

Informality, financial development and income inequality in South Africa

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Tolulope Osinubi and Munacinga Simatele
University of Fort Hare, Alice, South Africa

Abstract

Purpose – The study investigates the link between the informal economy, financial development and income inequality in South Africa over the period 1991–2020.

Design/methodology/approach – The study employs the ARDL and Dynamic OLS techniques. Also, the Toda-Yamamoto (TY) causality test is employed to determine the direction of causality between the informal economy and income inequality.

Findings – The study reveals that the informal economy and financial development narrow the income gap between the rich and the poor. However, financial development plays a substitutability role in the relationship between the informal economy and financial development, limiting the informal economy's ability to alleviate income inequality. The TY causality test indicates a one-way causal relationship between the informal economy and income inequality.

Originality/value – The study examines the moderating effect of financial development on the association between the informal economy and income inequality, given the limited research on this topic in South Africa. Also, it employs a robust measure of financial development developed by Svirydzhenka (2016). Finally, the study focuses on the South African economy, given its high-income inequality and the large proportion of its black population in the informal sector.

Keywords Informal economy, Income inequality, Financial development, South Africa

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1. Introduction

In terms of economic growth (measured by Gross Domestic Product, GDP), South Africa ranks first with US\$373.23, followed by Egypt, Algeria, Nigeria, and Ethiopia with US\$347.59, US\$266.78, US\$252.74, and US\$205.13, respectively (Galal, 2024). Despite being one of the most developed economies in Africa, South Africa has the highest level of income inequality (INQ, henceforth) in Africa and the world. According to the Statista report in 2024, South Africa has a Gini index [1] of 63% (Fleck, 2024), indicating a wider income gap between the poor and rich than in any other country. Also, the World Inequality Database (WID) reports that the “top decile (10% of the population) accounts for ten times the share of national income (NI) as the bottom half of the population”. Based on this report, the richest decile accounts for about 65% of NI, while the poorest half of the population accounts for only 6% of NI. Apartheid's legacy of systematically excluding Black South Africans from economic opportunities, which resulted in differences in education, skills, employment, and land ownership, is the main cause of South Africa's high inequality. This is made worse by high unemployment rates, unequal access to high-quality education, and a skewed distribution of wealth that benefits the white minority. Also, low growth and rising unemployment have been identified as factors contributing to South Africa's persistence of INQ (International Monetary Fund, IMF, 2020a). As shown in Figure 1, INQ from the WID ranges between 0.488 and 0.654

JEL Classification — C22, D63, E26, O17

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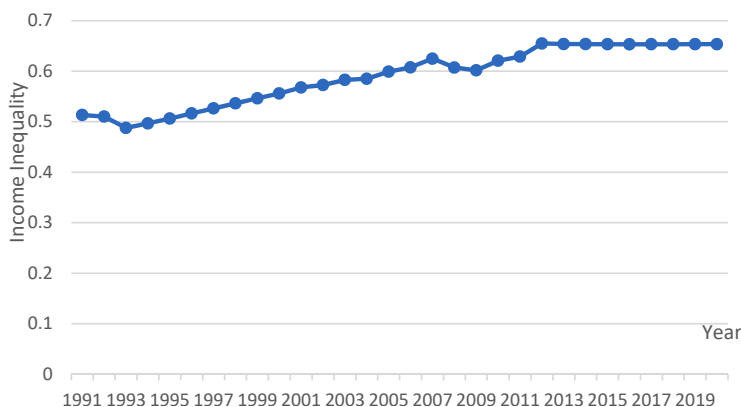


Figure 1. Income inequality in South Africa (1991–2020). Source: World Inequality Database (WID)

over the study period, indicating a highly skewed income distribution. This implies that a small percentage of the South African population holds a disproportionately large share of the country’s wealth. Meanwhile, a high level of INQ can adversely affect the economy by retarding growth, increasing the number of people living in abject poverty, and reducing investment levels, among other effects.

Reducing INQ directly contributes to Sustainable Development Goal (SDG) 10 (Reduced Inequalities), and several efforts have been undertaken in South Africa to reduce it. To diversify wealth ownership and encourage entrepreneurship among the impoverished, these initiatives include social expenditures, targeted government transfers, and affirmative action (IMF, 2020a). However, these actions need to be supported by changes that encourage employment, private investment, and inclusive growth. Considering this, this study examines how the informal economy (INF, henceforth) affects INQ, with a view to determining the role FD plays in this relationship.

The motivation of this study is based on the following. INQ is a serious developmental issue in South Africa that needs to be addressed, and the INF is considered to be among the factors influencing INQ (Ajide *et al.*, 2024; Pham *et al.*, 2024; Masca and Chis, 2023; Rashid *et al.*, 2023; Wong, 2023; Saha *et al.*, 2021; Yap *et al.*, 2018). Researchers and policymakers are interested in the INF because of its potential to impact social and economic development (Osinubi and Simatele, 2024a, b, 2025; Elbahnasawy *et al.*, 2016). This implies that the INF can either worsen or alleviate INQ. On the one hand, since one of the main causes of South Africa’s substantial income disparity is high unemployment, the INF can lead to job creation and employment opportunities, leading to increased income for the vulnerable population (see also Ajide *et al.*, 2024; Esaku, 2021; Huynh and Nguyen, 2020). IMF (2020b) reported that approximately 60% of South Africa’s youth (ages 15–24) are unemployed, resulting in a much higher unemployment rate than in other emerging markets. According to statistics, the INF’s average size across Africa is over 38% of GDP; however, in South Africa, it is roughly 27% (see Figure 2). This suggests that South Africa is one of the African nations with the lowest INF percentage. Given that one-third of South Africa’s workforce is employed in the unorganised sector, the informal sector nevertheless provides a sizable number of jobs compared to the formal sector (Osinubi and Simatele, 2024a). This view of inequality-reducing effect is situated within the dualistic theory of development proposed by Lewis (1954), which holds that excess labour from the formal sector is absorbed by the informal sector, thereby providing income prospects for low-skilled and marginalised workers. The expansion of income-earning opportunities at the lower end of the income distribution through the informal sector would help reduce the income gap, suggesting the distributive role of the informal sector. Another

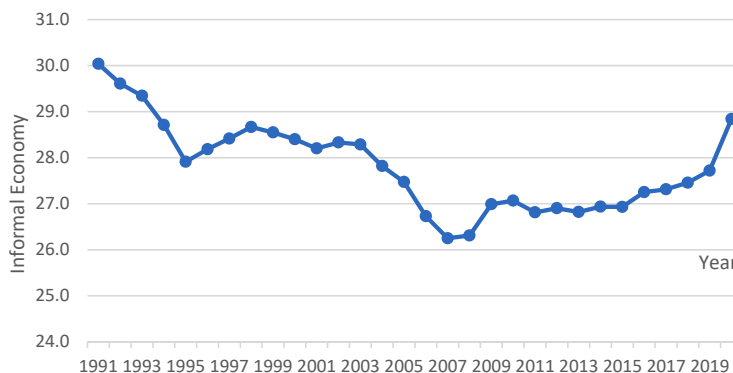


Figure 2. Informal economy (% of GDP) in South Africa (1991–2020). Source: [Elgin et al. \(2021\)](#)

perspective on this inequality-reducing effect is that informal entrepreneurship redistributes economic opportunities geographically, especially within townships excluded from formal economic development, allowing the disadvantaged population to be actively involved in economic activity that can help lessen the gap between the poor and the rich.

On the other hand, the INF can worsen INQ due to employer exploitation, inadequate social protection (including workers' compensation, health insurance, and pensions), and restricted access to credit. According to studies such as [Vellutini et al. \(2019\)](#) and [Elveren and Özgür \(2016\)](#), the INF limits society's capacity to fund welfare programs and collective goods that can reduce poverty. INQ in many countries can worsen in the face of informality due to the structure of the labour market, institutional quality, and access to financial services in these nations. For instance, when informality reinforces structural labour market segmentation, unfair access to economic participation, and productivity gaps, the INF may worsen INQ. Also, if the institution's quality is poor, informality may not always shrink INQ because poor institutional quality, as evidenced by high levels of corruption, lack of accountability and the rule of law, government ineffectiveness, and political instability, would adversely affect the INF's ability to alleviate INQ. Limited access to finance would also prevent the INF from contributing to workers' welfare in the unorganised sector.

Based on the argument that limited access to finance is one of the ways through which the INF can worsen INQ, the study captures the interactive effect of the INF and financial development (FD, henceforth) on INQ in South Africa. A weak financial sector can limit access to financing, especially for the most vulnerable, thereby reducing the INF's ability to reduce INQ. [Levine \(1997\)](#) posited that FD helps transfer funds and provide financial services, especially for informal workers. Thus, a well-developed financial system is expected to provide the credit informal sector workers need to increase their productivity, thereby boosting their incomes and narrowing wealth and poverty disparities. Additionally, a strong financial system gives low-income people the chance to invest in entrepreneurship, healthcare, and education, all of which can help close the income gap. FD shapes the invisible INF ([Ameer et al., 2025](#)). In the study of [Rahman et al. \(2024a\)](#), financial markets help to channel savings from lenders to borrowers to spur economic development (see also [Pan and Mishra, 2018](#)). Thus, a well-developed financial system can complement the INF in alleviating INQ, suggesting that FD may play a complementary role.

Contrarily, even with sufficient credit availability, FD can reduce the activity of the unorganised sector ([Onwuka and Ayeni, 2023](#); [Khan et al., 2023](#); [Canh and Thanh, 2020](#); [Gharleggi and Jahanshahi, 2020](#)). According to [Afful et al. \(2025\)](#), a robust financial system facilitates access to credit and financial services, which promotes economic growth and the rise of the organised sector. People would be encouraged to transition from informal to formal

employment, thereby creating additional opportunities for formal employment. This implies that FD may play a substitutability role. The dualistic theory of development (Lewis, 1954) states that FD improves credit availability, which can support the expansion of formal enterprises in the modern sector and help hire people who were previously engaged in low-productivity informal activities (the traditional sector). Therefore, FD plays a crucial role in the relationship between the INF and INQ, since an efficient and well-developed financial system can help lower entry barriers into the formal (modern) sector, thereby reducing the size of the INF and alleviating INQ. Based on Svirydzienka's (2016) overall FD index, the South African financial sector is moderately developed, with an average value of 0.449 over 1991–2020 (see Figure 3).

