Global Journal of Economics and Business (GJEB)

Volume.12, Issue.5, pp: 637-648 Article 8
Oct (2022)

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Velenkosini Matsebula [1], Johannes P S Sheefeni [2]

[1,2] Department of Economics, University of the Western Cape, Private Bag X17, Bellville, 7535, South Africa

[1] vmatsebula@uwc.ac.za, [2] jsheefeni@uwc.ac.za

Received: 4/6/2022 Revised: 3/7/2022 Accepted: 27/7/2022

DOI: https://doi.org/10.31559/GJEB2022.12.5.8

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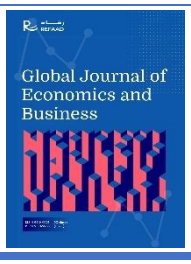
Global Journal of Economics and Business (GJEB)

Journal Homepage: https://www.refaad.com/Journal/Index/2

E-ISSN 2519-9293 | P-ISSN 2519-9285



An Analysis of the Relationship Between Financial Inclusion and Financial Stability in South Africa

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[1,2] Department of Economics, University of the Western Cape, Private Bag X17, Bellville, 7535, South Africa
[1] vmatsebula@uwc.ac.za, [2] jsheefeni@uwc.ac.za

Received: 4/6/2022 **Revised:** 3/7/2022 **Accepted:** 27/7/2022 **DOI:** https://doi.org/10.31559/GJEB2022.12.5.8

Abstract: This paper examined the relationship between financial inclusion and financial stability in South Africa. In so doing, the Engle-Granger approach to Error Correction Model (ECM) was used on quarterly time-series data for the period 2004 to 2020. Two different variables were used to measure financial inclusion, namely commercial bank branches per 100,000 adults (CBB) and number of ATMs per 100 000 adults (ATMs), which was regressed separately against Bank Z-Score (BZS) which was used as a measure of financial stability. The results revealed that higher levels of financial inclusion either, positively or negatively impact financial stability, depending on the type of financial inclusion initiative.

Keywords: *Financial inclusion; Financial Stability; South Africa.*

1. Introduction

The financial inclusion agenda has become an issue of global concern in the recent years. Particularly, because growing empirical evidence indicates that lack of financial inclusion results to negative consequences for a country's economic growth harms the development of SMEs, slows transformation and affects the ability of the poor to take part in the formal financial sector (Demirguc-Kunt & Klapper, 2012). Recently, however, there has also been a growing concern from organisations responsible for financial stability, suggesting that, the growing promotion of financial inclusion interventions could pose a threat to the financial stability of developing economies (FSB, IMF and WB 2011).

The efficient functioning of any market economy is determined by the stability of key economic sectors and systems. Monetary and financial stability are of central importance to this phenomenon. Financial stability is not an end to itself but, as the case with concepts such as price stability, it is widely regarded as an essential precondition for sustainable economic growth, development and the creation of employment opportunities. A stable financial system also provides certainties to economic participants that aids efficient allocation of resources and increase the confidence and willingness to enter into intertemporal contracts. It also provides a conducive environment for individuals, firms and governments to make rational decisions about the allocation of real resources and subsequently improve the bases for savings, investment and making use of other key financial inclusion services (World Bank, 2018).

South Africa's financial system is known to be amongst the most developed financial systems in the world. The system boasts with a highly sophisticated financial sector, which is backed by a sound regulatory and legal framework, and comprising of both domestic and global institutions that caters the public with dozens of advanced series of services. These range from insurance and investment, to lending, mortgages, merchant banking, commercial, borrowing and retail, among other financial products. This range of financial services options can be used by customers to enhance their daily consumption activities and also manage their risk (International Monetary Fund, 2022).

However, just like many other developed financial sectors, the South African financial sector is widely criticised for being mostly tailored for the advanced segment of the economy (Schoombee, 2004). This criticism raises from the reality that, all members of the society must benefit from the financial sector. The financial system should expand products to meet the needs of the whole population particularly individuals and small and medium sized enterprises (SMEs) that make little use of it, in order to achieve the global concern of financial inclusiveness (World Bank, 2018).

The significance of these two economic factors and the complexity of the relationship between financial inclusion and financial stability, create a scholarly vacuum and a need to investigate this relation. Moreover, due to scarcity and relative newness of macroeconomic data on financial inclusion, there is very few studies conducted on its macroeconomic impact, including the relationship between financial stability and financial inclusion. This lack of literature is even worse from a South African point of view. Existing empirical literature suggests contradicting results on how financial inclusion could affect financial stability. For instance, García (2006) indicates that new financial inclusion institutions and instruments, as well as poorly regulated players of the financial system, that causes rapid credit growth could cause risk of financial stability. However, broader access to financial inclusion services that diversifies the base of deposits could significantly improve the strength of the overall financial system and subsequently financial stability. While Morgan and Pontines (2014) also advocates for a positive relationship between financial inclusion and financial stability. They indicate that, increasing lending to SMEs improves stability, particularly through the reducing of non-performing loans (NPLs) and the probability of default by financial institutions.

This study examines this relationship between financial inclusion and financial stability in the South African economy. According to our knowledge, there has not yet been a South Africa study that examine relationship. Findings from the study will contribute to the wanting of local literature on this subject.

The rest of the paper is organised as follows: section 2 presents analytical literature review pertaining the relevant theories between financial inclusion and financial stability and covers evidence from existing empirical literature. Section 3 describes the available data on financial stability and financial inclusion, and outlines the research methodology to be employed in the study. Section 4 presents the empirical results and write-up. Finally, the study concludes in section 5.

