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**-RESEARCH ARTICLE-**

# FINANCIAL DEVELOPMENT – INCOME INEQUALITY NEXUS IN SOUTH AFRICA: A NONLINEAR ANALYSIS

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**-Abstract-**
*This study was aimed at investigating the nonlinear effect of financial development on income inequality in South Africa. Annual data from 1970 to 2018 was investigated, and based on the ARDL bounds testing technique, the estimates indicated that financial development exerts a nonlinear impact on income inequality. In addition, the relationship between the two variables was found to be U-shaped, implying that financial development at early stages narrows the income-inequality gap before crossing certain thresholds beyond which the gap is widened. These results could imply the presence of market imperfections such as prohibitive transaction costs, information asymmetries, as well as collateral and credit history constraints in the system. Consequently, the monetary authorities should prioritise an evaluation of the nation's financial system, with a view to reducing imperfections in the markets so as reduce income inequality through the mechanism of financial development.*

**Keywords:** Inequality, financial development, ARDL, bounds testing, nonlinear
**JEL classification:** D6:D63; G2:G21

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## 1. INTRODUCTION

Over the years, income inequality has continually been a major issue of concern to development and welfare economists, especially in developing countries as it is considered to be a major impediment to welfare development and peaceful coexistence. It is therefore not surprising that reducing inequality within and among nations constitutes Goal 10 of the United Nations' sustainable development goals (SDGs). In South Africa, the problem of income inequality has long been a major source of concern for a number reasons. Firstly, for a long time, inequality has been acknowledged as one of the most notable attributes of the country. Secondly, the inequality situation in South Africa has been persistent over the years, giving rise to the country being consistently ranked among the most unequal countries in the world (Stats SA, 2019). Thirdly, the income inequality being experienced in the country is very deep, with the gap being disproportionately wide to the detriment of the vast majority of the income earners (WID, 2019). Recent figures indicate that a whopping 65% of all income in the economy goes to the top 10% of the income earners, while only 35% of all income is shared among the remaining 90%, who constitute an overwhelming majority of all income earners. The figures also portray the top 1% of the income earners as earning approximately 20% of all income in the economy (WID, 2019).

In its review of Goal 10 of the SDGs, the United Nations (2019) suggested the need for sound and robust financial systems as a way of promoting equal access to financial services, as part of the measures to reduce income inequality. This suggestion is in line with the recent preponderance of interest among policymakers and researchers being shown on the relevance of financial development as a tool for narrowing income inequality. According to Gehringer (2013), financial development refers to the improving of the quality of financial services, as well as the observance of financial depth in an economy. The connection between financial development and income inequality has been described in the literature by two linear hypotheses: The inequality-narrowing hypothesis and the inequality-widening hypothesis. While the former holds that financial development reduces income inequality by increasing access to financial services to the poor (Hamori & Hashiguchi, 2012; Beck, Dermirguc-Kunt & Levine, 2007), the latter suggests that financial deepening would only aggravate income inequality, as the poor might lack collaterals and loan repayment capability, thereby further excluding them from financial services (Ang, 2010).

However, recent empirical studies have explored the possibility that the relationship between income inequality and financial development follows a

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nonlinear pattern, more especially as a way of testing the Greenwood and Jovanovic (1990) hypothesis that the relationship between the two variables is inverted U-shaped. According to their postulation, the poor would have very limited or no access to financial services at the early stages of development because of the accompanying initial costs that are unaffordable to them; therefore, only the rich would benefit from financial deepening at that stage, thereby aggravating income inequality. However, as time goes on and financial services deepen beyond a threshold, such costs would become affordable to the poor, which would grant them increasing access to financial services, thereby leading to a narrowing of income inequality. This position has been corroborated by the majority of studies on the nonlinear relationship between the two variables (Kim & Lin, 2011; Deida 2006; Townsend & Ueda, 2006; Smith, 2003; Acemoglu & Zilibotti, 1997; Greenwood & Smith, 1997). Contrariwise, findings from few other studies by Tan and Law (2012), Clarke et al. (2003) and Nasreddine and Mensi (2016) denied this hypothesis. showed that the relationship between financial development and income inequality is U-shaped. While Clarke et al. (2003) denied the validity of the inverted U-shaped hypothesis, the remaining two studies found the relationship between the two variables to be nonlinear and U-shaped. Hence, the nature of the relationship between financial development and income inequality cannot be said to be conclusive.

