AL-ARBAH: Journal of Islamic Finance and Banking
Vol. 7 No. 2 (2025), 223-248; DOI: 10.21580/al-arbah.2025.7.2.26598
E-ISSN: 2716-2575, P-ISSN: 2716-3946



# The non-linear impact of stokvel savings and banking sector development in South Africa

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## Abstract

**Purpose** - The study investigated the non-linear impact of stokvel savings and banking sector development in South Africa.

**Method** - The study applied the unit root break-even test, bounds F-test or cointegration and the nonlinear autoregressive distributed lag (NARDL) model for short- and long-run asymmetric impact with economic time series data ranging from 2009Q4 to 2020Q2.

**Result** - The results of the break-even unit root tests reveal that variables were found to be I(0) and I(1), thus confirming that variables that are I(2) were not present. The findings of NARDL bounds F-test cointegration that there is a long-run relationship between banking sector size and the selected predictors. The short- and long-run multipliers portray adjustment to a new equilibrium after positive and negative shock.

**Implication** - The empirical results demonstrates that NARDL is not the best model to detect long-run relationship between banking sector size and its predic.

**Originality** - This study investigated the impact of stokvel savings and banking sector size in South Africa using the non-linear autoregressive distributed lag (NARDL) bound testing approach technique.

**Keywords:** Non-Linear Autoregressive Distributed Lag, stokvel savings, banking sector size, gross domestic product, money supply, South Africa.

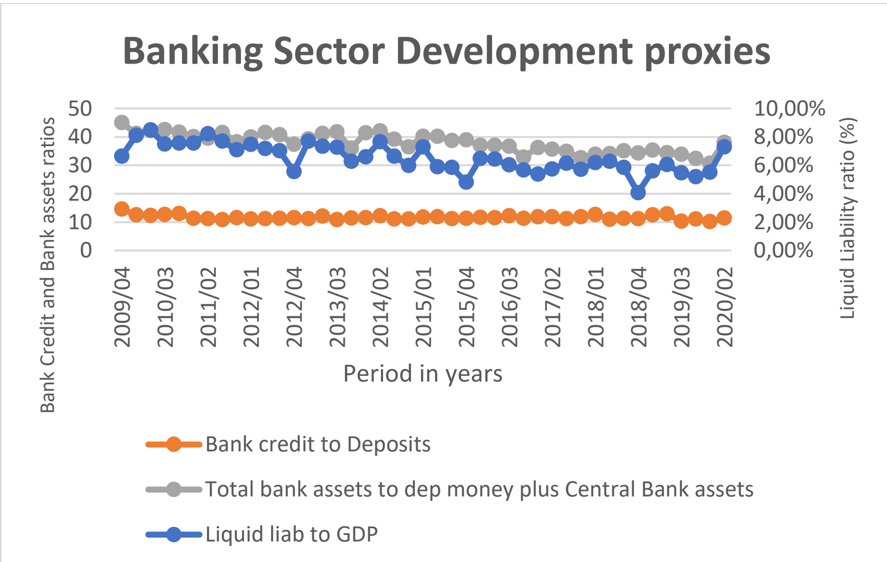
## Introduction

In South Africa, during the apartheid era, the popular view was that low- and middle-income households could not save with financial institutions (Lukhele, 2018; Kaseke and Matuku, 2014; Moyo, Musona, Mbhele and Coetzee, 2002). They were regarded as unbanked as they held little financial savings (Dupas, Karlan, Robinson and Ubfal, 2018; Tengeh and Nkem, 2017; Oji, 2015). Due to a lack of access to financial institutions, low- and middle-income households formed informal schemes as savings and credit clubs/societies, known as stokvels savings in South Africa, at affordable and reasonable costs in the community (Lukhele, 1990; Kaseke and Olivier, 2008; Mashigo, 2012; Oji, 2015). Worldwide, stokvel savings are commonly known as 'rotating savings and credit associations' (ROSCAs) (Kaseke and Matuku, 2014; Karlan, Ratan and Zinman, 2014; Mphahlele, 2011). Stokvel savings are non-bank financial institutions, they do not have a full banking licence and cannot take deposits (Rateiwa and Aziakpono, 2017). Oji (2015) opines that stokvel savings benefit households, filling gaps by providing savings and credit to the low- and middle-income earners. However, stokvel savings serve a different purpose and come in different types and sizes, to keep it manageable and to ensure effective social control (Mboweni, 1990).

