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The Asymmetric Effect of Stokvel on Banking Sector Liquidity: Evidence From A Nonlinear ARDL Approaches

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Abstract

The objective of this study was to empirically investigate the possible nonlinear relationship between *stokvel saving* and banking sector liquidity, that is to determine whether there exists a turning point or a threshold level above which the effect of *stokvel saving* on banking sector liquidity switches from positive to negative in South Africa; to assess the long-run as well as the short-run relationship between the two variables, controlling for other *stokvel saving* determinants. The estimation of this relationship has been carried out using a novel methodology combining the autoregressive distributed lag (ARDL) bounds testing approach to cointegration developed by Pesaran, Shin and Smith (2001) and nonlinear autoregressive distributed lag (NARDL) applied to quarterly time series secondary data for the period from 2009Q4-2020Q2. The study results found that all the explanatory variables were statistically insignificant in explaining banking sector development implying that the NARDL is not an appropriate model for predicting banking sector development proxied by banking sector liquidity. Similar results obtained when using *stokvel savings* and money supply as the dependent variables suggesting an insignificant influence of baking sector liquidity on *stokvel savings* and money supply. With gross domestic product growth (GDPG) as the dependent variable, only a negative shock on money supply (M3) resulted in a significant increase in GDPG at 5%. *STOKVSAV* can provide the opportunity for the South African government and formal financial/banking sector to develop mutually beneficial relationships or linkages to make such *STOKVSAV* more effective and efficient in mobilising savings and advancing credit to the low- and middle-income households.

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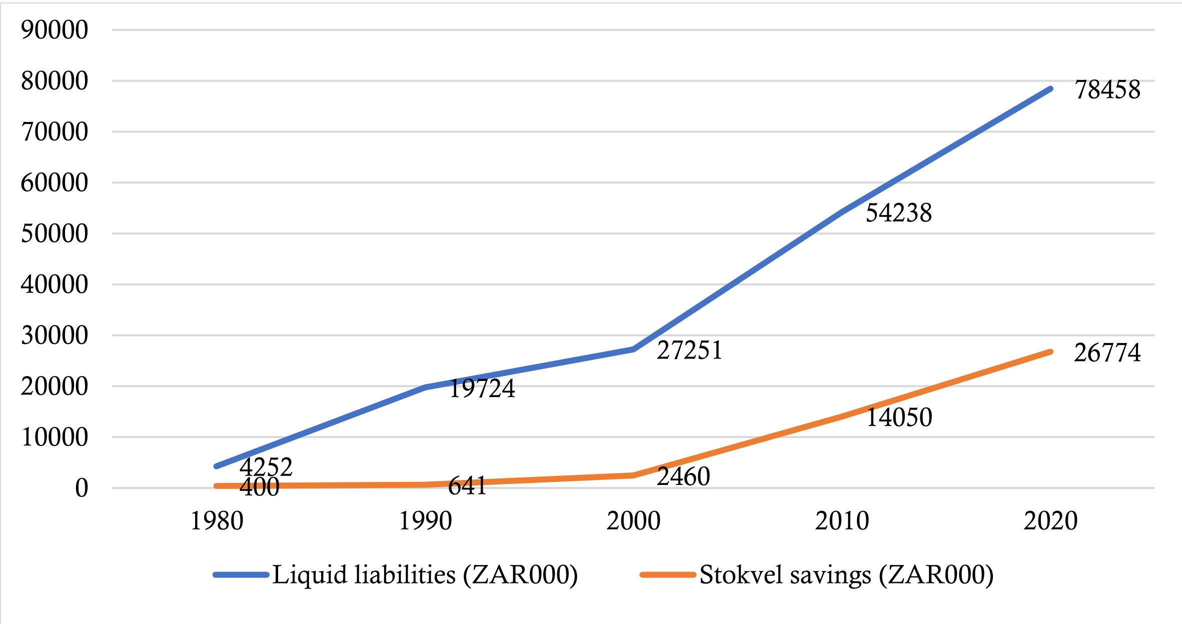
INTRODUCTION

