Symmetric and asymmetric effects of financial deepening on income inequality in South Africa

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Abstract

The aim of this study is to examine the financial development-inequality nexus in South Africa from 1980 to 2017, specifically if financial deepening reduces income inequality. The initial results indicate a positive association between financial deepening and income inequality. On further exploration, we find evidence that the Greenwood and Jovanovich hypothesis holds for South Africa. We observe an inverted non-linear relationship between financial deepening and income inequality in the long-run. The results suggest that at early stages of financial development, income inequality increases, but gradually starts to decrease as the financial sector becomes more established in the long-run. The findings highlight the need for policymakers to focus on inclusive financial sector reforms in the early stages of financial development.

Keywords: financial deepening, income inequality, ARDL, South Africa

JEL Codes: C22, D63, G20, O55

1. Introduction

The contributory role of financial sector development to economic growth has received considerable attention in the literature. Financial development improves access to credit and other financial products that can stimulate economic growth, such as mobilization of savings for physical and human capital accumulation, and provision of capital to businesses that generate employment (Tchamyou & Asongu, 2017; Tchamyou, 2020). However, an emerging strand of literature has also linked financial development to poor growth outcomes, mainly through increased income inequality, especially in developing countries (Bolarinwa et al., 2021; Destek et al., 2020).

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In the last two decades since 1994, South Africa has made significant efforts to strengthen its financial sector stability and improve financial inclusion through various reforms in the sector, such as the South Africa Financial Sector Development and Reform Program [3], as well as improved regulatory and supervisory systems through the Twin Peaks model (Hawkins, 2004; IMF, 2022). These reforms have been established to address existing structural constraints left behind by the apartheid regime as a way to expand access to financial services by the marginalized population that makes little use of the financial sector, as well as to aid small to medium enterprises. Moreover, the financial sector reforms improve customer protection and reduce potential threats to the stability of the financial systems (IMF, 2022). The expected return from broadening the financial sector is to encourage economic growth in the country. However, while positive inroads have been made in the financial sector, income inequality remains persistently high in South Africa. According to the World Inequality Database (2020), South Africa is ranked among the most unequal countries in Africa with the income share of the top 10% estimated at 65% (Robilliard, 2020). These income levels have changed very little over the last decade.

Given South Africa's developed financial sector and yet high income inequality provides us with an interesting case study to test our hypothesis on the financial development-inequality nexus, specifically, the association between financial deepening and income inequality. With financial sector development comes financial deepening that allows for increased provision of financial services through a wider choice of services and better access to different socioeconomic groups, thus contributing to pro-poor growth (Omar & Inaba, 2020). Evidence by Matsebula and Yu (2020) evaluates the effect of financial inclusion on poverty reduction using the South African National Income Dynamics Study (NIDS) across different household income categories and finds a positive association between financial inclusion and poverty reduction. Moreover, because of the increased credit availability, the development of the financial sector affords poor people with opportunities to borrow and invest, thereby narrowing the income gap (Kapingura, 2017). According to the 2017 Global Findex data, the percentage of the people with accounts at financial institutions in South Africa's low income category (40% poorest) has increased from 40% to 61% between 2011 and

[3] https://www.worldbank.org/en/news/press-release/2018/09/21/south-africas-efforts-to-improve-financial-stability-and-inclusion-boosted

2017 (Demirgüç-Kunt et al., 2018). Similarly, the percentage of people from rural areas in South Africa with accounts at financial institutions has increased from 46% to 67% in the same period. In comparison, the percentage of people with accounts at financial institutions in South Africa's high income category (60% richest) has increased from 63% to 72% between 2011 and 2017 (Demirgüç-Kunt et al., 2018). While financial inclusion in terms of people with bank accounts and access to financial services in the formal sector has increased since 2010 in South Africa (IMF, 2022), income inequality remains persistently high.

Against this background, we pose the following research question: has financial deepening through contributed to income inequality in South Africa? We propose that financial deepening reduces income inequality in South Africa. Using South African annual data from 1980 to 2017 and time series analysis, namely ARDL models, we find that our preliminary results indicate a positive association between financial deepening and income inequality. On further investigation, we find that our results support the Greenwood and Jovanovic (1990) hypothesis for an inverted non-linear relationship between financial deepening and inequality in South Africa. The findings suggest that in the initial stages of financial development, the marginal returns to economic growth may still be minimal and only impact the wealthy, therefore ineffective in reducing income disparities. However, with greater financial deepening, we start to observe the expected lower income inequality outcomes as the financial sector becomes more inclusive of people from different socioeconomic backgrounds. The implications of our study highlight an important channel that can be used by policymakers to reduce income inequality in South Africa: less stringent access to credit for the poor provides them with opportunities to better themselves, such as affording health, education, or starting up a small business in their communities that may generate employment for other poor people, thus creating a virtuous cycle.

2. Literature review

Our study contributes to the literature on financial development and economic development, mainly with a focus on income inequality. The growth-promoting effects of financial development are well documented in the literature. Financial development enhances economic growth by allowing for efficient allocation of capital and reducing constraints to borrowing (Jauch & Watzka, 2016). Contemporary growth theories, such as Romer (1990) or Grossman and Helpman (1991)

also support the contributory role of financial development in capital accumulation and savings levels. For example, the improved flow of capital encourages consumption and investment, while the increased domestic savings can be used by entrepreneurs to start micro enterprises, which generate employment, increase incomes and reduce poverty (Iheonu et al., 2020). Education and healthcare usually contribute significantly to households' expenses, especially the low income ones. As such, financial development can play a critical role in alleviating the burden of these expenses by providing access to credit on the demand side, while on the supply side, financial development can facilitate investments in health and education infrastructure (Calice, 2019). Furthermore, Levine (2021) advances that financial development can foster economic growth by improving resource allocation and technological change, not only by increasing saving rates.