Following on the problem statement enunciated above, the study seeks to empirically investigate the possible nonlinear relationship between stokvel savings that is to determine whether there exists a turning point or a threshold level above which the effect of stokvel savings switches from positive to negative; to determine the short-run relationship between stokvel savings and banking sector development in South Africa. Available empirical literature has attempted to provide a conclusive explanation of the drivers of banking sector development without much success. Since McKinnon (1973) and Shaw (1973), the debate on the determinants of banking sector development has raged on. This is not surprising, especially for emerging economies, such as South Africa, due to high levels of poverty. Yu and Gan (2010), Mahmoud (2014), Ayunku and Etale (2014) and Dogga, Suresh and Mahendra (2017) failed to identify it as such and focus on examining determinants of savings. These studies focus on real GDP, financial liberalisation, real interest rate and trade openness are factors that influence household savings significantly. The authors do not refer to the link between savings and banking sector size.

It is evident that there is an inconclusive debate on the drivers of banking sector development. This study contributes to this debate by introducing the variable, stokvel savings (STOKVSAV)and independent variables gross domestic product growth (GDPG) and money supply (M3). This is the first study to assess the impact of stokvel savings on banking sector development in South Africa and elsewhere. Figure 1 provides a trend analysis of the proxies for banking sector development based on data obtained from the South African Reserve Bank (SARB) and Old Mutual SA from 2009Q4 to 2020Q2.

**Figure 1. Trends of banking sector development proxies in South Africa.**




Source: Author's own compilations, data from SARB and Old Mutual SA(2020)

When using the ratio of bank credit to total deposits the results show that banking sector development slowed down, especially from 2009Q4 to

2011Q4. This decline may be attributed to the global financial crisis of 2008/2009, which resulted in the introduction of restrictions on credit growth in response to a steep rise in defaulting debtors (Verick and Islam, 2010). However, since then, relative stability has been observed. On 1 March 2020, the SARB cut the repo rate by 25 basis points. Bureau information from the National Credit Regulator notes that consumers with impaired credit records increased as of 2019Q3 (GCR Ratings, 2020). However, banking sector financing conditions for low- and middle-income households remain uncertain, contributing to currency weakness. Furthermore, the banking sector experienced stress and was forced to reduce the supply of credit to the economy. This could impact low- and middle-income households (GCR Ratings, 2020). The advent of the Covid-19 pandemic has caused a negative impact on asset quality for the banking sector in South Africa (GCR Ratings, 2020).

The last four sections of the study have been separated. Section 2 provides evidence from the empirical literature review. Section 3 carries out a methodology that shows econometric model specification, data, definition of variables and a priori expectation are described in this section. Section 4 explains the NARDL approach results in discussion and interpretation. Lastly, the study summary of the research.

## Literature Review

A stokvel savings is formed by more than two people who live in the same area, and membership is kept as small as possible so that each member can get an opportunity to receive his/her turn (Bozzoli, 1991; Anderson, Baland and Moene, 2009). Membership to stokvel savings is voluntary, and stokvel saving members choose whom they want to be in a group with (Dallimore, 2013; Nyathi, 2017). Stokvel savings members select a chairperson, treasurer and secretary together with their deputies that form an executive committee based on trust (Mfeti, 2017; Mashigo and Schoeman, 2010; Calvin and Coetzee, 2010; Verhoef, 2001; Verhoef, 2008). Stokvel savings as entities are fairly structured in that they are governed by constitutions, and meetings are guided by an agenda, and a drive for efficiency is instilled (Bophela, 2018; Matuku and

Kaseke, 2014; Mphahlele, 2011; Mashigo, 2007). In general, a management committee is elected by stokvel savings members for a certain period (Kedir, 2005).

