

Article

Effect of Financial Regulation on Financial Inclusion in the SADC Region

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Abstract

Financial regulation has the potential and power to instil trust and stability in the financial system, but its impact on financial inclusion is still debatable. Hence, the objective of this study is to examine the effects of financial regulation on financial inclusion in fourteen SADC countries. This study applies the Generalised Method of Moments system (system-GMM) to the period 2010 to 2022. Based on the results, financial regulation, and domestic credit to the private sector have a significant positive impact on financial inclusion in the SADC region. However, financial stability and broad money as a percentage of GDP were indicated to have a significant negative effect on financial sectors in the SADC. Since the SADC region is still struggling with access to and use of financial services, this study recommends that the government and financial sector form a strong partnership to drive financial regulatory compliance while placing financial inclusion goals at the centre.

Keywords: financial regulation; financial inclusion; system-Generalised Method of Moments (sys-GMM)

1. Introduction and Background

Financial inclusion is regarded as a tool that provides all people and businesses with a range of high-quality, reasonably priced financial goods and services that satisfy their needs (World Bank, 2018; Alliance for Financial Inclusion, 2017). These financial goods and services may comprise savings and deposit bank accounts, insurance, credits, and payments (Gul et al., 2018; Simatele & Maciko, 2022). These financial goods and services can be delivered by an efficient financial system, which mainly depends on financial regulation (White, 1999). It should be noted that, based on the theory of asymmetric information, when a market transaction involves two parties and one party has more information than the other, this reduces efficiency of resource allocation (Zhang, 2024). Hence, in the presence of an asymmetric information problem, lenders became reluctant to extend credit to borrowers without obtaining credit history information (Coetzee & Genukile, 2020). Therefore, although banks and financial institutions implement financial inclusion strategies, they are also required by financial regulation to guarantee a safer and fairer financial system for citizens. Hence, this study aims to investigate the impact of financial regulation on financial inclusion in the SADC region.

This comes after the severe effects of the 2008 global financial crisis, which have led many nations globally to prioritise actions that stabilise financial systems (Lewis & Lindley, 2015). Instability was largely experienced in the financial sector by many nations after the negative shocks from the global financial crisis of 2008. It compelled policymakers



Academic Editor: Robert Czudaj

Received: 25 February 2026

Revised: 5 April 2026

Accepted: 10 April 2026

Published: 16 July 2026

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and regulators to formulate stringent regulatory measures in response and make efforts to stabilise the world economy (Jungo et al., 2022).

Thus, the International Basel Committee established Basel III financial regulatory reforms to tighten global capital, leverage, and liquidity requirements to ensure resilience in the financial industry (Bank for International Settlements, 2011). Thus, it is essential to recognise that financial regulation was established to enhance the financial system by ensuring financial stability, consumer protection, and minimising risk (Abreu & Gulamhussen, 2015; Klomp & De Haan, 2015). Jomini (2011) highlighted that in past years, reforms of financial regulation have succeeded in enhancing credit access for businesses and households, reducing borrowing costs, and increasing the availability of various financial products in the system (Jomini, 2011). According to the Basel Committee, the purpose of the reforms is to boost the banking industry's capability to withstand shocks from financial and economic slowdowns, as well as its capacity to minimise spillover risk to the real economy due to failures in the financial sector (Bank for International Settlements, 2011).

According to Bank for International Settlements (2025), the implementation of the last elements of the Basel III minimum regulatory capital commenced on 1 January 2023 and led to changes in capital ratios. By the end of June 2024, the Bank for International Settlements reported that the Tier 1 minimum required capital increased from 1.4% to 1.8%. The implementation of Basel III led to an increase in the Common Equity Tier 1 (CET1) ratio from 13.4% at the end of June to 14% by the end of December 2024. An increase from 6.1% to 6.2% was reported for the leverage ratio by the end of December 2024. After implementing the Basel III liquidity requirements, the Bank for International Settlements (2025) reported that the liquidity coverage ratio (LCA) experienced a decline from 135.9% at the end of June 2024 to 134.8% by the end of December 2024. Also, the Net Stable Funding Ratio (NSFR) was stable at 123.7%, which is greater than the minimum requirement of 100% (Bank for International Settlements (2025)). In the context of SADC, the implementation of Basel III led to an increase in capital ratio; for instance, South Africa exceeded the CET1 requirement and maintained healthy capital buffers (Sibande & Milne, 2024).

Oino (2021) argued that banks with higher capital requirements tend to lend more, and this positively influences liquidity requirements. For instance, providing a credit extension to borrowers depends on the level of liquidity, which later influences the status of economic well-being (Alkomsan & Gameel, 2023; Lin et al., 2025). Furthermore, Momanyi (2018) emphasised that financial stability and economic growth are best achieved in a strong financial regulation environment. Nutassey et al. (2023) stated that enhanced financial regulations motivate individuals to use financial goods and services. In addition, Jungo et al. (2022) highlighted that stringent financial regulation is an obstacle to new bank entries in the industry, as regulations like capital adequacy requirements might compel smaller banks to merge to remain operational and comply. Finally, Anarfo et al. (2020) and Gwatidzo (2025) acknowledged the key role of financial regulation, including preventing unfair competition, ensuring market integrity, preventing external shocks, and alleviating asymmetric information.

At this stage, it is not clear whether financial regulation stimulates financial inclusion. There is no consensus in the existing empirical literature due to contradicting inferences. For example, Anarfo et al. (2020) argued that strengthening prudential regulations could negatively impact financial inclusion since it reduces banks' ability to offer financial services. In addition, Kodongo (2018) and Raksmeiy et al. (2022) asserted that prudential regulations could discourage the use of banking services, while Saifurrahman and Kassim (2024) argued that regulatory restrictions hinder access to financial services. However, contrary to the latter, Besong et al. (2022) argued that banking regulations significantly improve financial inclusion. There are a few studies that suggest a positive effect of financial regulation on

financial inclusion (see studies by [Klapper et al., 2021](#); [Muriu, 2020](#); [Gichuru & Namada, 2022](#); [Yakubi et al., 2022](#)).

