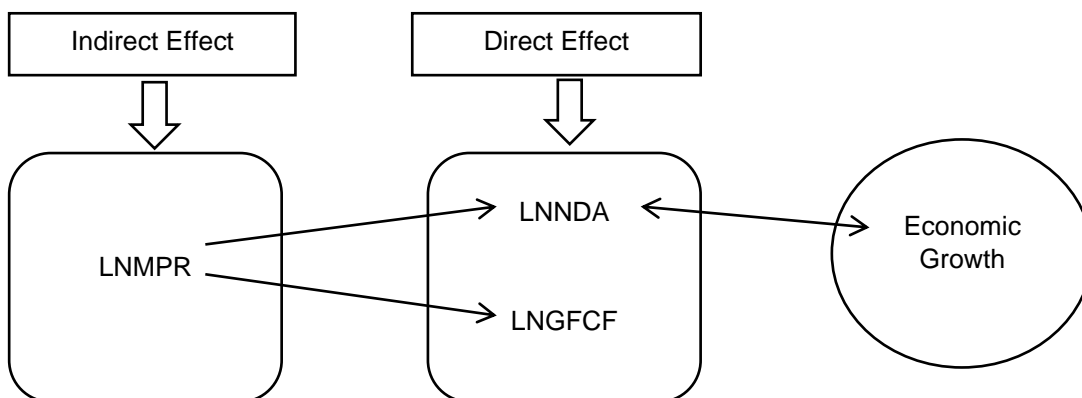SADC Low Income Countries**

**Figure 3. TYDL Granger causality between economic growth and financial inclusion:
SADC Middle Income Countries**