Despite low saving rates in the banking sector, stokvel have significantly participated in informal saving schemes which have now been legalised (Mishi, 2012, Irving, 2005). Stokvel savings provide opportunities to low- and middle-income households to save, invest and accumulate assets (Landman and Mthombeni, 2021; Matuku and Kaseke, 2014). However, Aidoo-Mensah (2018), Kumarasinghe and Munasinghe (2016) noted that savings could be considered one of the crucial tools' households utilise to accomplish their financial expectations to improve their financial well-being. In addition, Kumarasinghe and Munasinghe (2016) used factor analysis to examine the most important purpose for savings among predetermined savings motives of bequest, precautionary and life cycle. The most significant savings motive of households in Kalutara District was the precautionary savings motive, suggesting that households are aware of the uncertain future and the financial and social challenges it may pose. Thus, it can be inferred that households demand savings facilities to hedge themselves against the uncertain future. As in previous studies (Ngcobo and Chisasa, 2018), informal saving institutions are observed to be efficient and the preferred suppliers of these saving instruments. While stokvels are the vehicles for informal household savings in South Africa, similar informal arrangements exist globally. For instance, Cheruiyot, Cheruiyot and Yegon (2016) examined the operations and impact of ROSCAs on the lives of middle-income earners. The study's results indicated that ROSCAs impacted middle-income earners' lives and enabled them to acquire financial, physical, human, and social assets. The research also showed that the organisations also impacted money management since members used the funds to meet current expenditure needs.

The level of banking sector development has been widely heralded as a condition necessary for savings; however, Sawuyah (2018) failed to identify it as such. Rather, the study examined the micro-level determinants of household savings in Uganda and using household-level cross-sectional data; evidence revealed that income was the main determinant of variation of household savings in Uganda. Additionally, household income, the education level of the household head, the spouse's education, gender, age and household location (living in urban areas) are factors that influence household savings significantly. On the other hand, household size, marital status, age of the household head and regional differences negatively and significantly affect household savings. Similarly, Ahmad and Asghar (2004) used the ordinary least square method in Pakistan for the period 1998–1999 to examine the savings behaviour of households. The study's results showed that various factors, including wealth, employment status, education, age and dependency ratio, influence saving behaviour. However, the most important factor influencing savings behaviour is household income. The authors do not refer to the link between savings and banking sector development.

Pitonáková (2018) studied the savings rate of the private sector in Slovakia. The results suggest that inflation, the real interest rate on bank deposits, public savings, the level of private disposable income, growth of income per capita and the dependency ratio of the elderly are determinants of private savings. Higher income stimulates the private sector to increase their savings and to build a buffer to cover expenditures in the future. The outcomes suggest a negative impact of public savings on private savings. However, the relationship between savings and the real interest rate is positive. Furthermore, a rising dependency ratio pushes private savings up, both in the short- and long-run, showing savings for the bequest. Since most household savings in Slovakia are in bank accounts, the findings have implications for banking institutions for managing deposit policy from non-banking subjects.

`Samantaraya and Patra (2014) used the ARDL approach in India to analyse the role of various determinants of household savings. The estimated results revealed that GDP dependency ratio, interest rate and inflation have a statistically significant influence on household savings, both in the long- and short-run, suggesting that the banking sector should be ready to absorb these household savings by developing suitable products for households. Similarly, at a micro level, ur Rehman, Faridi and Bashir (2010) used data obtained from 293 respondents drawn through a field survey conducted in the Multan District of Pakistan for the period 2009–2010 to investigate the determinants of households' savings. It was concluded that spouse participation, total dependency rate, household income and size of properties significantly raise household savings. On the other hand, the educational level of the household head, children's educational expenditures, family size, liabilities to be paid, marital status and value of the house significantly reduce the savings levels of households. Their study also supports the existence of the life cycle hypothesis.

Wamuyu (2016) investigated the potential of using mobile money accounts as a money management platform to help promote a savings culture and establish and nurture financial discipline among poor households in Kenya. The study's results indicated that a lack of awareness of the available and affordable mobile money savings products, low-interest rates on mobile money fixed deposit savings accounts and high transaction costs when making mobile money payments negatively impacts mobile money fixed deposit savings accounts usage. In contrast, the availability of microcredit on mobile money savings accounts positively affects usage.

