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Mobile Financial Services and the Shadow Economy in Southern African Countries: Does Regulatory Quality Matter?

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Abstract: This study investigated the impact of mobile financial services on the shadow economy in Southern Africa countries and explored how regulatory quality moderates this relationship. Utilising panel data from 1993 to 2022, this study employed dynamic common-correlated effect (DCCE) and dynamic seemingly unrelated regression (DSUR) methods to assess long-run effects. The findings reveal that increased mobile financial services adoption markedly diminishes the scale of the underground economy by enhancing transaction transparency and accessibility, thus drawing more participants into the formal economy. The results are consistent across DCCE and DSUR estimations. Additionally, improvements in regulatory quality further diminish the shadow economy by bolstering trust and compliance within the financial system, suggesting that well-crafted regulations enhance the effectiveness of mobile financial services. Economic and financial sector developments also contribute to a reduced shadow economy, indicating that broader economic growth and advanced financial systems facilitate formal sector participation. Conversely, larger public sector expenditures appear to expand the shadow economy enterprises, likely due to inefficient resource allocation and increased fiscal burdens that push economic activities underground. Policy recommendations include the need to expand mobile financial services infrastructure, enhance financial literacy, and optimise financial regulatory frameworks to balance oversight with innovation encouragement.

Keywords: mobile financial services; shadow economy; regulatory quality; financial inclusion; inclusive growth; mobile phones; financial institutions

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1. Introduction

Financial services exclusion has been identified as one of the barriers to achieving inclusive growth (Mishra and Bisht 2013). The application of the traditional financial services framework has been criticised for deepening financial exclusion due to its failure to cater to the needs of the underprivileged demographic (Neaime and Gaysset 2018). Mobile financial services (MOFISs) have been introduced to stem this tide, and it has been viewed as a step in the right direction towards enhancing financial inclusion and achieving inclusive growth. The acronym MOFIS describes financial service offerings that enables access through a mobile phone to financial services like sending and receiving money, savings, credit, and other financial services without the requirement to own a traditional bank account or visit a physical bank branch (GSMA 2018). Following the advent of mobile phones and the emergence of MOFISs, account ownership has considerably grown through MOFIS providers and transaction volumes. For example, GSMA (2021) reported that, in 2020, the number of accounts reached 1.2 billion, exhibiting growth rates in the double digits, while daily transaction values amounted to USD 2 billion.

The role of MOFISs in promoting inclusive growth in developing countries cannot be overemphasised. As per the Global Findex database for 2021, most of the income generated in agriculture is predominantly in cash. On average, only 25% of recipients receive payments for agricultural sales in an account, with mobile money accounts being the most common payment method, particularly in sub-Saharan Africa (SSA). Moreover,

typically, only 40% of households in developing nations employ an account for settling utility bills (Demirgüç-Kunt et al. 2022). This implies that most still lean towards paying their utilities exclusively with cash or through alternative means; additionally, one-third of those utilising an account began attempting this for the first time since the COVID-19 pandemic began (Demirgüç-Kunt et al. 2022).

A component of the economy wherein MOFISs could engender inclusive growth is the shadow economy. The "shadow economy" concept encompasses all enterprises, economic events, or activities occurring beyond the administrative boundaries of the public sector and private entities (Hart 2008). According to Ihrig and Moe (2004), the endeavours in the shadow economy (SE) may result in legitimate goods, but they operate beyond the confines of the regulatory framework. Dell'Anno (2016) asserted that the terms "shadow, informal, underground, hidden, unofficial" are frequently interchanged and linked with concepts like economy, sectors, market, or GDP. In developing countries, the SE, which accounts for approximately 36% of the GDP (Medina and Schneider 2018), is frequently perceived as hindering development. This is because it can lead to notable broad-scale losses in economic efficiency, such as diminished capital and labour productivity, increased income inequality and poverty, and significant microeconomic distortions like competition and sectoral capital allocation. Particularly, while the SE can provide opportunities for marginalised individuals and contribute to economic resilience, it poses challenges that can hinder the attainment of inclusive growth, such as lost tax revenue, reduced transparency and trust erosion, labour market distortions, social exclusion, and crime (Schneider and Enste 2013; Williams and Schneider 2016).