The study contributes to the existing literature as follows. First, the study focuses on South Africa, highlighting its unique characteristics. It is claimed that the nation's labour-market rigidities, ongoing structural unemployment, and historical spatial inequalities affect formal-sector employment. According to statistics, there are 7.5 million people in South Africa's informal sector, compared to 9.5 million in the formal sector (Asmal et al., 2024), indicating that the INF is crucial for absorbing surplus labour from the formal sector. The INF is acknowledged to have a large impact on INQ as one of the socio-economic circumstances, since INQ is a serious developmental issue in South Africa with an inequality index of over 60% (Osinubi and Simatele, 2024a, b, 2025). The apartheid regime, which imposed racial segregation and economic inequality for many years, had a significant influence on South African INQ. As a result, non-white South Africans, especially Black Africans, have less access to resources, job opportunities, and educational opportunities (Osinubi and Simatele, 2024a). Second, the study captures FD's moderating role in the relationship between the INF and INQ. To the best of our knowledge, no study has examined the role of FD in the INF-INQ nexus, especially in South Africa. It is crucial to include FDs' functions in the link, as it provides unorganised-sector workers with access to financial credit, thereby reducing INQ. It also expands access to formal financial services, which can help informal workers transition into the formal sector. This implies that FD can play either a complementary or a substitutability role in the informality-inequality nexus.

Third, in accordance with Ojeyinka and Osinubi (2026), Afful et al. (2025), and Ajide and Osinubi (2024), the study uses a robust measure of FD created by Svirydzienka (2016). The index is preferred over other single FD measures because it provides a comprehensive assessment of financial system development. It includes the efficiency, depth, and accessibility of financial markets and institutions. In addition to the index, the study employs an alternative measure of FD and an alternative econometric technique to validate empirical results. Lastly,

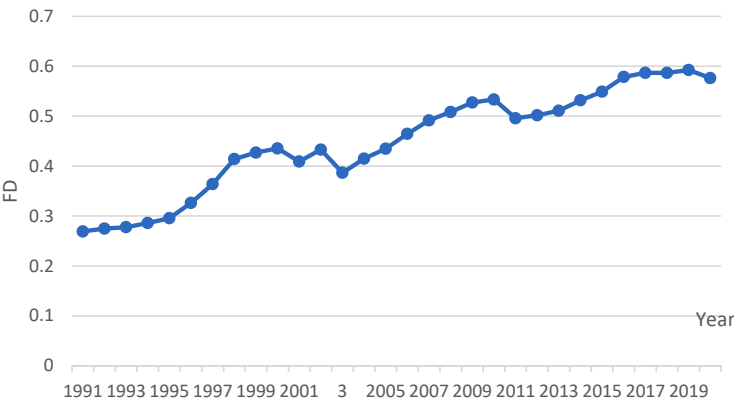


Figure 3. Overall financial development index in South Africa (1991–2020). Source: Svirydzienka (2016)

the study analyses the direction of causality between the INF and INQ, since it remains controversial which causes what. For instance, [Ajide et al. \(2024\)](#) and [Alvarado et al. \(2021\)](#) established a bidirectional causal link between the INF and INQ, while [Gutiérrez-Romero \(2021\)](#) and [Dell'Anno \(2016\)](#) demonstrated that INQ can influence the INF. A high degree of INQ can push people into the INF, which is seen as a coping mechanism to raise income.

The rest of the paper is structured as follows. [Section 2](#) discusses the relevant studies. [Section 3](#) focuses on research methodology. [Section 4](#) presents empirical results and discusses them. The concluding remark is presented in Section Five.

2. Relevant studies

2.1 Informality and income inequality

In line with the 2030 Agenda for Sustainable Development, which calls for leaving no one behind, the United Nations has identified alleviating INQ as a central focus of many domestic and foreign policy debates. This is important because the United Nations agreed that all should enjoy equal access to opportunities ([United Nations, 2020](#)). There are relatively few studies (both theoretical and empirical, quantitative and qualitative) on the association between the INF and income distribution, especially in South Africa. Scholars and policymakers have shifted attention to the INF due to its contribution to economic growth and development ([Berdiev and Saunoris, 2018](#); [Schneider and Enste, 2000](#); [Asea, 1996](#)). Even though some studies argued for the formalisation of the informal sector, others still highlighted its importance in the economy. Thus, this section specifically discusses the role of informality in either alleviating or worsening income distribution based on extant studies.

The first strand of the literature concentrates on the advantages of the unorganised sector. [Masca and Chis \(2023\)](#) examined the distributional consequences of the INF across 28 EU nations, accounting for cultural traits and the distribution of tax evasion gains. According to their findings, domestic informality has a negative impact on INQ, but when individuals' international tax evasion is connected to the top-bottom income gap, the effect turns positive. [Magwedere and Marozva \(2025\)](#) found that the INF reduces INQ by providing impoverished individuals with economic options, based on a sample of 18 African nations. A similar outcome is established by [Ajide et al. \(2024\)](#) and [Huynh and Nguyen \(2020\)](#) for several countries in West Africa and Asia, respectively. According to them, the INF reduces INQ. Based on the single-country analysis, [Esaku \(2021\)](#) concluded that INQ increases with a larger size of the INF in Uganda. [Kireenko and Nevzorova \(2015\)](#) and [Valentini \(2009\)](#) are other supporting studies regarding the negative association.

The second strand documents that the INF contributes to the unequal distribution of income. This is frequently justified by the claim that the INF encourages tax evasion, which keeps the government from funding welfare programs intended to enhance income distribution ([Masca and Chis, 2023](#)). This is also supported by [Vellutini et al. \(2019\)](#) and [Elveren and Özgür \(2016\)](#), who argued that society's ability to organise welfare programmes and provide collective goods is hindered by tax evasion, thereby threatening the implementation of progressive income distribution. [Xue et al. \(2014\)](#) investigated the impact of informal employment on urban income distribution in China using survey datasets from the China Urban Labour Surveys of 2005 and 2010. Their findings showed that there is a large earnings gap between informal and formal workers, which increased the Gini coefficient to 0.42 in 2005. [Wong \(2023\)](#) for a panel of 127 countries and [Saha et al. \(2021\)](#) for 21 Asian countries are two more studies that corroborated the beneficial impact of the INF on INQ. Apart from the linear relationship between INF and INQ, few studies have investigated their nonlinearity. [Pham et al. \(2024\)](#) showed an inverted U-shaped relationship between the INF and INQ in a panel of 99 countries, while [Yap et al. \(2018\)](#) discovered an inverted N-shaped pattern between the two variables.

As established in the literature, INQ can also influence INF, suggesting a feedback effect between the two variables. For instance, [Ajide et al. \(2024\)](#) and [Alvarado et al. \(2021\)](#)

documented a bidirectional causality between INF and INQ. Whereas studies such as [Esaku \(2021\)](#), [Gutiérrez-Romero \(2021\)](#), [Dell'Anno \(2016\)](#), [Elveren and Özgür \(2016\)](#), [Dell'Anno and Solomon \(2014\)](#), and [Chong and Gradstein \(2007\)](#) revealed that INQ causes the INF. We hypothesise the following based on this discussion.

H1. There is a feedback effect between the INF and INQ in South Africa.

2.2 Financial development and income inequality

There is no consensus in the literature regarding the relationship between FD and INQ. To start, [Akisik and Gal \(2023\)](#) examined the mediating role of FD in the nexus between International Financial Reporting Standards and INQ using a global sample, finding that FD reduces INQ levels. In line with [Akisik and Gal \(2023\)](#), [Zhang and Naceur \(2019\)](#) showed that FD, in terms of access, depth, efficiency, and stability, reduces INQ across 143 countries. Also, [Chen and Kinkyo \(2016\)](#) argued that FD and INQ are negatively related in the long run across 88 countries. In a sample of 17 developed nations, [Hailemariam et al. \(2021\)](#) found that advances in FD alleviate INQ in the selected countries. On the contrary, [de Haan and Sturm \(2017\)](#) and [Seven and Coskun \(2016\)](#) reported otherwise. Hence, we hypothesise that:

H2. FD influences INQ in South Africa.

2.3 Financial development, informality and income inequality

Furthermore, numerous studies have examined the association between FD and the INF, suggesting that FD can affect the link between the INF and INQ. Most studies documented a negative relationship between FD and the INF. It is anticipated that a well-developed financial system will improve enterprises' and firms' access to formal financial services and credit, thereby reducing the size of the INF. [Afful et al. \(2025\)](#) argued that FD eventually reduces the size of the informal sector by facilitating a transition from the informal to the formal sector. The authors further argued that an economy and a formal sector tend to grow in the face of FD. As this happens, more formal job opportunities would emerge, and people would be encouraged to leave informal jobs for formal jobs. A similar outcome is obtained by [Canh and Thanh \(2020\)](#) using 114 countries. The authors found that the INF's operations are diminished by all nine FD parameters (markets' and financial institutions' access, depth, and efficiency). The INF was more significantly impacted by financial institutions than by financial markets, particularly by the efficiency of financial institutions.

According to [Capasso and Jappelli \(2013\)](#), FD encourages investment in high-tech projects, decreases credit rationing and incentives to operate informally, and raises the opportunity cost of informality by lowering credit costs. Meanwhile, some studies affirmed that FD alone cannot reduce the activities of the informal sector. For instance, [Rahman et al. \(2024b\)](#) argued that FD can only reduce the size of the INF by controlling a country's financial, economic, and political risks. The same outcome is also found in the study of [Rahman et al. \(2023b\)](#). Other studies in support of a negative association between FD and the INF include [Onwuka and Ayeni \(2023\)](#), [Khan et al. \(2023\)](#), [Rahman et al. \(2023a\)](#), [Karimo et al. \(2022\)](#), [Gharleghi and Jahanshahi \(2020\)](#), [Njangang et al. \(2020\)](#), [Bayar and Ozturk \(2016\)](#), [Berdiev and Saunoris \(2018\)](#), [Capasso and Jappelli \(2013\)](#), and [Bose et al. \(2012\)](#), to mention a few.