A *stokvel saving* (STOKVSAV) is a South African term for an investment group where members contribute a certain amount to a central fund weekly, fortnightly or monthly; they typically constitute themselves as clubs or societies and are also known to be financially mutual (Bozzoli 1991; Lukhele 1990; Verhoef 2001a; Mashigo and Schoeman 2010; Kaseke and Matuku 2014; Karlan, Ratan and Zinman 2014; James 2015). Worldwide, *STOKVSAV* are commonly known as 'rotating savings and credit associations' (ROSCAs) (Kaseke and Matuku 2014; Karlan, Ratan and Zinman 2014; Mphahlele 2011; Yusuf, Gafar, and Ijaiya 2009). *STOKVSAV* play a pivotal role in increasing access to finance for the so-called 'unbanked' in South Africa (Dupas, Karlan, Robinson and Ubfal 2018). Instead of using banks, low- and middle-income households tend to save in more informal ways, such as keeping cash at home or buying illiquid assets, which may be costly, risky or inconvenient (Dupas, Karlan, Robinson and Ubfal 2018).

The rate of access to savings and credit by low- and middle-income South African households in the banking sector remains a challenge (Mishra and Bhardwaj 2022, Omar and Inaba 2020; Biyase and Fisher 2017; Goncharuk 2016). For instance, the banking sector in South Africa does not cater for the credit needs of low- and middle-income households due to information asymmetry and lack of collateral, among other borrower shortcomings (Atamja and Yoo 2021; Biyase and Fisher 2017; James 2014; Mashigo 2009; Mashigo and Schoeman 2012). This suggests that the banking sector is still not sufficiently developed to fully serve its diverse clientele (Duvendack and Mader 2019; Mashigo and Kabir 2016). Figure 1 below illustrates trends in growth of *stokvel savings* compared to formal bank deposits proxied by liquid liabilities. What is evident is that the share of *stokvel savings* is growing in sympathy with formal bank deposits. This trend is cause for concern as it is a recipe for allocational inefficiency of funds in informal financial markets due to financial disintermediation. In addition, the problem of information asymmetry derives from a lack of trust between the lender and the borrower, which results in a perceived challenge of the probability of low returns (Bime and Mbanasor 2019; Sackey 2018; Sukmaningsih 2018).



Source: Author construction.

Figure 1. Trends in stokvel savings and bank liquid liabilities

The ever-deteriorating economic situation, poverty and unemployment in South Africa are significant reasons for households to participate in stokvel savings (Chineka and Mtetwa 2021). According to Sambo (2019:1), unemployment is the number one cause of poverty and inequality in the country. In 2006, more than two out of every five (42.2%) households in South Africa lived below the upper-bound poverty line. While the poverty level was similar in 2009 at 42.7%, there was a decline in households living in poverty in 2011, with approximately a third (32.9%) of all households below this level. This shows a significant reduction in the proportion of poor households in the country from 2006 to 2011. However, given the results of the 2011 Census, this still translates into approximately 4.75 million households in South Africa living below the poverty line (Stats SA 2014).

Access to and the use of financial institutions by low- and middle-income households is complicated because the majority of stokvel savings members cannot provide valid Identity documents (Landman and Mthombeni 2021). Additionally, a lack of education influences member preference to communicate in their mother language when being served in financial institutions (Verhoef 2001b; Beck Kibuuka and Tiongson 2010; Moliea 2007; Mashigo 2012; Damodaram 2013). These are also the main reasons low- and middle-income households do not use formal financial institutions (Burkett and Sheehan, 2009; De Cock, Fitchett and Volkmann, 2005). Many South Africans are not part of the formal financial system; hence, they save, invest and use CR from stokvel savings (Kumarasinghe and Munasinghe 2016; Kaseke and Olivier 2008). This situation is not likely to improve in the short-term considering that unemployment has escalated by to 32.9% in the first quarter of 2024, up 0.8 percent of a percentage point from 32.1% in the fourth quarter of 2023 (StatsSA 2024:Q1). Additionally, in its expanded form, unemployment rose by 0.8 of a percentage point to 41.9% in 2024:Q1 relative to 2023:Q4. Implicitly, this is likely to cause a decrease in household capacity to save with formal banks and raise an appetite stokvel savings.