2. Literature Review and Development of Hypothesis

2.1. Research Question and Hypothesis

This chapter intends to examine two key questions on the relationship between financial inclusion and financial stability in South Africa, mainly:

- How does financial inclusion impact financial stability in South Africa?
- How does financial inclusion relate to financial stability in South Africa?

The corresponding hypotheses are as follows:

- $H0$: Financial inclusion impacts financial Stability in South Africa.
- $H1$: Financial inclusion does not impact financial Stability in South Africa.

2.2. Theoretical Literature

Keynes (1930), while taking up the ideas of Wicksell in his treatise on money, advocates for the important role played by the banking sector in economic growth. He argues that the bank credit provides conducive grounds for production and bankers have a duty to insure such a relation takes its full impact on the economy. The Keynesian theory is also famous for emphasizing the role of government spending on the nation's economic growth during slow economic productivity. According to this theory, expansion of government spending leads to financial inclusion and deepening. By increasing government spending, money is injected into the economy, thereby increasing productivity, income and demand for money.

Economic theories that are influenced by the Keynesian narrative are often immediate-result oriented, as such, policies that stem from this discipline usually focus on the short-term needs and how they can provide instant solutions to the economy. In times of economic meltdowns, recessions or depressions, people and firms often do not have the sufficient resources for consumption and investment, and the government, through the fiscal and monetary policies, is regarded as the main participant to increase demand and restore stability to the economy.

The Keynesian theory achieves financial deepening or inclusion through government spending expansion. Government intervention, through regulations, is also crucial in the efficient and equitable allocation of credit, particularly in developing economies. Financial institutions and markets that function properly and are well regulated, provide all economic participants with investment opportunities by channelling funds to their best use, and thereby boosting the economy, stabilizing the financial system, and improve the efficient distribution of income. Stabilizing the financial system and improving financial accessibility speed up economic growth and alleviate poverty and income inequality.

Ozili (2020) outlines the Systems theory of financial inclusion. This theory essentially proposes that financial inclusion relies on existing sub-systems, such as economic, social and financial systems, and these systems can be used to achieve financial inclusion. Subsequently, greater financial inclusivity will also passively impact the sub-systems it relies on. A significant change in a sub-system can have significant impact on the financial inclusion outcome expectation. For example, imposing regulation on financial sector agents can align their interests with those of the consumers of basic financial services, and further force financial services providers to offer formal financial services that are affordable and equitable to the consumers, and provide rules to project those users from price discrimination and exploitation.

The theory further indicates a substantial change at the level of a full system, such as the replacement of the prevailing national financial inclusion plan with a new one, does not necessarily result in a change in the existing sub-system. This is because changes in a sub-system have to be done at sub-system level Ozili (2020). Some key factors emphasised by the theory are that:

- The success of national financial inclusion agenda depends on the effectiveness and efficiency of the sub-systems.
- Under the systems theory, sub-systems that exist within a country are the ultimate beneficiaries of financial inclusion.

Key merits to draw from the systems theory of financial inclusion are: firstly, it is clear recognition that economic, financial and social systems or structures that exist within a country play an important role in promoting financial inclusion. Secondly, unlike most theories of financial inclusion theories, this theory provides a macro perspective on the subject. Lastly, the systems theory of financial inclusion is considerate of how interrelationship among the sub-systems that financial inclusion relies on affects the outcomes of financial inclusion.

2.3. Review of Past Empirical Studies

While there has been a growth in empirical work done on the relationship between financial stability and financial inclusion from a global perspective in the past few years, it is still quite limited. In South Africa, there is no existing research conducted to examine this relationship specifically. There is, however, some evidence of work done for the BRICS countries and The Southern African Development Community (SADC) region. For instance, Arora (2018) examines the links between financial inclusion and financial stability in the BRICS countries. The study showed that there is considerable emphasis on the increasing financial inclusion in this group of countries, yet there is evidence that financial sector reforms together with regulatory reforms have also taken place. The study also finds that the BRICS countries were resilient and did not experience any direct losses during the recent global financial system. The study further observed that shadow banking has significantly grown within the BRICS group over the recent years, which has been found to have a positive impact on financial inclusion and growth, it has however remained much lower compared to the global average especially the US, UK and Europe. The final emphasis made by the study is that, there should not be any complacency in this region, there is a need to keep a vigilant eye for the potential risks likely to surface in case of macroeconomic vulnerabilities.

Hlophe (2018) examined whether financial development causes an increase in financial inclusion in the small country of Eswatini right next to South Africa. The study reveals that, there is a long run relationship between financial inclusion and financial development. The causal direction discovered by that study is that of financial development towards financial inclusion, indicating that financial development causes financial inclusion in Eswatini. Another African study is conducted by Aduda and Kalundam (2012) examines the relationship between financial inclusion and financial stability in Kenya. The study essentially explores existing literature on financial inclusion both in Kenya and Globally, without conducting any empirical analyses. According to the authors, the theoretical and empirical literature indicates that majority of world's population is financially excluded, and that, while there is a need for interventions to increase financial inclusion in Kenya, there is even a greater need for care to be taken when doing so, so as to avoid creating financial instability.