Conversely, [Ameer et al. \(2025\)](#) demonstrated that FD helps raise the INF in industrialised nations. The claim is that FD provides informal labourers with access to the credit and financial services they need to grow their businesses. Additionally, [Din et al. \(2019\)](#) noted an inverted U-shaped link between FD and the INF. This suggests that as FD advances in Malaysia from lower to higher levels, the informal economy initially grows, then declines, after reaching a certain threshold.

Against this backdrop, it is evident that FD can influence the INF to either reduce or increase INQ. Considering this, the following hypothesis is tested.

H3. FD moderates the nexus between the INF and INQ in South Africa.

2.4 Research gaps

Our current analysis fills a critical gap in the literature regarding the moderating role of FD in the INF-INQ nexus in South Africa. This is crucial, given the South African government's coordinated efforts to address substantial informality and income inequality in the nation, and to bolster the financial sector through the National Financial Inclusion Strategy in 2023 and recent FinTech (digital banking) initiatives by the South African Reserve Bank in 2024. Additionally, this study estimates the short- and long-term moderating impacts of FD and INF on INQ in South Africa using the ARDL approach. This is premised on the idea that FD reforms may have distinct short- and long-term effects in the INF-INQ nexus, which is important for policymakers designing effective interventions.

3. Methodology

3.1 Theoretical framework

In line with the study of [Ajide et al. \(2024\)](#), the theoretical framework underpinning the link between the INF and INQ is based on the dualistic theory of development. According to the dualistic perspective, as outlined by [Harris and Todaro \(1970\)](#) and [Lewis \(1954\)](#), the INF is a temporary and marginal phenomenon. They argue that informal economic activities are essential for the survival of marginalised citizens and can improve income outcomes for low-income households. However, the theory is indirectly linked to FD since FD serves as an avenue for structural transformation. For instance, FD enhances access to credit, which can help formal businesses in the modern sector grow and employ those formerly engaged in low-productivity informal activities (the traditional sector). Hence, FD plays a critical role in linking the INF and INQ, as a well-functioning and well-developed financial system can help lower entry barriers into the formal (modern) sector, thereby reducing the size of the INF and alleviating INQ. In an underdeveloped financial system, people are trapped in the informal sector due to inadequate finance and continue to see it as a coping strategy to escape poverty and reduce income gaps.

3.2 Model specification and method of analysis

The present study follows dualistic theory and other existing studies, such as [Ajide et al. \(2024\)](#), [Masca and Chis \(2023\)](#), and [Saha et al. \(2021\)](#), in modelling the association among INF, FD, and INQ. The augmented model includes education and economic growth as factors that affect INQ. As stated in [Equation 1](#), INQ is a function of informality and other variables.

$$INQ_t = \omega_0 + \omega_1 INF_t + \omega_2 FD_t + \omega_3 EDU_t + \omega_4 GDP_t + \epsilon_t \quad (1)$$

where *INQ*, *INF*, *FD*, *EDU*, and *GDP* represent income inequality, the informal economy, financial development, education, and economic growth, respectively. The study employs the overall FD index developed by [Sviryzdenka \(2016\)](#), which provides a more robust representation of the financial system's functionality and complexity. According to [Afful et al. \(2025\)](#), the measure is preferred over traditional measures, such as credit availability and liquid assets, because it captures the depth, efficiency, and access of financial markets and institutions. *t* denotes the study period. ω_0 is the intercept, while ω_1 - ω_4 are the estimates. As shown in [equation 2](#), [equation 1](#) is modified to assess the moderating role of FD in the INF-INQ nexus.

$$INQ_t = \omega_0 + \omega_1 INF_t + \omega_2 FD_t + \Omega(INF*FD)_t + \omega_3 EDU_t + \omega_4 GDP_t + \epsilon_t \quad (2)$$

where $INF*FD$ is the interactive coefficient of INF and FD that moderates the role of FD in the nexus.

In this study, we employ an Autoregressive Distributed Lag (ARDL) approach, developed by [Pesaran et al. \(2001\)](#) and [Pesaran and Shin \(1999\)](#), to achieve the stated objectives. This approach is appropriate because (1) it can be used with a mixed order of integration other than I (2); (2) it can be employed when the study period is small, which is the case of this study (1991–2022); and (3) it can produce both short- and long-run unbiased estimates in a dynamic environment. Thus, the ARDL model is stated in [equation 3](#).

$$\begin{aligned}\Delta INQ_t = & \omega_0 + \sum_{j=1}^a \varnothing_j \Delta INQ_t + \sum_{j=0}^b \omega_{1j} \Delta INF_t + \sum_{j=0}^c \omega_{2j} \Delta FDI_t + \sum_{j=0}^d \Omega_j \Delta (INF*FD)_t \\ & + \sum_{j=0}^e \omega_{3j} \Delta EDU_t + \sum_{j=0}^f \omega_{4j} \Delta GDP_t + \pi_1 INQ_{t-1} + \pi_2 INF_{t-1} + \pi_3 FDI_{t-1} \\ & + \pi_4 INF_t + \pi_5 EDU_t + \pi_6 GDP_t + \epsilon_t\end{aligned}\quad (3)$$

where Δ is the difference operator. $\varnothing_j$, ω_{1j} , ω_{4j} , and Ω_j are the short-run estimates, while $\pi_1 - \pi_6$ are the long-run estimates. The long-run estimates from [equation 3](#) are normalised on INQ. Thus, the normalised equation is specified in [Equation 4](#).

$$INQ_{t-1} = \beta_0 + \beta_1 INF_t + \beta_2 FDI_t + \beta_3 (INF*FD)_t + \beta_4 EDU_t + \beta_5 GDP_t + \epsilon_t \quad (4)$$

where $\beta_0 = \frac{\omega_0}{-\pi_1}$; $\beta_1 = \frac{\omega_1}{-\pi_1}$; $\beta_2 = \frac{\omega_2}{-\pi_1}$; $\beta_3 = \frac{\Omega}{-\pi_1}$; $\beta_4 = \frac{\omega_3}{-\pi_1}$; $\beta_5 = \frac{\omega_4}{-\pi_1}$

[Equation 4](#) is partially differentiated, following studies such as [Osinubi and Simatele \(2024b\)](#), [Osinubi et al. \(2023\)](#), and [Ehigiamusoe et al. \(2020\)](#), to obtain the long-run marginal effect of the INF on INQ as stated in [equation 5](#).

$$\frac{\partial INQ_t}{\partial (INF*FDI)_t} = \beta_1 + \beta_3 FDI_t \quad (5)$$

As expected, the INF and FD should help reduce the income gap among South Africans. However, the statistical significance and direction of β_1 and β_3 in [equation 3](#) determine the role played by FD in the nexus between INF and INQ. If β_3 is negative and significant, it indicates that FD plays a complementary role, further strengthening INF to alleviate INQ. If β_3 is positive and significant, it shows that FD plays a substitutability role by weakening the potency of the INF in reducing INQ. If β_3 is insignificant, it suggests that FD does not complement or substitute the INF in alleviating INQ. Based on extant studies, education and economic growth can either alleviate or exacerbate INQ, making their impacts ambiguous.

The study employs an alternative technique, the Dynamic Ordinary Least Squares (DOLS) approach proposed by [Stock and Watson \(1993\)](#), to support the empirical findings from the ARDL approach. The technique is important because it (1) produces efficient and reliable estimates with a small sample size, which is the case of this study; (2) addresses the problem of serial correlation in time series regression models; (3) resolves endogeneity and simultaneity bias in regression models since changes in any of the variables of interest can simultaneously influence another, causing a feedback loop. The endogeneity issue arises because INQ can also influence other independent variables in the study, and these independent variables can influence one another. For instance, [Ajide et al. \(2024\)](#) and [Alvarado et al. \(2021\)](#) supported a feedback effect between the INF and INQ, while [Gutiérrez-Romero \(2021\)](#) and [Dell'Anno \(2016\)](#) argued that INQ can influence the INF. The explanation for the latter finding is that a wider income gap can push people into the informal sector. Additionally, [Rahman et al. \(2025\)](#) and [Faisal et al. \(2024\)](#) revealed that the INF can influence the development of the financial

sector on the argument that the informal businesses inhibit investment and economic activities that can foster FD and market performance; (4) is valuable in analysing cointegrated relationships between variables; and (5) estimates the long-run coefficients of these cointegrating relationships, offering valuable insights into the equilibrium dynamics of the system.

A modified version of the [Granger \(1969\)](#) causality test, developed by [Toda and Yamamoto \(1995\)](#), is used to determine the causal relationship between INF and INQ. This approach is superior to the Granger causality test since “it avoids the problems of testing granger causality with respect to the power and size properties of unit root and cointegration tests” ([Zapata and Rambaldi, 1997](#)). In other words, the TY causality test is applicable regardless of the integration order. Also, it is applicable when the variables are cointegrated, meaning they are individually non-stationary but have a long-run equilibrium relationship. The maximum order of integration ($d_{\max}$) and the optimal lag length (k) must be determined before conducting the TY causality test ([Amiri and Ventelou, 2012](#)). Having determined these, the $(k + d_{\max})$ th-order VAR will then be estimated. Thus, the TY causality test has a null hypothesis of no causality, and the model is stated in [equation 6](#).

$$\begin{aligned} INQ_t &= \alpha + \sum_{j=1}^{k+d_{\max}} \theta INQ_{t-j} + \sum_{j=1}^{k+d_{\max}} \pi INF_{t-j} + \mu_{1t} \\ INF_t &= \lambda + \sum_{j=1}^{k+d_{\max}} \varphi INQ_{t-j} + \sum_{j=1}^{k+d_{\max}} \gamma INF_{t-j} + \mu_{2t} \end{aligned} \quad (6)$$

where $t = 1, 2, 3, \dots, T$, $d_{\max}$ is the maximum order of integration, and k denotes the optimal lag length. The null hypotheses to be tested are H_A : *INF does not granger-cause INQ* and H_B : *INQ does not granger-cause INF*. A significant p -value of the TY causality test rejects the null hypothesis of no causality. Most importantly, the TY causality test will include additional explanatory variables (FDI, EDU, and GDP) in addition to INF.