Despite playing second fiddle to formal banking institutions, stokvels are community-based savings schemes aimed at improving the lives of low- and middle-income earners (Van Wyk 2017; Floro and Seguino 2002). Members prefer saving with stokvels because of the transparency of transactions and the control it brings to their money (Bophela and Khumalo 2019; Storchi 2018). Money in this pool is then paid in full or partially to every member participating in the stokvel savings, either on a rotational basis or in times of financial need (Verhoef 2008; Matuku and Kaseke 2014; Nyandoro 2018). Low- and middle-income households often use precautionary savings for stokvel savings, which are meant to safeguard against any possible future unexpected income shocks, often referred to as "rainy days" or "emergency savings" (Simleit, Keeton and Botha 2011; Floro and Seguino 2002:1). Stokvel savings provide an alternative for low- and middle-income households which cannot meet the requirements of the banking sector (Nyandoro 2018; Mboweni 1990). This view is supported by Oji (2015), who observed that African countries have a proportion of financially excluded people, which reflects a lack of access to financial resources.

This research is different from prior similar empirical studies because using the multiple regression model, it attempts to show the nonlinear relationship of banking sector liquidity affected by stokvel savings in South Africa. Another advantage of the multiple regression model is that its results are more likely to be accurate because of its completeness. This is because it includes all the important variables in a single study, for example, the dependent variable banking sector liquidity (BSL), independent variable stokvel savings (STOKVSAV) and the control variables gross domestic product growth (GDPG) and money supply (M3).

The objective of this study was to empirically investigate the possible nonlinear relationship between stokvel savings (STOKVSAV) and banking sector liquidity (BSL). Thus, the paper sought to determine whether there exists a turning point or a threshold level above which the effect of STOKVSAV on banking sector liquidity switches from positive to negative in South Africa; to assess the long-run as well as the short-run relationship between the two variables, controlling for other STOKVSAV determinants. To this end, the paper hypothesises that there is a nonlinear relationship between stokvel saving and banking sector liquidity in South Africa. The estimation of this relationship was carried out using a novel methodology combining the autoregressive distributed lag (ARDL) bounds testing approach to cointegration developed by Pesaran, Shin and Smith (2001) and nonlinear autoregressive distributed lag (NARDL).

The remainder of the paper is organized as follows. A selected review of the theoretical and empirical literature, the methodology used, the empirical results, the summary, conclusions and the policy implications of the study are presented sequentially.

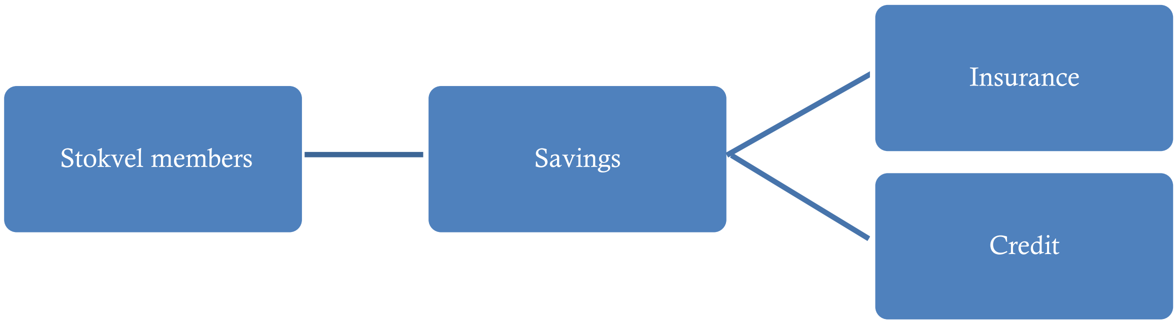
EMPIRICAL LITERATURE

The financial system pools together the savings generated in the household sector. (Levine, 1997). In the banking sector, this task is primarily performed by banks' local branches, which, being close to savers, can create stable relationships with savers based on trust and on the repeated provision of financial services (Giovannini, Lacopettaand Minetti 2013). Banks create a relationship with household savers, and the financial systems pool together savings by households which are referred to as liquid liabilities due to their short-term nature. An increase in savings leads to output growth by allowing an increase in investments. The banking sector induces the mobilisation of low- and middle-income households' savings, resulting in an increase in output growth (Gurley and Shaw 1960).