Recent evidence in the literature has focused on the association between financial development and income inequality premised on a strand of theoretical frameworks. On the one hand, Galor and Zeira (1993) theorise that an economy where human capital accumulates due to financial development can improve income distribution, suggesting that finance can reduce inequality and poverty. On the other hand, an opposing framework from Hazari and Mohan (2015) posits that capital accumulation can result in wage reductions and welfare loss of the impoverished share of population. Another theory predicts a non-linear relationship between financial development and income inequality. For instance, Greenwood and Jovanovic (1990) and Galor and Moav (2004) propose that at early stages of development, only a wealthy minority of the population can access financial services, resulting in higher income inequality. However, as the financial sector becomes more established and eases credit constraints to be more inclusive of the poor, income inequality decreases.

Various empirical studies support the predictions of these theoretical frameworks, making it difficult to find conclusive evidence on the relationship between financial development and income inequality. According to Batuo et al. (2010), income inequality decreases as economies develop their financial sector in a sample of 22 African countries. Menyelim et al. (2021) also find that inclusive financial access mitigates the negative impact of income inequality on economic growth in the short run for a sample of 48 African countries. Evidence from a sample of Asian countries reveals a negative long-run relationship between financial development and income

inequality in Malaysia, Indonesia and Thailand, but not in the Philippines were income distribution worsened with financial development (Ridzuan et al., 2021). Omar and Inaba (2020) also provide evidence that financial inclusion reduces poverty and income inequality in a sample of 116 developing countries by increasing access to and usage of formal financial services to previously marginalized groups of the population.

While Demirguc-Kunt et al. (2008) and Weychert (2020) support the finding that financial access reduces poverty and income inequality, Bumann and Lensik (2016) and Zhang and Naceur (2019) provide evidence that liberalizing the financial sector can worsen income inequality by benefitting the wealthy. This adverse effect on income inequality is supported by Jung & Cha (2021) who find evidence that financial deepening, in the form of increased ratio of total deposits and loans to provincial GDP, makes inequality worse in China, mainly because most of the financial resources are available only to the rich. Moreover, Jauch and Watzka (2016) find that after controlling for country fixed effects and control variables, such as GDP per capita, financial development increases income inequality in a sample of 138 developed and developing countries. Similarly, Bolarinwa et al. (2021) also reports a positive association between financial development and income inequality across high, middle-low and low-income African countries.

In the same study, however, Bolarinwa et al. (2021) finds evidence of an inverted non-linear relationship between financial development and income inequality only among the low-income African countries. Evidence from Chakroun (2019) is also consistent with the inverted non-linear effect between banking sector development and inequality, but not between stock market development and inequality, in a sample of 60 developed and developing countries. Destek (2020) also observes an inverted non-linear relationship with income inequality for overall financial development and banking sector development in Turkey. However, a study by Kavya and Shijin (2020), for a sample of 85 countries, finds that the inverted non-linear effect between financial development and income inequality only holds for high income countries, whereas low and middle-income countries exhibited a U-shaped effect. They conclude that there is no clear-cut evidence to support the theory that economic growth along with financial development will reduce income inequality.

Within South Africa, we also find mixed evidence regarding the association between financial development and inequality. While Kapingura (2017) finds a negative linear relationship between financial development, in particular financial inclusiveness, and income inequality in South Africa between 1990 and 2012, Haffejee and Mansur (2018) find no long-run asymmetry between financial development and inequality from 1975 to 2015. On the other hand, Adams and Klobodu (2019) observe an inverted non-linear effect between financial development and inequality from 1965 to 2014, whereas Hassan and Meyer (2020) find contrary results to Adams and Klobodu (2019). They find evidence of a U-shaped non-linear effect in South Africa between 1970 and 2018, implying that financial development in the early stages reduces income inequality before worsening the gap as financial sector continues to develop.

It is within this context of the financial development-inequality nexus that we make our contribution. Firstly, the mixed evidence suggests that there is still scope for further exploration on the effects of financial development and inequality in South Africa. Currently South Africa remains the most unequal country in the world, with a Gini index of 67 (Cuevas et al., 2022). According to the latest World Bank Report, it is estimated that the top 10% of the population hold 71% of wealth, whereas the bottom 60% hold only 7% (Cuevas et al. 2022). On the other hand, stylized facts related to South Africa's financial sector indicate that the banking sector is well developed and compares favourably with the international standards. For example, the Global Competitiveness Report ranks South Africa number 2 out of 138 countries for soundness of banks, 11th for financial market development and number 27 for affordability of financial services (Moyo, 2018). The high score for bank soundness has remained consistent for South Africa, even with the Covid-19 pandemic (Schwab & Zahidi, 2020). The high inequality and sound financial development in South Africa leaves one speculating if the financial reforms in place are inclusive enough to capture the full potential of financial development on having an impactful effect on improving living standards for the poor, thereby reducing income inequality as the intended outcome.

Secondly, we observe that previous studies related to South Africa do not include a measure of institutions in their analyses. The quality of institutions in a country are important in creating a conducive environment for further investments that can work simultaneously with other growth-

promoting factors, such as financial development, to reduce income inequality (Sarkhosh-Sara et al., 2020). South Africa's history of an apartheid regime that excluded the majority of the population from key economic sectors, and its subsequent transition to a more inclusive democratic economy offers a dynamic economic climate to observe if the growth in the financial sector, particularly increased access, has been effective in addressing the income inequality gap. Enhancing access to financial institutions and reducing income inequality play an important role in achieving the Sustainable Development Goal 10 (i.e. reduce inequality within and among countries), especially in developing countries.