This study focuses on the impact of financial regulation and financial inclusion specifically for SADC countries. Studies for this region are limited; thus, more knowledge is needed. This study differs from studies in sub-Saharan Africa and other African countries by employing system-GMM as the main estimation technique. It is well known to provide reliable and robust estimates, solutions to endogeneity issues, and is the best fit for panel data. This study differs from existing studies on this subject, such as those of [Kodongo \(2018\)](#), who used the Probit regression model for Kenya, and [Anarfo et al. \(2020\)](#), who employed a mixed-effect regression model for sub-Saharan Africa. This study further contributes to the literature by combining capital adequacy and liquidity requirements as measures of financial regulation to determine financial inclusion: a topic that is rarely discussed in the existing literature. Lastly, the study uses panel data as it provides meaningful insights, enhances estimation efficiency, includes more variables, and reduces multicollinearity ([Gujarati & Porter, 2009](#); [Wooldridge, 2012](#)). The paper is structured as follows: Section 2 is a discussion of the literature; Section 3 includes the methodology, and Section 4 provides an analysis of the empirical results.

2. Literature Review

2.1. Theoretical Review

Financial intermediation institutions ensure that the process of channelling funds from lenders to borrowers is smooth by dealing directly with lenders and borrowers in the market. ([Allen & Santomero, 1998](#)). The theory of financial intermediation is based on the notion that it reduces transaction costs and asymmetric information in the market ([Scholtens & van Wensveen, 2003](#)). [Hidayat and Sari \(2022\)](#) indicated that a well-functioning financial system can limit asymmetric information and transaction costs. They argued that it may encourage investments through an increase in efficient capital allocation and asset liquidity ([Hidayat & Sari, 2022](#)).

When those with excess funds invest in a financial institution, the decision to invest increases the adverse selection of investment in the market since investors lack information about current economic conditions. ([Botha & Makina, 2011](#)). It also creates reckless behaviour, known as moral hazard by financial institutions, since investors receive information about the economic condition of the institution ([Asongu & Odhiambo, 2018](#)). However, governments are responsible for addressing these challenges by crafting financial regulations that institutions are required to abide by ([Botha & Makina, 2011](#)).

In the theory of financial intermediation, regulation involves determining liquidity and capital requirements for financial institutions that act as intermediaries. Both these regulatory requirements help financial intermediaries maintain their operations through debt refinancing and debt recovery ([Li & Qiu, 2023](#)). [Sibande et al. \(2025\)](#) argued that financial institutions such as banks can monitor borrowers and collect funds when payments are overdue. [Li and Qiu \(2023\)](#) argued that strengthened capital regulation eliminates excessive risk appetite through financial intermediaries, and the availability of information in the market helps improve people's welfare. This theory argues that an increase in financial intermediation is a result of efficient resource allocation by financial institutions, leading to an increase in the access and use of financial services and products by the public.

The capital buffer theory argues that financial institutions hold capital as a buffer above the minimum required regulatory capital ([Valencia & Bolanos, 2018](#)). Capital buffers are necessary for financial institutions to guard against economic uncertainty and benefits of maintaining capital ([Albert & Olweny, 2017](#)). Capital buffer was introduced to allow financial institutions to hold excess capital, making them resistant to economic slow-

down and able to support the real economy (Bank for International Settlements, 2022). Callem and Rob (1999) posited that the capital buffer intends to strengthen resilience, curb unforeseen events, and absorb losses during economic slowdowns to ensure financial institutions can continue to function. Based on the counter-cyclical buffer, financial institutions are expected to balance the level of capital they keep guided by the business cycle (Duho, 2023). This means that when faced with an expansionary economy, financial institutions are required to increase capital accumulation, while at times of economic recession, financial institutions can decrease capital to absorb losses and continue lending activities. In summary, the rationale for the capital buffer theory is to ensure the continuous operation of financial institutions even during times of financial distress.

2.2. Empirical Literature Review

This section discusses several studies in the empirical literature and groups research on financial regulation and financial inclusion, financial inclusion and financial stability, and institutional and macroeconomic determinants of financial inclusion.

2.2.1. Financial Regulation and Financial Inclusion

From a general perspective, suppose any enhancements in regulations in an economy give individuals a motive to use financial services. This is because it has the potential to terminate the problem of asymmetric information, enforce agreements, and decrease transaction costs (Jungo et al., 2022). However, the latter would lead to the protection of individuals against issue of adverse selection, and it might encourage individuals to access and use financial services. Based on this evidence, Klapper et al. (2021) examined whether cross-country differences in owning and usage of financial services are driven by regulations. Using maximum likelihood estimation techniques, the simple Probit model, and the 2017 Global Findex database, the authors argued that formal savings accounts are strongly associated with consumer protection regulations, whereas formal savings are linked to regulations that advocate maintenance account fees. Financial inclusion is promoted more by tax subsidies. It was further indicated that the strength of regulation should be realised more than the acceptance of financial services (Klapper et al., 2021).

In the context of Kenya, Kodongo (2018) used the Probit regression model and fixed model on a cross-sectional panel and indicated that financial literacy and agency banking regulations enhance access to formal financial services. Kodongo (2018) further posits that factors like know-your-customers and prudential regulations (capital and liquidity requirements) could discourage financial inclusion.

Anarfo et al. (2020), in the case of Sub-Saharan Africa, used a mixed-effect regression model to suggest that contraction of prudential regulations negatively affects access to financial services. Here, capital adequacy requirements lead to a severe decline in financial institutions' ability to offer financial services and could lead to reluctant credit expansion that reduces financial inclusion. However, they argued that collaboration of financial regulation and financial stability promotes access to financial products and services.

Momanyi (2018) used a multivariate logit regression model in the case of Kenya's banking sector and established a positive correlation between variables of financial inclusion, such as quality, usage, and access, and the financial stability of institutions regulated by the Banking Act (Momanyi, 2018).