In this study, banking sector liquidity (BSL) is denoted by banking sector liquid liabilities as a percentage of GDP (Singh and Sharma 2016; Laštůvková 2016; Marozva 2013; Marozva 2015). Banking sector liquidity is expected to have a direct relationship with stokvel savings. The higher the liquidity the higher the households' incomes which then promotes stokvel savings. On the other hand, stokvel savings are expected to positively influence banking sector liquidity. The higher the stokvel savings the higher the liquid liabilities of the bank.

In South Africa, there are 11 official languages with different names for a 'stokvel'. For example, it is known as 'mohodisano' in Sotho-speaking regions, 'kuholisana' in isiZulu-speaking regions, 'umgalelo' in Xhosa-speaking regions and 'gooi-goois' in Afrikaans-speaking regions (Van Wyk 2017). Stokvels offer financial services outside of the domain of the banking sector of South Africa and are not governed by banking regulations (Tengeh and Nkem 2017). Terminology varies among countries; however, the names invariably signify some sort of community activity or derive from the name of the money fund, e.g., box-money, boxi. The participants are often referred to as 'players', sometimes as 'throwers' (Besson 1996), and the contributions may be termed the 'hand' or 'shares' (Handa and Kirton 1999). Sometimes the association may be known by the purpose for which the share-outs are to be used, e.g., kitchen ROSCAs (Niger-Thomas 1995) or named after the day on which members meet (Geert 1962; Ardener 1964; Low 1995). Figure 2 below presents the schematic conceptual framework of stokvels.

Informal savings organisations are known as stokvels and are substitutes for formal banks. Stokvels are formed by groups of friends to encourage social inclusion and poverty alleviation (Mashigo and Kabir 2016). They provide savings, credit and insurance services to households. They are easy to start up and banks have special accounts for group schemes (Mashigo 2012). A schematic framework of stokvels is presented in Figure 2 below.



Source: Author construction
Figure 2. Stokvel-conceptual framework

Snow and Buss (2001) view microcredit as a method for linking the formal and informal sectors of African economies to increase the reach of the formal sector. However, according to Nawai and Shariff (2010), loans given to the poor are minimal and are for a short-term period. Collateral is not needed, and borrowers are required to make weekly repayments. Similarly, Ngcobo and Chisasa (2018) study the characteristics of credit instruments issued by stokvels savings to households in South Africa. The study showed that stokvels savings issue short-term loans from less than three to six months. Thus, participating in a stokvel enhances the probability of accessing credit compared to the alternative of accessing credit from banks and similar formal lenders.

James (2017) examined how group lending can be used to improve access to credit by households. The study revealed that group lending mechanisms improve social capital and reduce the barriers that deter access to credit. Similarly, Karlan, Savonitto, Thuysbaert and Udry (2017) examined savings-led microfinance programmes in poor rural communities in developing countries to establish groups that save and then lend out the accumulated savings to each other. Their study's results found that promoting community-based microfinance groups leads to an improvement in household business outcomes and women's empowerment.

The majority of the world's poor live in rural areas of developing countries with little access to financial services. Setting up Village Savings and Loan Associations (VSLAs) has become an increasingly widespread intervention aimed at improving local financial intermediation (Ksoll, Lilleor, Lonborg and Rasmussen 2016). Habumuremyi, Habamenshi and Mvunabo (2019) assessed the role of VSLAs in improving the social economic development of poor households in Murundi Sector in Karongi District of Rwanda. The findings revealed that VSLA promotes financial inclusion where the loan is proportional to savings. Ksoll, Lilleor, Lonborg and Rasmussen (2016) used a cluster randomised trial to investigate the impact of VSLAs in Northern Malawi over a two-year period. Their study found evidence of positive and significant intention to increase savings and credit obtained through the VSLAs, which has increased agricultural investments and income from small businesses.