3. Methodological framework

3.1 Data and Modeling

Using annual data for South Africa for the period 1980 to 2017, we investigate symmetric and asymmetric effects of financial deepening on income inequality. Following many scholars in this field (Benczúr & Kvedaras, 2021; Beck et al., 2007; and Shahbaz et al., 2015), we use the Gini index as our dependent variable of interest to measure income inequality. The Gini index ranges from zero to hundred — the lower the value of the Gini index, the more equal is the distribution of income. The dependent variable of interest (income inequality) comes from Standardized World Income Inequality Database (SWIID).

Our primary explanatory variable (financial deepening) is measured by domestic credit to private sector by banks (% of GDP) from the World Development Indicators. The measure has been used regularly in previous studies (Jauch & Watzka, 2016; Benczúr & Kvedaras, 2021). This proxy is superior to alternative proxies of financial deepening (such as M2) in that it captures the key role of 'financial intermediaries' channeling deposits from surplus units to deficit units (Beck et al., 2007). Financial deepening generally refers to an increased ratio of money supply or financial assets to GDP. Such an indicator provides an understanding of the size, or depth, of the banking industry. Our choice of control variables, which includes inflation, gross domestic product (GDP) per capita growth and democracy is guided by previous literature on income inequality (see Benczúr & Kvedaras, 2021; Michael & Stelios, 2020 and Robinson, 1976).

The empirical model borrows from the theoretical framework of Greenwood and Jovanovich (1990) on the non-linear association between financial deepening and income inequality (Benczúr & Kvedaras, 2021). The model is expressed as follows:

$$lnIE = f(lnFD, lnLFDSQ, INF, GDPpc, DEMO) \quad (1)$$

Where $lnIE$ denotes the log of income inequality (proxied by Gini index), $lnFD$ is the log of domestic credit to private sector by banks (our measure for financial deepening), INF is the inflation rate (annual %), $GDPpc$ represents GDP per capita growth (annual %) and $DEMO$ is the institutional variable (measured by democracy). To capture the non-linear effect, we also include the squared term of financial deepening ($lnLFDSQ$). The definition of the variables used in the analysis are also presented in the Appendix (Table A4). GDP per capita growth and inflation rate are obtained from World Bank's World Development Indicators (WDIs). Data on the institutional variable is obtained from the Polity IV Project (Marshal et al., 2018). The variable is a revised combined score that is computed by subtracting the autocracy score from the democracy score. The resulting unified polity score ranges from −10 (strongly autocratic) to +10 (strongly democratic). A decrease/increase in the polity score will indicate a decrease/increase in democracy. Financial deepening, democracy and GDP per capita growth have been shown to be negatively related to income inequality in a number of studies (Michael1 & Stelios, 2017). On the other hand inflation has been established by Albanesi (2007) to have detrimental effects on inequality in low-income countries. We discuss the associations for the explanatory variables in detail in the Results section.

3.2 ARDL framework

The linear effects of financial deepening on income inequality are investigated by employing the autoregressive distributed lag (ARDL) by Pesaran et al. (2001). To examine the non-linear effects, we add the squared term of financial deepening into the same equation. The existence of non-linearity is confirmed if and only if the coefficient of the squared term of financial deepening enters the model with a different sign to the linear model and is statistically significant. The benefits of the ARDL estimator are well documented: for example, it can be consistently used with variables integrated of order zero I(0) or order one I(1) — integrated of different order, and are able to cope with endogenous bias. These ARDL estimators also outperform other alternative estimators (such

as cointegration methods) in that they have a greater statistical power in small samples (Panopoulou & Pittis, 2004).

To explore the short-run and long-run relationship between our dependent variable and the explanatory variables we first specify the ARDL as follows:

$$\Delta lnIE_t = \alpha_0 + \sum_{i=1}^{n} \emptyset_i \, \Delta lnIE_{t-i} + \sum_{i=1}^{n} \Omega_i \Delta lnFD_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta lnFDSQ_{t-i} + \sum_{i=1}^{n} \Psi_i \Delta INF_{t-i}$$
$$+ \sum_{i=1}^{n} \varphi_i \Delta RGDPpc_{t-i} + \sum_{i=1}^{n} \delta_i \Delta DEMO_{t-i}$$
$$+ \xi_i lnIE_{t-1} + \vartheta_i lnFD_{t-1} + \pi_i lnFDSQ_{t-1} + \theta_i INF_{t-1}$$
$$+ \psi_i RGDPpc_{t-1} + \beta_i DEMO_{t-1} + e_t \quad . \quad (2)$$

Where α_0 denotes the intercept, Δ is the first difference, $\emptyset_i$, Ω_i, λ_i, Ψ_i, φ_i and δ_i captures estimated coefficients of the short-run effects of the lagged dependent variable, the independent variable of interest (financial deepening) and the control variables (inflation, GDP per capita and institutions) on income inequality. We infer the long-run effects of the explanatory variables from the estimated coefficients of ξ_i, ϑ_i, π_i, θ_i, ψ_i and β_i. The long-run relationship between our dependent variable and explanatory variables are evaluated based on the lower and upper bounds of Pesaran et al. (2001). We reject the null hypothesis of no long-run association between variables, H0: $\xi_i = \vartheta_i = \pi_i = \theta_i = \psi_i = \beta_i = 0$ if the upper bound value is lower than the *F*-statistic. On the other hand, we fail to reject null hypothesis that there is a long-run association between variables H1: $\emptyset_i \neq \Omega_i \neq \lambda_i \neq \Psi_i \neq \varphi_i \neq \delta_i \neq 0$ if the lower bound value is above the *F*-statistic value. If the estimated coefficients point toward the existence of the long-run association between variables, then we estimate the error correction model (ECM) as shown below:

$$\Delta lnIE_t = \alpha_0 + \sum_{i=1}^{n} \emptyset_i \, \Delta lnIE_{t-i} + \sum_{i=1}^{n} \Omega_i \Delta lnFD_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta lnFDSQ_{t-i} + \sum_{i=1}^{n} \Psi_i \Delta INF_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta GDPpc_{t-i} + \sum_{i=1}^{n} \delta_i \Delta DEMO_{t-i} + \rho_1 ECM_{t-1} \quad (3)$$

