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Book

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University of Pretoria
Department of Economics Working Paper Series

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Working Paper: 2022-14
February 2022

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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 asymmetric effects of financial deepening on income inequality is investigated by employing the autoregressive distributed lag by Pesaran et al. (2001). 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 development.

Keywords: financial deepening, income inequality, ARDL, South Africa
JEL Codes: C22, D63, G20, O55

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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).

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 (Hawkins, 2004), the latest being the South Africa Financial Sector Development and Reform Program.[1] These reforms have been established to address existing structural constraints left behind by the apartheid regime in order to expand access of financial services to the marginalized population that makes little use of the financial sector, as well as to aid small to medium enterprises. 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 currently 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 and better access to different socioeconomic groups, thus contributing to pro-poor growth. We therefore pose the following research question: has financial deepening contributed to the

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

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 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 an 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). Furthermore, financial development can also influence technological progress by facilitating borrowing for human capital accumulation (Levine, 1997).

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. While Demirguc-Kunt et al. (2008) and Weychert (2020) also support the finding that financial access reduces poverty and income inequality, Bumann and Lensik (2016) and Zhang and Naceur (2019) provide evidence that liberalising the financial sector can worsen income inequality by benefitting the wealthy. 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 report 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 a non-linear relationship between financial development and income inequality only among the low-income African countries. Destek (2020) also observes an inverted U-shaped relationship with income inequality for overall financial development and banking sector development in Turkey. It is within this context of the financial development-inequality nexus that we make our contribution. 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 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 (Benczúr1 & Kvedaras, 2020; 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 one — 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), a measure that has been used in previous studies (Jauch & Watzka, 2016; Benczúr1 & Kvedaras, 2020). 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, real gross domestic product (GDP), general government expenditure, gross capital formation and an institutional variable, is guided by previous literature on income inequality (see Benczúr1 & Kvedaras, 2019; Michael & Stelios, 2020 and Robinson, 1976).

We estimate the following specification based on a model by Benczúr1 & Kvedaras (2019):

$$lnIE = f(lnFD, lnLFDSQ, INF, lnRGDP, DEMO, lnGE, lnGCF) \quad (1)$$

Where $lnIE$ denotes income inequality (proxied by Gini index), $lnFD$ captures financial deepening, INF stands for inflation rate (annual %), $lnRGDP$ represents GDP (constant 2010 US$), $DEMO$ is the institutional variable (measured by democracy), $lnGE$ describes the general government final consumption expenditure (% of GDP) and $lnGCF$ represents gross capital formation (% of GDP). The definition of the variables used in the analysis are also presented in the appendix (Table A4). Real GDP, inflation rate, general government expenditure and capital formation are obtained from World Bank's World Development Indicators (WDI), with the exception of income inequality and the institutional variable. 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.

Most of the variables are transformed into logarithm to facilitate their interpretation, except democracy, which is an index, and inflation rate. Financial deepening, democracy and general government expenditure have been shown to be negatively related to income inequality in a number of studies (Michael1 & Stelios, 2017). On the other hand, other control variables, such as inflation, has been established by Albanesi (2007) to have detrimental effects on low-income countries. We discuss the associations for the explanatory variables in detail in the Results section.

3.2 ARDL framework

The nonlinear effects of financial deepening on income inequality is investigated by employing the autoregressive distributed lag by Pesaran et al. (2001) and the recent non-linear autoregressive distributed lag estimators proposed by Shin et al. (2014). The benefits of ARDL estimators are well documented: for example, both estimators can be consistently used with I(0) or I(1) variables— 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 unravel the short-run and long-run relationship between our dependent variable and the explanatory variables we first specify the ARDL as follows:

$$\Delta lnIE_t = \alpha_0 + \sum_{i=1}^{n} \emptyset_{1i}\, \Delta lnIE_{t-i} + \sum_{i=1}^{n} \emptyset_{2i} \Delta lnFD_{t-i} + \sum_{i=1}^{n} \emptyset_{3i} \Delta lnFDSQ_{t-i} + \sum_{i=1}^{n} \emptyset_{4i} \Delta INF_{t-i} + \sum_{i=1}^{n} \emptyset_{5i} \Delta lnRGDP_{t-i} + \sum_{i=1}^{n} \emptyset_{6i} \Delta DEMO_{t-i} + \sum_{i=1}^{n} \emptyset_{7i} \Delta lnGE_{t-i} + \sum_{i=1}^{n} \emptyset_{8i}\, \Delta lnGCF_{t-i} + \vartheta_1 lnIE_{t-1} + \vartheta_2 lnFD_{t-1} + \vartheta_3 lnFDSQ_{t-1} + \vartheta_4 INF_{t-1} + \vartheta_5 lnRGDP_{t-1} + \vartheta_6 DEMO_{t-1} + \vartheta_7 lnGE_{t-1} + \vartheta_8\, lnGCF_{t-1} + e_t \quad (2)$$

Where α_0 denotes the intercept, Δ is the first difference and $\emptyset_1, \emptyset_2, \emptyset_3, \emptyset_4, \emptyset_5, \emptyset_6, \emptyset_7, \emptyset_8$ captures estimated coefficients of the short-run effect of our independent variable of interest (financial deepening) and control variables—inflation, real GDP, general government expenditure, gross capital formation and democracy on income inequality. We infer the long-run effects of the explanatory variables from the estimated coefficient of $\vartheta_1, \vartheta_2, \vartheta_3, \vartheta_4, \vartheta_5, \vartheta_6, \vartheta_7, \vartheta_8$. 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: $\vartheta_1 = \vartheta_2 = \vartheta_3 = \vartheta_4 = \vartheta_5 = \vartheta_6 = \vartheta_7 = \vartheta_8 = 0$ 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: $\vartheta_1 \neq \vartheta_2 \neq \vartheta_3 \neq \vartheta_4 \neq \vartheta_5 \neq \vartheta_6 \neq \vartheta_7 \neq \vartheta_8 \neq 0$ 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:

$$\Delta lnIE_t = \alpha_0 + \sum_{i=1}^{n} \emptyset_{1i}\, \Delta lnIE_{t-i} + \sum_{i=1}^{n} \emptyset_{2i} \Delta lnFD_{t-i} + \sum_{i=1}^{n} \emptyset_{3i} \Delta lnFDSQ_{t-i} + \sum_{i=1}^{n} \emptyset_{4i} \Delta INF_{t-i} + \sum_{i=1}^{n} \emptyset_{5i} \Delta lnRGDP_{t-i} + \sum_{i=1}^{n} \emptyset_{6i} \Delta DEMO_{t-i} + \sum_{i=1}^{n} \emptyset_{7i} \Delta lnGE_{t-i} + \sum_{i=1}^{n} \emptyset_{8i}\, \Delta lnGCF_{t-i} + \delta_{it} ECM_{it-i} + e_t \quad (3)$$

Similar to equation 2, α_0 still denotes the intercept, Δ is the first difference and $\emptyset_1, \emptyset_2, \emptyset_3, \emptyset_4, \emptyset_5, \emptyset_6, \emptyset_7, \emptyset_8$ represent estimated coefficients of the short-run effect of our independent variable of interest (financial deepening) and control variables—inflation, real GDP, general government expenditure, gross capital formation and democracy on income inequality. What is new in

equation 3 is δ_{it}, denoting the coefficient for the speed of adjustment to equilibrium. Lastly, we perform validity tests for both symmetric and asymmetric ARDL models and related robustness checks, such the Breusch-Godfrey LM and the cumulative sum of recursive residuals (CUSUM) test for stability of the models.