To the best of the researcher's knowledge, no empirical research has investigated on the impact of stokvel saving on banking sector development. However, the closest empirical research done is on the effect of savings on the banking sector. Hussein, Mohieldin and Rostom (2017) used a system generalised method of moments (GMM) panel estimation method examining the impact of financial access on the accumulation of domestic savings in 16 emerging market economies included in the Morgan Stanley Capital International emerging market index for the period 1980-2018. They used control variables for a domestic saving regression, including current account balance, real interest rate, age dependency ratio, inflation, domestic credit, and private sector growth. The results revealed a convex and non-monotonic statistically significant relationship between financial access and domestic savings. However, in a study using bounds tests cointegration approach, also known as the ARDL. Ewetan, Ike and Ige (2015) examined the long-run relationship between financial sector development and domestic saving in Nigeria for the period 1980-2012. The econometric results provide evidence of a long-run relationship between FS development and domestic saving. The constructed composite index of financial development has a positive and significant impact on domestic savings; likewise, each of the respective three components of this index positively impacts domestic savings.

## Methods

This study used quarterly time series secondary data ranging from 2009Q4 to 2020Q2 collected from the South African Reserve Bank and Old Mutual South Africa. The literature extensively demonstrated, from both empirical and theoretical angles, that stokvels play a significant role in the development of the banking sector size.

### Banking sector development key variables

### Banking sector size (BSS)

The size of the banking sector, herein referred to as BSS, is measured by the ratio of total bank assets to deposit money plus central bank assets. The higher the total bank assets, the bigger the banking sector (Montfaucon, 2015; Chitokwindo, Mago and Hofisi, 2014). If the banking sector is big, this provides more scope for financial inclusion. For instance, members of stokvel savings formally get involved in banking activities, thus, contributing to economic development. The advantage of the measure of total bank assets (to deposit money plus central bank assets) on BSS in the economy is that; when many households are financially included to participate in the banking sector, this will result in higher stokvel savings (Nandru, Anand and Rentala, 2015). Therefore, total banking sector being more correlated with economic growth than stokvel savings may indicate the importance of the link between banking sector development and, thus, economic growth.

### Stokvel savings

In earlier empirical work, several authors (Makori, Matundura, and Mose, 2022; Khan, Teng, Khan, Jadoon and Rehan, 2017; Jagadeesh, 2015; Turan and Gjergji, 2014; Prinsloo, 2000) identified stokvel savings deposit as a percentage of GDP as the most suitable proxy of stokvel savings in the context of South Africa. This is because stokvel savings help maintain high growth rates through their effect on capital formation and investment from stokvel savings. Similarly, Naumovska, Jovanovski and Gockov (2015) argued that the ratio of stokvel savings deposits as a percentage of GDP is the best indicator of savings mobilisation ability and the banking sector in the economy. Moreover, Remble, Marshall and Keeney (2014), and Prinsloo (2000) described stokvel savings deposit (% of GDP) as a portion of current income that is put aside and not consumed after direct taxes and other expenses have been paid off.

**Control variables definition**

**Gross Domestic Product Growth (GDPG)**

Gross Domestic Product is the total value of goods and services produced within the borders of an economy or a country during a given period of time measured in market prices (Ribaj and Mexhuani, 2021; Mogale, Mashamaite and Khoza, 2018; Zwane, Greyling and Maleka, 2016; Jagadeesh, 2015).

**Money Supply (M3)**

M3 includes both cash and deposits that can be used almost as quickly as cash (Mierau and Mink, 2018; Omodero (2019); Tenenbaum, 2021).

Equation 1 below is illustrative.

$$\text{BSS} = \text{f(STOKSAV, GDPG, M3)} \qquad (1)$$

The following general econometric model represents the impact of STOKVSAV on BSS in South Africa (see equation 2).

$$\Delta\text{BSS} = \beta_0 + \beta_1\,\Delta\text{LnSTOKVSAV}_t + \sum_{j=1}^{n} X_{jt} + u_t \qquad (2)$$

Where: STOKVSAV = stokvel savings, $X_{jt}$ is the vector of control variables

If $\beta_1 \neq 0$ and have significance, meaning there exists a break-point and the impact of STOKVSAV on BSS is the difference between the two periods. The minimum stokvel savings is $\beta_0$ in the period before the break-point is ($\beta_0$ + $\beta_1$ ) in the period after the break-point. If β3>0 and have significance, this implies the impact of stokvel savings on BSD in the period after the break-point is bigger than the effect in the period before the break-point.