3.3 Data

The study uses time-series data from South Africa. It covers 30 years, from 1991 to 2020, due to data availability.

Dependent Variable: INQ is the dependent variable. Following [Osinubi and Simatele \(2026\)](#) and [Wang and Xu \(2023\)](#), the study measures it as “the share of total pre-tax national income held by the top 10%” from the World Inequality Database (WID). According to [Chandy and Seidel \(2017\)](#), the GINI index may not be the best indicator of objective inequality because it does not accurately reflect the income of the wealthiest members of a given society. [Haddon and Wu \(2022\)](#) established that “the top 10% share is the concentration of cumulative taxable individual income split by couples among the top 10% of a country’s population at the current point”.

Core Independent Variables: These include INF, following [Elgin et al. \(2021\)](#), and FD, proxied by [Sviryzdenka’s \(2016\)](#) overall FD index. The INF is proxied by “Multiple indicators multiple causes model-based (MIMIC) estimates of informal output (% of official GDP)” in line with [Osinubi and Simatele \(2025\)](#), [Ajide et al. \(2024\)](#), [Bolarinwa and Simatele \(2023\)](#), and [Dada et al. \(2021\)](#). This indicator is frequently adopted because of its adaptability and reliability ([Swain et al., 2022](#); [Schneider et al., 2011](#); [Chen et al., 2018](#)). Consistent with the study of [Ojeyinka and Osinubi \(2026\)](#), [Ajide and Ojeyinka \(2022\)](#), [Aluko and Ibrahim \(2021\)](#), and [Opoku et al. \(2019\)](#), the FD is measured by the overall FD index obtained by aggregating the depth, efficiency, and access of the financial markets and institutions ([Sviryzdenka, 2016](#)). This index is preferred over other specific FD metrics, such as broad money supply, domestic credit to the private sector, and stock market capitalisation to GDP, because it encompasses all

facets of a nation’s financial system. The index goes from 0 (weak FD) to 1 (strong FD). The degree of FD increases as the index value approaches 1.

Control Variables: The study includes other explanatory variables that can influence INQ. The variables are gotten from the World Bank’s World Development Indicators and include education (primary school enrolment, % gross) and economic growth (GDP growth, annual %). Both variables, according to studies such as [Ajide et al. \(2024\)](#), [Kartiasih et al. \(2023\)](#), [Pham et al. \(2024\)](#), [Masca and Chis \(2023\)](#), [Rashid et al. \(2023\)](#), [Wong \(2023\)](#), [Saha et al. \(2021\)](#), and [Yap et al. \(2018\)](#), are very crucial in determining INQ. INQ may improve or deteriorate as a result of increased economic growth and education. For instance, while exclusive economic growth can result in capital-intensive growth and skill-biased technological change that can exacerbate INQ, inclusive economic growth, particularly when it is enhanced, leads to job creation, fiscal redistribution, and the accumulation of human capital required to close the gap between the rich and the poor. Similarly, education can improve people’s abilities, productivity, and earning potential, thereby encouraging income convergence across socio-economic levels. Meanwhile, skill-biased technological progress and unequal access to high-quality education might exacerbate INQ. The variable descriptions are shown in [Table 1](#).

The results of the descriptive statistics and correlation analysis are displayed in [Table 2](#) with a focus on the main variables. From the table, the average values of INQ (INQ), INF (INF), and overall FD (FD) are 0.589, 27.809%, and 0.450, respectively. The average values of these variables lie within their minimum and maximum values, indicating a high level of consistency. Furthermore, the INQ mean and maximum values indicate that South Africa has a higher INQ level than other African nations.

The INF, averaging 27.809% and reaching 30.037%, accounts for close to one-third of South African GDP. On FD, the mean of 0.450 and the highest value of 0.593 indicate that the financial sector in South Africa is moderately developed. The standard deviation shows that INQ, INF, and FD do not deviate from their means, indicating that the variables are less volatile.

Furthermore, the average values of INQ and FD are below their medians over the study period, indicating that INQ and FD are left-skewed. In contrast, the average value of INF is greater than its median, suggesting that INF is right-skewed. These outcomes are also supported by the skewness values being negative for INQ and FD, and positive for INF. The values of Kurtosis are less than 3 for INQ, INF, and FD. This suggests that the variables are platykurtic, meaning that INQ, INF, and FD have fewer extreme values or outliers. The Jarque-Bera statistic reveals that the variables are normally distributed. This is also consistent with the fact that their mean values are close to their median values.

Table 1. Variables description

Variable	Symbol	Measurement	Source
Income Inequality	INQ	The share of total pre-tax national income held by the top 10%	WID
Informal Economy	INF	Multiple indicators multiple causes model-based (MIMIC) estimates of informal output (% of official GDP)	Elgin et al. (2021)
Financial Development	FD	Financial development index generated from the depth, access, and efficiency of the financial sector. It ranges between 0 and 1	Sviryzdenka (2016) , IMF
Education	EDU	Natural logarithm of primary school enrolment (% gross)	WDI
Economic Growth	GDP	GDP growth (annual %)	

Source(s): Authors’ compilations

Table 2. Descriptive statistics and correlation matrix

	INQ	INF	FD	EDU	GDP
Mean	0.589	27.809	0.449	102.689	2.056
Median	0.600	27.768	0.450	102.030	2.543
Maximum	0.655	30.037	0.593	119.008	5.604
Minimum	0.488	26.250	0.269	89.828	−5.963
Std. Dev.	0.057	0.973	0.103	6.833	2.455
Skewness	−0.313	0.396	−0.367	0.194	−1.223
Kurtosis	1.692	2.424	1.998	2.736	5.114
Jarque-Bera	2.629	1.198	1.929	0.275	13.065
Probability	0.269	0.549	0.381	0.871	0.001
INQ	1.000	−0.732	0.945	0.167	−0.095
INF		1.000	−0.696	−0.166	−0.412
FD			1.000	0.071	−0.147
EDU				1.000	−0.315
GDP					1.000
Observations	30	30	30	30	30

Source(s): Authors' compilations

To ensure that the analysis is free of multicollinearity, the pairwise correlations are examined in the lower section of [Table 2](#). The findings indicate that INQ is positively correlated with FD and education, but negatively correlated with INF and economic growth. None of the independent variables shows a high correlation coefficient, indicating that multicollinearity is absent in the regression analysis.

4. Results

4.1 Unit root tests

The empirical results begin with an investigation of the integration orders of the variables in the regression to avoid spurious regression. This is done using the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) unit root tests. The tests are carried out with and without trend and intercept, and trend and intercept, as displayed in [Table 3](#). The three specifications

Table 3. ADF and PP unit root tests

Variable	Intercept		Trend and intercept		Without trend and intercept	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Augmented Dickey-Fuller test						
INQ	−0.733	−4.613**	−1.612	−4.584***	2.510	−3.847***
INF	−2.208	−2.567	−0.142	−3.246*	0.188	−2.405**
FD	−1.306	−4.504***	−1.909	−4.549***	2.283	−3.797***
EDU	−1.752	−5.423***	1.741	−5.373***	−0.674	−5.324***
GDP	−1.675	−4.499***	−1.784	−5.098***	−1.407	−4.585***
Phillips-Perron Test						
INQ	−0.736	−4.574***	−1.968	−4.547***	2.403	−3.859***
INF	−2.227	−2.565	−0.523	−3.265*	−0.538	−2.190**
FD	−1.291	−4.543***	−2.208	−4.562***	2.283	−3.730***
EDU	−1.790	−5.431***	−1.757	−5.403***	−0.242	−5.317***
GDP	−1.610	−4.362***	−1.279	−5.036***	−1.434	−4.461***

Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively

Source(s): Authors' compilations

are included in the study to provide robust evidence, given that macroeconomic variables may exhibit non-zero means and deterministic growth patterns. The intercept specification captures possible level effects, allowing the series to fluctuate around a constant mean; the intercept-trend specification accounts for deterministic trends in addition to the series evolving around a constant mean; while the specification without trend and intercept assumes that the series has no deterministic drift and fluctuates around a zero mean. However, subsequent estimations are obtained using the intercept model, since the three specifications yield similar results. From the table, all the variables are stationary at first difference, indicating that the variables are $I(1)$, and this justifies the use of the ARDL technique, which is appropriate when the variables are all $I(0)$, $I(1)$ or a combination of both $I(0)$ and $I(1)$.

4.2 Empirical findings

4.2.1 Causality analysis. We start the analysis by investigating the causal link between the INF and INQ in South Africa. To do this, the study adopts the [Toda and Yamamoto \(1995\)](#) Causality Test as presented in [Table 4](#). The outcomes from the table invalidate hypothesis two of a bi-causal relationship between the INF and INQ. According to the findings, there is only one-way causality between the INF and INQ running from the INF to INQ. This implies that the INF only granger causes INQ in South Africa. The finding further supports the extant studies on the effect of INF on INQ. At the same time, it contradicts the findings of [Ajide et al. \(2024\)](#) and [Alvarado et al. \(2021\)](#), who documented a bidirectional causality between INF and INQ, and of [Gutiérrez-Romero \(2021\)](#) and [Dell’Anno \(2016\)](#), who revealed that INQ causes INF. In addition, the results indicate a one-way causal effect from INQ to FD, a bidirectional causal link between EDU and INQ, and no evidence of a causal relationship between GDP and INQ in South Africa. This implies that the high-level INQ in South Africa can inhibit the development of the financial system, as many people will be unable to participate in formal financial markets. This aligns with [Rahman et al. \(2025\)](#) and [Faisal et al. \(2024\)](#). Education helps people secure jobs that can reduce the income gap. In contrast, a high level of INQ can prevent people from obtaining the education they need in South Africa, as unequal income distribution affects both access to education and educational outcomes. The finding is established in the studies of [Ajide et al. \(2024\)](#) and [Pham et al. \(2024\)](#).