4 Empirical Analysis

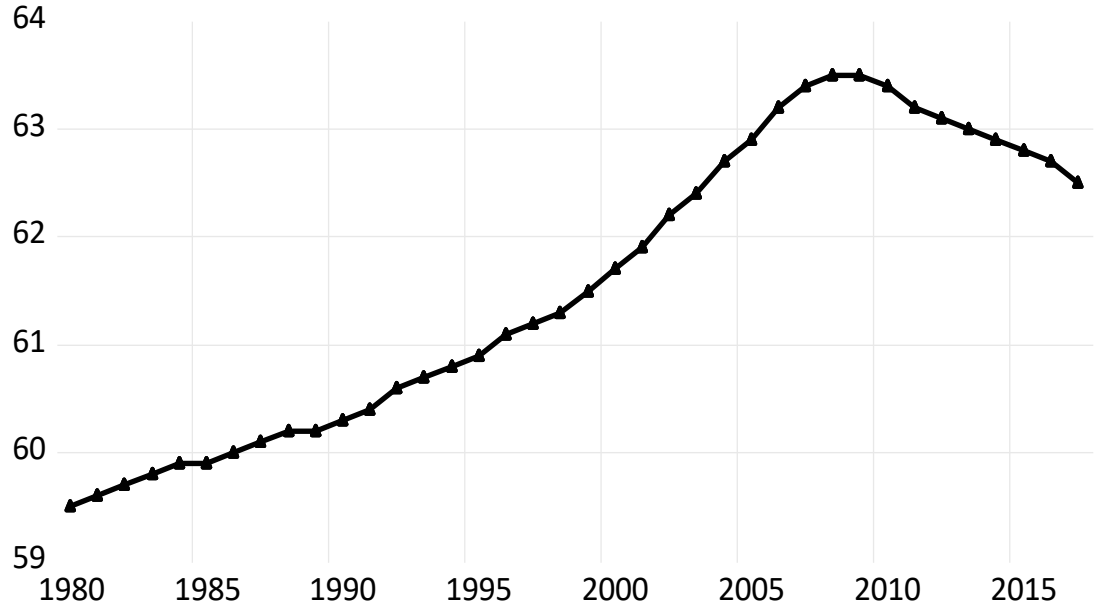
4.1 Descriptive Statistics

A brief overview of the descriptive statistics is reported in Table 1. The Gini index has a mean value of 4.236 and shows minimal variation between the minimum (4.190) and maximum (4.283) 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 of selected variables

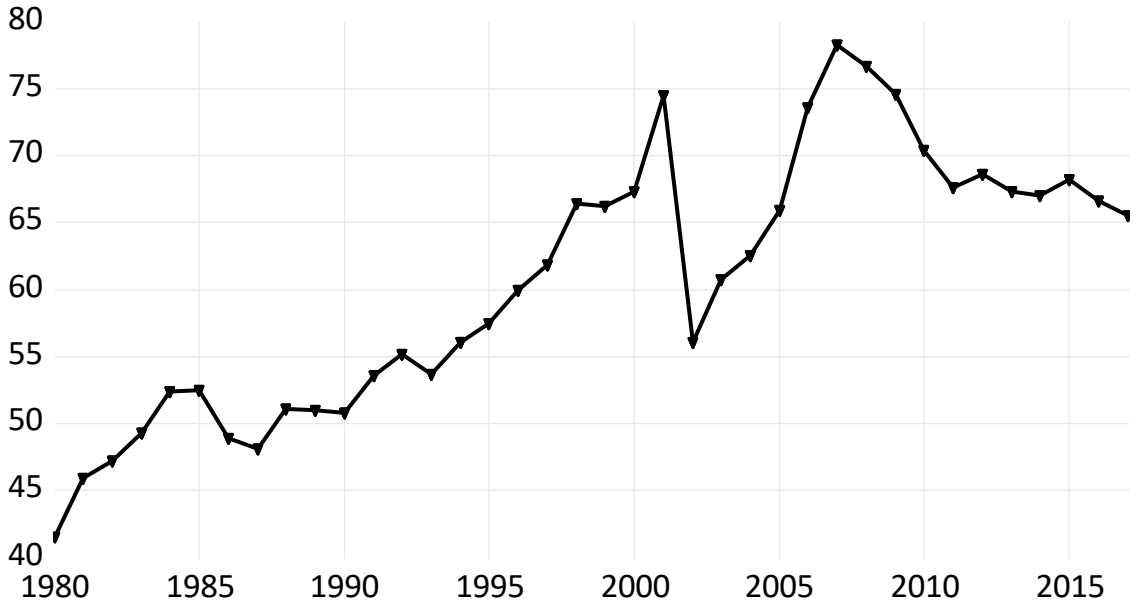
	***ln*FD**	***ln*GCF**	***ln*GE**	***ln*IE**	**INF**	**lnRGDP**	**DEM**
Mean	4.094	3.000	2.913	4.236	7.700	2.408	7.432
Median	4.125	2.971	2.934	4.233	7.582	2.600	9.000
Maximum	4.360	3.530	3.035	4.284	13.311	6.621	9.000
Minimum	3.726	2.719	2.562	4.190	3.148	2.137	4.000
Std. Dev.	0.164	0.180	0.108	0.033	2.695	2.241	2.267
Skewness	(0.295)	1.096	(1.612)	0.039	0.109	0.302	(0.795)
Kurtosis	2.064	4.164	5.556	1.423	2.116	2.380	1.698
Jarque-Bera	1.887	9.501	26.100	3.841	1.278	1.153	6.510
Probability	0.389	0.009	0.000	0.147	0.528	0.562	0.039
Observations	37	37	37	37	37	37	37