The introduction of MOFISs could impact the SE in a few ways. First, it could engender a decline in the use of cash. It was argued that informal businesses lack productivity not just because they mainly engage in subsistence activities but also due to their sole reliance on cash transactions (La Porta and Shleifer 2014). Hence, transitioning to electronic transactions, using MOFISs, enhances productivity and profitability by lowering operational expenses and ensuring smoother, more secure, and cost-effective commercial transactions (Beck et al. 2018; Klapper 2017). The resulting enhanced efficiency raises the trade-offs associated with remaining in the small-scale and comparatively inefficient SE. Second, MOFISs have the potential to positively impact the SE by facilitating credit availability. This is because self-employed individuals and informal micro, small, and medium-sized firms (MSMEs) comprise around 80% of all MSMEs (Ulyssea 2018), and their primary challenge is typically access to credit (GPFI 2018). An increasing number of MOFIS providers are diversifying their businesses to offer a full range of customer relationships akin to those offered by traditional banks by combining mobile money with broader financial services. Since MOFISs cater to hitherto unbanked groups in the underground economy, it promotes entrepreneurship and aids in empowering the disadvantaged population. Moreover, MOFISs could indirectly diminish the SE by fostering growth in the formal sector. This is because the transmission mechanisms previously discussed are equally applicable to formal businesses, which may have priority access to MOFISs, particularly regarding credit services. Specifically, enhanced productivity among formal enterprises resulting from adopting MOFISs could lead to an uptick in employment, consequently diminishing the SE.

This study has two objectives. First, this study examines the impact of MOFISs on the SE in Southern Africa. Second, it explores the role of regulatory quality in the relationship between MOFISs and the SE in the sub-region. Barriers to financial inclusion of the SE go beyond merely possessing mobile phones and having online access. Factors tied to individuals, such as digital illiteracy and insufficient comprehension of digital products and services, could stymie the diffusion of MOFISs. According to Demirgüç-Kunt et al. (2022), on average, 30% of MOFIS subscribers across Sub-Saharan Africa (SSA) require assistance to effectively utilise their accounts, while in Liberia, Malawi, and South Africa, more than 50% of account holders need such assistance. Such individuals and households may hesitate to adopt MOFISs due to a lack of confidence in them, alongside its providers, especially when there is an absence of clarity regarding the costs and terms outlined

in loan contracts. For example, in an investigation of MOFISs in Kenya and Tanzania, it was noted that many customers are trapped in high-cost, short-term loans that offer limited value, potentially missing out on loans more favourably structured to support productive activities (Kaffenberger et al. 2018). Moreover, it has been found that certain MOFIS providers structure their user interface in a way that increases the likelihood of users inadvertently subscribing to additional services, and that signing up for these costly additional services is straightforward, while cancelling afterwards proves to be exceedingly complex (Fritz and Hilbig 2019).

The existence of a robust regulatory framework could serve to allay the fears of this demographic. Regulatory quality describes and measures the ability of governments to formulate and enforce regulations that allow for private sector development, balancing economic growth with the need for protecting public interests (Kaufmann et al. 2011). According to the World Bank (2020), evidence of high regulatory quality includes well-functioning regulatory institutions, clear legal frameworks, and proper enforcement mechanisms, while low regulatory quality is often associated with corruption, bureaucratic inefficiency, and market distortions. Scholars are divided in their assessment of the moderating role of regulation in the MOFIS-SE nexus. Some scholars argue that a well-laid-out regulatory framework could foster transparency and trust and engender financial inclusion of the SE. According to Schneider and Enste (2000), effective regulation can help combat SE activities by promoting transparency, accountability, and compliance with anti-money laundering (AML) and counter-terrorism financing (CTF) measures. Regulatory authorities can impose stringent Know Your Customer (KYC) requirements and transaction monitoring mechanisms to detect and deter illicit financial flows facilitated through MOFIS channels (Beck et al. 2018). Moreover, regulatory measures directed towards enhancing financial inclusion can indirectly aid in diminishing the size of the SE by channelling informal transactions into formal financial systems.