Ngcobo, Chisasa and MaseTshaba (2023) established the presence of a long-run relationship and causality between stokvel savings, money supply, gross domestic product growth rate and banking sector liquidity in South Africa. Applying the Autoregressive Distributed Lag (ARDL) and Error Correction Model (ECM) techniques on quarterly time series data for the period from 1987Q3 to 2020Q1, the study reveals that in the long run, stokvel savings and money supply were found to have a negative relationship with banking sector liquidity albeit insignificant, however, gross domestic product growth rate exhibited a negative and statistically significant relationship at 1%. The coefficient of the error correction model (ECM(-1)) was, as expected, negative and statistically significant thus providing evidence of a short-run relationship.

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 BSL. Equation 1 below is illustrative.

$$\mathrm{BSL} = f(STOKSAV, GDPG, M3) \tag{1}$$

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

$$\Delta \mathrm{BSL_t} = \beta_0 + \beta_1\, \Delta \mathrm{LnSTOKVSAV_t} + \sum_{j=1}^{n} X_{jt} + u_t \tag{2}$$

Where:
STOKVSAV - stokvel savings
X_{jt} - vector of control variables

If $\beta_1 \neq 0$ and have significance, meaning there exists a break-point and the impact of STOKVSAV on BSL is the difference between the two periods. The minimum stokvel savings is β_0 in the period before the break-point is ($\beta_0 + \beta_1$) in the period after the break-point. If $\beta 3>0$ 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:

$$\Delta LnBSL_t = \alpha_0 + \beta_1\, InBSL_{t-1} + \beta_2\, STOKVSAV_{t-1} + \beta_3\, GDPG_{t-1} + \beta_4\, M3_{t-1} + \sum_{k=0}^{m1} \alpha_{1k}\, \Delta InBSL_t + \sum_{k=0}^{m2} \alpha_{2k}\, \Delta STOKVSAV_{t-k} + \sum_{k=0}^{m3} \alpha_{3k}\, \Delta GDPG_{t-k} + \sum_{k=0}^{m4} \alpha_{4k}\, \Delta M3_{t-k} + \omega_t \tag{3}$$

Where:
Δ - first difference
$\beta 1$, $\beta 2$, $\beta 3$ and $\beta 4$ -coefficients of the long-run impacts
$\boldsymbol{\alpha} 1$, $\boldsymbol{\alpha} 2$, $\boldsymbol{\alpha} 3$ and $\boldsymbol{\alpha} 4$ - coefficients of the short-run impacts
$\boldsymbol{\omega}$ - 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:

$$\Delta \mathrm{BSL_t} = \beta_{0+}\ \beta_1\ \mathrm{BSL_{t-1}} + \beta_2\, \mathrm{STOKVSAV_{t-1}} + \beta_3\ \mathrm{GDPG_{t-1}} + \beta_4\, \mathrm{M3_{t-1}} + \mu_t \tag{4}$$

$$\mathrm{STOKVSAV_t} = \mathrm{STOKVSAV} + \mathrm{STOKVSAV_t}^{+} + \mathrm{STOKVSAV_t}^{-} \tag{5}$$

$$\mathrm{GDPG_t} = \mathrm{GDPG} + \mathrm{GDPG_t}^{+} + \mathrm{GDPG_t}^{-} \tag{6}$$

$$\mathrm{M3_t} = \mathrm{M3} + \mathrm{M3_t}^{+} + \mathrm{M3_t}^{-} \tag{7}$$

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

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

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

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

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

$$\mathrm{NEG}(\mathrm{M3_t}) = \sum_{s=0}^{t} \mathrm{M3}_s^{-} = \sum_{S=0}^{T} \mathrm{MIN}(\Delta \mathrm{M3_s}, 0) \quad (12)$$

$$\mathrm{POS}(\mathrm{M3_t}) = \sum_{s=0}^{t} \mathrm{M3}_s^{+} = \sum_{S=0}^{t} \mathrm{MAN}(\Delta \mathrm{M3_s}, 0) \quad (13)$$