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



Source: Standardized World Income Inequality Database

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



4.2 Results

We commence the empirical analysis by testing 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 2 displays the ADF and PP unit root tests estimates and shows that income inequality, inflation, real GDP and general government spending are stationary at levels, while financial deepening, gross fixed capital formation and democracy are stationary only after first difference, thus making it suitable to use ARDL estimators (Pesaran et al., 2001).

Table 2: Unit root test results

PP UNIT ROOT TEST TABLE AT LEVEL

		lnIE	*ln*FD	INF	*ln*RGDP	DEMO	*ln*GE	*lnGCF*
With Constant	t-Statistic	-1.056	-2.152	-3.056	-4.430	-1.335	-4.670	-2.791
	Prob.	**0.723**	**0.227**	**0.039**	**0.001**	**0.603**	**0.001**	**0.069**
		no	no	**	***	no	***	*
With Constant & Trend	t-Statistic	-0.869	-2.557	-3.946	-4.479	-1.140	-4.336	-2.312
	Prob.	**0.949**	**0.301**	**0.019**	**0.005**	**0.908**	**0.008**	0.418
		no	no	**	***	no	***	no
AT FIRST DIFFERENCE								
With Constant	t-Statistic	-1.329	-6.685	-8.736	-9.232	-3.214	-6.144	-6.400
	Prob.	**0.605**	**0.000**	**0.000**	**0.000**	**0.027**	**0.000**	**0.000**
		no	***	***	***	**	***	***
With Constant & Trend	t-Statistic	-1.636	-6.752	-8.562	-8.878	-3.395	-6.471	-7.001
	Prob.	**0.758**	**0.000**	**0.000**	**0.000**	**0.068**	**0.000**	**0.000**
		no	***	***	***	*	***	***

ADF UNIT ROOT TEST TABLE AT LEVEL

		lnIE	*ln*FD	INF	*ln*RGDP	DEMO	*ln*GE	*lnGCF*
With Constant	t-Statistic	-1.951	-2.155	-3.153	-4.419	-1.576	-3.945	-2.772
	Prob.	**0.306**	**0.226**	**0.031**	**0.001**	**0.485**	**0.004**	**0.072**
		no	no	**	***	no	***	*
With Constant & Trend	t-Statistic	-3.953	-2.490	-3.947	-4.479	-1.553	-3.878	-2.411
	Prob.	**0.021**	**0.331**	**0.019**	**0.005**	**0.792**	**0.023**	0.368
		**	no	**	***	no	**	no
AT FIRST DIFFERENCE								
With Constant	t-Statistic	-1.408	-6.677	-7.804	-7.164	-3.258	-6.128	-6.400
	Prob.	**0.568**	**0.000**	**0.000**	**0.000**	**0.025**	**0.000**	**0.000**
		no	***	***	***	**	***	***

With Constant & Trend	t-Statistic	-1.722	-6.731	-7.694	-7.076	-3.353	-5.077	-6.814
	Prob.	**0.721**	**0.000**	**0.000**	**0.000**	**0.074**	**0.001**	**0.000**
		no	***	***	***	*	***	***

Where lnFD, lnGCF, lnGE, lnIE, lnINF, lnRGDP, DEMO, represent financial deepening, gross capital formation, general government expenditure, income inequality, inflation rate, real GDP and democracy.
Notes: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant
*MacKinnon (1996) one-sided p-values.