In Nigeria, Mbutor and Uba (2013) investigated the impact of financial inclusion on monetary policy in the country, between 1980 and 2012. The study found that financial inclusion is an impactful strategy for improving the effectiveness of the monetary policy in Nigeria. Particularly, the study indicates that the increase in credit accessibility in the system would boost investment and dampen inflation. Increasing rural customers' overall exposure to bank branches is also found to have a positive influence on monetary policy. The positive impact of financial inclusion on monetary policy is also realised by Khan (2011) who investigates whether financial inclusion and financial stability are two sides of the same coin. He indicates that financial inclusion has the ability to improve financial status and living standards of the poor segment of the society, especially when being viewed from the overall economic inclusion context. He adds that there is a greater need for financial inclusion and financial stability to co-exist. This is because it may be difficult to achieve financial inclusion without a stable financial system, and also it is difficult to achieve and maintain a financial stability when an increasing portion of the socio-economic systems is kept financially excluded.

Khan (2011) findings further emphasized the impact of financial inclusion on financial stability, indicating that financial inclusion can make the intermediation process between savings and investment even more efficient while also facilitating change in the composition of the financial system with regards to transaction process, service users/ clients, the new risk created, and in some cases the institutions that partake in the new or expanded financial markets. He adds that financial inclusion brings about a more stable retail base of deposits for financial institutions, particularly banks. While the author shows sufficient evidence of how financial inclusion improves financial stability, he also indicated that, there are potential risks to financial stability emanating from greater financial inclusion. He indicates that there is a need to understand the risks for financial institutions rendering service to less developed and low-income markets well.

Neaime and Gaysset (2018) also found financial inclusion to contribute positively to financial stability. The authors use Generalized Methods of Moments and Generalized Least Squared models to empirically investigate the

impact of financial inclusion on financial stability, as well as on other macroeconomics factors, particularly income inequality and poverty, in eight countries in the Middle East and North Africa (MENA) region, from 2002 to 2015. On financial stability, the study indicated that while financial integration is found to contribute to financial instability in MENA, financial inclusion has a positive impact on financial stability. Just as indicated by Khan (2011), this study also shows that, greater access to financial services positively contributes to the resilience of the banks depositing funding base.

While most of the existing literature indicates a positive link between financial stability and financial inclusion, mixed results are also observed. For instance, Morgan and Pontines (2018) estimated a dynamic-panel equation and investigated the effects of various financial inclusion measures on measures of financial stability, such as bank Z-scores and bank non-performing loans, in Asia from 2005 to 2011. The study shows a twofold result. On one hand, financial inclusion measures, such as increased share of lending to small and medium-sized enterprises, were found to improve financial stability, while on the other, the study indicates that financial inclusion expands the range for borrowers, lowers lending standards and thereby raising financial and economic risk. The study also found higher per capita GDP to enhance financial stability while on the other hand financial stability is found to be decreased by a higher ratio of private bank credit to GDP.

Garcia (2016) conducted a review of studies that investigate the relationship between financial inclusion and stability. The study found that mixed conclusions can be drawn from the existing empirical literature on the subject. Firstly, it is shown that rapid credit growth that comes as a result of new financial inclusion initiatives and unregulated financial channels may result to the rise in risk. However, access to deposits at a broader scale, that lead to a diversified base of deposits may result in a significantly improved resilience of the overall financial system and subsequently financial stability.

Hannig and Jansen (2010) took a rather direct link to this relationship, and examined the policy issues of the relationship between financial inclusion and financial stability. The authors argue that increased financial inclusion presents opportunities for financial stability to be enhanced. They express that while some risks may be posed by financial inclusion, there are only at institutional level and hardly systematic in nature. They discovered that during the financial crisis savers and borrowers from the lower end of the income bracket kept a consistent solid financial behaviour throughout the crises period, ensuring that their deposits are kept in a safe place and their loans are paid back. They add that, although profiling clients at the lower end of the financial market may raise some concerns about the reputation risks for the central bank and consumer protection, such institutional risk profiles are characterized by a large group of vulnerable clients whose balances are limited and only transact small volumes, but as far as financial instability is concerned, the potential risk brought by inclusive policies is negligible. Furthermore, with known prudential instruments and better effective client protection, the risks prevalent at the institutional level are largely manageable. They also emphasize that, the financial inclusion potential risks are compensated for curial dynamic advantage that boosts financial stability over time through a more diversified and deeper financial system.

From a general point of view, there is fairly an increase in the empirical work done on financial inclusion, however, there is too little done on its relationship with financial stability, on a global perspective. Moreover, most of the existing results are somewhat outdated, especially when one considers the reality that macroeconomic financial inclusion data has only recently became available. While from a local perspective, there is no evidence of research done to investigate such a direct link, with South Africa as a case study. This study fills up the gap and contribute to addressing the shortage of empirical literature on the relationship between financial inclusion and financial stability while also providing evidence with up-to date data.

3. Methodology and Data

3.1. Model Specification and Analytical Framework

The study makes use of the Engle-Granger (Residual Based) Error Correction (1987) modelling approach to explore the link between financial inclusion and financial stability in South Africa. The model is specified as follows:

$$\boldsymbol{Z_t = \alpha + \beta_1 FI_t + \beta_2 X_t + \varepsilon_t} \quad \textbf{(1)}$$

Where Z_t represent Bank Z-score which is used as a measure of financial stability. In a simple term, the Z-score measures the standardized return of a country's banking system. FI_t represents financial inclusion. While X_t stands for the control variables, which comprises of Gross Domestic Production (GDP), Private credit by deposit money banks and other financial institutions to GDP (%) (PCGDP), and Liquid assets to deposits and short-term funding (%) (LIQ). The coefficient α captures the impact of financial inclusion on financial stability. ε_t refers to the random error term while $t =$ Time period. β means the set of nuisance parameters.