**Autoregressive Distributed Lag (ARDL) approach**

The study employed the ARDL approach proposed by Pesaran, Shin and Smith (2001) and long- and short-run estimations econometric approaches postulated by Engle and Granger (1987), Johansen and Juselius (1990), and Johansen (1996). The ARDL models are presented in equation [3] as follows:

$$\begin{aligned}\Delta \mathrm{LnBSS}_t = \alpha_0 &+ \beta_1 \mathrm{InBSS} + \beta_2 \mathrm{STOKVSAV}_{t-1} \\ &+ \beta_3 \mathrm{GDPG}_{t-1} + \beta_4 \mathrm{M3}_{t-1} \\ &+ \sum_{k=0}^{m1} \alpha_{1k} \Delta \mathrm{InBSS}_{t-k} \\ &+ \sum_{k=0}^{m2} \alpha_{2k} \Delta \mathrm{STOKVSAV}_{t-k} \\ &+ \sum_{k=0}^{m3} \alpha_{3k} \Delta \mathrm{GDPG}_{t-k} + \sum_{k=0}^{m4} \alpha_{4k} \Delta \mathrm{M3}_{t-k} \\ &+ \omega_t\end{aligned} \tag{3}$$

Where: Δ = first difference, β1, β2, β3 and β4 =coefficients of the long-run impacts, **α**1, **α**2, **α**3 and **α**4 =coefficients of the short-run impacts, ***ω***= error

**The cointegration relationship is estimated as follows:**

The long-run and short-run parameters of the equations are estimated once the cointegrating relationship has been detected. The cointegration relationship is estimated as follows:

$$\Delta \mathrm{BSS}_t = \beta_{0+} \beta_1 \ \mathrm{BSL}_{t-1} + \beta_2 \mathrm{STOKVSAV}_{t-1} + \beta_3 \ \mathrm{GDPG}_{t-1} + \beta_4 \mathrm{M3}_{t-1} + \mu_t \tag{4}$$

$$STOKVSAV_t = STOKVSAV + STOKVSAV_t^{\ +} + STOKVSAV_t^{\ -} \quad (5)$$

$$GDPG_t = GDPG + GDPG_t^{\ +} + GDPG_t^{\ -} \quad (6)$$

$$M3_t = M3 + M3_t^{\ +} + M3_t^{\ -} \quad (7)$$

Where stokvel savings control variances are partial sum processes of positive and negative changes in independent variables obtained as follows:

$$NEG(STOKVSAV_t) = \sum_{s=0}^{t} STOKVSAV_s^{-} = \sum_{S=0}^{t} MIN(\Delta STOKVSAV_s, 0) \quad (8)$$

$$POS(STOKVSAV_t) = \sum_{s=0}^{t} STOKVSAV_s^{+} = \sum_{S=0}^{t} MAX(\Delta STOKVSAV_s, 0) \quad (9)$$

$$NEG(GDPG_t) = \sum_{s=0}^{t} GDPG_s^{-} = \sum_{S=0}^{t} MIN(\Delta GDPG_s, 0) \quad (10)$$

$$POS(GDPG_t) = \sum_{s=0}^{t} GDPG_s^{t} = \sum_{S=0}^{t} MAX(\Delta GDPG_s, 0) \quad (11)$$

$$NEG(M3_t) = \sum_{s=0}^{t} M3_s^{-} = \sum_{S=0}^{T} MIN(\Delta M3_s, 0) \quad (12)$$

$$POS(M3_t) = \sum_{s=0}^{t} M3_s^{+} = \sum_{S=0}^{t} MAN(\Delta M3_s, 0) \quad (13)$$

Therefore, the non-linear asymmetric long-run equilibrium relationship can be expressed as:

$$BSS_t = POS^{+} STOKVSAV_s^{+} + NEG^{-} STOKVSAV_s^{-} + u_t \quad (14)$$

$$BSS_t = POS^{+} GDPG_s^{+} + NEG^{-} GDPG_s^{-} + u_t \quad (15)$$

$$BSS_t = POS^{+} M3_s^{+} + NEG^{-} M3_s^{-} + u_t \quad (16)$$

NARDL model, and non-linearity is introduced through partial sum or cumulative sum concept included in generating the new variables POS (+) and NEG (-), where all variables (STOKVSAV, GDPG and M3) are lag orders.