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

$$\mathrm{BSL_t} = \mathrm{POS}^{+} \mathrm{STOKVSAV}_s^{+} + \mathrm{NEG}^{-} \mathrm{STOKVSAV}_s^{-} + \mathrm{u_t} \quad (14)$$

$$\mathrm{BSL_t} = \mathrm{POS}^{+} \mathrm{GDPG}_s^{+} + \mathrm{NEG}^{-} \mathrm{GDPG}_s^{-} + \mathrm{u_t} \quad (15)$$

$$\mathrm{BSL_t} = \mathrm{POS}^{+} \mathrm{M3}_s^{+} + \mathrm{NEG}^{-} \mathrm{M3}_s^{-} + \mathrm{u_t} \quad (16)$$

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.

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

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				
BSL	-	-5.282460***	-	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				
BSL	-6.810936***	-6.753963***	-6.680936***	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 BSL. These results align with the findings of Khan and Qayyum (2006). Additionally, a long-run relationship exists between GDPG, M3 and BSL.

Table 2. Bounds F-test for ARDL cointegration

Dependent variable	Independent variable	F-test statistic	Lower and upper- bounds
BSL	STKOVSAV GDPG M3	16.03214***	4.45– 6.36
STOKVSAV	GDPG M3 BSL	6.070329***	4.45-6.36
GDPG	STKVSA M3 BSL	9.043872***	4.45-6.36
M3	STKVSA GDPG BSL	4.281633***	4.66-3.2

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

Results revealed an F-statistic lower than the lower bound and were statistically significant. This implies that the null hypothesis of no cointegration was accepted as the F-statistic lay below the lower bound of the F-statistic. Thus, it was concluded that there is no long-run relationship between BSL and its explanatory variables. When *STOKVSAV* and GDPG were used as dependent variables, the F-statistics of 67.82906 and 7.074817, respectively, were found to be greater than the upper bounds, suggesting the presence of a long-run relationship between the dependent variables and their predictors. Thus, the null hypothesis of no cointegration was rejected. However, the same could not be said about the relationship between *STOVSAV*, GDPG and M3. The F-statistic of 3.613920 was found to be between the upper and lower bounds, implying that the relationship is inconclusive. The F-statistics were statistically significant at 1% in all four cases.

Table 3. Banking sector liquidity

	BSL		
BSL	STOKVSAV GDPG M3	1.398563***	2.53-3.59
STOKVSAV	BSL GDPG3 M3	67.89206***	3.59-4.9
GDPG	BSL STKVSA M3	7.074817***	3.59-4.38
M3	BSL STKVSA GDPG	3.613920***	3.2-4.66

Note: F-statistic values are calculated by bounds testing approach by Pesaran, Shin and Smith (2001) and Shin, Yu and Greenwood-Nimmo (2014). The null hypothesis of asymmetric cointegration is $p = \theta^{+} = \theta^{-} = 0$

Asymmetric non-linear ARDL long-run results

The presence of asymmetry in the long-run equilibrium due to negative and positive shocks in stokvel savings was examined. Using banking sector liquidity as the dependent variable, all the explanatory variables were found to be statistically insignificant in explaining banking sector development implying that the N-ARDL is not an appropriate model for predicting banking sector development proxied by banking sector liquidity. Similar results obtained when using stokvel savings and money supply as the dependent variables suggesting an insignificant influence of baking sector liquidity on stokvel savings and money supply. With GDPG as the dependent variable, only a negative shock on money supply resulted in a significant increase in GDPG at 5%.