Similar to equation 2, α_0 still denotes the intercept, Δ is the first difference and $\emptyset_i$, Ω_i, λ_i, Ψ_i, φ_i and δ_i represent estimated coefficients of the short-run effects of our right-hand side variables on income inequality. New in equation 3 is ρ_1 denoting the coefficient for the speed of adjustment to equilibrium. Lastly, we perform validity tests for both ARDL models, such as the Breusch-Godfrey serial correlation LM test, the Breusch-Pagan-Godfrey test for heteroscedasticity of errors and the cumulative sum of recursive residuals (CUSUM) test for stability of the models. For robustness checks, we also employ a different financial development measure ($lnFI$) which represents financial inclusion measured by commercial bank branches (per 1,000km²) from the WDIs. This measure of financial development takes into account the accessibility of financial services. We also check our findings using three long-run estimators: dynamic OLS (DOLS), Fully modified OLS (FMOLS) and Canonical Cointegrating methods (CCR) advanced by Stock and Watson (1993), Phillips and Hansen (1990) and Park (1992) respectively. These estimators are suitable not only for dealing with issues related to endogeneity, but also mitigate issues of omitted variables, serial correlation, and small sample size bias (Alhassan et al., 2014).

4 Empirical Analysis

4.1 Descriptive Statistics

A brief overview of the descriptive statistics is reported in Table 1. The Gini index has a mean value of 61.5 and shows minimal variation between the minimum (59.5) and maximum (63.5) values, highlighting the persistence in inequality in South Africa. This persistence is corroborated in Figure 1, which displays the inequality trend for the period 1980 to 2017. Figure 1 also shows that while inequality experienced an upward trend from 1980 to 2009, the trend was reversed from that period onwards, indicating an inverted-U shape. It is interesting to note that the major shift in

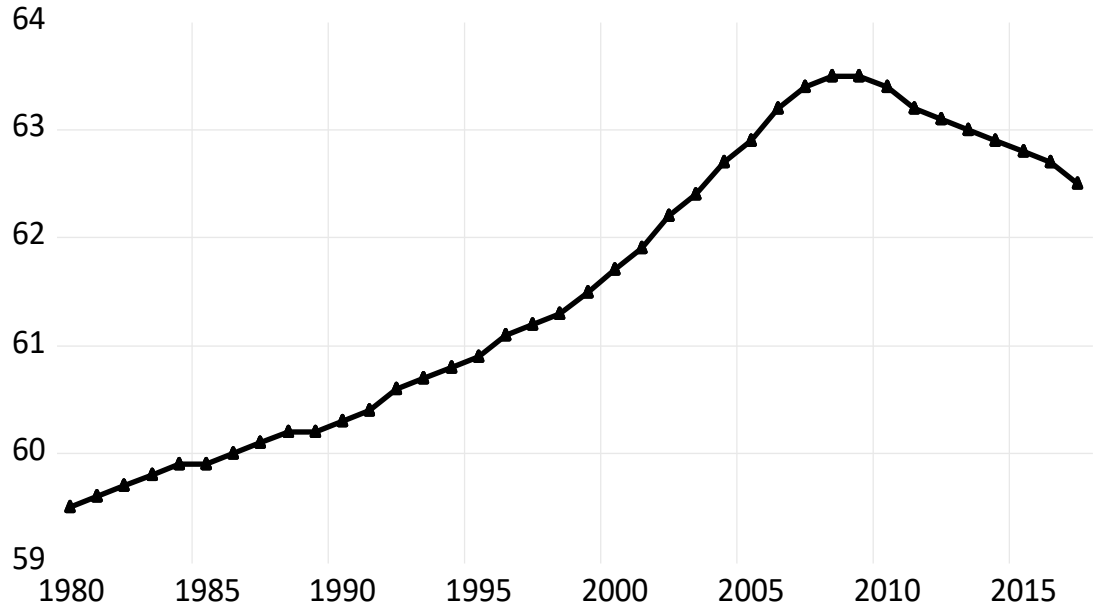
economic policy in South Africa, which occurred when it transitioned from the system of apartheid to democratic system in 1994, did not immediately reverse the gap in income distribution. Over the same period, we observe a general increasing trend in our measure for financial deepening in Figure 2, suggesting that initially both income inequality and financial deepening were increasing together, but in the last decade the financial sector has continued to develop while income inequality has started to decrease, albeit gradually. These trends motivate our hypothesis that financial deepening is associated with lower income inequality in South Africa.