Using a descriptive study design, Gichuru and Namada (2022) examined the effect of regulatory requirements on financial inclusion for 38 FinTech companies. When using the Pearson correlation coefficient and multiple regression, Gichuru and Namada (2022) stressed that consumer and investor protection regulations strongly boost access to financial products and services. This means that regulations drive financial inclusion.

[Yakubi et al. \(2022\)](#) employed structural equation modelling with a causal research approach to confirm that business regulations and digital technology are significant factors influencing financial inclusion and socioeconomic development.

Contrary to [Kodongo \(2018\)](#), [Raksmey et al. \(2022\)](#) argued that macroprudential regulations decrease the use of banking services because they limit access to the lending market and increase access to general banking services. [Saifurrahman and Kassim \(2024\)](#) asserted that regulatory imbalances and restrictions hamper the likelihood of gaining access to financial services.

[Fraisie et al. \(2017\)](#) argued that the Basel III financial regulation led to a decline in the lending activities of banks by regulated institutions and an expansion of shadow lending. Similarly, [Sibande and Milne \(2024\)](#) argued that the establishment of higher capital requirements translated to a decline in lending supply, which negatively impacts the goal of financial inclusion for all. On the contrary, [Mutarindwa et al. \(2020\)](#) affirmed that lending is enhanced by banks that meet the capital requirement threshold, whereas those complying with the liquidity threshold requirement tend to lend less than non-complying banks ([Mutarindwa et al., 2020](#)). In the case of European banks, the expansion of lending depends on the link between capital and liquidity requirements; for instance, elevated levels of liquidity mean that capital requirements influence lending positively since banks maintain enough liquid funds ([Thornton & Tommaso, 2020](#); [Kim & Sohn, 2017](#)).

2.2.2. Financial Inclusion and Financial Stability

In the literature, it is noted that the association between financial inclusion and financial stability has been widely debated. Hence, this section is necessary to ascertain whether a consensus has been reached. Among recent studies on financial inclusion and financial stability, after using Hierarchical Linear Regression (MLR), [Joudar and El Ghmari \(2025\)](#) argued that individual indicators of financial inclusion, such as digital payment and number of bank branches, negatively impact financial stability. They also argued that savings, ATMs, and money supply negatively impact financial stability. However, [Kebede et al. \(2025\)](#) argued that the impact depends on the financial inclusion threshold: being below the threshold enhances financial stability, and being above the threshold reduces financial stability. [Barik and Pradhan \(2021\)](#) examined this subject for BRICS countries using system-GMM. Their work suggested that financial inclusion is negative and significantly influences financial stability. In the case of Nigeria, [Ahmad \(2018\)](#) indicated that greater financial inclusion translates to financial instability. Employing the GMM dynamic estimator, [Amatus and Alireza \(2015\)](#) argued that when financial inclusion is measured by outstanding deposits with commercial banks, it negatively influences financial stability. However, when measures are conducted using outstanding loans from commercial banks, financial inclusion contributes positively to financial stability.

A cross-country analysis by [Siddik and Kabiraj \(2018\)](#) used a GMM dynamic estimator with panel data from 2001 to 2013. They contended that financial inclusion contributes positively and significantly to financial stability. In the case of 42 Asian countries, [Pham and Doan \(2020\)](#) asserted that financial inclusion has a weak positive influence on financial stability when Feasible Generalised Least Squares (FGLS) regression is used. While on this subject, [Al-Smadi \(2018\)](#), in the case of Jordan, used the Fully Modified Least Squares (FMOLS) model and came to the same findings as [Pham and Doan \(2020\)](#). [Sethy and Goyari \(2022\)](#) further argued that for seven Asian countries, when using FMOLS and dynamic ordinary least squares (DOLS), enhancing the coverage of financial inclusion translated to long-term financial stability for the seven Asian countries. [Dienillah et al. \(2018\)](#) suggested that when the Tobin model is used, higher financial inclusion has a positive and significant impact on financial stability, but only in countries with a high income. In addition, for

54 African countries, [Koudalo and Toure \(2023\)](#) used fixed and random effect models to argue that the level of account penetration (financial inclusion) enhances financial stability.

2.2.3. Institutional and Macroeconomic Determinants of Financial Inclusion

Using the random effect model for 12 Sub-Saharan African countries, [Markjackson and Timipa \(2023\)](#) argued that institutional quality leads to an increase in financial products and access to services. They further indicated that political stability and violence have a significant negative impact on access to financial inclusion in the Sub-Saharan Africa region ([Markjackson & Timipa, 2023](#)). [Muriu \(2020\)](#) used a standard regression model from 2004 to 2015 and suggested that the rule of law is a crucial institutional dimension in enhancing financial inclusion. In agreement with [Muriu \(2020\)](#), [Tran and Thi Dinh \(2021\)](#) argued that big formal loans, bank accounts, savings books, and ATM cards are more likely to be attained by those living in provinces with higher institutional quality. They further suggested that wage recipients who live in areas with higher-quality institutions are more likely to receive compulsory social insurance ([Tran & Thi Dinh, 2021](#)). [Chinoda and Kwenda \(2019\)](#) studied this subject in Africa employing the system-GMM estimator and asserted that institutional quality and governance promote financial products and access to services. An international evidence study by [Vo \(2024\)](#) using panel smooth transition regression indicated that an improvement in institutional quality is correlated with the expansion of financial inclusion in high- and middle-income countries.

[Nsiah and Tweneboah \(2023\)](#) examined the determinants of financial inclusion using the GMM and OLS for the demand and supply sides, respectively. [Nsiah and Tweneboah \(2023\)](#) argued that GNI per capita, money supply, and institutional quality are the main drivers of financial inclusion. On the one hand, [Tuesta et al. \(2015\)](#) and [Evans and Adeoye \(2016\)](#) used a dynamic panel data approach from 2005 to 2014 and suggested that per capita income, broad money, literacy, internet access, and Islamic banking are significant factors that determine financial inclusion in Africa. On the other hand, domestic credit, deposit interest rates, inflation, and population were insignificant in explaining financial inclusion ([Evans & Adeoye, 2016](#)). [Eshun and Kocenda \(2025\)](#) also argued that literacy rate, trade openness, political stability, bank stability, bank efficiency, income, and remittances are the main determinants of financial inclusion in the Sub-Saharan African and Organisation for Economic Cooperation and Development (OECD) regions.