$$\begin{aligned} \Delta BSS_t = \alpha_0 + + \sum_{i=0}^{p} \alpha_{1i} \Delta BSS_{t-i} + \sum_{i=0}^{p} \alpha_{2i} \Delta NEG(STOKVSAV)_{t-i} + \sum_{i=0}^{p} \alpha_{3i} \Delta POS(STOKVSAV)_{t-i} + \\ \sum_{i=0}^{p} \alpha_{4i} \Delta NEG(GDPG)_{t-i} + \sum_{i=0}^{p} \alpha_{5i} \Delta POS(GDPG)_{t-i} + \\ \sum_{i=0}^{p} \alpha_{6i} \Delta NEG(M3)_{t-i} + \sum_{i=0}^{p} \alpha_{7i} \Delta POS(M3)_{t-i} + \\ \alpha_{8i} BSL_{t-i} + \alpha_{9i} NEG(STOKVSAV)_{t-1} + \\ \alpha_{10i} POS(STOKVSAV)_{t-1} + \alpha_{11i} NEG(GDPG)_{t-1} + \\ \alpha_{12i} POS(GDPG)_{t-1} + \alpha_{13i} NEG(M3)_{t-1} + \\ \alpha_{14i} POS(M3)_{t-1} + \omega_t \end{aligned} \quad (17)$$

## Results and Discussion

### Unit root test with breakpoints

The study applies the structural break method for determining the time series properties of the variables investigated by the ADF test. The results of unit root tests in levels and at intercept are presented in Table 1. The variable tests were employed for this study to see whether the data was stationary. The test is more robust to heterogeneity and unit roots when under a non-standard distribution. The variables were found to be I(0) and I(1), thus confirming that variables that are I(2) were not present. The presence of I(2) variables in the model would result in spurious F-statistics since the F-statistics computed by Pesaran, Shin and Smith (2001) and Nayaran (2005) have their root in the presumption that the variables are I(0) or I(1). The results of the study suggest that the variables are mutually integrated in the order of either zero or one, or both, which supports the conditions for the use of the ADF unit root test.

**Table 1. Stationarity tests of variables using Augmented Dickey-Fuller (ADF) unit root**

| Variable | Trend | Intercept | Trend and Intercept | Diagnosis |
|---|---|---|---|---|
| Stationary tests of variables using Augmented Dickey-Fuller (ADF) test: Trend Specification: Intercept only | | | | |
| BSS | - | -5.435252*** | - | I(0) |
| STOKVSAV | - | -4.600730*** | - | I(0) |
| GDPG | - | -6.394021*** | - | I(0) |
| M3 | - | -7.126778*** | - | I(1) |
| **Stationary tests of variables using Augmented Dickey-Fuller (ADF) test: Trend Specification: Trend and Intercept** | | | | |
| BSS | -6.025610*** | -6.924560*** | -6.733788*** | I(0) |
| STOKVSAV | -7.763481*** | -6.578931*** | -5.978431*** | I(0) |
| GDPG | -17.42696*** | -6.441841*** | -8.182452*** | I(0) |
| M3 | -4.210961** | -5.328696*** | -4.307545** | I(0) |

Source: Author's own compilation from E-Views ***; **; * indicates that we reject the null hypothesis of unit root tests at 1%, 5% and 10%, respectively

**ARDL and Non-linear ARDL Long-run Results: Bounds F-test for cointegration**

**ARDL Long-run Results: Bounds F-test for cointegration**

Table 2 show that the value of the F-statistic for all three models is greater than the upper-bound critical values suggesting that the null hypothesis can be rejected. The F-statistics were all significant at the 1% level. Thus, it can be concluded that there is a long-run relationship between STOKVSAV and BSS. These results align with the findings of Khan (2005) and Khan and Qayyum (2006). Additionally, a long-run relationship exists between GDPG, M3 and BSS.

**Table 2. Bounds F-test for ARDL cointegration**

| Dependent variable | Independent variable | F-test statistic | Lower and upper-bounds |
|---|---|---|---|
| BSS | STKOVSAV GDPG M3 | 13.66468*** | 4.45– 6.36 |
| STOKVSAV | GDPG M3 BSS | 6.873440*** | 4.45-5.62 |
| GDPG | STKVSA M3 BSS | 6.218284*** | 3.77-5.61 |
| M3 | STKVSA GDPG BSS | 5.886491*** | 3.77-5.61 |

Source: Author's own compilations, ARDL F-statistic values are calculated by bounds testing approach Source: Author's own compilations, data from SARB & Old Mutual South Africa (2022)

**Non-linear ARDL Long-run Results: Bounds F-test for cointegration**

In the first model, BSS was used as the dependent variable. The F-statistic of 4.014581 is above the upper bound of 4, implying that we reject the null hypothesis that there is no cointegration between banking sector development proxied by banking sector size and its predictors. The results suggest that there is a long-run relationship between BSS and the selected predictors. Similarly, when using STOKVSAV, GDPG, and M3, it is observed that all the variables in the model are cointegrated.