To examine how financial stability is affected by the financial inclusion in both long run and short run, a regression analysis based on the co-integration and Error Correction Model (ECM) of Engle and Granger was utilised. The EC model is unique in the sense that it is an ordinary least square based approach that can be used in cases where the time series data is integration order. That is, it does not necessarily require the variables to be integrated of specific order, but the order would suffice as long as all the variables are integrated of that order.

3.2. Estimation Techniques

Prior to estimating the EC model, it is important to first test for stationarity. In fact, this test is crucial when studying any different time series data. Ensuring that the variables are stationery, eliminating the possibility of the estimated equation is being spurious. A stationery series is one with a mean and variance that does not change over time. This study makes use of the Augmented Dickey-Fuller (ADF) unit root tests to test for stationarity. The ADF tests for a null hypothesis of the presence of a unit root while the alternative hypothesis is that there is no unit root. Should the value of the calculated statistics be greater than the value of the critical statistic at a certain significance level, between the standard significance levels 1%, 5% or 10%, then the null hypothesis is rejected (Enders, 2004).

Secondly, the cointegration analysis is required to determine whether or not there exists a long run relationship amongst the variables. Therefore, cointegration analytic technique is used to test for common trends time series and to model short-run and long-run dynamics. In this study, a residual based cointegration test is better known as the Engle-Granger approach to cointegration that is applied for that purpose.

Thirdly, Engle et al. (1987) developed a means of combining the long run information with a short run adjustment mechanism (correcting for disequilibrium). That is exactly the purpose of estimating an error correction model in order to overcome the problems of spurious regression through the use of appropriate differenced variables in order to determine the short-term adjustment in the model. The model consists of following equations;

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\alpha_0 \Delta X_t} + \boldsymbol{\Phi ecm_{t-1}} + \boldsymbol{\mu_t} \quad (2)$$

$$\mathbf{ecm_{t-1}} = \boldsymbol{Y_{t-1}} - \boldsymbol{\beta_t X_{t-1}} \quad (3)$$

Where ΔY_t represents the data-series derived from the first difference of the time series Y_t and ΔX_t denote the data series X_t at the first difference level, $t = 1,2.3,\ldots,n$ and n is dimension of the vector variable. The time series of Y_t and X_t are both integrated at the first difference level, I (1). α_0 represents the short-term elasticity and the symbol φ stands for the rapidity of adjustment back to equilibrium status and μ_t is the residual value of the ECM. ecm_{t-1} represents the error correction term, and in the expression of $\Phi\text{ecm}_{t-1}, \beta_0$ denotes the constant item and β_1 is the long-term elasticity. The calculation of ecm_{t-1} is derived as the residual value of the cointegration regression equation.

As already stated, the ECM is mainly utilised to correct the disequilibrium for testing the causality in the cointegrated variable for both the short-run and long-run which can be expressed as follows.

$$\Delta \boldsymbol{LZ} = \boldsymbol{\delta_0} + \sum_{i=1}^{p} \boldsymbol{\lambda_i \Delta LZ_{t-i}} + \sum_{i=1}^{p} \boldsymbol{\lambda_i \Delta LFI_{t-i}} + \boldsymbol{\varphi_1 ECT_{t-1}} + \boldsymbol{e_{1t}} \quad (4)$$

$$\Delta \boldsymbol{LFI} = \boldsymbol{\delta_0} + \sum_{i=1}^{p} \boldsymbol{\lambda_i \Delta LFI_{t-i}} + \sum_{i=1}^{p} \boldsymbol{\lambda_i \Delta LZ_{t-i}} + \boldsymbol{\varphi_1 ECT_{t-1}} + \boldsymbol{e_{2t}} \quad (5)$$

ECT_{t-1} in the equations above, represents the lagged error correction term, as well as the first difference to capture the disturbance in the short-run. The error term that should be the white noise and serially uncorrelated is represent by e_{1t} and e_{2t}. The ECM makes a difference between the short and long-run Granger causality. To test for statistical significance of the short run, the individual coefficients of the lagged terms are used while the long-run causality is indicated by coefficient of the ECT_{t-1} being statistically significant. The value of the ECT should lie between 0 and 1, and be negative to indicate the system convergence back to equilibrium. To check for joint significance, the joint causation of both long-run and short-run can be tested.

Other diagnostic and model stability tests are conducted to examine whether the estimation of the EC model is reliable and valid. The diagnostic test is performed to check for serial correlation and heteroscedasticity. The CUSUM test developed by Brown *et al.* (1975) is used to examine the structural stability of the model.

3.3. Data

The study makes use of secondary data to examine the relationship between financial inclusion and financial stability. The dependent variable is financial stability which is measured by the bank Z-score indicator. The Z-score measures the distance to distress for bank, explicitly comparing buffers with risk to measure solvency risks for banks. The Z-score essentially reflects the buffers against earnings shocks or rather a country's banking system probability of default, and is defined as:

$$\boldsymbol{Z} \equiv \frac{(\boldsymbol{k}+\boldsymbol{\mu})}{\boldsymbol{\sigma}} \quad (6)$$

Where k represents the equity capital as percent of assets, μ denotes returns as a percentage of assets, and lastly σ represents the return on assets' standard deviation as proxy return volatility. The bank Z-score data used in this study is secondary data harvested from the Global Financial Development database.