In terms of the effect of financial regulation on financial inclusion, the empirical literature revealed an unreached consensus, specifically in the case of the SADC region. It was discovered that few studies found financial regulation to have a positive effect on financial inclusion (see the studies by [Klapper et al., 2021](#); [Muriu, 2020](#); [Gichuru & Namada, 2022](#); [Yakubi et al., 2022](#)). Few studies found financial regulation to have a negative effect on financial inclusion, apart from [Anarfo et al. \(2020\)](#), who contended that prudential regulations negatively affect access to financial services. [Kodongo \(2018\)](#) and [Raksmeay et al. \(2022\)](#) stated that prudential regulations could discourage the use of banking services, and [Saifurrahman and Kassim \(2024\)](#) found that regulatory restrictions hinder access to financial services. The study aims to add evidence to the lack of an existing consensus on financial regulation and financial inclusion, specifically in the case of the SADC region.

3. Methodology of the Study

This study examines the impact of financial regulation on financial inclusion in the SADC region; it uses adopted and modified estimation methods established by [Anarfo et al. \(2020\)](#) using panel data analysis. Therefore, unlike [Anarfo et al. \(2020\)](#), this study focuses particularly on the impact of financial regulation in the SADC region, employing the generalised methods of moments system (system-GMM). The study introduces other

variables like domestic credit to private sectors by banks, broad money supply, and bank liquidity requirements in the same regression model. To determine the impact of financial regulation on financial inclusion in the SADC, this study employs the system-GMM technique. However, the functional form model was developed as follows:

$$FIN_{it} = F(FIR_{it}, DCREDIT_{it}, ZSCORE_{it}, M3_{it}) \quad (1)$$

The research model is formulated as follows:

$$FIN_{it} = \beta_0 + \beta_1 FIN_{it-1} + \beta_2 FIR_{it} + \beta_3 DCREDIT_{it} + \beta_4 ZSCORE_{it} + \beta_5 M3_{it} + \varepsilon_{it} \quad (2)$$

Here, in both Equations (1) and (2):

FIN = financial inclusion index;

FIR = financial regulation;

$DCREDIT$ = domestic credit to the private sector by banks (% of GDP);

$ZSCORE$ = bank z-score;

$M3$ = broad money supply (% of GDP);

ε_{it} donates the unexplained terms in the model;

i and t represents the number of countries and the period, respectively.

3.1. Estimation Techniques

The pooled OLS, fixed effects, and random effects models are static panel regression models, which are not appropriate for a dynamic panel model (Ullah et al., 2018). For instance, the empirical specification design of the current study is dynamic, which means that in the regression equation, it incorporates lagged dependent variables like HDI as explanatory variables. This means that in a dynamic model, previous values of the dependent variable can predict its future values. Ullah et al. (2018) hold that pooled OLS fails to account for unobserved heterogeneity. The existence of unobserved effects on the OLS model could result in endogeneity, which occurs when explanatory variables are correlated with the error term (Gujarati & Porter, 2009). Gil-Garcia and Puron-Cid (2015) state that when the lagged dependent variable is correlated with the error term, OLS, the fixed effects and random effects models produce biased and inconsistent estimates, which violate the fundamental assumption of regression. However, due to the above difficulties, the difference-GMM is suitable for a dynamic model and can be used as a solution to control the unobserved heterogeneity of individual-specific effects over time (Bond, 2002). However, Bond et al. (2001) stress that when using a first-difference GMM estimator for a persistent time series, the estimator can behave improperly because lagged levels of the series can produce weak instruments of the first differences. Wooldridge (2012) mentioned that the first-difference transformation improves the GMM estimates, but only after excluding several observations. Hence, this study opted for the system-GMM estimator to address the weakness of the difference-GMM estimator.

The system-GMM was established by Blundell and Bond (1998) as an augmented difference-GMM after discovering a weakness in the standard GMM. Although it eliminates unobserved country-specific effects by conducting first differences, Blundell and Bond (1998) argued that it produces unsatisfactory outcomes. The reason for unsatisfactory outcomes could be weak instruments in the model, which are highly persistent. Therefore, when first-difference GMM is used in this situation, it could potentially lead to what is called large-finite-sample biases (Gujarati & Porter, 2009). According to Blundell and Bond (1998) and Bond et al. (2001), the mentioned weakness of differenced GMM can be addressed by taking advantage of stationary restrictions on the original process. However, the system-GMM overcomes the above weakness by employing both the levels and first

differences specification, unlike the difference-GMM estimator (Blundell & Bond, 1999). In a system-GMM, the lagged first difference in the series is employed as an instrument in the levels series equation.

To be precise, the system-GMM is a preferred model over alternative models since it has the capacity to address the problem of endogeneity while ensuring results are reliable and robust by employing internal instruments. This leads to consistent and efficient estimates (Blundell et al., 2000). Secondly, the system-GMM controls unobserved heterogeneity, which might lead to biased estimates. The system-GMM estimator is suitable for dynamic models since it includes lagged dependent variables as explanatory variables in the regression (Blundell et al., 2000). This means previous values of the dependent variable influence its current performance. Lastly, the system-GMM estimator is suitable when the time periods (T) are small while the number of individuals (N) is large (Roodman, 2006). Thus, this study considers 14 countries and a period of 13 years from 2010 to 2022, due to data unavailability in some countries. For this study, explanatory variables are not strictly exogenous, financial inclusion as a dependent variable is dynamic, and its past values qualify as independent variables in the model. Hence, this study employs the generalised method of moments system (sys-GMM) to investigate the impact of financial regulation on financial inclusion for 14 SADC region countries.