The financial sector in South Africa has gone through several stages of development over time and, going by the level of financial development in developing countries, South Africa is considered as one of the countries Africa with the most developed and robust financial systems (IMF, 2016). For instance, it has been credited with experiencing rapid development since the 1980s and as one of the few in Africa with depth (Franklin & Allen, 2011). Furthermore, according to the IMF (2016), it has the highest percentage of financial inclusion in Africa and it remains one of the few countries with higher standards in the implementation of Basel accords. However, the nature of its impact on the high level of income inequality experienced in the country has not received adequate attention in the literature, as studies on the subject are sparse for South Africa. While Kapingura (2017) presumed a linear relationship in his study of the subject, a recent study by Adams and Klobodu (2019) investigated a nonlinear relationship between the two variables, but did not consider the determination of threshold of financial development beyond which the income-inequality gap is narrowed or widened in their analysis. Determining a threshold of financial development regarding its effect on income inequality could help monetary authorities to guide the financial sector towards an optimal level of development as part of their

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oversight functions. Furthermore, while it has been clearly established that financial development serves as a mechanism for engendering long-term economic growth across countries (Ang & McKibbin, 2007; Beck & Levine, 2004; Demetriades & Hussein, 1996), the same conclusion cannot be drawn with regard to the nature of its effect on income inequality for different countries. This study is therefore aimed at contributing to the debate on the nature of the relationship between financial development and income inequality in South Africa by investigating the nonlinear effect of financial development on income inequality. The rest of the paper is organised as follows. Section 2 provides a review of the literature, while section 3 highlights the methodology. Results from data estimation are presented and discussed in section 4, while section 5 concludes the study.

## 2. LITERATURE REVIEW

As noted earlier in the study, the literature on financial development-income inequality nexus is predicated on inequality-narrowing and inequality-widening hypotheses, and more recently a nonlinear hypothesis. In their investigation of the effect of financial development on the poor, for a broad cross-country sample between 1980 and 2005 and using OLS and GMM, Beck et al. (2007) found that financial development disproportionately enhances the income of the poor and narrows the income-inequality gap. In a similar study by Clarke, Xu and Zou (2006), on the finance-income inequality nexus for 83 developing and developed economies for the period 1960 to 1995, findings from the panel analysis indicated that the income-inequality gap is generally narrower in economies with more developed financial markets. They also pointed out that the level of income inequality reduces in the economies as they develop their financial system. In another study involving 91 countries over the same period (1960-1995), Clarke et al. (2003) found that developing financial intermediary lowers income inequality. Furthermore, in a study on the connection between financial development and inequality for Brazil in the 1980s and 1990s, Bittencourt (2006) used pooled OLS and the instrumental variable estimator and concluded that deepening the financial and credit markets is very effective in reducing income inequality.

On the other hand, a study to investigate the financial sector development-inequality nexus in South Africa was conducted by Kapingura (2017) using quarterly data over the period 1990 to 2012. The study concluded that financial development on its own cannot reduce inequality and that it can only benefit the poor when it is inclusive. In another study of provinces in China from 1991 to 2000, Liang (2006) employed the GMM technique and concluded that financial

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development greatly contributes to the reduction of rural income distribution in the provinces. Furthermore, Fowowe and Abidoye (2013), in an investigation of African countries used the OLS and system GMM technique. They concluded that financial development has no significant effect on poverty and inequality and that financial systems in Africa are deficient and require intensified effort to render it accessible to the poor.