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 3 suggest that the null hypothesis of no long-run association between variables should be rejected since the F-value of 23.9 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 (2, 1, 3, 3, 2, 3, 3) as our final specification.

Table 3: F-Bounds test results

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	23.92420	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43

The long-run and short-run coefficients derived from the ARDL model are shown in panel A and B of Table 4. Panel A of Table 4 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. nonlinear 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 4, 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 5.6% increase in income inequality. However, at later stages in financial development, further increases in financial deepening can lower income inequality by 0.7%. 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).

Though the financial deepening-inequality nexus is a topic of recent attention in South Africa, 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 4: ARDL estimates of the relationship between financial deepening and inequality

Panel A: Long-run estimates

	Model 1			***Model 2***			***Model 3***		
Variable	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
*ln*FD	0.011	0.025	0.670	5.591	1.823	0.010	4.534	1.730	0.026
*ln*FDSQ	--	--	--	-0.680	0.223	0.010	-0.553	0.210	0.025
INF	0.000	0.001	0.618	0.002	0.001	0.031	0.002	0.001	0.139
*ln*RGDP	0.121	0.018	0.000	0.156	0.020	0.000	0.152	0.018	0.000
*ln*GE	-0.168	0.080	0.047	-0.381	0.109	0.004	-0.360	0.095	0.004
*ln*GCF	-0.083	0.035	0.027	-0.086	0.031	0.018	-0.072	0.028	0.028
DEMO	--	--	--	--	--	--	0.002	0.002	0.408

Panel B: Short-run estimates

C	-1.258	0.079	0.000
Δ (*ln*LIE(-1))	-0.095	0.082	0.269
Δ (*ln*IE(-2))	0.698	0.073	0.000
Δ (*ln*FD)	0.025	0.066	0.708
Δ (*ln*FD(-1))	-0.354	0.061	0.000
Δ (*ln*FDSQ)	-0.004	0.008	0.634
Δ (*ln*FDSQ(-1))	0.043	0.007	0.000
Δ (*ln*RGDP)	0.022	0.007	0.006
Δ (*ln*RGDP(-1))	0.043	0.006	0.000
Δ (INF)	0.000	0.000	0.093
Δ (*ln*GE)	-0.022	0.003	0.000
Δ (*ln*GE(-1))	0.006	0.003	0.064

Δ (lnGCF)	0.000	0.001	0.767
ECM (–1)	-0.126	0.008	0.000
R-squared	0.988		
Adjusted R-squared	0.980		
S.E. of regression	0.000		
Sum squared resid	0.000		
Log likelihood	210.691		
F-statistic	117.364		
Prob(F-statistic)	0.000		

The estimated coefficients of the control variables – inflation, real GDP, general government expenditure, and capital formation enter the model with the anticipated signs. The estimated long-run coefficients of general government expenditure and capital formation are negative and statistically significant, suggesting that income inequality falls as general government expenditure increases and capital formation increases. This inverse association between government spending and income inequality is consistent with Destek (2020) who finds that government redistributive spending brings about a decrease in income inequality both in the short-run and the long-run. The findings for gross capital formation are in line with the Harrod-Domar theory that accumulation of capital increases production capacity, resulting in higher employment (Limosani and Monteforte, 2017). As such, investing in capital goods for production purposes should reduce inequality through the increased employment channel.

On the other hand, income inequality is positively associated with inflation and real GDP. 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 real GDP and income inequality respectively. Holding other things constant, a 1 % increase in real GDP increase income inequality by 0.02 % (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.