4.2.2 Short- and long-run estimates. The next step is to examine the long-run relationship between the variables using the ARDL bounds test, as shown in the lower section of [Table 5](#), based on the variables’ integration orders. The null hypothesis of no long-term association between the variables is rejected, as shown in the table, because the F-statistic exceeds the upper-bound critical values at various significance levels. The ideal lag length is determined to be two, and the lag length criterion is based on the Akaike information criterion (AIC). When

Table 4. Toda-Yamamoto causality test

Hypothesis	Chi-square	Lag (k)	Prob.	Remarks	Conclusion
INF → INQ	10.439***	4	0.004	Yes	INF causes INQ
INQ → INF	3.651	4	0.455	No	INQ does not cause INF
FDI → INQ	0.929	3	0.819	No	FDI does not cause INQ
INQ → FDI	11.194**	3	0.011	Yes	INQ causes FDI
EDU → INQ	2.785*	1	0.095	Yes	EDU causes INQ
INQ → EDU	3.097*	1	0.078	Yes	INQ causes EDU
GDP → INQ	1.216	1	0.270	No	GDP does not cause INQ
INQ → GDP	0.931	1	0.335	No	INQ does not cause GDP

Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. The maximum order of integration (d_{max}) is 1 and the optimal lag length (k) depends on the Akaike information criterion

Source(s): Authors’ compilations

Table 5. Informal economy-overall financial development index-income inequality trilogy (2, 2, 2, 2, 2)

Variable	Coefficient	Std. error	t-statistic	Prob.
<i>Short run</i>				
D(INF)	−0.038**	0.017	−2.173	0.055
D(INF(−1))	0.077***	0.021	3.746	0.004
D(FD)	−3.152**	1.252	−2.518	0.031
D(FD(−1))	5.641***	1.535	3.675	0.004
D(INF*FD)	0.105**	0.045	2.361	0.040
D(INF*FD (−1))	−0.209***	0.055	−3.812	0.003
D(EDU)	0.236***	0.054	4.383	0.001
D(EDU(−1))	−0.166***	0.029	−5.691	0.000
D(GDP)	0.005***	0.001	4.504	0.001
D(GDP(−1))	−0.006***	0.001	−5.343	0.000
CointEq(−1)*	−0.519***	0.057	−9.176	0.000
<i>Long run</i>				
INF	−0.277***	0.072	−3.825	0.003
FD	−20.347***	4.840	−4.203	0.002
INF*FD	0.754***	0.173	4.364	0.001
EDU	1.077***	0.228	4.732	0.001
GDP	0.024**	0.010	2.303	0.044
C	1.581*	0.794	1.992	0.074
<i>Post estimations</i>				
R-squared	0.899			
Adjusted R-squared	0.818			
F-statistic (p-value)	11.145***			
Prob. (F-statistic)	(0.000)			
Breusch-Godfrey Serial Correlation LM Test	0.173			
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.367			
<i>ARDL (2, 2, 2, 2, 2)</i>				
F-statistic	9.35564***	<i>Critical Values</i>		
K	5	10%	2.26	3.35
		5%	2.62	3.79
		2.50%	2.96	4.18
		1%	3.41	4.68

Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively

Source(s): Authors' compilations

sample sizes are limited, the AIC is favoured because it chooses models that are closer to the actual lag structure (Pan and Mishra, 2018; Adu *et al.*, 2013; Shahbaz *et al.*, 2012; Pesaran *et al.*, 2001). Hence, the ARDL results in Table 5 are obtained using the ARDL (2, 2, 2, 2, 2) as shown in Table A1 in the Appendix. This section discusses the moderating effects of FD on the link between the INF and INQ in South Africa, both in the short and long run. Table 5 displays the empirical findings.

The short-run model enables us to observe how INQ instantly adapts to changes in FD and INF before long-term convergence to equilibrium. The short-run results indicate that the variables exhibit delayed transmission processes rather than conflicting effects. In particular, contemporaneous coefficients indicate that any growth in FD and in the informal sector will reduce the current period's income disparity between the rich and the poor. Due to improved financial access and income opportunities for the underprivileged population, the results show that FD and the INF have an instantaneous decreasing influence on INQ. Nonetheless, INQ is positively affected by the lagged values (past values) of INF and FD, indicating dynamic

persistence in INQ. In all, the findings show that current changes in both variables lead to short-term distributional improvements by reducing INQ levels in South Africa.

In contrast, previous improvement in the INF and FD may initially worsen INQ before they can reduce it. This could be due to the challenges informal workers encountered when they first entered the sector and their lack of access to financial services. Similarly, the findings suggest that changes in the structure of financial services and the size of the INF may have a delayed effect on INQ, manifesting the next year; thus, the consequences of FD and the INF may not be felt immediately. In a similar vein, INQ in South Africa is negatively and significantly impacted by the INF and FD in the long run. The negative effect of the INF on INQ aligns with [Ajide et al. \(2024\)](#), [Magwedere and Marozva \(2025\)](#), [Masca and Chis \(2023\)](#), and [Esaku \(2021\)](#), who found that the INF could serve as a tool to reduce the gap between the rich and the poor. However, the finding contradicts the studies of [Saha et al. \(2021\)](#), [Dell'Anno \(2016\)](#), and [Xue et al. \(2014\)](#). In the same spirit, the reducing effect of FD suggests that a well-developed financial sector would help to alleviate INQ in South Africa. This finding aligns with the studies by [Akisik and Gal \(2023\)](#), [Hailemariam et al. \(2021\)](#), and [Zhang and Naceur \(2019\)](#), but it is contrary to the study by [de Haan and Sturm \(2017\)](#).

On the contrary, the current interactive effect of the INF and FD on INQ is positive, while its previous effect is negative in the short run. This implies that whereas the INF's prior value plays a complementarity role, its current value plays a substitutability role. This suggests that, compared with the current time, the interaction between the INF and FD in the prior year may lower INQ. This is because the availability of financial services to informal workers may contribute to a decrease in INQ during the early phases of FD. However, if FD develops, people who are already in better financial positions might benefit more, widening the income gap. This demonstrates that inadequate financial services may hamper INF's capacity to reduce income disparity in the current period. Also, an advanced financial system makes credit and financial services more accessible, boosting economic growth and expanding the unorganised sector. This will create more formal work opportunities, encouraging people to switch from informal to formal employment. As a result, FD would reduce the size of the INF to alleviate INQ ([Afful et al., 2025](#)). To support this finding, the long-run effect of the interactive term of INF and FD further shows a positive association with INQ. However, the magnitude of the interactive term is greater in the long run than in the short run. The result implies a substitutability role between the INF and FD, meaning that FD weakens the potency of the INF in alleviating INQ in South Africa. The finding aligns with [Afful et al. \(2025\)](#), who found that FD reduces the size of the INF.

Regarding other important factors in the relationship between the INF and INQ, present EDU and GDP are significantly and positively related to INQ. Their previous (historical) values have a negative impact on INQ in the short run. Meanwhile, EDU and GDP do not narrow the income gap among citizens in the long run. The increasing effect of EDU aligns with the studies of [Saha et al. \(2021\)](#). On EDU, the findings support the empirical submissions of [Ajide et al. \(2024\)](#) and [Wong \(2023\)](#) but contradict the findings of [Pham et al. \(2024\)](#), [Kartiasih et al. \(2023\)](#), and [Yap et al. \(2018\)](#).

A significant and correctly signed error correction term (ECT) indicates that the dependent variable rapidly returns to its equilibrium following a change in the independent variables. Also, a negative, significant ECT indicates a long-term association between the variables. The R-squared shows that approximately 90% of the variation in INQ is explained by INF, FD, EDU, and GDP. The F-statistic is significant, indicating that the independent variables jointly explain INQ. Also, the Breusch-Godfrey serial correlation LM test implies that the model is free of serial correlation, meaning the error terms are not correlated across different time lags. The Breusch-Pagan-Godfrey heteroscedasticity test indicates that the variance of the residuals (error terms) in the regression model is constant across observations. [Figure 4](#) depicts the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) of the recursive residuals estimated to assess the stability of the model. The figures reveal that the model is stable since their lines (plots) fall within the 5% critical bounds.

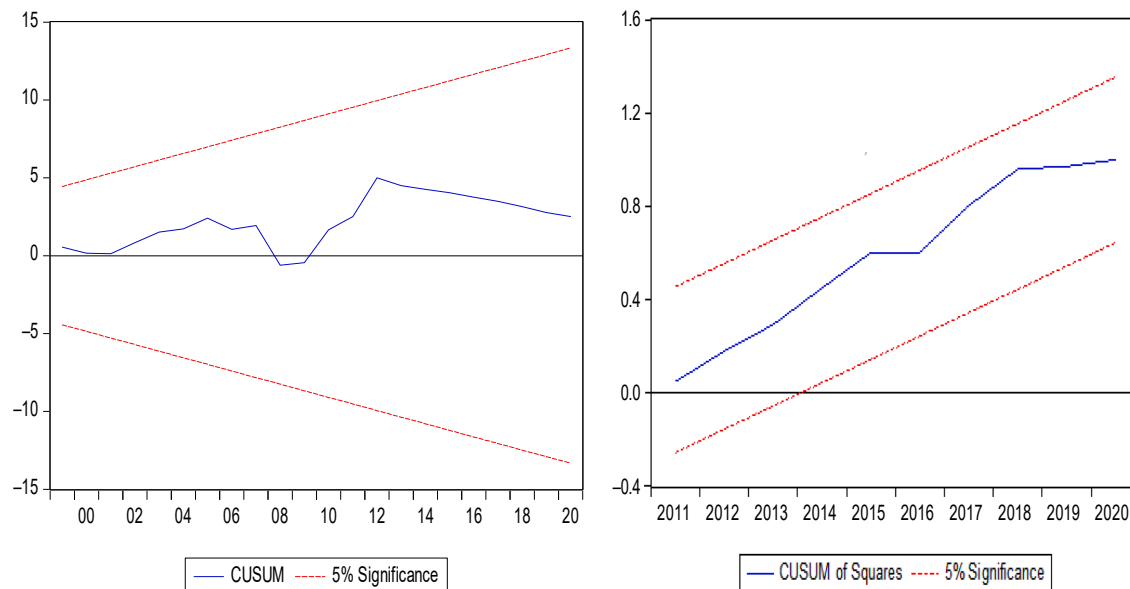


Figure 4. Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) plots (with FD). Source: Authors' computations