**Table 3. Bounds F-test for non-liner cointegration – N-ARDL**

| Dependent variable | Independent variables | F-test statistic | Lower and upper pounds |
|---|---|---|---|
| BSS | STKOVSAV GDPG M3 | 4.014581*** | 2.87-4 |
| STOKVSAV | GDPG M3 BSS | 6.873440*** | 4.01-5.07 |
| GDPG | STKVSA M3 BSS | 6.466161*** | 2.45-3.61 |
| M3 | STKVSA GDPG BSS | 5.886491*** | 3.23-4.35 |

Source: Author's own compilations, Non-linear ARDL F-statistic values are calculated by bounds testing approach Source: Author's own compilations, data from SARB & Old Mutual South Africa (2022)

**Asymmetric non-linear ARDL long-run results**

For the asymmetric relationship, the non-linear ARDL model was applied that decompose partial sum of stokvel savings positive and negative changes to show the asymmetric effect. The results are presented in Table 4 The long-run results show that the effect of a 1% positive change in stokvel savings results in a 26% decrease in banking sector size via its diminished money multiplier effect. The impact is statistically significant at 5% level. This may be attributed to that as unbanked balances of stokvels increase, the growth of bank deposits is retarded. Conversely, the impact of a negative change in stokvel savings, while negative, is statistically insignificant. It can be concluded that policies should be developed that influence significant negative changes in stokvel savings and stimulate banking sector development by channeling savings deposits held by stokvels to banks. Additionally, both positive and negative changes in money supply (M3) exhibited a positive and statistically significant increase in banking sector size with a higher impact resulting from positive changes (βstokvsav+=1.764328; βstokvsav- = 1.079936). Both the positive and negative variations in GDPG were observed to have no explanatory power for banking sector size as they exhibited negative coefficients which were both statistically insignificant. When using STOKSAV and M3 as the dependent variable, all the predictor variables were insignificant and thus deemed N-ARDL model an inappropriate model to estimate the long-run relationship between GDGP, BSS, M3 and STOKSAV. Finally, it is observed that a 1% positive change in money supply (M3) leads to a 1.76% positive change in banking sector size. While a 1% negative change in M3 is expected to contribute to a reduction in banking sector size, in fact, a 1.07% positive response is enunciated and is statistically significant at 5%. This implies that, monetary policies that seek to increase banking sector size through increased positive doses of money supply (M3) should be designed.

**Table 4. N-ARDL long-run form and bounds tests**

| N-ARDL Long-Run Coefficients Result | | | | |
|---|---|---|---|---|
| Variable | Coefficient | St.Error | t.Statistic | Prob |
| STOKVSAV_POS | -2.670.613 | 8.707.578 | -3.066.999 | 0.0279 |
| STOKVSAV_NEG | -1.130.675 | 5.013.007 | -2.255.483 | 0.0738 |
| GDPG_POS | -1.609.122 | 7.154.241 | -2.249.186 | 0.0744 |
| GDPG_NEG | -1.487.465 | 6.681.603 | -2.226.210 | 0.0765 |
| M3_POS | 1.764.328 | 0.635369 | 2.776.855 | 0.0390 |
| M3_NEG | 1.079.936 | 0.211415 | 5.108.139 | 0.037 |

Source: Author's own compilations, data from SARB & Old Mutual (2020)