3.2. Data Sources

The study uses panel data to analyse the empirical model, establishing the credibility and frequency of observations in yearly data from 2010 to 2022. The study concentrated on 14 SADC region countries (Lesotho, Tanzania, Democratic Republic of Congo, Swaziland, Angola, Botswana, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Zambia, and Seychelles) to investigate the impact of financial regulation on financial inclusion in the SADC region. The study strictly focused on 14 SADC countries; as such, the inferences of this study cannot necessarily be extended to all SADC countries or regions. The study period used is 2010–2022 and is limited by data unavailability; that is, after the 2008 global financial crisis, many economies revised their financial regulations in response to the crisis. Data unavailability was also caused by various financial circumstances and views on financial inclusion and financial regulation between countries and regions. Due to the unavailability of data, the study used only traditional measures of financial inclusion like access, availability, and use of formal financial services and products. However, it is also possible to incorporate other indicators, like digital financial inclusion. For bank regulatory capital and risk-weighted assets (%), the IMF has noted that these are strictly not comparable across countries due to differences in national accounting, taxation, and supervisory regimes.

The data was sourced from different platforms such as the World Bank website under the database of the World Development Indicators (WDIs) <https://databank.worldbank.org/source/world-development-indicators> (accessed on 30 January 2026) and the International Monetary Fund (IMF) website https://data.imf.org/datasets#t=coveo117bcfc4&sort=@idata_publication_date%20descending (accessed on 30 January 2026).

3.3. Principal Component Analysis (PCA) to Construct Financial Inclusion

In general, principal component analysis is used when more than one component is involved to measure a specific variable. It transforms multidimensional original variables into a single uncorrelated variable named the principal component (Greenacre et al., 2022). The study employs PCA to construct a financial inclusion index as highly correlated series are transformed into small components of uncorrelated series called principal components (Ajide et al., 2022). In the process of constructing a financial inclusion index, PCA has the

power to maintain the true originality of the variables in the databases. PCA became a popular method due to its capacity to prevent high correlation between the measures of financial inclusion (Ajide et al., 2022). Many scholars have recognised financial inclusion as a multidimensional concept that cannot be measured by a single variable, as it might not reflect the true degree of financial inclusion (Camara & Tuesta, 2017; Nguyen, 2020; Gharbi & Kammoun, 2023). However, when constructing a financial inclusion index based on PCA, each component is regarded as equally important and has some contribution towards defining financial inclusion (Nguyen, 2020).

This undermines the strength of moving averages in calculating the financial inclusion index, producing equal weights for the indicators while their contribution to financial inclusion is not the same (Sarma & Pais, 2011; Afandi & A'yun, 2018). For instance, Sarma and Pais (2011) believed that the financial inclusion index should be one single number falling between 0 and 1, where zero represents financial exclusion and one represents financial inclusion. After calculating the financial inclusion index using a moving average, Sarma and Pais (2011) argued that financial inclusion is defined by the following weights, where 1 is used for accessibility, 0.5 is used for availability, and 0.5 is used for usage indexes.

3.4. Description of Variables

The financial inclusion index (FIN) ensures that reasonably priced and accessible financial goods and services are available to the whole economy. Gharbi and Kammoun (2023) regard financial inclusion as the degree of access, availability, and usage of affordable financial products and services open to individuals and businesses. This can include savings, credit, transactions, payments, and insurance. To construct a financial inclusion index, the study uses similar approaches to Nguyen (2020) and Gharbi and Kammoun (2023), who incorporated dimensions such as access, availability, and usage. Therefore, the following inclusion indicators were used to formulate the financial inclusion index using the PCA approach.

- The number of commercial bank branches per 100,000 adults.
- The number of ATMs per 100,000 adults.
- The number of commercial bank branches per 1000 km².
- The number of ATMs per 1000 km².
- Outstanding deposits with commercial banks as a percentage of GDP.
- Outstanding loans from commercial banks as a percentage of GDP.

These measures of financial inclusion were supported by Jungo et al. (2022) and Okereke et al. (2023). The study faced data limitations, as Ajide et al. (2022) noted that most economies in Africa collect data on access and usage of financial services. Based on a priori information, the relationship is expected to be positive between financial inclusion and HDI.

Financial regulation (FIR) is composed of capital adequacy and liquidity requirements and is assessed using PCA. According to the World Bank (2025), the capital adequacy ratio (CAR) is defined as the proportion of total regulatory capital compared to assets held over its weighted risk assets. In simple terms, it measures the level of available capital against risk-weighted assets to ensure financial institutions meet their obligations (Anarfo et al., 2020). To be precise, the CAR is the aggregated regulatory capital from all financial institutions operating in a country compared to the aggregated risk-weighted assets from all financial institutions (Bank for International Settlements, 2010). It is the central bank of each country with the mandate to decide which level of capital adequacy ratio is maintained as the regulator of the financial system. As established by the Bank for International Settlements (2010), Basel III set the mandatory CAR level at 8%, which needs to be maintained by financial institutions to absorb any shocks. The higher

the CAR, the more financial institutions have sufficient capital to protect the finances of depositors against unforeseen losses (Duho, 2023). Siddika and Haron (2021) argued that the capital adequacy ratio is maintained to operate even during economic downturns, take profitability chances for growth, handle losses, and ensure consumer confidence. Therefore, the CAR is represented by the formula below.

$$\text{CAR} = \frac{(\text{Tier 1 capital} + \text{Tier 2 capital})}{\text{Risk weighted assets}} \quad (3)$$

The bank liquidity requirement was introduced under BASEL III, where banks or financial institutions are required by regulation to hold enough high-quality assets to safeguard short-term obligations like withdrawals within 30 days (Bank for International Settlements, 2013). The liquidity coverage ratio (LCR) is used as a tool to represent the liquidity requirement, and it consists of banks' liquid asset stocks, which can be easily converted into cash over a period of 30 days during periods of liquidity stress (Bank for International Settlements, 2013). Chipeta and Mapela (2024) raised concerns that when banks are mandated to strengthen liquidity requirements to safeguard against liquidity shortages, this hinders lending capacity and drives borrowers to informal financial services and fintech institutions for lending activities. This would undermine efforts aimed at promoting financial inclusion. However, based on previous studies, financial regulation is expected to be positively correlated with financial inclusion, as stated by Nambie and Obobi (2022) and Nutassey et al. (2023).