Meanwhile, building on Kuznet's (1955) hypothesis of inverted U-shaped link between income inequality and economic development, Greenwood and Jovanovic (1990) hypothesised that the relationship between financial development and income inequality follows an inverted U-shaped pattern, in which case income inequality first widens in the face of increased sophistication of the financial system, during which the poor are excluded. Thereafter, the level of income inequality stabilises, before eventually reducing as the sector deepens and enables greater participation. This hypothesis was later corroborated by Deida (2006), Greenwood and Smith (1997), Smith (2003) and Townsend and Ueda (2006). In a similar vein, Acemoglu and Zilibotti (1997) claimed that for gains from financial development to be reaped, it has to develop up to a certain minimum level, which would enable enough funds to be mobilised for investment projects for higher returns. Furthermore, a study by Adams and Klobodu (2019) confirms the hypothesis for South Africa by investigating annual data from 1965 to 2014, and using cointegration methods of DOLS and FMOLS, they concluded that the relationship between financial development and income inequality in the country is inverted U-shaped.

On the other hand, findings from some studies contradict the abovementioned hypothesis. In his analysis involving the use of numerical simulations, Bhattacharya (2011) denies the validity of the inverted U-shape hypothesis. He claims, though, that the GINI coefficient always rises at the early stage of development, and once it begins to fall, it does not necessarily need to fall continuously. Similarly, in an investigation of 28 developing countries from 1980 to 2000 and using the GMM estimation technique, Tan and Law (2012) found that the relationship between financial deepening and income inequality is nonlinear and U-shaped, which bespeaks narrowing the income-inequality gap at the early stages of development until a certain threshold of financial deepening is crossed beyond which the income-inequality gap begins to widen. In a similar study, a sample of 42 sub-Saharan African countries was investigated over the period 1996 to 2015 using the system GMM technique on the relationship between financial development and income inequality by Adeleye, Osabuohien and Bowale (2017). Estimates from their study indicated the persistence of income inequality in the

region. They further found that financial development does not significantly reduce income inequality until corruption is controlled for, after which domestic credit exerts a nonlinear and inverted U-shaped effect on income inequality. Lastly, a similar result was obtained by Law and Tan (2009) in their investigation of the effect of financial development on income inequality in Malaysia from 1980 to 2000. The empirical findings based on the ARDL bounds testing approach revealed that financial development is at best very weak and insignificant in narrowing the income-inequality gap in the country. In addition, estimates from their investigation draw attention to the need for the government to intensify efforts to improve the quality of institutions, as well as maintaining low inflation.

In conclusion, though there seems to be an implicit assumption that deepening financial services in an economy automatically leads to a narrowing of the income-inequality gap, the review of empirical literature has shown that this assumption is not necessarily true, as shown by the various dimensions of effect that financial development exerts on income inequality from the reviewed literature on the subject.

## 3. METHODOLOGY

Kuznet's (1955) curve remains the prominent theoretical model often used to explore nonlinearity in the financial development-income inequality nexus. Kuznet (1955) had theorised that the inequality-economic development nexus is inverted U-shaped. An extension of Kuznet's hypothesis was developed by Greenwood and Jovanovich (1990), who hypothesised that the relationship between financial development and income inequality is nonlinear and inverted U-shaped. They posited that deepening the financial system initially leads to an increase in income inequality, which later stabilises and eventually reduces as financial inclusion improves.

To achieve the objective of the study, an econometric model is specified in line with Greenwood and Jovanovich (1990) hypothesis as follows:

$$GINI_t = \alpha + \beta_1 FD_t + \beta_2 FD_t^2 + X_t + \varepsilon_t \qquad (1)$$

where $GINI$ represents income inequality, $FD$ is financial development variable, $FD^2$ is the squared term of the financial development variable, $X$ is a vector of control variables, $t$ is the time index and $\varepsilon$ is the error term. The inclusion of the squared term of the financial development variable in the model enables the determination of the nonlinear effect of financial development on income