Table 1: Descriptive Statistics

	IE	FD	INF	GDPpc	DEMO
Mean	61.54	138.22	7.82	0.41	7.37
Median	61.40	148.57	7.71	0.84	9.00
Maximum	63.50	192.66	13.31	4.28	9.00
Minimum	59.50	74.11	3.15	-4.55	4.00
Std. Dev.	1.36	38.00	2.76	2.46	2.27
Skewness	0.02	-0.33	0.09	-0.44	-0.72
Kurtosis	1.48	1.63	2.05	2.32	1.59
Jarque-Bera	3.65	3.56	1.47	1.99	6.41
Probability	0.16	0.17	0.48	0.37	0.04
Observations	38	38	38	38	38

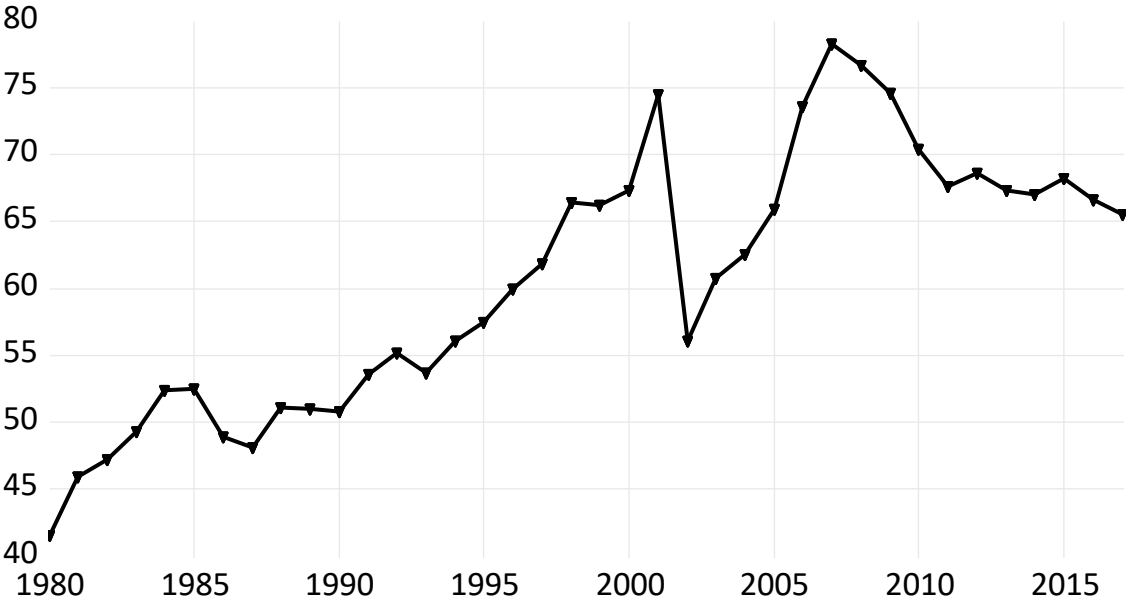
Source: SWIID, WDIs, Polity IV Project

Figure 1: Income inequality (Gini index) in South Africa, 1980 to 2017



Source: Standardized World Income Inequality (SWIID) Database

Figure 2: Financial Deepening (domestic credit to private sector by banks, % of GDP) in South Africa, 1980 to 2017



Source: World Development Indicators (WDIs)

4.2 Results

We commence the empirical analysis by testing for multicollinearity between the independent variables using the Variance Inflation factor (VIF) test. If the variables are collinear, it can result in spurious regression results. According to Kock and Lynn (2012), a centered VIF threshold greater than 5 suggests the existence of collinearity among the independent variables. Table 2 shows the centered VIF of less than 5 for all the variables. This suggests that no severe multicollinearity exists between the variables, thus we can keep all independent variables in the model.

Table 2: Multicollinearity test

Variance Inflation Factors
Sample: 1980 2017
Included observations: 38

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LFD	0.000353	2680.998	4.195839
INF	4.74E-07	14.20436	1.512200
GDPpc	4.58E-07	1.217562	1.162903
DEMO	1.73E-06	47.20910	3.919924
C	0.005151	2327.888	NA

We test for integration of the variables using Dickey Fuller (ADF) as well as the Phillips and Perron (PP) unit root tests. The ARDL bounds testing do not require variables to be strictly integrated of order zero or order one. That being the case, applying the ARDL to an I(2) series can cause the model to crash (Emeka & Kelvin, 2016). To ensure that our results are not I(2), we perform unit root tests based on ADF and PP models. Table 3 displays the ADF and PP unit root tests estimates and shows that income inequality, inflation and GDP per capita growth are stationary at levels, while financial deepening and democracy is stationary only after first difference, thus making it suitable to use ARDL estimators (Pesaran et al., 2001).

Table 3: Unit root test results

PP UNIT ROOT TEST TABLE AT LEVEL

		*ln*IE	*ln*FD	INF	GDPpc	DEMO
With Constant	t-Statistic	-1.056	-2.152	-3.056	-4.43	-1.335
	Prob.	**0.723**	**0.227**	**0.039**	**0.001**	**0.603**
		no	no	**	***	no
With Constant & Trend	t-Statistic	-0.869	-2.557	-3.946	-4.479	-1.140
	Prob.	**0.949**	**0.301**	**0.019**	**0.005**	**0.908**
		no	no	**	***	no
		AT FIRST DIFFERENCE				
With Constant	t-Statistic	-1.329	-6.685	-8.736	-9.232	-3.214
	Prob.	**0.605**	**0.000**	**0.000**	**0.000**	**0.027**
		no	***	***	***	**
With Constant & Trend	t-Statistic	-1.636	-6.752	-8.562	-8.878	-3.395
	Prob.	**0.758**	**0.000**	**0.000**	**0.000**	**0.068**
		no	***	***	***	*

ADF UNIT ROOT TEST TABLE AT LEVEL

		*ln*IE	*ln*FD	INF	GDPpc	DEMO
With Constant	t-Statistic	-1.951	-2.155	-3.153	-4.419	-1.576
	Prob.	**0.306**	**0.226**	**0.031**	**0.001**	**0.485**
		no	no	**	***	no
With Constant & Trend	t-Statistic	-3.953	-2.49	-3.947	-4.479	-1.553
	Prob.	**0.021**	**0.331**	**0.019**	**0.005**	**0.792**
		**	no	**	***	no
		AT FIRST DIFFERENCE				
With Constant	t-Statistic	-1.408	-6.677	-7.804	-7.164	-3.258
	Prob.	**0.568**	**0.000**	**0.000**	**0.000**	**0.025**
		no	***	***	***	**
With Constant & Trend	t-Statistic	-1.722	-6.731	-7.694	-7.076	-3.353
	Prob.	**0.721**	**0.000**	**0.000**	**0.000**	**0.074**
		no	***	***	***	*

Where *ln*FD, *ln*IE, INF, GDPpc, *ln*FI, and DEMO represent financial deepening, income inequality, inflation rate, GDP per capita growth, financial inclusion and democracy. Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1% and (no) Not Significant.