Domestic credit given to the private sector by banks (% of GDP), according to the World Bank (2025), is defined as a source of financial support in the form of loans, purchases of non-equity securities, and trade credits, as well as other receivable accounts that establish obligations for repayment (World Bank, 2025). Begum and Aziz (2019) noted that domestic credit to the private sector is essential for the economic development of any nation and necessary to foster investments, create employment, and improve productivity. In the long run, this reduces unemployment and poverty. Gizaw et al. (2024) argued that domestic credit plays a crucial role in both economic development and the enhancement of individual standards of living. As such, this study hypothesised that domestic credit would have a significant positive relationship with financial inclusion. These a priori expectations are based on the findings of Zeqiraj et al. (2022) and Nsiah and Tweneboah (2023), who argued that domestic credit significantly contributes to an enhancement of both access and usage of financial services.

The bank z-score was used in this study to measure financial stability and the probability of bank failure (Lelissa & Fava, 2024). The bank z-score is widely used to test a financial system's likelihood of insolvency (Mercadier & Strobel, 2024). The z-score measures solvency risk by linking buffers such as capital and returns with risk, which is the volatility of returns (Jungo et al., 2022; Sanderson et al., 2025). It is important to note that the z-score is calculated based on aggregated return on assets (ROAs) and the aggregated ratio of bank equity to total assets at the country-year level. Therefore, the z-score was calculated using the following formula:

$$\text{ZSCORE}_{it} = \frac{(\text{ROA}_{it} + \text{EQTA}_{it})}{\text{sd}(\text{ROA}_{it})} \quad (4)$$

where z-score is the bank's capability to absorb risk, ROA is the return on assets, EQTA represents the ratio of bank equity to total assets, and sd(ROA) is the standard deviation of ROA. Therefore, the higher z-score implies fewer chances of insolvency.

For the bank z-score, the study hypothesised that its relationship with financial inclusion would be negative. This is also supported by the findings of Oanh et al. (2023);

Sebai et al. (2025); and Joudar and El Ghmari (2025), who argued that financial inclusion negatively correlates with financial stability.

Broad money (% of GDP), according to the World Bank (2025), as a percent of GDP, is the measure of total liquid financial instruments controlled by the financial sector, which could be used as an acceptable medium of exchange. These instruments should be easily convertible in a short time to the medium needed for exchange. Mashoene et al. (2025) argued that an increase in broad money to GDP enables financial institutions to provide more loans. Thus, the expansion of money supply translates to a decline in interest rates, which makes access and usage of financial services and products more affordable to many people. Based on the above, this study hypothesised that broad money as a percentage of GDP would have a positive relationship with financial inclusion in the SADC region. This was also confirmed by Evans and Adeoye (2016), who argued that broad money (% of GDP) significantly determines financial inclusion.

4. Empirical Results

This section presents the empirical results based on objective two, which sought to investigate the relationship between financial regulation and financial inclusion in the SAC region.

4.1. Descriptive Statistics Analysis

Table 1 below presents a summary of the statistics for the main variables of this study. They illustrate the relationship between financial inclusion and financial regulation, and the impact of other explanatory variables.

Table 1. Descriptive statistics.

Variable	Obs	Mean	Std.dev	Min	Max
Fin	182	5.501	1.000	−1.096	4.053
Fir	182	1.290	1.000	−1.244	3.500
Dcredit	182	28.801	23.138	5.951	104.849
z-score	182	14.790	5.821	4.268	27.017
M3	182	43.995	27.160	15.202	159.949

Source: Author's own computation.

The mean of financial inclusion is 5.501 with a minimum of −1.096 and a maximum of 4.053; this means that access to financial products and services is still a significant problem for the SADC region. These results are supported by Nutassey et al. (2023) and Jeke (2025). Financial regulation, which is measured by the capital adequacy ratio and bank liquidity requirement, has an average value of 1.290 with a minimum of −1.244 and a maximum of 3.500. The transfer of domestic credits to the private sector by banks has an average of 28.801 with a standard deviation of 23.138. The minimum and maximum values for this variable were 5.951 and 104.849, respectively. Bank z-score, which measures financial stability in the SADC region, had an average of 14.790, a standard deviation of 5.821, and minimum and maximum values of 4.268 and 27.017, respectively. The average z-score for Africa was 17.81 for 2021, which means that the z-score for the SADC region is low. The z-score measures the likelihood of a country's banking system becoming insolvent. This means the probability of bank insolvency is high in the SADC region relative to Africa. These results align with the findings of Anarfo et al. (2020). Broad money as a percentage of GDP averaged at 43.995 with a standard deviation of 27.160, while the minimum and maximum were 15.202 and 159.949, respectively.

4.2. Preliminary Statistics: Pairwise Correlation

The pairwise correlation matrix in Table 2 below indicates the coefficients of the main variables and explanatory variables of the study. The variables include financial inclusion (FIN), financial regulation (FIR), domestic credit given to private sectors by banks (DCREDIT), bank z-score, which measures financial stability (z-score), and broad money as a percentage of GDP (M3).

Table 2. Correlation matrix.