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inequality. As such, equation (1) is based on the hypothesis that the impact of financial development on income inequality is not always negative or positive, such that financial development at lower levels could widen (or narrow) the income-inequality gap before reaching a certain threshold beyond which it begins to narrow (or widen) the income-inequality gap. In this model, if $\beta_1$ and $\beta_2$ were both significant with the former and the latter being negative and positive respectively, then the relationship is U-shaped or convex. On the other hand, if $\beta_1$ and $\beta_2$ were both significant with the former and the latter being positive and negative, respectively, then the relationship is inverted U-shaped or concave. From the equation, the external debt threshold can be estimated by finding the first partial derivative of income inequality with respect to financial development and setting the same equal to zero to obtain equation (2) as the financial development threshold:

$$\frac{\partial GINI_t}{\partial FD_t} = \frac{-\beta_1}{2\beta_2} \qquad (2)$$

For parameter estimations, the autoregressive distributed lag (ARDL) or bounds testing technique introduced by Pesaran, Shin and Smith (2001) has been employed because it is considered by many researchers as being superior to traditional cointegration techniques, given its several merits in comparison with other methods. Firstly, the ARDL technique enables a simultaneous estimation of both long-run and short-run parameters in a model. Secondly, Pesaran et al. (2001) demonstrated that with some modifications to the standard cointegration techniques, ARDL is able to produce consistent and efficient long-run results for a model containing variables that are either I(0) and/or I(1). Thirdly, the technique is able to avoid the problem of endogeneity. The ARDL representation of equation is expressed as follows:

$$\Delta GINI_t = \emptyset + \sum_{i=1}^{p} \theta_1 \Delta GINI_{t-i} + \sum_{i=1}^{p} \theta_2 \Delta FD_{t-i} + \sum_{i=1}^{p} \theta_3 FD_{t-i}^2 + \sum_{i=1}^{p} \theta_4 \Delta X_{t-i} +$$
$$\vartheta_1 GINI_{t-1} + \vartheta_2 FD_{t-1} + \vartheta_3 FD_{t-1}^2 + \vartheta_4 X_{t-1} + \varepsilon_t \qquad (3)$$

The bounds testing approach of Pesaran et al. (2001) is predicated on the null hypothesis of the absence of long-run relationship between the variables $(H_0: \vartheta_1 = \vartheta_2 = \vartheta_3 = \vartheta_4 = 0)$, against the alternative hypothesis that there is a

long-run relationship between the variables ($H_1: \vartheta_1 \neq \vartheta_2 \neq \vartheta_3 \neq \vartheta_4 \neq 0$). The long-run relationship among the variables in equation (3) is tested for the joint significance of estimated coefficients of the lagged level from which the F-statistic is computed; the computed F-statistic is then compared with the two critical values provided by Pesaran et al. (2001). The first critical value that assumes that all variables are I(0), is the lower bound, while the second critical value, which assumes all variables to be I(1), is the upper bound. If the computed F-statistic is greater than the upper bound critical value, then the null hypothesis that there is no long-run relationship among the variables is rejected. On the other hand, if the computed F-statistic is less than the lower bound critical value, then the null hypothesis of no long-run relationship among the variables cannot be rejected. In the event that the computed F-statistic falls between the lower bound and upper bound critical values, then the result is inconclusive. This requires the use of the significance or otherwise of the error correction term to conclude on the existence or otherwise of cointegration, respectively.

This study employed annual data covering a period of 49 years from 1970 to 2018 for South Africa. Income inequality was measured by the GINI index, which is reputed for being the most used indicator of income inequality (Milanovic, 2014; Kim & Lin, 2011). The variable was drawn from the Global Consumption and Income Project (GCIP), computed by Lahoti, Jayadev and Reddy (2016), and it ranges from 0 to 1. While the former indicates perfect income equality, the latter signifies perfect income inequality. This implies that the closer a country's GINI index is to 0, the narrower the level of income inequality in the country will be and vice-versa. As for financial development, two different indicators drawn from World Bank's WDI were used to measure it. First is the private credit, which is a measure of credit from the financial institutions to the private sector as a percentage of GDP. The second measure is the broad money income velocity, otherwise known as the monetisation ratio. It is computed as the ratio of M2 to GDP. The control variables in the model comprise the log of real GDP per capita, measuring economic growth and the consumer price index, measuring inflation. Both were drawn from WDI.