Financial inclusion is the explanatory variable and two financial inclusion indicators are used in the chapter, namely, number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults. This data is from Financial Access survey (FAS), a financial inclusion survey that has been conducted by the International Monetary Fund (IMF) since 2009. The survey compiles supply-side data with information about access to and usage of financial services. This dataset is aimed at giving policymakers support in measuring and analysing financial inclusion as well as to monitor progress across countries. Until recent, there has been a huge shortage of

macroeconomic data on financial, and due to this reason, the study makes use of quarterly time series data from 2010 to 2020.

Gross Domestic Production (GDP), Private credit by deposit money banks and other financial institutions to GDP (%) (PCGDP), and Liquid assets to deposits and short-term funding (%) (LIQ).

4. Empirical Findings

4.1. Stationarity (Unit Root Tests)

The ADF test in Table 1 shows results at trend and intercept. According to the results, the variables BZS, LGDP, CBB, ATMs, PcGDP and LIQ are all stationary in second difference. Therefore, the null hypothesis that there is a presence of unit root at second difference was rejected for all the variables. This implies that all the variables are integrated of the same order. This validates the use of the Engle-Granger (Residual Based) Error Correction Modelling technique to estimate the relationship between financial inclusion and financial stability in South Africa.

4.2. Cointegration Test

Now that the variables' order of integration has been established, the practice is that the test for cointegration among the variables should be conducted. To do this, the long-run model has to be estimated, from which the residual is derived, and that residual is then tested for unit root. For cointegration to exist, the residual derived must be stationery in levels. The results of the residual based test for cointegration, for both tests CBB and ATMs as a measure of financial inclusion, are respectively shown in table 2 below.

Table (1): Unit root tests: ADF in levels, first and second difference

Variable	Trend and intercept			
	Level	First Difference	Second Difference	Order of Integration
BZS	-2.95	-1.91	-7.82**	I (2)
LGDP	0.25	-1.79	-7.91**	I (2)
CBB	-1.13	-3.01	-8.27**	I (2)
ATMs	-0.99	-2.49	-8.04**	I (2)
PcGDP	-3.67	-4.04	-7.71**	I (2)
LIQ	-1.79	-2.34	-6.61**	I (2)

* Statistically significant at 5% level

Table (2): The Engle-Granger residual-based test for cointegration

BZS f (CBB, LGDP, LIQ, PcGDP)		**t-Statistic**	**Prob.***
Augmented Dickey-Fuller test statistic		-3.325803	**0.0178**
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	
BZS f (ATMs, LGDP, LIQ, PcGDP)		**t-Statistic**	**Prob.***
Augmented Dickey-Fuller test statistic		-3.290378	**0.0198**
Test critical values:	1% level	-3.546099	
	5% level	-2.911730	
	10% level	-2.593551	

According to the ADF test results shown in table 2, the calculated t-statistic is greater than the critical value at 5% and 10% level of significance, suggesting that the residual is stationary at least at 5% level of significance and a conclusion can be made that cointegration exists. The existence of cointegration is a prerequisite to then estimate an error correction model. This is also the case after estimating the ADF test with ATMs as a measure of financial inclusion, the t-statistic is also greater than the critical value at least 5% level of significance.

4.3. Error Correction Model

Now that the existence of cointegration is confirmed. The error correction model is estimated to understand the long run behaviour while taking into account the short run adjustments (dynamics) of the relationship between the financial inclusion and financial stability, as well as the other observed variables. The results of the error correction model are presented in table 3 below. For the error correction model to be valid, the error correction term (EC) must be negative and statistically significant, and according to the results in table 3 below, it is so. The EC (-1) is negative and statistically significant at 5% level of significance, confirming that the model is indeed valid.

Table (3): Error Correction Model Results [BZS f (CBB, LGDP, LIQ, PcGDP)]

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.007102	0.015738	-0.451242	0.6535
D(CBB,2)	0.023270	0.119779	0.194276	0.8467
D(LGDP,2)	5.743593	5.225346	1.099180	0.2763
D(LIQ,2)	-0.137213	0.041668	-3.293020	0.0017
D(PCGDP)	0.013677	0.008950	1.528159	0.1320
EC(-1)	-0.104376	0.024847	-4.200776	0.0001

R-squared	0.402658	Mean dependent var	-0.010791
Adjusted R-squared	0.350260	S.D. dependent var	0.151164
S.E. of regression	0.121848	Akaike info criterion	-1.281692
Sum squared resid	0.846275	Schwarz criterion	-1.077584
Log likelihood	46.37330	Hannan-Quinn criter.	-1.201415
F-statistic	7.684551	Durbin-Watson stat	2.263491
Prob(F-statistic)	0.000014		

The short-run error correction model results show that the coefficient of the commercial bank branches (CBB) is positive, suggesting that financial inclusion positively affects financial stability. These findings confirm those of Morgan and Pontines (2018), Neaime and Gaysset (2018), and Khan (2011), however, the results in this study shows that the coefficient is statistically insignificant. This indicates that while there is a positive relationship between financial inclusion and financial stability, the significance of the relationship depends on the variable used to measure financial inclusion. After estimating the regression with ATMs as a measure of financial inclusion, the results depict contradicting results. As shown in table 4 below, the ATMs coefficient is negative, but also insignificant. These findings are consistent with the discoveries by Rwechungura et al. (2020), who develops an index of financial inclusion with a few measures of financial inclusion, including number of ATMs per 100 000 people and regress it against bank score to assess the relationship between financial inclusion and financial stability. The study also finds financial inclusion to negatively impact financial stability.