	Fin	Fir	Dcredit	z-Score	M3
Fin	1.000				
Fir	−0.291 *** 0.000	1.000			
Dcredit	0.786 *** 0.000	−0.500 *** 0.000	1.000		
z-score	0.061 0.416	−0.447 *** 0.000	0.180 ** 0.015	1.000	
M3	0.755 *** 0.000	−0.370 *** 0.000	0.885 *** 0.000	0.017 0.819	1.000

Source: Author's own computation; Note: ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

As the study investigates the relationship between financial inclusion and financial regulation in the SADC region, Table 2 above includes some of the coefficients that agree with the literature. As demonstrated in column one of Table 2, financial inclusion is positively correlated with financial regulation, domestic credit given to the private sector by banks, financial stability, and broad money. The correlation of financial stability with financial inclusion was insignificant. Based on the correlation results displayed in Table 2, no multicollinearity was observed among the variables. It can be concluded that absolute values lie between −0.291 and 0.786. This conclusion is reached because the values are lower than the benchmark value of 0.80, which signifies the existence of multicollinearity. However, the variables of broad money and domestic credit given to the private sector by banks had a high correlation of 0.885, which is above the benchmark of 0.80. The strong correlation was expected since both variables are often used in the literature to measure financial development.

4.3. Panel Unit Root Test

Table 3 below displays the panel unit root test for the variables in objective two. Based on the display, it is evident that variables have different integrations.

Table 3. Panel unit root test.

Variables	Levin Lin Chu (LLC)		Order	Im-Pesaran-Shin		Order	ADF-Fisher Chi-s		Order
	Test Sta.	p-Value		Test Sta.	p-Value		Test Sta.	p-Value	
Fin	−3.493	0.000 ***	I(0)	−2.666	0.004 ***	I(1)	1.407	0.080 *	I(0)
Fir	−2.944	0.002 ***	I(0)	−2.626	0.004 ***	I(1)	4.170	0.000 ***	I(0)
Dcredit	−2.434	0.008 ***	I(0)	−1.808	0.035 **	I(1)	5.030	0.000 ***	I(0)
z-score	−4.574	0.000 **	I(0)	−1.342	0.090 *	I(0)	1.532	0.063 *	I(0)
M3	−2.075	0.019 **	I(0)	2.641	0.004 ***	I(1)	1.846	0.032 **	I(1)

Source: Author's own computation; Note: ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

As demonstrated above, when Levin Lin Chu (LLC) tests are used, all variables are integrated in order zero $I(0)$. While under Im Pesaran Shin (IPS), most variables are integrated in order one $I(1)$ except for financial stability, as measured by the z-score, which is integrated in order zero $I(0)$. Moreover, under ADF-Fisher Chi-s, all variables are integrated in order zero $I(0)$ except for broad money, which is integrated in order one $I(1)$. Thus, the study is warranted to identify long-term cointegration between variables since mixed cointegration is evident.

4.4. Panel Cointegration Tests

Table 4 below presents the results for the Kao, Pedroni, and Westerlund panel cointegration tests.

Table 4. Panel cointegration results.

Kao Cointegration Test			Pedroni Cointegration Test			Westerlund Cointegration Test		
	Statistic	p-Value		Statistic	p-Value		Statistic	p-Value
Modified DF	−0.954	0.170	Modified PP	3.973	0.000 ***	Variance ratio	2.092	0.02 **
DF	−2.5260	0.006 ***	PP	−1.588	0.056 *			
ADF	−1.226	0.110	ADF	−2.808	0.003 ***			
Unadjusted								
Modified DF	−4.964	0.000 ***						
Unadjusted DF	−4.612	0.000 ***						

Source: Author's own computation; Note: ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Table 4 displays the results of the panel cointegration test. As suggested by the cointegration tests of Kao, Pedroni, and Westerlund, it can be concluded that all tests strongly fail to accept the null hypothesis of no cointegration. It was concluded that long-term cointegration exists among the variables. Therefore, the cointegration test under this stage grants permission to conduct the system-GMM to find the association between financial inclusion and financial regulation in the SADC region.

4.5. Empirical Results Using System-GMM

Table 5 displays the empirical results of the relationship between financial regulation and financial inclusion using the system-GMM estimator.

Table 5. System-GMM for financial regulation and financial inclusion.

Dependent Variable-Fin		Sys-GMM	Difference-GMM
Lagged-fin		0.505 *** (0.000)	0.453 *** (0.000)
Fir		0.061 *** (0.000)	0.007 (0.673)
Dcredit		0.026 *** (0.000)	0.025 *** (0.000)
z-score		−0.034 *** (0.000)	−0.021 *** (0.000)
M3		−0.002 ** (0.046)	−0.004 ** (0.037)
_cons		−0.264 ** (0.047)	−0.273 ** (0.011)
Arellano–Bond test	AR(1)	−1.066 (0.287)	−1.076 (0.282)
	AR(2)	0.555 (0.579)	0.422 (0.673)
Sargan test		9.534 (1.000)	9.451 (1.000)
No. of observation		182	182
No. of groups		14	14

Source: Author's own computation; Note: ***, **, and * represent 1%, 5%, and 10% significance levels, respectively. Note: Each variable is presented with its coefficient and p-value in brackets.

The results indicate that lagged financial inclusion has a positive and significant coefficient of 0.539 at the level of one percent. These results suggest that the current performance of financial inclusion is influenced positively by previous performance. For

instance, if lagged financial inclusion increases by one percent, holding all other variables constant, current financial inclusion is expected to increase by 0.539 percent.

Based on the empirical results displayed in Table 5, the results revealed a positive and significant coefficient of 0.022 at the one percent level. These results suggested a significant positive relationship between financial regulation and financial inclusion. The results demonstrate that financial regulation positively influences the performance of financial inclusion. Hence, when financial regulation increases by one percent, financial inclusion is expected to increase by about 0.022 percent when all other variables are unchanged. These results are supported by the literature, as they align with empirical results by Besong et al. (2022) and Nutassey et al. (2023), who argued that regulation enables people to access the financial system. The results are in line with Nambie and Obobi (2022), who argued that without quality regulations, financial institutions do not offer efficient access and usage to financial services.

The results are in line with financial intermediation theory, as it states that an increase in financial regulation increases financial intermediation by reducing asymmetric information problems and transaction costs and ensuring that contracts run smoothly. The positive effect of financial regulation on financial inclusion also strongly aligns with the capital buffer theory. As this theory advocates for the idea that financial institutions hold a high capital buffer with strong regulatory supervision, and can maintain stable credit extension even during economic downturns, it thus promotes financial inclusion. Hence, financial regulation instils confidence in financial institutions, which are reluctant to provide access to and use of financial services and products to citizens.