## 4. DISCUSSION OF EMPIRICAL FINDINGS

### 4.1 Descriptive statistics

Table 1 shows the summary of descriptive statistics. The mean GINI index for the study period stands at 0.656632, which is closer to 1 (perfect inequality) than to 0 (perfect equality). This confirms the high level of income inequality in the country as mentioned earlier. The average private credit and broad money are 64.67 and

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59.96, respectively. This figures bespeaks a reasonable level of financial development for a developing economy. Furthermore, the kurtosis statistics show that only the GINI index is characterised by a leptokurtic (peaked) distribution, as the value of its kurtosis at 7.86 is higher than 3. The remaining variables are characterised by platykurtic distribution, as their kurtosis is less than 3.

**Table 1: Descriptive statistics**

| | GINI | PC | BM | GDP | CPI |
|---|---|---|---|---|---|
| Mean | 0.656632 | 64.66586 | 59.95891 | 6520.084 | 50.29152 |
| Maximum | 0.851645 | 84.42205 | 80.79989 | 7582.697 | 152.6328 |
| Minimum | 0.571887 | 49.52513 | 45.50002 | 5517.53 | 2.346818 |
| Std. Dev. | 0.051437 | 10.61759 | 9.688121 | 629.7601 | 45.26903 |
| Kurtosis | 7.860185 | 1.664267 | 2.153622 | 1.97692 | 2.303338 |
| Obs. | 49 | 49 | 49 | 49 | 49 |

Note: GINI=GINI index, PC=Private credit, BM=Broad money income velocity, GDP=Real GDP per capita and CPI=Consumer price index

## 4.2 Unit root tests

To determine the order integration of the variables in the model, the traditional unit root tests of augmented Dickey and Fuller (1975) and Phillips and Perron (1988) were employed. Table 2 reports the results of the two tests and it shows that only the GINI index is stationary at level, while all the remaining variables only become stationary after the first difference. These results confirm that the variables in the model are integrated of orders 0 and 1, indicating that none of the variables are integrated of order 2 or higher.

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**Table 2: Unit root tests**

| | **Augmented Dickey-Fuller** | | **Phillips-Perron** | |
|---|---|---|---|---|
| | Level | 1st Diff. | Level | 1st Diff. |
| GINI | -3.0717** | -8.2576*** | -3.0133** | -9.1852*** |
| PC | -2.1025 | -7.8713*** | -2.1077 | -7776*** |
| PC2 | -2.1819 | -7.6765*** | -2.2192 | -7.6001*** |
| BM | -1.6039 | -4.9889*** | -1.5268 | -5.0039*** |
| BM2 | -1.7431 | -4.4659*** | -1.5821 | -4.4659*** |
| LGDP | -1.2154 | -4.3215*** | -0.8257 | -4.2598*** |
| CPI | -0.6363 | -3.3162** | -0.2338 | -3.3797** |

Notes: ** and *** indicate significance at 5% and 1% respectively; GINI=GINI index, PC=Private credit, BM=Broad money income velocity, GDP=Real GDP per capita and CPI=Consumer price index.

## 4.3 Bounds testing for cointegration

Table 3 reports the results of the bounds testing for cointegration among the variables in the models. The first model has private credit as the financial development variable, while the second model has broad money income velocity as the financial development variable. The F-statistics are computed at 9.275 and 8.642 for private credit and broad money models respectively. Both of them are greater than their respective upper bound critical values, which indicates that the variables in both models are cointegrated.

**Table 3: Bounds test for cointegration**

| | Private credit model | Broad money model |
|---|---|---|
| F-statistic | 9.275*** | 8.642*** |
| Critical value | 1% | 1% |
| Lower bound | 3.74 | 3.74 |
| Upper bound | 5.06 | 5.06 |

Note: *** indicates significance at 1%.

## 4.4 Regression results

Table 4 reports both the long-run and short-run estimates of the parameters in the two models. The long-run estimates of the private credit model indicate that both private credit and its squared term are statistically significant at 1%. In addition, while private credit carries a negative sign, its squared term carries a positive sign. These results indicate that the relationship between financial development and income inequality is nonlinear and U-shaped. This finding implies that financial