4.2.2.1 Accounting for structural breaks in South Africa's economy. The South African economy has experienced several regime shifts that can influence the long-run association among the INF, FD, and INQ, and controlling for these shocks is important. These shocks include the democratic transition in 1994, the currency crisis in 2001, the global financial crisis (GFC) in 2008–09, and the COVID-19 shock in 2020. Among these shocks, this study focuses specifically on the 2008–09 GFC to account for potential structural instability in the economy. This crisis constitutes a significant exogenous shock that influences labour market conditions, the financial system, income distribution, and economic growth in South Africa. According to Verick (2010), the 2008–2009 GFC deeply affected South Africa through its trade and financial ties with the rest of the world. Verick (2010) found that the crisis increased the number of discouraged individuals in South Africa, thereby raising the unemployment rate, which is expected to increase the size of the INF. However, during this period, the informal sector's employment rate decreased, contradicting the general view that the sector helps absorb excess labour from the formal sector (Verick, 2010). Hence, this study accounts for the GFC, as a financial crisis is detrimental to the development of the financial sector, which serves as a moderating variable. To do this, the study includes a dummy variable for the crisis, which takes value 1 for 2008–11 and 0 elsewhere. The years 2010 and 2011 are included as part of the GFC because their effects are expected to linger beyond 2009, as seen in the studies by Afonso and Blanco-Arana (2022) and Afonso and Jalles (2013).

The study includes a dummy variable in the model to ensure that the earlier findings of a negative relationship between INF, FD, and INQ are not influenced by temporary macroeconomic shocks. This implies that the relationships between the variables will remain stable after incorporating the crisis into the model. The estimates, using an ARDL (2, 2, 2, 2, 2, 2) model, as shown in Table A1 in the Appendix, are displayed in Table 6. While the ECT shows the correct sign and is significant, the bound test indicates evidence of a long-term association between the variables. According to the previous findings, the direction of the link between INF, FD, and INQ is unaffected by the inclusion of the crisis variable in the ARDL model. While the combined effect of these factors has a positive impact on INQ, INF and FD still show separate negative relationships with INQ. In the short run, a crisis has a major negative impact, but in the long term, it has a positive, though insignificant impact. The model is valid and reliable, as indicated by the post-diagnostic tests in Table 6. The ARDL model with structural breaks is stable because the CUSUM and CUSUMSQ lines fall within the 5% critical bounds, as shown in Figure 5.

4.3 Robustness analysis

4.3.1 *An alternative measure of the informal economy.* Here, we employ another measure of informality, developed by Elgin *et al.* (2021), to validate the INF's effect on inequality reduction. The measure is a “Dynamic general equilibrium model-based (DGE) estimate of informal output (% of official GDP)”. The estimates with this new measure of the INF are shown in Table 8. The lag length criterion is based on AIC, and the optimal lag length is two. The ARDL results are obtained using the ARDL (2, 2, 2, 2, 2, 2) as shown in Table A1 in the Appendix. The bound test at the lower segment of Table 7 reveals a long-run relationship between the variables. The results are not in any way different from the earlier findings in Tables 5 and 6, indicating that the effects of the INF and FD on INQ remain negative and significant. In addition, the interaction coefficient between the two variables remains positive and significant. Post-diagnostic tests, shown at the bottom of Table 7, show that the estimates are valid and reliable, while the CUSUM and CUSUMSQ graphs in Figure 6 exhibit that the ARDL model is stable.

4.3.2 *An alternative measure of financial development.* Having used a robust FD measure (the overall FD index), we employ an additional measure to validate the regression model's findings further. The measure is “domestic credit to the private sector (as a percentage of GDP)”. This measure of FD has been widely used in several studies, including Ojeyinka and

Table 6. Informal economy-overall financial development index-income inequality trilogy with financial crisis (2, 2, 2, 2, 2, 2)

Variable	Coefficient	Std. error	t-statistic	Prob.
<i>Short run</i>				
D(INF)	−0.040***	0.008	−4.751	0.002
D(INF(−1))	0.065***	0.010	6.536	0.000
D(FD)	−2.943***	0.597	−4.931	0.002
D(FD(−1))	4.852***	0.744	6.519	0.000
D(INF2*FD)	0.103***	0.021	4.808	0.002
D(INF2*FD (−1))	−0.175***	0.026	−6.650	0.000
D(EDU)	0.399***	0.067	5.928	0.001
D(EDU(−1))	−0.232***	0.032	−7.207	0.000
D(GDP)	0.004***	0.001	6.717	0.000
D(GDP(−1))	−0.002***	0.001	−4.447	0.003
D(DUM)	−0.013***	0.002	−5.835	0.001
D(DUM(−1))	−0.021***	0.003	−6.768	0.000
CointEq(−1)*	−0.422***	0.028	−15.158	0.000
<i>Long run</i>				
INF	−0.227**	0.074	−3.076	0.018
FD	−15.603**	6.067	−2.572	0.037
INF2*FD	0.580**	0.220	2.629	0.034
EDU	1.476**	0.701	2.105	0.073
GDP	0.016**	0.010	1.651	0.143
DUM	0.015	0.024	0.626	0.551
C	−0.227**	0.074	−3.076	0.018
<i>Post estimations</i>				
R-squared	0.979			
Adjusted R-squared	0.957			
F-statistic (p-value)	43.556***			
Prob. (F-statistic)	(0.000)			
Breusch-Godfrey Serial Correlation LM Test	0.332			
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.911			
<i>Bound test</i>				
ARDL (2, 2, 2, 2, 2, 2)				
F-statistic	17.675***	<i>Critical Values</i>		
K	5	10%	2.12	3.23
		5%	2.45	3.61
		2.50%	2.75	3.99
		1%	3.15	4.43
Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively				
Source(s): Authors' compilations				

Osinubi (2022), Hailemariam *et al.* (2021), Njangang *et al.* (2020), Chen and Kinkyoo (2016), and Beck *et al.* (2007). This measure is used because the financial sector in most African countries is dominated by banks (Henri *et al.*, 2019). The measure has its own benefits despite its drawback of failing to account for the depth, accessibility, and effectiveness of financial markets and institutions. To mobilise savings for investment objectives in an economy, for example, the financial sector must provide a favourable environment. Consequently, the private sector, including the unorganised sector, can receive credit from the financial sector. The null hypothesis that there is no long-term relationship between the variables is rejected, as shown in the lower portion of Table 8, because the F-statistic exceeds the upper-bound critical values at various significance levels.

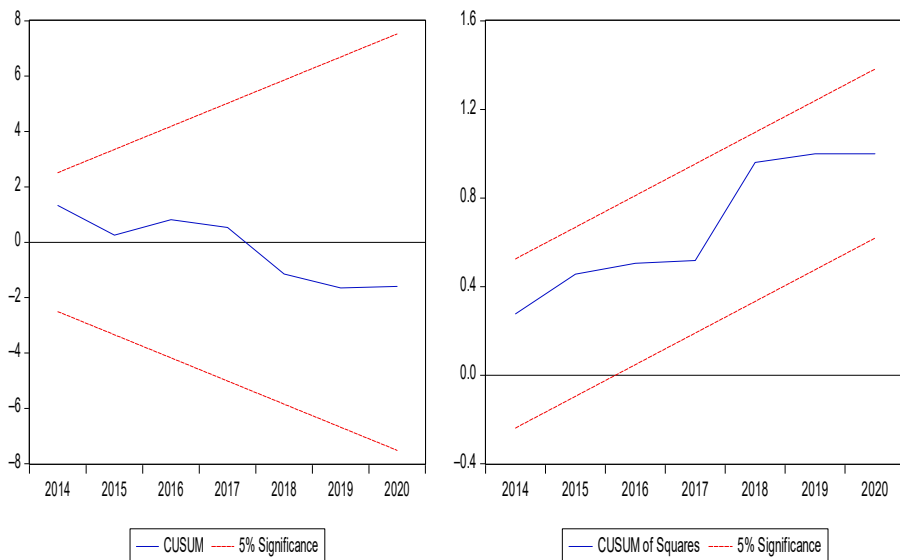


Figure 5. Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) plots (with FD) while accounting for structural breaks. Source: Authors' computations

The estimates are provided in [Table 8](#), using an ARDL (2, 2, 2, 2, 2, 0) model, as shown in [Table A1](#) in the [Appendix](#). The results do not differ from the long-run estimates of the ARDL from the previous models (using overall FD from IMF), except for EDU, whose impact is now insignificantly negative, and GDP, whose effect is now significantly negative. In all, it can be established that the INF and FD reduce INQ. The interactive term between INF and FD indicates that FD reduces the potency of INF in alleviating INQ by serving as a substitute in the relationship between INF and INQ in South Africa. The diagnostic statistics are shown in the lower section of [Table 8](#).

The post-estimation results show that approximately 84% of the variation in INQ is explained by INF, FD, EDU, and GDP. The F-statistic is significant, indicating that the independent variables jointly explain INQ. Also, the findings show that the model is free of serial correlation and that the residual variance (error terms) is constant across observations. [Figure 7](#) indicates that the model is stable since the lines (plots) fall within the 5% critical bounds.