According to Demirgüç-Kunt and Klapper (2012), increased access to formal financial services, facilitated by supportive regulatory policies, can incentivise enterprises to transition away from cash-based transactions towards digital payments, thereby reducing opportunities for tax evasion and underground economic activities. Furthermore, a sound regulatory framework can address systemic risks associated with the SE by fostering a MOFIS system that safeguards consumers against predatory practices and fraud in mobile financial transactions, thereby encouraging SE practitioners to transition into MOFISs, resulting in a reduced SE. Izaguirre (2020) advocated for the practice of responsible finance, emphasising the importance of consumer protection regulations in ensuring the integrity and trustworthiness of MOFISs.

Contrariwise, it has been argued that the regulatory architecture in place could further increase the scale of the SE. For example, regulatory frameworks governing MOFIS operations vary across jurisdictions but commonly entail stringent KYC provisions. While these requirements are essential for mitigating financial crime risks, they tend to impose significant compliance burdens on financial institutions and users. As highlighted by Evans and Pirchio (2014), overly onerous KYC regulations can hinder the onboarding of unbanked individuals into the formal financial system, thus perpetuating their reliance on informal channels. In this case, the regulatory burden could have a paradoxical effect of exacerbating the prevalence of the SE, as excessive regulations could drive enterprises towards unregulated, cash-based transactions to circumvent compliance requirements. Additionally, regulatory constraints impede innovation in MOFISs, limiting their capacity to effectively compete with informal financial systems. As Hoskins and Labonte (2015) noted, stringent licensing requirements and compliance costs deter small financial institutions and fintech startups from entering the market or offering innovative solutions tailored to underserved segments and SE demographics. Consequently, the dynamism and adaptability inherent in MOFISs are stifled, curtailing their potential to catalyse economic growth and formalisation.

The Southern African countries make a compelling choice for this study, as the SE often surpasses 30% of their GDP. For example, in Zimbabwe, the SE was estimated at around

60.6% of the GDP in 2018, driven by a prolonged economic crisis, hyperinflation, and the collapse of formal employment opportunities (Medina and Schneider 2018). Similarly, in Zambia and Mozambique, from 1993 to 2022, the SE averagely accounted for 48.4% and 39.1% of the GDP, respectively (Figure 1). South Africa, despite being more industrialised and consistently one of the top three largest African economies, has a significant informal sector, averagely contributing to 27.7% of its GDP over the period of 1993–2022 (Figure 1). Moreover, South Africa's unique SE historical antecedent is rooted in the dark shadows brought forth by four decades of apartheid policies, when the minority white-run government either paid little or no attention to the MSMEs economy or actively impeded their growth, particularly in the case of informal enterprises owned by black people, through negative and repressive policies (Rogerson 1988). The SE in Southern Africa is defined by a high prevalence of unofficial employment. In Zimbabwe, for example, informal employment constitutes over 90% of the workforce (Medina and Schneider 2018). While the percentage is lower in South Africa, informal employment still makes up about 35% of the workforce (Stats SA 2020), with a resurgence in recent years, as the Mineral Council South Africa reported that illegal mining activities are surging across South Africa, with widespread occurrences now observed on a national scale (Manduna 2023). This suggests that a substantial share of the population relies on informal activities for their livelihoods.