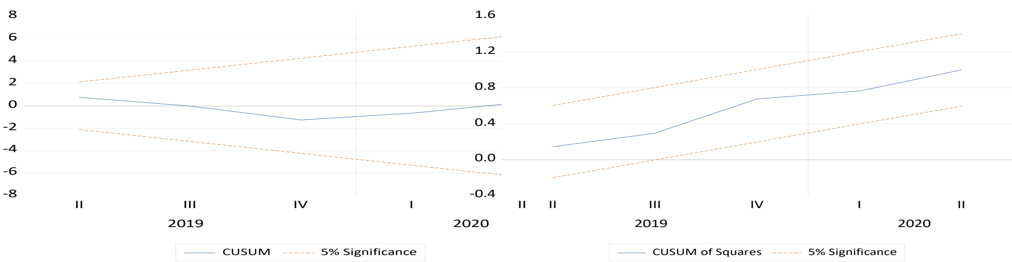
**Stability tests**

**CUSUM and CUSUM Squares Tests**

The stability of the regression coefficients of the above empirical model is estimated by employing the cumulative sum (CUSUM) test and cumulative sum of square (CUSUMQ) test. The estimated results of the CUSUM test and CUSUMQ squares test (Figure 1) reveal that the plots of both tests are found to be within the boundaries at a 5% significance level, thus, confirming the stability of the regression coefficients of the empirical models for banking sector development.

**Figure 2. CUSUM and CUSUM Squares Tests**

BSS (STOKVSAV GDPG M3)



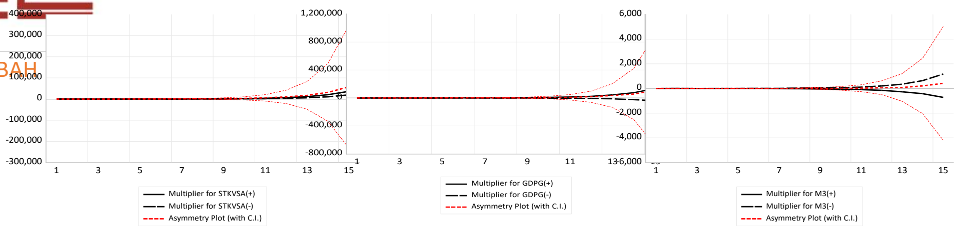

**Short- and long-run multipliers for banking sector size**

Figure 3 depicts the short- and long-run multipliers for banking sector size. The short- and long-run multipliers portray adjustment to a new equilibrium after positive and negative shocks. The black dotted line indicates the non-linear adjustment of BSS to adverse shocks, whereas the solid black line portrays the adjustment of BSS to a positive shock. The asymmetric pattern indicated by the red dotted line is the difference between both negative and positive shocks (Andriamahery & Qamruzzaman, 2022; Ahmad, Haq, Khan, Rahman & Khan, 2019). These results imply that in the long-run, any positive changes in stokvel savings (STOKVSAV+) or negative changes in stokvel savings (STOKVSAV-) have a significant impact on BSS. Similar observations are made for GDPG+ or GDPG- and M3+ or M3. Therefore, NARDL is not the best model to detect a long-run relationship between BSS and its predictors. Equally, when STOKVSAV, GDPG, and M3 are used as regressands, positive and negative changes in their regressors do not significantly impact the regressands. Therefore, the N-ARDL is not the best model to detect the long-run relationship between BSS and its explanatory variables presented in BSS.

**Figure 3. short- and long-run multipliers of banking sector size**

BSS (STOKVSAV GDPG M3)

STOKVSAV GDPG M3




## Conclusion

The study investigated impact of stokvel savings and banking sector development in South Africa using the nonlinear autoregressive distributed lag (NARDL) for short- and long-run asymmetric model using quarterly time series secondary data ranging from 2009Q4-2020Q2. The study also used the unit root break-even test, bounds F-test or cointegration and. In the analysis, banking sector development (BSD) is represented by banking sector size (BSS). The results of the break-even unit root tests reveal that variables were found to be I(0) and I(1), thus confirming that variables that are I(2) were not present. The results further show that NARDL bounds F-test cointegration that there is a long-run relationship between BSS and the selected predictors. The short- and long-run multipliers portray adjustment to a new equilibrium after positive and negative shock in stokvel savings. The empirical results also demonstrates that NARDL is not the best model to detect long-run relationship between BSS and its predictors. The country policies should be developed that influence significant changes in stokvel savings and stimulate BSD by channelling deposits by stokvels to bank.

## Acknowledgments

This research paper is a product of my unpublished Doctor of Philosophy's degree 2023 thesis entitled: "The role of stokvels in banking sector development in South Africa". This thesis may be found in the UNISA repository but is unpublished material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