Table 4. N-ARDL Long Run Form and Bounds Test (3.4.4.4.4.4.4) on BSL

N-ARDL Long-Run Coefficients Result				
BSL				
Variable	**Coefficient**	**St.Error**	**t.Statistic**	**Prob**
STOKVSAV_POS	-0.148380	0.053603	-2.768109	0.0697
STOKVSAV_NEG	-0.168193	0.068647	-2.450116	0.0917
GDPG_POS	-1.432016	0.836693	-1.711519	0.1855
GDPG_NEG	-1.335738	0.771733	-1.730830	0.1819
M3_POS	-0.000454	0.001863	-0.243590	0.8233
M3_NEG	-0.000323	0.000875	-0.368924	0.7367
STOKVSAV				
BSL_POS	99.12984	38.07290	2.603685	0.0801
BSL_NEG	150.7024	54.76167	2.751968	0.0706
GDPG_POS	-44.22538	20.48404	-2.159017	0.1197
GDPG_NEG	-49.40970	22.31685	-2.214008	0.1137
M3_POS	-0.411536	0.160589	-2.562666	0.0830
M3_NEG	0.283400	0.113765	2.491108	0.0884
GDPG				
BSL_POS	-1.407221	0.809725	-1.737900	0.1258
BSL_NEG	-0.911961	0.551559	-1.653425	0.1422
STOKVSAV_POS	-0.074372	0.036830	-2.019350	0.0832
STOKVSAV_NEG	-0.072385	0.039913	-1.813560	0.1126
M3_POS	-0.001263	0.001185	-1.066353	0.3217
M3_NEG	-0.002837	0.001051	-2.698173	0.0307
M3				
STOKVSAV_POS	-43.55979	23.53003	-1.851242	0.1013
STOKVSAV_NEG	-43.19048	26.22274	-1.647062	0.1382
BSL_POS	-468.8431	271.1939	-1.728811	0.1221
BSL_NEG	-303.9212	206.5404	1.471486	0.1794
GDPG_POS	-231.4554	109.5958	-2.111901	0.0677
GDPG_POS	-291.8407	127.8901	-2.2811965	0.0519

Short- and long-run multipliers

The adjustment of asymmetry in the long-run equilibrium due to negative and positive shocks in *stokvel savings* have been explored with the use of a dynamic multiplier graph. The multipliers for the variables are plotted in Figure 3, which portrays adjustments to a new equilibrium after positive and negative shocks. The black dotted line indicates the non-linear adjustment of BSL to adverse shocks, whereas the solid black line portrays the adjustment of BSL to a positive shock. The asymmetric pattern indicated by the red dotted line is the difference between both negative and positive shocks (Andriamahery and Qamruzzaman 2022). In the long-run, when BSL is the dependent variable, any positive or negative changes in stokvel savings (*STOKVSAV+* or *STOKVSAV-*) do not significantly impact BSL. The same is observed for gross domestic product growth and money supply (GDPG+ or GDPG-; M3+ or M3). Therefore, N-ARDL is not the best model to detect the presence of a long-run relationship between BSL and stokvel savings, GDPG and M3, which are used as the independent variables.