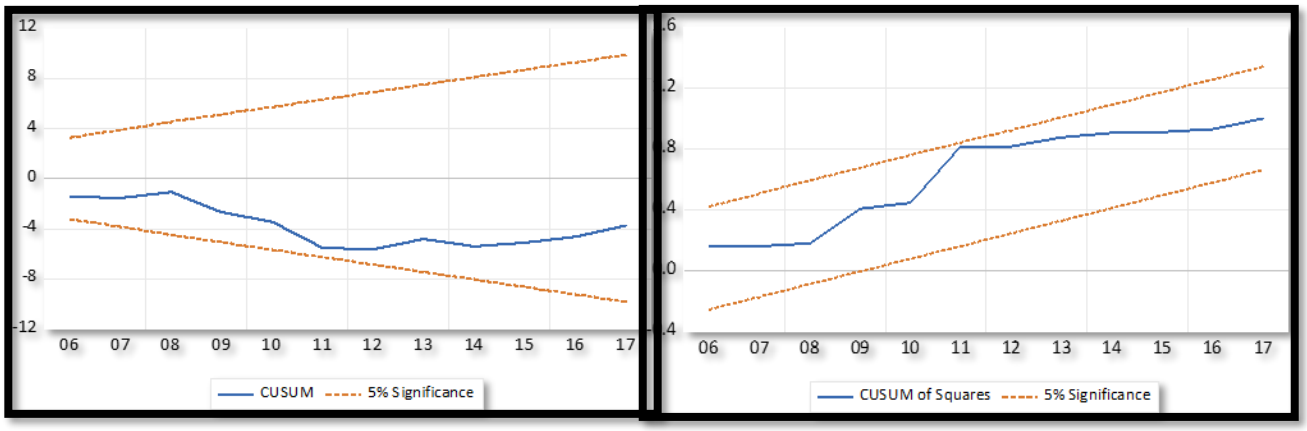
Model 3 accounts for the possibility that the quality of institutions (captured by democracy) can have some influence on inequality. According to Pérez-Moreno and Angulo-Guerrero (2016) and Sarkhosh-Sara et al. (2020), democratic institutions can facilitate economic opportunities to the lower income groups thus reducing inequality. The long-run estimated coefficients of democracy is however positive and not significant, implying that democracy is not inequality-reducing as expected. 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.
Model 3 also confirms that despite the inclusion of the democracy variable in the model, the parameter estimates of the financial deepening and its square term keep their signs and are significant. It also shows that the estimated coefficients of the control variables: inflation, real GDP, general government expenditure, and capital formation do not change in any substantive way after adding the democracy variable.

Panel B of Table 4 presents the short-run estimates. The estimated coefficient of the error correction term ECM (-1) enters the model negatively and significantly at the 1% level, confirming that our model tends to gravitate back to long-term equilibrium immediately after a shock. The ECM (-1) of −0.126 shows that the speed of adjusted subsequent to a shock is 12.6% 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, though the estimates are not significant.

We also performed 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 A2). The results reveal no evidence of serial correlation nor heteroscedasticity. Neither did 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



4.3 Robustness Check: Using FMOLS, DOLS and CCR

This section assesses the robustness of our results by employing Canonical Cointegration (CCR) regression by Park (1992), fully modified least square (FMOLS) model of Phillips and Hansen (1990) and dynamic ordinary least square method (DOLS) by Stock and Watson (1993) as alternative estimators. 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).

The results displayed in Table 5 are consistent with ARDL estimates. 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 coefficient of general government expenditure and capital formation, remain negative and statistically significant at 1% level, while real GDP and inflation continue to demonstrate a significantly positive relationship.

Table 5: 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	0.740	0.095	0.000	0.681	0.179	0.007	4.303	0.095	0.000
*ln*FDSQ	-0.082	0.010	0.000	-0.075	0.019	0.005	-0.547	0.010	0.000
*ln*RGDP	0.114	0.011	0.000	0.118	0.023	0.002	0.164	0.011	0.000
*ln*INF	0.002	0.001	0.001	0.003	0.001	0.012	-0.102	0.001	0.000
*ln*GE	-0.103	0.028	0.001	-0.100	0.042	0.049	-1.917	0.024	0.000
*ln*GCF	-0.040	0.013	0.004	-0.044	0.034	0.235	-0.763	0.014	0.000
R-squared	0.969			0.998			0.998		
Adjusted R-squared	0.963			0.993			0.993		

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, 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 socio-economic 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 disenfranchised. These reforms can include different credit requirements for different income groups, or lower interest rates on loans for businesses that

qualify as small enterprises to encourage participation in the financial sector. 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 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
GCF	Gross capital formation (% of GDP)	WDI
GE	General government final consumption expenditure (% of GDP)	WDI
INF	Inflation, consumer prices (annual %)	WDI
RGDP	GDP (constant 2010 US$)	WDI
DEM	Democracy	Polity IV Project