Having established the order of integration, we apply the bounds-testing to verify if there exists a long-run association between the variables. The estimates displayed in Table 4 suggest that the null hypothesis of no long-run association between variables should be rejected since the F-value

of 16.1 exceeds the upper bound critical value at 1% significance level. After confirming the existence of long-run association between variables, we estimate equation 4 by setting the maximum lag-length to three, using the Akaike information Criteria (AIC) in order to choose the model's lag order. We opted for the ARDL (1, 2, 2, 1, 2) as our final specification.

Table 4: F-Bounds test results

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	16.14795	10%	1.9	3.01
k	4	5%	2.26	3.48
		2.5%	2.62	3.9
		1%	3.07	4.44

The long-run and short-run coefficients derived from the ARDL model are shown in panel A and B of Table 5. Panel A of Table 5 presents three long-run ARDL models which were estimated—Model 1, Model 2, and Model 3. Model 1 (linear long-run model) only shows financial development and control variables without the squared term and democracy variable. Model 2 (i.e. non-linear long-run model) adds the squared term of financial development and other covariates with the exception of democracy variable. Model 3 incorporates the entire set of explanatory variables, including democracy.

According to the estimates of Model 1, financial deepening has a positive impact on income inequality although it is not significant. The result suggests that financial deepening exacerbates income inequality. However, when we include the squared term in Model 2 of Table 5, we observe an inverted U-shaped association between financial deepening and income inequality in South Africa, in line with the Greenwood and Jovanovic (1990) hypothesis. The coefficient for financial deepening is statistically significant and positively associated with income inequality, whereas its squared term is negative and statistically significant. Specifically, the long-run elasticities of financial deepening indicate that a 1% increase in financial deepening at early stages of development in the financial sector leads to a 1.9% increase in income inequality. However, at later stages in financial development, further increases in financial deepening can lower income inequality by 0.2%. This suggests that at the initial stages of financial development, inequality tends to increase at an increasing rate, but gradually falls as more and more people gain access to

the financial markets (Kim & Lin, 2011). Our findings highlight that in the early stages of financial development, the poor may still struggle to have equal access to credit because of their inability to offer collateral, which discourages banks from loaning out to the poor. However, as the financial sector continues to adopt more inclusive reforms, economic opportunities expand, which narrows income distribution, mainly by improving the incomes of the poor (Levine, 2021).

Though the financial deepening-inequality nexus is a topic of recent attention in South Africa (Kapingura, 2017; Hassan & Meyer, 2020), our results are consistent with evidence from several studies from different countries. These studies include, among others, Destek (2020) for Turkey, Shahbaz et al. (2015) for Iran, Chakroun (2020) across developed and developing countries, Younsi and Bechtini (2018) for a sample of BRICS countries, and Baiardi and Morana (2018) across 19 European countries.

Table 5: ARDL estimates of the relationship between financial deepening and inequality

Panel A: Long-run estimates

	Model 1			***Model 2***			***Model 3***		
Variable	Coeff	SE	Prob.	Coeff	SE	Prob	Coeff	SE	Prob
*ln*FD	0.054	0.021	0.021	1.980	0.036	0.000	1.967	0.047	0.000
*ln*FDSQ	—	—	—	-0.238	0.008	0.000	-0.234	0.012	0.000
INF	-0.001	0.001	0.491	0.002	0.001	0.248	0.001	0.002	0.577
GDPpc	0.009	0.002	0.000	0.012	0.003	0.001	0.012	0.003	0.003
DEMO	—	—	—	—	—	—	-0.002	0.003	0.540

Panel B: Short-run estimates

Δ(*ln*FD)	0.113	0.146	0.446
Δ(*ln*FD(-1))	-0.317	0.127	0.021
Δ(*ln*FDSQ)	-0.014	0.018	0.436
Δ(*ln*FDSQ(-1))	0.038	0.015	0.022
Δ(INF)	0.000	0.000	0.878
Δ(*ln*GDPpc)	0.001	0.000	0.000
Δ(*ln*GDPpc(-1))	-0.001	0.000	0.000
ECM(t-1)	-0.117	0.012	0.000
R-squared	0.779		
Adjusted R-squared	0.717		
S.E. of regression	0.001		
Sum squared resid	0.000		
Log likelihood	180.093		
Durbin-Watson stat	1.025		

The estimated long-run coefficient of inflation is positive but statistically insignificant in Model 2. The positive influence of inflation on income inequality confirms evidence from Koçak et al. (2019) who finds that inflation is positively associated with income inequality in Turkey. According to Saimi-Namini and Hudson (2019), the positive relationship between these variables derives from the fact that a continuous increase in the general price level would reduce the purchasing power of the poverty-stricken individuals especially those individuals who are dependent on social grants that do not adjust with inflation. A long-run positive and significant association is also revealed between GDP per capita growth and income inequality respectively. Holding other things constant, a 1% increase in GDP per capita growth increases income inequality by 0.003% (Model 2). This finding is in line with the work of Shahbaz (2010) for Pakistan and Shahbaz (2015) for Iran. Rising incomes in developing nations can increase the inequality gap between the rich and the poor. According to Dabla-Norris et al. (2015), the efficiency of economic growth in reducing poverty can be lower in countries with high initial levels of inequality, or in countries with redistributive patterns that are not favourable for the poor.