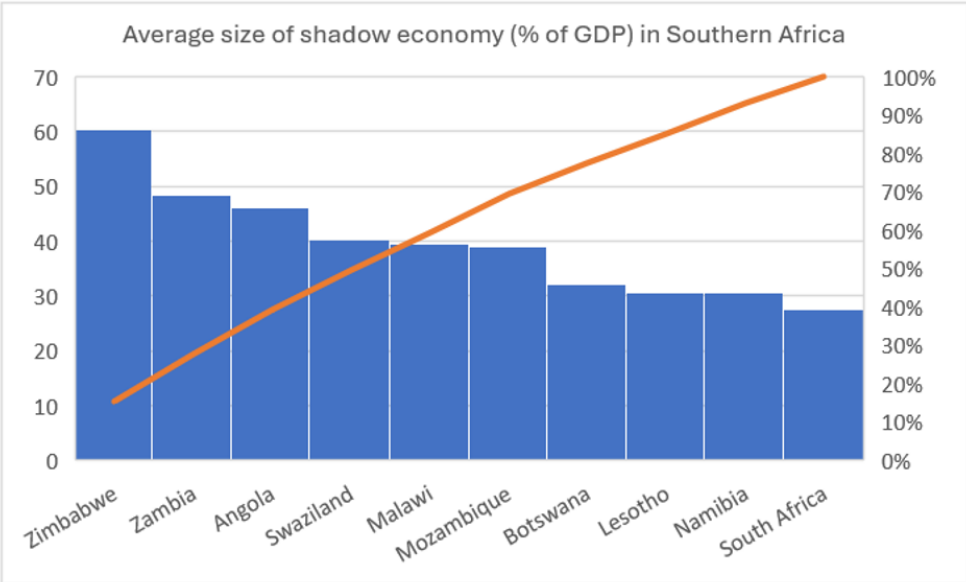

Figure 1. Average size of shadow economy (% of GDP) in Southern Africa (1993–2022). Source: Author's computation based on Elgin et al. (2021).

Governments in Southern Africa have attempted various strategies to integrate the SE into the formal economy, with mixed success. Efforts include streamlining business registration procedures, alleviating tax pressures on MSMEs, and improving the enforcement of labour and tax laws (World Bank 2020). South Africa, for example, has introduced initiatives like the National Informal Business Upliftment Strategy (NIBUS) to support informal businesses in transitioning to the formal sector (Kiaga and Leung 2020). However, the effectiveness of these policies is often limited by weak institutions, corruption, and the pervasive nature of informality (World Bank 2020). As part of the measures to reduce the size of the SE through MOFISs, regulatory measures have been implemented based on several interlinked laws, with the Financial Action Task Force (FATF) and Eastern and Southern Africa Anti-Money Laundering Group (ESAAMLG) passing a fair appraisal and subjecting the sub-region to the routine follow-up procedure (Sujee 2016). However, despite the intriguing attributes of Southern Africa's SE and its bourgeoning financial system and regulations, the relationship between MOFISs, regulatory quality, and the SE has been

overlooked by researchers, especially in the context of Southern Africa, as there is no evidence of previous empirical study on the subject. Therefore, this study contributes to the existing literature and bolsters the policymakers' efforts to reduce the size of the SE by examining the impact of MOFISs on the SE in Southern Africa and the moderating impact of the regulatory framework.

The novelty of this lies in several key aspects. First, while the literature acknowledges the benefits of MOFISs in promoting financial inclusion, there is insufficient empirical evidence on how MOFISs impact the SE specifically. This study directly addresses this by examining the influence of MOFISs on the size and nature of the SE in Southern Africa, filling a crucial gap. Second, the moderating role of regulatory frameworks in the relationship between MOFISs and the SE has not been adequately explored. There is a debate in the literature about whether regulation facilitates or hinders financial inclusion and whether it can reduce the SE, but no previous study explored how regulatory quality influenced the impact of MOFISs on the SE. This study aims to fill this gap in the literature by examining the dual role of regulation in promoting MOFIS adoption and managing the risks associated with informal economies, offering empirical insights into how effective regulation can either reduce or exacerbate the SE. By investigating how MOFISs and regulatory frameworks interact, this study can offer policymakers practical recommendations on balancing regulatory control with financial innovation. This is especially pertinent in Southern Africa, where regulatory efforts to combat money laundering and financial crime sometimes clash with efforts to include the unbanked population (Sujee 2016).

Moreover, while previous research has recognised the significance of informal sectors, especially in low-income regions, few studies have focused on how MOFISs could systematically transition informal enterprises into the formal economy. This study tackles the practical challenges, such as digital literacy and regulatory barriers, that prevent MOFISs from fully realising their potential in informal settings. Additionally, this study applied cutting-edge econometric methods, including dynamic common-correlated effect (DCCE), dynamic seemingly unrelated regression (DSUR), and Dumitrescu–Hurlin panel causality test to achieve the study objectives. This ensured the generation of reliable estimates from the data investigated, as these methods can accommodate several challenges that beset panel data which cannot be handled by many traditional panel estimation techniques such as parameter heterogeneity, cross-sectional dependency, endogeneity, and structural breaks (Chudik and Pesaran 2015).

This study is divided into five sections, with the introduction and literature review comprising Sections 1 and 2, respectively. Section 3 presents the methodology, while the Section 4 contains the interpretation and discussion of the results. Section 5 concludes the study.