4.3.3 An alternative econometric approach. The study also employs an alternative econometric approach (Dynamic Ordinary Least Squares {DOLS} regression) to achieve the stated objective. The ARDL estimations are supported by the DOLS approach, developed by Stock and Watson in 1993. Additionally, according to [Kao and Chiang \(2001\)](#), the DOLS strategy helps eliminate the correlation among regressors, in addition to the benefits of the ARDL estimating technique. The DOLS estimates are similar to the ARDL estimates. The focus here is on the core variables. As shown in [Table 9](#), INF and FD have negative, significant effects on INQ, suggesting that both variables ameliorate INQ in South Africa. The interactive terms of the INF and FD are significantly positive. As stated above, the positive coefficient of their interactive term implies that FD reduces the potency of INF in reducing INQ in South Africa. Also, the results for the control variables for both FD indicators are similar to those from the ARDL approach.

In summary, the study provides robust evidence on the relationship between informality, financial development, and income inequality in South Africa. Specifically, evidence from

Table 7. Second measure of informal economy-overall financial development index-income inequality trilogy (2, 2, 2, 2, 2, 2)

Variable	Coefficient	Std. error	t-statistic	Prob.
<i>Short run</i>				
D(INF2)	−0.091***	0.012	−7.341	0.000
D(INF2(−1))	0.073***	0.015	4.968	0.000
D(FD)	−4.055***	0.645	−6.290	0.000
D(FD(−1))	1.592**	0.676	2.356	0.038
D(INF2*FD)	0.158***	0.025	6.216	0.000
D(INF2*FD (−1))	−0.065**	0.027	−2.410	0.035
D(EDU)	−0.140***	0.030	−4.645	0.001
D(EDU(−1))	0.016	0.027	0.588	0.568
D(GDP)	0.002***	0.001	9.581	0.000
D(GDP(−1))	−0.004***	0.012	−7.341	0.000
CointEq(−1)*	−0.986***	0.057	−9.176	0.000
<i>Long run</i>				
INF2	−0.168***	0.012	−13.615	0.000
FD	−5.670***	0.550	−10.308	0.000
INF2*FD	0.227***	0.021	10.689	0.000
EDU	−0.123***	0.036	−3.444	0.006
GDP	0.007***	0.001	7.840	0.000
C	4.961***	0.277	17.920	0.000
<i>Post estimations</i>				
R-squared	0.969			
Adjusted R-squared	0.948			
F-statistic (p-value)	46.103***			
Prob. (F-statistic)	(0.000)			
Breusch-Godfrey Serial Correlation LM Test	0.201			
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.567			
<i>Bound test</i>				
<i>ARDL (2, 2, 2, 2, 2, 2)</i>				
F-statistic	36.727***	<i>Critical Values</i>		
K	5	10%	2.26	3.35
		5%	2.62	3.79
		2.50%	2.96	4.18
		1%	3.41	4.68

Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively

Source(s): Authors' compilations

structural breaks, DOLS estimation, and alternative measures of informality and financial development consistently supports the baseline findings that informality and financial development reduce the income gap. In contrast, financial development plays a substitutability role in the relationship between the informal economy and financial development, thereby limiting the informal economy's ability to alleviate income inequality.

4.4 Discussion of findings and policy recommendations

This study presents the role of FD in the relationship between the INF and INQ in South Africa. Understanding how FD influences the INF to either lower or raise INQ is crucial for putting into practice inclusive financial policies that can lower INQ (SDG 10) and promote fair economic opportunities for all (SDG 8), since the INF gives the poor access to economic opportunities. Hence, the study provides policy recommendations for the South African government, financial regulators, and other policymakers to alleviate INQ in the country.

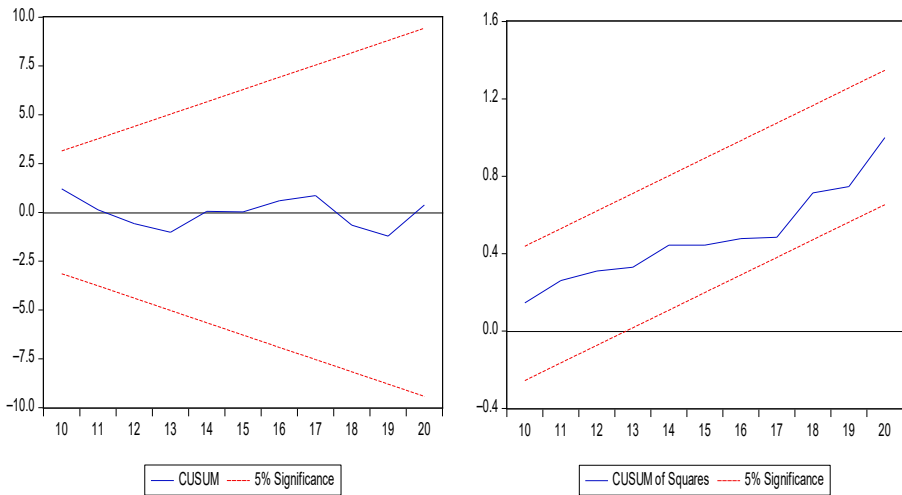


Figure 6. Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) plots using the second measure of informality (with FD). Source: Authors' computations

South Africa is among the top 10 countries with the highest INQ levels worldwide, indicating that INQ is a key developmental issue. The study's findings show that a larger size of the INF ameliorates INQ in South Africa in the long run. The implication is that the INF in South Africa favours the poor and low-skilled individuals as their relative incomes increase and INQ reduces, especially in the long run. In addition, the finding aligns with the dualistic theory of development proposed by [Lewis \(1954\)](#), which opines that excess labour from the formal sector is absorbed by the informal sector, thereby providing income opportunities for low-skilled and marginalised workers. The expansion of income-earning opportunities at the lower end of the income distribution through the informal sector would help reduce the income gap, suggesting the distributive role of the informal sector. The finding is unsurprising in South Africa, which is characterised by labour-market rigidities, persistent structural unemployment, and historical spatial inequality that affect employment in the formal sector. As a result, the informal sector is seen as a rescue sector to alleviate poverty (SDG 1) and INQ. Therefore, policymakers in South Africa, such as the Department of Employment and Labour (DEL) and the Department of Small Business and Development (DSBD), should focus on strategies to support informal workers, especially when they first enter the informal sector. The South African INF is an integral part of the economy and cannot be eliminated. Rather than viewing the sector as a bad one, policymakers and all stakeholders in the country should create the necessary business environment to improve informal-sector activities and continue ameliorating INQ. The policies should focus on improving access to financial services (such as grants, credits, and loans), enhancing access to essential services (such as quality education, healthcare, and good road networks), providing social welfare packages (such as pension plans and health insurance), streamlining regulations, and implementing training programs for informal workers. These actions can facilitate the transition from the informal to the formal economy, thereby significantly reducing INQ in South Africa.

A similar outcome is found for FD while examining its direct impact on INQ, indicating that FD reduces the income gap in South Africa, especially in the long run. The financial system in South Africa is found to be moderately developed, with an average financial index of 0.449 (see [Figure 3](#)). The negative effect of FD on INQ in South Africa suggests that a well-developed financial system is expected to provide the credit informal-sector workers need to increase their productivity, thereby increasing their income and reducing INQ. A sound

Table 8. Informal economy-domestic credit to private sector-income inequality trilogy ARDL (2, 2, 2, 2, 0)

Variable	Coefficient	Std. error	t-statistic	Prob.
<i>Short run</i>				
D(INF)	0.015	0.015	0.995	0.340
D(INF(−1))	0.066***	0.016	4.110	0.001
D(DCP)	0.007*	0.003	2.181	0.050
D(DCP(−1))	0.018***	0.004	4.324	0.001
D(INF*DCP)	0.001*	0.001	−2.133	0.054
D(INF*DCP(−1))	−0.001***	0.001	−4.359	0.001
D(GDP)	−0.001	0.001	−1.372	0.195
D(GDP(−1))	0.002**	0.001	2.360	0.036
CointEq(−1)*	−0.219***	0.033	−6.576	0.000
<i>Long run</i>				
INF	−0.410**	0.152	−2.699	0.019
DCP	−0.078*	0.040	−1.958	0.074
INDP	0.003*	0.001	1.882	0.084
EDU	−0.295	0.316	−0.932	0.370
GDP	−0.026**	0.011	−2.436	0.031
C	2.997***	0.455	6.590	0.000
<i>Post estimations</i>				
R-squared	0.843			
Adjusted R-squared	0.751			
F-statistic	9.131***			
Prob. (F-statistic)	(0.000)			
Breusch-Godfrey Serial Correlation LM Test	0.958			
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.886			
<i>ARDL (2, 2, 2, 2, 0)</i>				
F-statistic	5.087083***	<i>Critical Values</i>		
K	5	10%	2.26	3.35
		5%	2.62	3.79
		2.50%	2.96	4.18
		1%	3.41	4.68

Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively

Source(s): Authors' compilations

financial system provides opportunities for low-income individuals to invest in healthcare, education, and entrepreneurial activities that can help to bridge the income gap. This could be because of the National Financial Inclusion Strategy adopted in South Africa in 2023. This strategy aims to increase access to formal financial services among informal workers, specifically. Also, the South African Reserve Bank (SARB) recently invested in digital finance and FinTech, including expanding mobile banking and developing digital payment platforms, to deepen financial inclusion and help reduce INQ (SARB, 2024). As a result, policymakers in South Africa, for instance, the National Treasury and the South African Reserve Bank, should continue to prioritise strengthening the financial sector to build a well-developed financial system that, in turn, would reduce INQ.