However, these findings are not in line with the findings of other scholars. Pham and Doan (2020), for instance, discovered that ATMs have a positive and significant relationship with financial stability in Asia. The differing views, however, are not surprising, as they have been noted in empirical literature before, for instance, Ghosh (2008) expresses it clearly that depending on the services used by the individuals, an increase in demographic penetration of banking services is linked to either a decrease or an increase in financial stability. These findings open up the debate about the relationship between financial inclusion and financial stability even further. This is an indication that the type of financial inclusion instrument determines the impact it has on financial stability.

The log GDP coefficient is positive in both regression panels, but only statistically significant when financial inclusion is measured using the ATMs variable. This positive relationship indicates that a 1% increase in LGDP increases the probability of financial stability by 6% when financial stability is measured by CBB. While after replacing CBB with ATMs, the results show that a 1% increase in LGDP increases the probability of financial stability by over 9%. These findings are in line with existing empirical literature and theoretical framework that study this relationship in detail (Manu et al. 2011; Levine and Zervos, 1998; King and Levine, 1993; Morgan and Pontines, 2014). The theoretical framework that advocates for this relation indicate that a stable financial market can impact growth positively during the transition to an economy's steady-state growth path only, as suggested in the traditional growth theories. While the new theories of endogenous growth argues that a stable financial market permanently elevate the economy to a higher growth path (Deabes, 2004).

The results in both regressions also show that contrary to the findings by Han and Melecky (2013) and Morgan and Pontines (2014), higher liquidity by banks (LIQ) has a negative impact on financial stability. While greater private sector credit relative to GDP (PCGDP), on the other hand, is found to have a positive relationship with both CBB and ATMs, implying that, greater private sector credit relative to GDP leads to a higher likelihood of financial instability. These findings follow on from what is found by other empirical studies (Gourinchas and Obstfeld, 2012; Morgan and Pontines, 2014; Drehmann et al. 2011). The lagged error correction terms in the two regression outputs both have a coefficient of -0.10, which essentially implies that, on average, about 10% of the deviations from the EC models would adjust towards its long-run equilibrium. Showing a convergence or speed of adjustment to equilibrium rate that is rather moderate. The results further show that, in both regressions, the Durbin-Watson statistic values are just above 2, indicating that both models passed the test for autocorrelation. The adjusted R-squared from the two regression results are 0.35 and 0.37 respectively, which indicates that the models respectively explain 35% and 37% of the variation in the response variable around its means. Finally, the F-statistics from the two models are both around 8%, which is greater than the Prob(F-statistic). From this, it can be concluded that in both regressions there is a linear relationship between financial stability and the set of predictor variables fitted.

Table (4): Error Correction Model Results [BZS f (ATMs, LGDP, LIQ, PcGDP)]

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006414	0.015430	-0.415709	0.6792
D(ATMS,2)	-0.045553	0.030520	-1.492598	0.1411
D(LGDP,2)	8.913945	5.093156	1.750181	0.0855
D(LIQ,2)	-0.135686	0.040906	-3.317028	0.0016
D(PCGDP)	0.012107	0.008654	1.399085	0.1672
EC2(-1)	-0.100664	0.026591	-3.785598	0.0004
R-squared	0.420923	Mean dependent var		-0.010791
Adjusted R-squared	0.370127	S.D. dependent var		0.151164
S.E. of regression	0.119971	Akaike info criterion		-1.312746
Sum squared resid	0.820399	Schwarz criterion		-1.108638
Log likelihood	47.35149	Hannan-Quinn criter.		-1.232469
F-statistic	8.286500	Durbin-Watson stat		2.216961
Prob(F-statistic)	0.000006			

4.4 Diagnostic Tests

4.4.1. Serial Correlation

To test the Serial Correlation, the study makes use of the Breusch-Godfrey Serial Correlation LM Test. The test is essentially conducted so as to ascertain if whether the variables are serially correlated. The results for both models are presented in table 5 below.

Table (5): Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test: Null hypothesis: No serial correlation at up to 2 lags			
BZS f (CBB, LGDP, LIQ, PcGDP)			
F-statistic	0.621955	**Prob. F(2,56)**	0.5406
Obs*R-squared	1.393331	**Prob. Chi-Square(2)**	0.4982
BZS f (ATMs, LGDP, LIQ, PcGDP)			
F-statistic	0.396538	**Prob. F(2,56)**	0.6746
Obs*R-squared	0.895519	**Prob. Chi-Square(2)**	0.6391

Based on the results in table 5, the Breusch Godfrey serial correlation LM tests indicate no existence of serial correlation problems in both models. This conclusion is made because the models p-values are both greater than 5%.

4.4.2. Heteroskedasticity Test

The results from the heteroskedasticity test in table 6 below shows that the probability of the Chi square, in both estimations, is greater than 5%, implying that there is no problem of heteroskedasticity between the variables for both models. As such, the null hypothesis of Homoskedasticity cannot be rejected.

Table (6): Heteroskedasticity Test Results

Heteroskedasticity Test: Harvey Null hypothesis: Homoskedasticity			
BZS f (CBB, LGDP, LIQ, PcGDP)			
F-statistic	1.195681	**Prob. F(5,58)**	0.3229
Obs*R-squared	5.980454	**Prob. Chi-Square(5)**	0.3081
Scaled explained SS	6.249584	**Prob. Chi-Square(5)**	0.2827
BZS f (ATMs, LGDP, LIQ, PcGDP)			
F-statistic	1.927241	**Prob. F(5,58)**	0.1039
Obs*R-squared	9.110376	**Prob. Chi-Square(5)**	0.1047
Scaled explained SS	12.33267	**Prob. Chi-Square(5)**	0.0305

4.4.3. Stability Test

To test for whether the model is stable or not, the study makes use of the cumulative sum (CUSUM) of recursive residuals and the CUSUM of square (CUSUM square) (Pesaran & Pesaran, 1997). The CUSUM test essentially detects if there are any systematic changes in the regression coefficients while the CUSUM Square test identities any sudden

changes from the constancy of the regression coefficients. The CUSUM and CUSUM Square tests results are respectively presented in figures 1a and 1b below.