Model 3 accounts for the possibility that the quality of institutions can have some influence on inequality. According to Pérez-Moreno and Angulo-Guerrero (2016) and Sarkhosh-Sara et al. (2020), democratic institutions can facilitate economic opportunities to the lower income groups thus reducing inequality. The long-run estimated coefficients of democracy is negative but not statistically significant, implying that the quality of institutions in South Africa may not have the expected inequality-reducing effect. This finding is in line with Scheve and Stasavage (2017) who find that when societies are divided along lines other than wealth (e.g. South Africa with a history of racial division), these social inequalities can hinder the adoption of wealth-equalizing policies. The inclusion of the democracy variable in Model 3 does not attenuate the non-linear effects between financial deepening and income inequality.

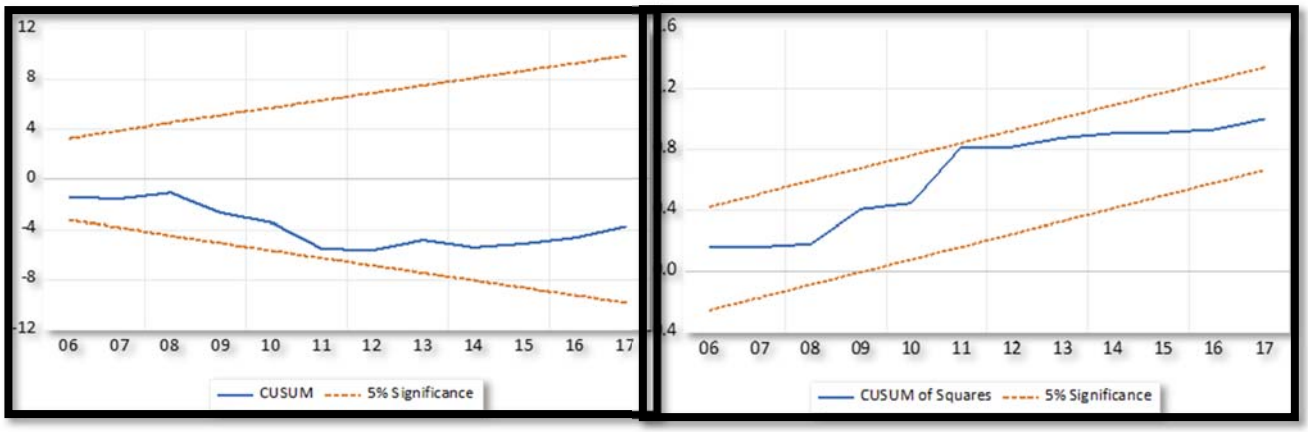
Panel B of Table 5 presents the short-run estimates. The estimated coefficient of the error correction term ECM (-1) enters the model negatively and statistically significant at the 1% level, confirming that our model tends to gravitate back to long-term equilibrium immediately after a shock. The ECM (-1) of -0.117 shows that the speed of adjustment subsequent to a shock is 11.7% over a year. The short-run estimates for the independent variable of interest is broadly consistent

with the long-run. Specifically the estimates appear to confirm an inverted-U relationship between financial deepening (lnFD and lnFDSQ) and income inequality.

4.3 Robustness Checks

We perform various specification tests – serial correlation, heteroscedasticity, the Ramsey-RESET and the long-run normality—to ensure that the ARDL model used in this study is indeed appropriate for this analysis (see Tables A1 to A3 and Figure 4). The results reveal no evidence of serial correlation nor heteroscedasticity. Neither do we detect evidence of model misspecification. In addition, we use the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) to ensure the stability of the short- and long-term models (see Figure 3). Reassuringly, the figures confirm that both CUSUM and CUSUMSQ tests statistics are located inside the critical bounds at the 5% significance level, proving that our models are stable.

Figure 3: CUSUM and CUSUM Squares



We conduct robustness check using FMOLS, DOLS and CCR to further verify the robustness of our long-run estimates. The results displayed in Table 6 are consistent with ARDL estimates from Model 2 in Table 5.[4] Specifically, the estimates derived from the FMOLS, DOLS and CCR models provide support for the Greenwood and Jovanovic (1990) hypothesis of an inverted non-linear relationship between financial deepening and inequality in South Africa. The non-linear findings remain robust to the inclusion of control variables in the models.

[4] We also run estimations for FMOLS, DOLS and CCR with the institutions variable included. The results for the non-linear effects remain consistent across the models. The results are available on request.

Table 6: Estimates of the relationship between financial deepening and inequality

	FMOLS			**DOLS**			**CCR**		
Variable	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
*ln*FD	1.883	0.013	0.000	1.892	0.016	0.000	2.894	0.445	0.000
*ln*FDSQ	-0.214	0.003	0.000	-0.217	0.004	0.000	-0.337	0.054	0.000
INF	0.001	0.001	0.135	0.001	0.001	0.148	0.003	0.001	0.000
*ln*RGDPpc	0.002	0.001	0.040	0.002	0.001	0.050	0.003	0.001	0.000
R-squared	0.807			0.792			0.691		
Adjusted R-squared	0.788			0.773			0.649		

We undertake a final robustness check by using an alternative measure of financial development, namely commercial bank branches (per 1,000km²) to account for financial inclusion. This financial measure indicates how easily people can access services and products from formal financial institutions. The data for this variable is available from 2004 in South Africa.[5] The results in Table 7 remain consistent with our previous findings for a non-linear effect between financial development and income inequality.