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development exerts dual impacts on income inequality in South Africa, in which case, financial development, when at early stages of development, narrows the income-inequality gap, before widening it after private credit crosses a certain reshold. This result supports some extant findings (Nasreddine & Mensi, 2016; Tan & Law, 2012), who found the relationship between financial deepening and income inequality to be nonlinear and U-shaped. However, it contradicts some previous studies that validate the Greenwood and Jovanovich (1990) hypothesis (Adams & Klobodu, 2019; Kim & Lin, 2011; Deida, 2006; Townsend & Ueda, 2006; Smith, 2003; Acemoglu & Zilibotti, 1997; Greenwood & Smith, 1997). This might result possibly because of the presence of market imperfections such as prohibitive transaction costs, information asymmetries as well as collateral and credit history constraints in the system. These imperfections are capable of obstructing the flow of funds and other financial services to the poor (Galor & Moav, 2004), and according to Banerjee and Newman (1993) and Galor and Zeira (1993), if present in an economy, they would almost certainly prevent the long-run convergence in the poor-rich income levels.

The dual impacts of financial development on income inequality, and the consequent U-shaped relation between the two variables, suggest the existence of an optimum threshold of financial development beyond which it aggravates income inequality. This threshold is determined by solving equation (2) to obtain private credit at 62.87% of GDP (0.064626/2(0.000514) = 62.87). This result indicates that financial development narrows the income-inequality only when the level of private credit falls below 62.87% of GDP. As soon as it crosses the threshold, the income-inequality gap begins to grow wider. The coefficient of log of GDP is negative and significant at the 1% level, which implies that an increase in economic growth leads to a reduction in income inequality. The consumer price index is found to be positive and insignificant, indicating that inflationary pressures in the economy do not affect income inequality.

As for the short-run estimates, the coefficients of private credit and its squared term are both significant and bear negative and positive signs, respectively. This indicates that just as the long-run results indicate, financial development also exerts a nonlinear impact on income inequality in the short run. The threshold of private credit in the short run is computed at 60.83% of GDP. The log of GDP is negative and significant at the 1% level, indicating that an increase in economic growth also reduces income inequality in the short run. Consumer price index is positive and insignificant, which implies that inflationary pressures do not influence income inequality in the short run.

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For the second model, the long-run results show that both broad money income velocity and its squared term are significant at 1%. In addition, they bear negative and positive signs, respectively, confirming that the relationship between financial development and income inequality is nonlinear and U-shaped, in line with the estimates of the first model. This result implies that financial development only reduces income development at its early stage, but leads to a widening of inequality as soon as a certain threshold of broad money income velocity is crossed. The threshold is computed at 57.42 of GDP. The log of GDP is negative and significant at 10%, indicating that improvement in economic growth helps in reducing income inequality in the long run. The coefficient of CPI is positive, but insignificant, which indicates that inflation does not affect income inequality in the long run. As for the short-run estimates, while the squared term of broad money and log of GDP are significant at 10%, the remaining variables are insignificant. This indicates that economic growth reduces income inequality in the short run, while the rest of the variables do not influence inequality in the short run. Another important result is that of the error correction term (ECT). In each of the two models, the ECT is found to be negative, less than one and statistically significant at the 1% level. These results indicate that any previous deviation from long-run equilibrium would be corrected at the high adjustment speeds of 84.3% and 94.6% for models 1 and 2, respectively.

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**Table 4: ARDL results**

| | **Private credit model** | | **Broad money model** | |
|---|---|---|---|---|
| | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Long-run results: | | | | |
| PC | -0.064626*** | -5.781785 | | |
| PC2 | 0.000514*** | 6.110634 | | |
| BM | | | -0.05249*** | -5.018453 |
| BM2 | | | 0.000457*** | 5.617206 |
| LGDP | -0.227807*** | -2.810294 | -0.211236* | -1.815038 |
| CPI | 0.000039 | 0.148763 | 0.00015 | 0.54607 |
| Short-run results: | | | | |
| ECT | -0.842708*** | -6.437372 | -0.94589*** | -6.438746 |
| D(PC) | -0.022873** | -2.060098 | | |
| D(PC2) | 0.000188** | 2.341107 | | |
| D(BM) | | | -0.020796 | -1.672069 |
| D(BM2) | | | 0.000175* | 1.769083 |
| D(LGDP) | -0.191975*** | -2.71709 | -0.199805* | -1.814617 |
| D(CPI) | 0.000033 | 0.148205 | -0.006546 | -1.464948 |

Notes: Dependent variable: GINI Index; PC=Private credit; BM=Broad money income velocity; GDP=Real GDP per capita and CPI=Consumer price index; *, ** and *** indicate significance at 10%, 5% and 1% respectively.