Furthermore, the interactive coefficient indicates that FD reduces the potency of the informal sector in ameliorating INQ in South Africa, implying that FD plays a substitutability role by altering the distributive function traditionally performed by the informal sector. In the context of South Africa, following this finding, access to credit, payment systems, and the formalisation of financial services due to FD would lead to a transition to the formal sector, thereby reducing the negative effect of INQ on the INF. This finding is consistent with the dualistic theory of development, in which FD enhances access to credit, helping formal

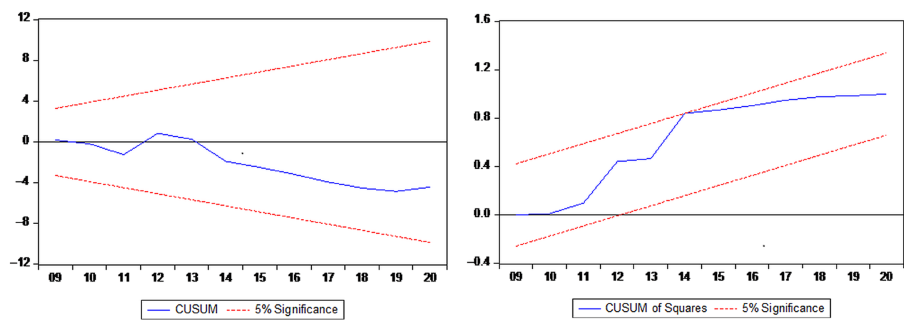


Figure 7. Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) plots (with DCP). Source: Authors' computations

Table 9. Dynamic ordinary least squares estimates

Variable	FD model				DCP model			
	Coeff.	Std. error	t-statistic	Prob.	Coeff.	Std. error	t-statistic	Prob.
INF	−0.136**	0.047	−2.895	0.028	−0.739***	0.127	−5.842	0.001
FD	−12.231***	3.034	−4.032	0.007				
INF*FD	0.468***	0.109	4.309	0.005				
DCP					−0.154***	0.031	−5.025	0.002
INF*DCP					0.006***	0.001	4.913	0.003
GDP	0.019*	0.009	2.039	0.088	−0.046***	0.011	−4.335	0.005
EDU	2.247***	0.447	5.025	0.002	−0.684	0.592	−1.156	0.292
C	−0.507	1.450	−0.349	0.739	22.772***	3.682	6.184	0.001
	R-squared	0.996	Adjusted R-squared	0.984	R-squared	0.988	Adjusted R-squared	0.948

Note(s): ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively

Source(s): Authors' compilations

businesses in the modern sector grow and employ those formerly engaged in low-productivity informal activities (the traditional sector). Hence, FD plays a critical role in the link between the INF and INQ, as a well-functioning and well-developed financial system can help lower entry barriers into the formal (modern) sector, thereby reducing the size of the INF and alleviating INQ. Rather than seeking to eliminate informal economic activities, South Africa should strengthen its financial sector to mitigate the negative effects of the INF on INQ. This suggests that the South African government, through the Department of Employment and Labour (DEL) and the Department of Small Business and Development (DSBD), should implement integration initiatives that would increase productivity in the informal sector by facilitating access to financial services and credit, streamlining formal regulations, and gradually formalising procedures for informal workers.

Several policies can be implemented to achieve a well-developed financial sector in South Africa. For instance, the National Treasury and the South African Reserve Bank should focus on enhancing financial inclusion, raising financial literacy, increasing access to financial services, and promoting digital financial services, especially for vulnerable groups. Also, a well-developed financial system can be achieved by improving the regulatory framework, developing a deep and liquid capital market, and supporting financial innovation through the development and adoption of new financial technologies. Financial institutions should allocate a portion of their lending capacity (loanable funds) to the informal sector at reduced interest rates. This would complement the INQ-reducing effect of the INF in South Africa.

The stability of the negative effects of the INF and FD after incorporating structural breaks confirms the robustness of our earlier findings. It is interesting to note that in South Africa, GFC has a significant short-run negative effect on INQ but a statistically insignificant long-run positive impact. The short-run negative effect of a crisis on INQ implies that the immediate effect of a financial crisis does not necessarily affect low-income individuals who already earn little. However, it significantly affects high-income earners, as they experience declines in asset prices, business contractions, reduced capital income, and financial market losses. Consequently, the income gap between the low- and high-income individuals temporarily narrows due to the financial crisis. However, the insignificant positive long-run effect of the crisis on INQ reveals the nature of INQ in South Africa. Mostly, INQ in South Africa is not due to external macroeconomic shocks but to underlying labour-market structure and institutional conditions.

5. Conclusion

Several efforts have been put in place in South Africa to reduce INQ, as the nation ranks highest globally in inequality. A call to reduce INQ in South Africa is a call to all. On this note, this study investigates the role of FD in the INF-INQ nexus in South Africa over the period 1991–2020. The study employs the ARDL approach as the main technique for analysing short- and long-run estimates. The Dynamic OLS approach serves as an alternative method to support the empirical findings from the main technique. Also, the study uses two measures of FD—overall FD and domestic credit to the private sector (% of GDP) for robustness checks.

The study makes a significant contribution to SDG 10 (Reduced Inequalities) by investigating whether FD strengthens or weakens the potency of the INF to alleviate INQ in South Africa. In the short run, the INF and FD have both positive (previous year) and negative (current year) effects on INQ in South Africa. This implies that the effects of FD and the INF may not be seen immediately, since shifts in the structure of financial services and the size of the INF may have a delayed influence on income disparity, which shows up the following year. The findings from the long-run estimates reveal that INF and FD are negatively and statistically related to INQ, implying that both variables reduce the income gap.

In the short run, the impact of the interactive term of the INF and FD is conflicting. In the short run, the previous year's effect of the interactive term is negative, whereas its current-year effect is positive. This demonstrates that while informal workers' access to financial services may help lessen INQ in the early stages of FD, over time the advantages may increasingly accrue to those already in better financial positions, thereby widening the INQ gap. This shows that poor financial services can reduce the INF's ability to reduce INQ in the current period. Also, FD serves as a substitute in the long run, as it reduces INF's potency in alleviating INQ in South Africa, underscoring the need for a sound financial system. A well-developed financial system in South Africa would not only complement the INQ-reducing effect of the INF but also spur economic growth and expand the formal sector, which is linked to SDG 8 (Decent Work and Economic Growth). This, in turn, would create more formal job opportunities, encouraging people to transition from informal to formal jobs and thereby contributing to government revenue for other developmental projects that can help lower income inequality in South Africa. To add to this, FD gradually reduces reliance on informal employment by enhancing access to credit and financial services, helping formal businesses grow and employ those formerly engaged in low-productivity informal activities. As informal workers have access to finance, they would be encouraged to transition from informal to formal employment, thereby creating additional opportunities for formal employment.

Based on the findings, the South African government and policymakers, such as the National Treasury, the South African Reserve Bank, the Department of Employment and Labour (DEL) and the Department of Small Business and Development (DSBD), are provided with the necessary policy recommendations to ensure that the INF and FD continue to help shrink the gap between the rich and the poor in the country. In addition to the National

Financial Inclusion Strategy by the South African government, the study argues for a more developed financial system that would enable the INF to continue helping in alleviating INQ. At the same time, a sound financial sector would help transition informal workers into the formal economy. Even though this study provides valuable insight into the relationships among the INF, FD, and INQ, it is not without some potential limitations that offer suggestions for future research.

The findings of the study should be assessed in light of South Africa’s institutional quality, financial sector, and labour-market structure, even though it provides strong evidence of the significance of financial development in the informality-income inequality nexus in Africa. The research findings may be affected by South Africa’s high-income inequality, distinct labour-market dynamics, a moderately developed financial sector, structural unemployment, and a sizeable informal economy. The research findings may be affected by South Africa’s high-income inequality, distinct labour-market dynamics, a moderately developed financial sector, structural unemployment, and a sizeable informal economy. Therefore, when generalising the results of this study to other developing or emerging nations, future research should exercise caution. The study is limited in scope, and future studies can broaden the focus to other African countries where INQ is a major developmental issue. Future research can broaden the analysis by performing cross-country comparative studies encompassing countries with varying degrees of financial development, informality, and income inequality. This kind of comparison analysis would be useful for determining whether the informality-inequality relationship is moderated by financial development or whether its impact depends on the institutional and economic conditions unique to each country. Panel analysis across African or emerging countries could be used in future research to bolster the broader validity of the findings of the study and provide more broadly applicable policy suggestions. Furthermore, since positive and negative shocks to these variables might affect INQ differently, future studies can investigate the nonlinear effects of INF and FD on INQ in South Africa and elsewhere. This would expand the frontier of knowledge, especially given the limited single-country studies on the subject.

Appendix

Table A1. Lag length order

Lag	LogL	LR	FPE	AIC	SC	HQ
<i>Model: INQ = f(INF, FD, INF*FDI, EDU, GDP)</i>						
0	148.913	NA	1.49E−12	−10.208	−9.923	−10.121
1	293.515	216.903	6.78E−16	−17.965	−15.967 ^a	−17.354
2	346.559	56.833 ^a	2.98e−16 ^a	−19.183 ^a	−15.472	−18.048 ^a
<i>Model: INQ = f(INF, FD, INF*FDI, DUM, GDP, EDU)</i>						
0	146.931	NA	0.000	−9.995	−9.662	−9.893
1	329.737	261.151	0.000	−19.553	−16.888	−18.738
2	436.336	98.984 ^a	2.98e−19 ^a	−23.667 ^a	−18.671 ^a	−22.140 ^a
<i>Model: INQ = f(INF2, FD, INF2*FDI, EDU, GDP)</i>						
0	158.509	NA	7.49E−13	−10.894	−10.608	−10.806
1	306.774	222.398	2.63E−16	−18.913	−16.914	−18.302
2	372.195	70.094 ^a	4.78e−17 ^a	−21.014 ^a	−17.303 ^a	−19.879 ^a

(continued)

Table A1. Continued

Lag	LogL	LR	FPE	AIC	SC	HQ
<i>Model: INQ = f(INF, DCP, INF*DCP, EDU, GDP)</i>						
0	−158.251	NA	0.005017	11.732	12.018	11.820
1	−32.748	188.255	8.96E−06	5.339	7.337 ^a	5.950
2	20.514	57.066 ^a	3.88e−06 ^a	4.106 ^a	7.817	5.241 ^a

Note(s) ^a Indicates lag order selected by the criterion. LR: Sequential modified LR test statistic (each test at 5%). FPE: Final predictor error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information Criterion

Source(s): Authors' compilations

Note

1. The Gini index is a measure of income distribution that ranges from 0 (perfect equality) to 1 (perfect inequality).

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Corresponding author

Tolulope Osinubi can be contacted at: oyeneyetolu@yahoo.com