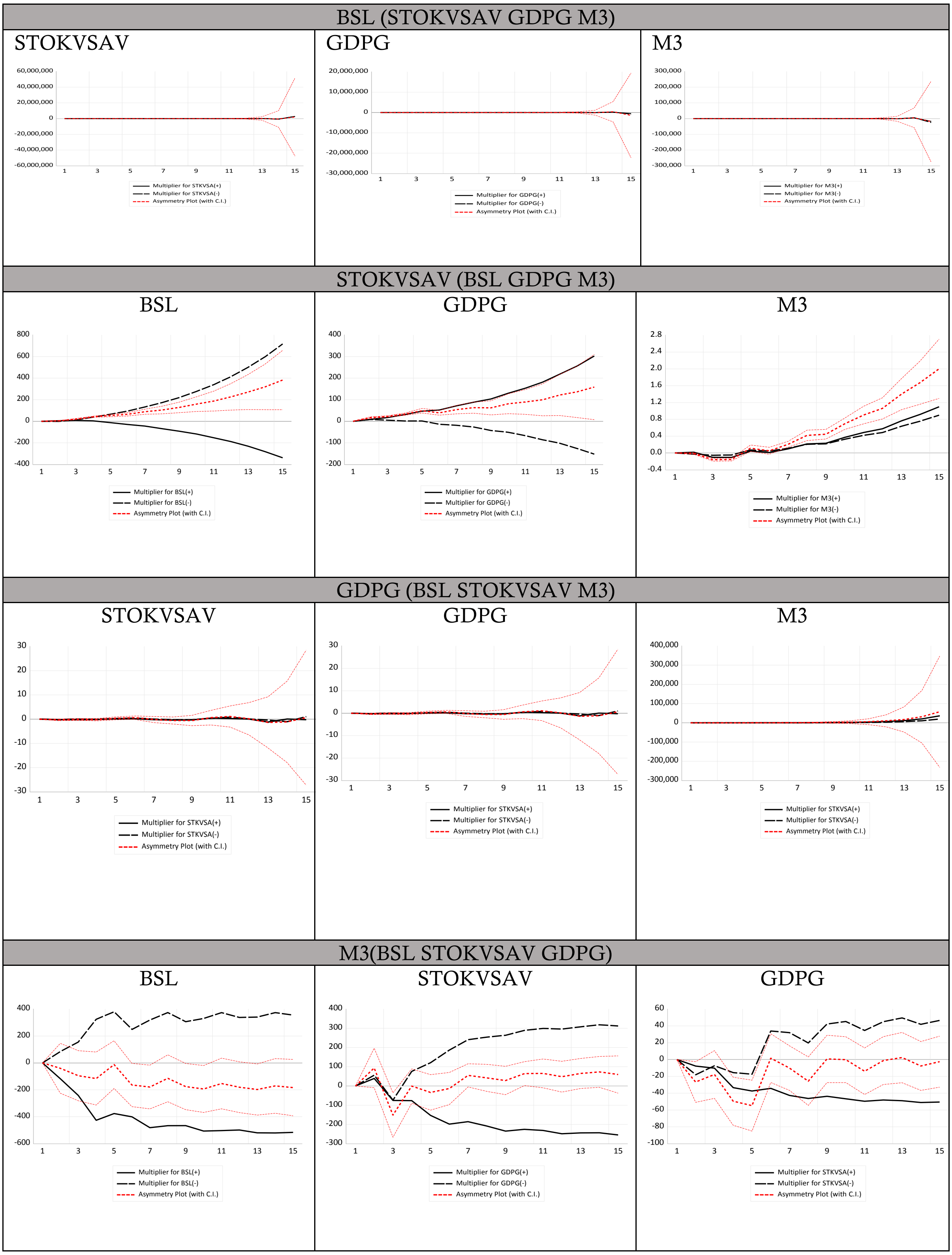


Figure 3. Short- and long-run multipliers

CONCLUSION

The study empirically investigates the possible nonlinear relationship between *stokvel saving* and banking sector liquidity using quarterly time series secondary data ranging from 2009Q4-2020Q2. 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 ARDL show that the value of the F-statistic for all three models (*STOKVSAV*, GDP and M3) are greater than the upper-bound critical values suggesting that the null hypothesis can be rejected. The asymmetry results revealed that in the long-run equilibrium due to negative and positive shocks in *STOKVSAV* was examined using BSL as the dependent variable, all the explanatory variables were found to be statistically insignificant in explaining banking sector development implying that the N-ARDL is not an appropriate model for predicting banking sector development proxied by BSL. Similar results obtained when using multipliers that in the long-run, when BSL is the dependent variable, any positive or negative changes in stokvel savings (*STOKVSAV*+ or *STOKVSAV*-) do not significantly impact BSL. The same is observed for gross domestic product growth and money supply (GDPG+ or GDPG-; M3+ or M3). N-ARDL is not the best model to detect the presence of a long-run relationship between BSL and *STOKVSAV*, GDPG and M3, which are used as the independent variables. The study suggests that *STOKVSAV* can provide the opportunity for the South African government and formal financial/banking sector to develop mutually beneficial relationships or linkages to make such *STOKVSAV* more effective and efficient in mobilising savings and advancing credit to the low- and middle-income households.

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