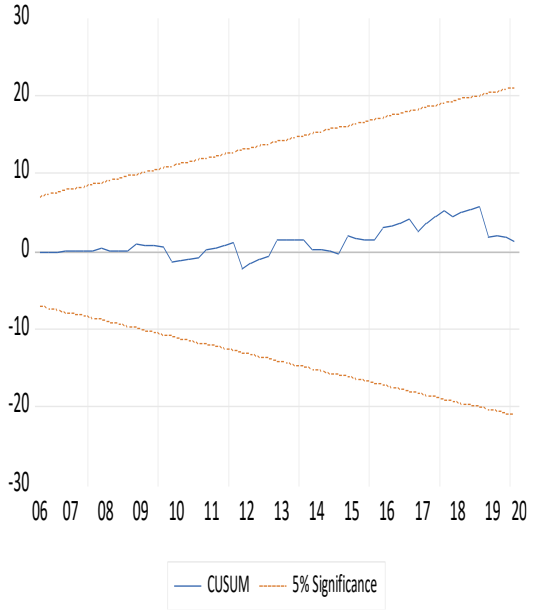

Figure (1a): CUSUM Test (CBB)

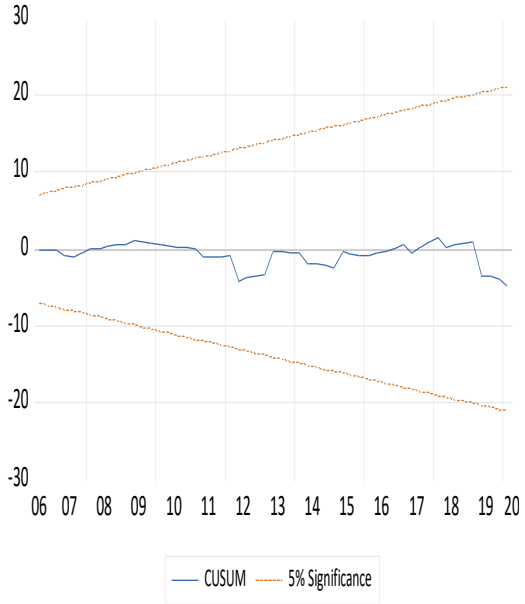

Figure (1b): CUSUM Test (ATMs)

According to figures 1a and 1b, the model has no stability problems. The conclusion of the absence of any instability can only be made when the plot of the CUSUM statistics fall within the critical bands of the 5 per cent confidence intervals of parameter stability, that is, the blue line falls inside the red lines as it is in this case. After running the test for the regression using ATMs as a measure the CUSUM test the shows still shows no structural change occurrence, where the test statistics starts crossing the any critical line. This indicate that the null hypothesis of coefficient stability of the model should be cannot be rejected, as the test essentially suggests that this model is also stable.

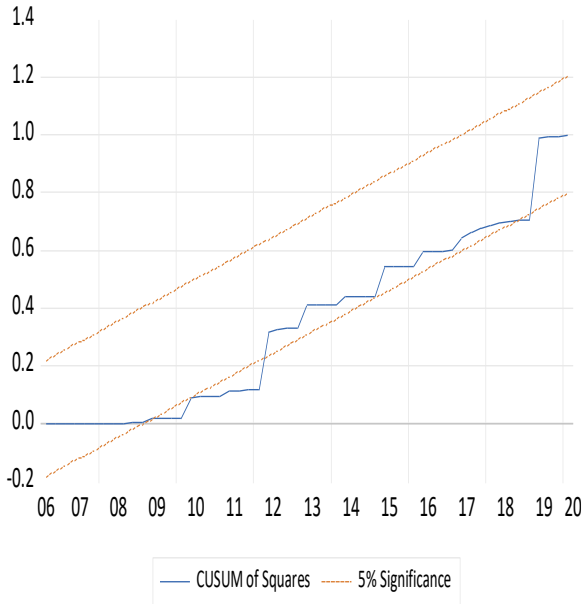

Figure (2a): CUSUM squared Test

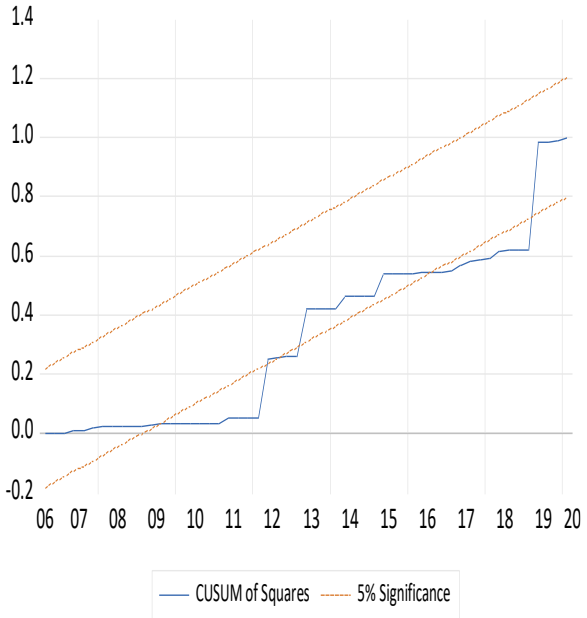

Figure (2b): CUSUM squared Test

The results from the CUSUM Square test conducted with CBB as the measure of financial inclusion, presented in figure 2a, indicate some structural changes occurring from observation 10, where the test statistics exceeded the bottom red line and stays outside the critical bands until observation 12, where it then returns and stays inside for the remaining period. As such, because the test statistics ends up within the critical bands, it can be concluded that, instability exists in the coefficients over the sample period, but the model is still reliable. After replacing CBB with ATMs, the CUSUM Square test results depict similar behaviour, as shown in figure 2b.