## 4.5 Diagnostics

Table 5 reports the results of the diagnostic tests conducted on the models in this study. The results of the normality tests in the two regressions indicate failure to reject the null hypothesis that the residuals are normally distributed. Consequently, the variables in both models exhibit normal distribution. Furthermore, the two models are free from the problem of serial correlation, as the probability values exceed 0.05, indicating that the null of the absence of serial correlation cannot be rejected. Finally, the models do not suffer from heteroscedasticity, as the probability value of the chi-square coefficient is insignificant.

**Table 5: Diagnostic tests**

| | Private credit model | Broad money model |
|---|---|---|
| | Probability | Probability |
| Normality | 0.1874 | 0.1143 |
| Serial correlation (LM) | 0.6626 | 0.6611 |
| Residual heteroscedasticity | 0.1507 | 0.1774 |

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### 4.6 Tests for stability

Figures 1 and 2 report the results of the stability tests conducted on the models. The stability of the estimates is tested by means of the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) tests suggested by Brown, Durbin and Evans (1975). The results of the tests show that estimates in both regressions are stable as the plots of both CUSUM and CUSUMSQ statistics fall within the 95% confidence level for both models.

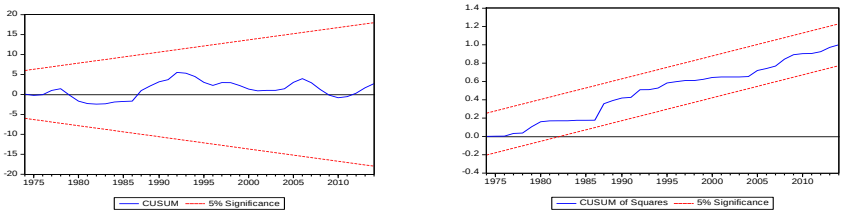


**Fig. 1:** CUSUM and CUSUM of squares plots of recursive residuals (model with private credit)

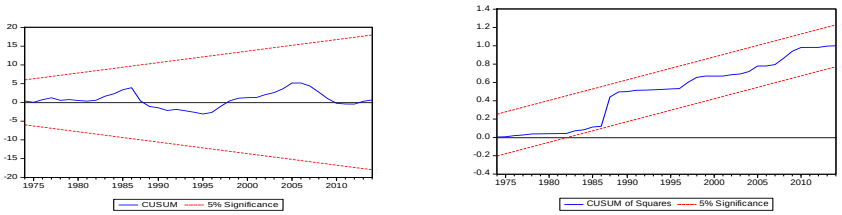


**Fig. 2:** CUSUM and CUSUM of squares plots of recursive residuals (model with broad money)

### 5. CONCLUSION

This study was aimed at investigating the nonlinear effect of financial development on income inequality in South Africa. To this end, annual data from 1970 to 2018 was investigated, and based on the ARDL bounds testing approach, two models with different measures of financial development were estimated. Results from both models indicate that financial development exerts a nonlinear effect on income inequality in the long run, while the relationship between the two variables was found to be U-shaped. This implies that financial development widens the income-inequality gap at early stages of the development, but once a certain threshold is crossed, financial development begins to narrow the gap. This threshold is computed as private credit at 62.87% of GDP, as well as broad money at 57.42% of GDP.

These results have policy implications. The existence of U-shaped relationship between financial development and income inequality that bespeaks that financial development at latter stages of development widens the income-inequality gap, could imply the presence of market imperfections such as prohibitive transaction costs, information asymmetries, as well as collateral and credit history constraints in the system, the presence of which could foreclose the long-run convergence in the poor-rich income levels (Banerjee & Newman, 1993; Galor & Zeira, 1993). To this end, the monetary authorities need to prioritise an evaluation of the entire structure of the nation's financial system, with a view to reducing imperfections in the markets to the barest minimum.

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