Table 7: ARDL estimates of the relationship between financial inclusion and inequality

Panel A: Long-run estimates			
Variable	Coefficient	Std. Error	Prob.
FI	0.047	0.020	0.046
LFISQ	-0.009	0.003	0.014
INF	-0.002	0.001	0.211
GDPpc	-0.001	0.001	0.469
Panel B: Short-run estimates			
ECM(-1)*	**-0.170**	**0.011**	**0.000**
R-squared	0.947		
Adjusted R-squared	0.947		
S.E. of regression	0.001		
Sum squared resid	0.000		
Log likelihood	83.470		
Durbin-Watson stat	1.430		

[5] We also perform unit root tests on the financial inclusion measure based on ADF and PP models. We find that the variable is stationary at levels. The inclusion of the institutions variable does not attenuate the non-linear effects. The results are available on request.

4. Discussion and conclusion

This study investigates the association between financial deepening and income inequality in South Africa. Using time series analysis from 1980 to 2017, our initial results indicate a positive association between financial deepening and income inequality in the long-run. However, when we include the squared term, we observe an inverted U-shape non-linear relationship in line with the Greenwood and Jovanovich (1990) hypothesis. These results remain robust to the inclusion of control variables, the quality of institutions and different estimation techniques. The findings suggest that at early stages of financial development, the returns from financial deepening are not inclusive as the financial services may only be accessible to the wealthy with means of collateral. This effect may work to increase the income distribution gap between the wealthy and the poor. On the other hand, when the financial sector is more established and has adapted to the needs of the different socioeconomic groups, then the returns from financial deepening may be more effective in reducing income inequality.

The implications of our findings are twofold. First, financial development and the level of economic development are interrelated (Bolarinwa et al., 2020). As such, we can expect the distributional effect of financial deepening to be constrained by the level of economic development in the country, which would then explain the differing effects of financial deepening on income inequality at different stages of economic development, similar to Kuznet's hypothesis (1955). Second, in order to generate more effective returns from financial development, policy makers need to be cognizant of the demographic make-up of their citizens and adopt financial sector reforms that will ensure inclusivity of the marginalized. Currently the top 10% of the population in South Africa hold 80.6% of financial assets (Cuevas et al., 2022), evidence that more needs to be done to include the poor in the country. These reforms can include different credit requirements for different income groups, lower interest rates on loans for businesses that qualify as small enterprises, or easy access to capital markets for entrepreneurs to encourage participation in the financial sector. Improvements in the ability of financial systems to mitigate information and transaction costs may also be necessary for inclusive growth. In addition, focusing on growth-promoting activities, such as financial development, will have positive spill-over effects (i.e. job creation, investment opportunities, human capital accumulation) leading to reduced inequality.

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Appendix

Table A1: Breusch-Godfrey Serial Correlation LM Test

Null hypothesis: No serial correlation at up to 1 lag

F-statistic	3.159981	Prob. F(1,5)	0.1356
Obs*R-squared	12.39211	Prob. Chi-Square(1)	0.0004

Table A2: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	0.486342	Prob. F(25,6)	0.9047
Obs*R-squared	21.42647	Prob. Chi-Square(25)	0.6686
Scaled explained SS	0.966328	Prob. Chi-Square(25)	1.0000

Table A3: Ramsey RESET Test

	Value	df	Probability
t-statistic	0.922540	20	0.3672
F-statistic	0.851079	(1, 20)	0.3672
Likelihood ratio	1.375223	1	0.2409

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	1.43E-06	1	1.43E-06
Restricted SSR	3.51E-05	21	1.67E-06
Unrestricted SSR	3.37E-05	20	1.69E-06

LR test summary:

	Value
Restricted LogL	180.0928
Unrestricted LogL	180.7804

Figure 4: Histogram Normality Test

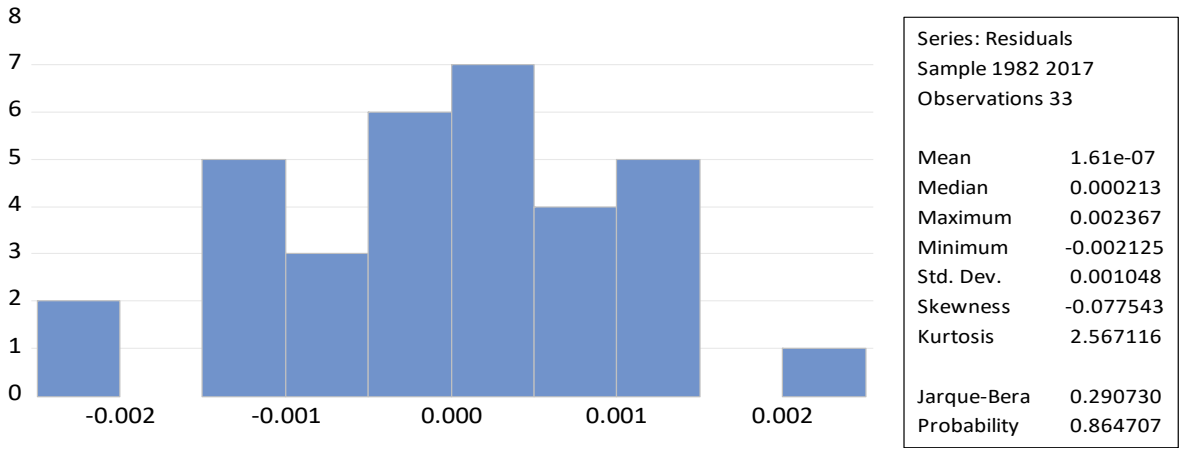

Table A4: Variables and data sources

Variable	Description	Source
Dependent variable		
IE	Gini index	SWIID
Independent variables		
FD	Financial deepening: domestic credit to private sector by banks (% of GDP)	WDI
INF	Inflation, consumer prices (annual %)	WDI
GDPpc	GDP per capita growth	WDI
DEM	Democracy	Polity IV Project