5. Conclusion

This study was conducted so as to investigate the relationship between financial inclusion and financial stability in South African. To do this, the study estimated two Engle-Granger (Residual Based) Error Correction Models, each with its unique measure of financial inclusion, using quarterly time series data from 2004 to 2020. To our knowledge, this is the first study of this kind conducted for the South African economy, and the findings from it will contribute to the wanting body of literature on this subject, locally and on a global scale.

The two financial inclusion variables used as the explanatory variables in the two EC models estimated in the study are, Commercial bank branches per 100,000 adults (CBB) and number of ATMs per 100 000 adults (ATMs). Bank Z-Score (BZS) was used to measure financial stability, which was the variable of interest (dependent variable) in both regressions. Additional variables used in the models were Gross Domestic Production (GDP), Private credit by deposit money banks and other financial institutions to GDP (%) (PCGDP), and Liquid assets to deposits and short-term funding (%) (LIQ), which were included as control variables.

The results derived from this study indicated quite broad findings. When estimating the model with CBB as the measure of financial inclusion, the study discovered a positive relationship between financial inclusion and financial stability, confirming findings from some of the empirical literature on the subject. However, after replacing CBB with ATMs, the results indicate a negative relationship between financial inclusion and financial stability, in line with other empirical studies, too. The differing results of this relationship is not something new. As mixed results are indicated in the empirical literature review. Moreover, these findings are in line with literature on the subject, which suggests that higher levels of financial inclusion can impact financial stability, either, positively or negatively. In line with existing literature, the study also finds a positive relationship between financial stability and GDP, for both model estimations. These findings imply that higher economic performance essentially increase the likelihood of financial stability. Greater private sector credit relative to GDP (PCGDP), is also found to lead to a higher likelihood of financial instability in South Africa. However, higher liquidity by banks (LIQ) is found to result to financial instability.

A lesson for policy makers from this study is that, while there is a mixed impact of financial inclusion of financial stability, financial inclusion can indeed be used to influence financial stability. As such, the study provides insightful information to policymakers on how best can the foundation of building a stable financial system for the country that is influenced by financial inclusion can be strengthened. An exercise that would face researchers and policymakers would be finding a balance on how to effectively promote financial inclusion without destabilising the financial system. Another important policy implication from this study is that national income can be used to influence the stability of the financial system in South Africa, and that financial stability can be increased by ensuring a higher private bank credit to GDP ratio. Finally, strengthening macroeconomic database for financial inclusion indicators is also a key policy priority to note, as the insufficiency of enough macroeconomics database on financial inclusion disadvantages the tracking of the progress of financial inclusion, and, thus its relationship with other key factors such as financial stability.

Future research should look at analysing the relationship between financial inclusion on financial stability in South Africa, using other the dimension and measures of financial inclusion, as well as other measures of financial stability, such as bank loans, bank deposits, or volatility of GDP growth. There is yet to be a study that takes this approach in South Africa. With the availability of data in the future, research can also conduct annual analysis of this relationship, as because of poor data, this has never been done before.

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المجلة العالمية للاقتصاد والأعمال
Global Journal of Economics and Business (GJEB)
Journal Homepage: https://www.refaad.com/Journal/Index/2
E-ISSN 2519-9293 | P-ISSN 2519-9285

تحليل العلاقة بين الشمول المالي والاستقرار المالي في جنوب أفريقيا

Velenkosini Matsebula [1], Johannes P S Sheefeni [2]

[1,2] Department of Economics, University of the Western Cape, Private Bag X17, Bellville, 7535, South Africa
[1] vmatsebula@uwc.ac.za, [2] jsheefeni@uwc.ac.za

DOI: https://doi.org/10.31559/GJEB2022.12.5.8 **قبول البحث:** 2022/7/27 **مراجعة البحث:** 2022/7/3 **استلام البحث:** 2022/6/4

الملخص:

تناولت هذه الدراسة العلاقة بين الشمول المالي والاستقرار المالي في جنوب أفريقيا. فعند القيام بذلك، تم استخدام نهج Engle-Granger لنموذج تصحيح الأخطاء (ECM) على بيانات السلاسل الزمنية ربع السنوية للفترة من 2004 إلى 2020. وتم استخدام متغيرين مختلفين لقياس الشمول المالي، وهما فروع البنوك التجارية لكل 100000 بالغ (مصرف البحرين المركزي) وعدد أجهزة الصراف الآلي لكل 100000 بالغ (ATMs)، والتي تم تراجعها بشكل منفصل مقابل درجة Z-Score (BZS) التي تم استخدامها كمقياس للاستقرار المالي. وأظهرت النتائج أن المستويات الأعلى من الشمول المالي تؤثر سلبًا أو إيجابًا على الاستقرار المالي حسب نوع مبادرة الشمول المالي.

الكلمات المفتاحية: الشمول المالي؛ الاستقرار المالي؛ جنوب أفريقيا.