The economic intuition of these results is that stringent financial regulation may boost the lending appetite of a financial institution. This is because it guarantees soundness, safety, and enhanced financial stability with a strong risk management framework and financial system (Anarfo et al., 2020). Although strengthening financial regulation has the potential to reduce profitability of financial institutions, tightened processes and information access help financial institutions to screen and exclude risky borrowers with a high probability of defaults. This means that since financial regulation eliminates market failures, it promotes greater operational efficiency by financial institutions (Nutassey et al., 2023). Hence, efficient and effective financial regulation promotes easy access to credit and financial services. However, when financial institutions feel safe or protected by regulations to offer financial services, this might lead to a reduction in lending rates, increase deposits rates, and further lower their transaction costs. This will enhance access to and use of financial services and credit, especially by low-income earners, as targeted by the SADC's financial inclusion goals.

As portrayed in Table 5, domestic credit given to the private sector by banks indicates a positive and significant coefficient of 0.027 at a one percent level of significance. However, the results revealed that there is a significant positive correlation between domestic credit given to the private sector by banks and financial inclusion. Hence, when the amount of domestic credit given to the private sector is extended by banks up to one percent, financial inclusion increases by 0.027 when all other variables are held constant. These empirical findings conform with Nsiah and Tweneboah (2023), who argued that domestic credit to the private sector is a significant driver of financial inclusion.

For financial stability, as measured by the bank z-score, in Table 5 above, a significant negative coefficient of -0.038 at one percent significance is presented. The results suggest that there is a negative correlation between financial stability and financial inclusion. The results imply that when the financial sector fosters financial stability, it ignores efforts to encourage financial inclusion. For instance, an increase in the bank z-score by one percent led to a decrease in financial inclusion by about 0.038, *ceteris paribus*. These results align

with the empirical findings of [Cihak et al. \(2021\)](#), who argued that financial inclusion correlates negatively with financial stability. Also, [Oanh et al. \(2023\)](#) asserted that financial inclusion negatively correlates with financial stability in a country with high financial development. This implies that improvements in financial inclusion could significantly lead to financial instability. In addition, [Sebai et al. \(2025\)](#) argue that the relationship between financial inclusion and financial stability is an inverted U-shaped. This means that at early stages, financial inclusion increases financial stability, and once it reaches a peak, financial inclusion starts contributing to financial instability.

In Table 5, broad money as a percentage of GDP was found to be negative and insignificant for financial inclusion in the SADC region at a coefficient of -0.003 . However, these results do not align with the findings of [Mashoene et al. \(2025\)](#), who argued that broad money as a percentage of GDP has a positive impact on financial inclusion since it influences the cost of financial services and products.

To ensure validation of the results, post-diagnosis tests were conducted, as presented in Table 5. Therefore, the null hypothesis of over-identifying restrictions is not rejected since the Sargan test p -value is 1.000. The Sargan test of over-identification has a p -value of 1.000, which indicates that the null hypothesis of over-identifying restrictions is not rejected. The results support the validity of the dynamic panel model specification. Lastly, the test for second-order serial correlation was conducted, and no evidence was found since the p -value was 0.539 above the level of significance, defined as 0.01, 0.05, and 0.10 percent.

5. Conclusions

In summary, the empirical findings indicate that financial regulation has a significant and positive effect on financial regulation in the SADC region, meaning that. Financial regulation affected financial inclusion in the SADC region significantly between 2010 and 2022. The results imply that strengthened financial regulation contributes significantly to enhanced financial inclusion. Domestic credit to the private sector by banks is indicated to have a significant effect on financial inclusion. The bank z -score, which measures financial stability, was shown to have a significantly negative effect on financial inclusion in the SADC region. However, since the SADC region is still struggling with access to and use of financial services, it is recommended that the government and financial sector form a strong partnership to drive financial regulatory compliance while placing financial inclusion goals at the centre. In support of the latter, [Meniago \(2025\)](#) argued that efforts to expand digital financial inclusion must be complemented by improvements in governance, regulatory frameworks, rules of law, and legal protections.

The SADC region has reported that only about 45% of the population have access to financial products and services in the formal financial institutions, 22% gain access from non-bank institutions, 7% gain access from informal institutions, and still about 25% are completely excluded ([Mwansa, 2024](#)). [Kampaundi and Budhedeo \(2025\)](#) stressed that financial inclusion remains a challenge for the SADC region, which is worsened by limited financial literacy, the high cost of financial services, and constrained access to credit and other financial services. [Mwansa \(2024\)](#) further noted that low financial inclusion may be due to poor infrastructure, regulatory conditions, low levels of economic development, limited financial literacy, and many other social factors. [Meniago \(2025\)](#) further noted that SADC countries are regarded as having weak institutions, with corruption, political instability, and insufficient regulatory environments. Therefore, this study adds to the current literature on the financial inclusion–financial regulation nexus by employing system-GMM to establish a link for the SADC region. Due to limited studies focusing on this subject in the region, future studies should expand this research. Such studies should look at a broad definition of financial inclusion that includes digital financial inclusion.

Author Contributions: Conceptualization, L.G.; methodology, L.G.; software, L.G.; validation, L.G. and L.J.; formal analysis, L.G.; investigation, L.G.; resources, L.G.; data curation, L.G.; writing—original draft preparation, L.G.; writing—review and editing, L.G. and L.J.; visualization, L.G.; supervision, L.J.; project administration, L.G.; funding acquisition, L.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data is publicly available on the following websites: World Development Indicators (WDIs) <https://databank.worldbank.org/source/world-development-indicators> (accessed on 30 January 2026) and the International Monetary Fund (IMF) website https://data.imf.org/datasets/t=coveo117bcfc4&sort=@idata_publication_date%20descending (accessed on 30 January 2026).

Conflicts of Interest: The authors declare no conflicts of interest.

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