2. Theoretical and Empirical Literature

2.1. Theoretical Literature

The relationship between the SE, MOFISs, and regulatory quality is explained by the institutional theory, particularly the version that focuses on formal and informal institutions in economic behaviour. Propounded by North (1990), institutional theory provides a strong framework for understanding the complex relationships between the SE, MOFISs, and regulatory quality. According to North (1990), the institutional theory posits that economic activities are shaped by the formal and informal rules within a society, and these rules include regulations, laws, and norms. The theory suggests that the SE often arises where formal institutions fail to provide effective regulatory frameworks, leading to the emergence of informal economic activities as alternative means of survival and income generation. Institutional theory explains that the SE tends to flourish when there are gaps or inefficiencies in formal regulatory frameworks. According to Schneider and Enste (2000), poor regulatory quality, characterised by bureaucratic inefficiency, corruption, and weak enforcement, pushes individuals and businesses to operate informally to avoid taxes, licensing fees, and regulatory burdens. In countries with large SE sizes, institutional failures

such as complex business registration processes, high tax rates, or corruption discourage businesses from integrating into the formal sector (Dell'Anno 2016). Consequently, a sizable section of the economy is concealed and untaxed, which hinders inclusive development and economic growth.

MOFISs can be seen as a disruptive institutional innovation that alters the economic behaviour of individuals and businesses by offering new ways to access formal financial systems without the need for traditional banking infrastructure. By providing accessible and cost-effective financial services such as money transfers, savings, and credit, MOFISs help individuals in the SE overcome barriers to financial inclusion. According to Beck et al. (2007), access to financial services can improve the productivity and growth of informal businesses, and ultimately their integration into the formal economy. Regulatory quality plays a critical role in the adoption and effectiveness of MOFISs. The institutional theory suggests that the development of efficient and supportive regulations can foster trust in MOFISs and encourage individuals in the shadow economy to transition into the formal sector (Evans and Pirchio 2014). High regulatory quality, through measures like consumer protection, transparency, and streamlined Know Your Customer (KYC) requirements, can facilitate broader MOFISs adoption, particularly in underserved populations that are vulnerable to financial exclusion. Conversely, overly burdensome or unclear regulations may stifle innovation and deter the unbanked from using MOFISs, thus reinforcing the reliance on informal channels (Hoskins and Labonte 2015).

The institutional theory also supports the notion that, by integrating mobile financial services into a well-regulated framework, governments can reduce the size of the SE. By providing formal financial services to previously unbanked populations, MOFISs reduce reliance on cash transactions, which are typically used in the SE (La Porta and Shleifer 2014). In the long run, increased financial inclusion through MOFISs can lead to greater formalisation of businesses, improved tax compliance, and enhanced economic development (Klapper 2017). However, this depends on the ability of governments to implement balanced regulations that do not overburden small enterprises while ensuring adequate protection for users.

2.2. Empirical Literature

The SE, otherwise called the underground economy, informal sector, black market, hidden sector, or parallel market encompasses all economic activities that are not disclosed to the government, especially the tax authorities, and they are perceived as unrecorded and unreported enterprises and economic activities happening outside the formal economic frameworks (Ajide 2021; Hart 2008). According to Medina and Schneider (2018), the SE is typically difficult to assess due to the usual practice of concealment by those involved. Defining and measuring the SE has always been contentious in the economic literature. Some studies (Buehn and Schneider 2012; Elgin and Oztunali 2012; Medina and Schneider 2018) have described the SE as comprising all legally productive and market-based activities that are not officially accounted for, excluding illicit activities. However, Alm and Embaye (2013) measured the SE by including illicit activities. Moreover, Gomis-Porqueras et al. (2014) argued that the SE refers to enterprises relying on cash transactions specifically to evade taxes that have been imposed. The modus operandi in the SE was described by Álvarez-Herránz et al. (2017) who asserted that people conducted SE activities by evading taxes and hiring workforce in an irregular manner.

The role of MOFISs in influencing the SE, especially through the channel of financial inclusion, has attracted scholars' attention. Jacolin et al. (2021) analysed data from 101 countries and found a large reduction in the size of the SE due to MOFISs application. Aker et al. (2016) noted that mobile banking's emergence has expanded the possibilities for cash transfers. The utilisation of mobile phones is essential to hasten digital finance, ensuring that the poor can benefit from new technology and enjoy various formal financial services. According to Evans (2018), financial inclusion is bolstered through these improvements in financial services' expansion and cost reduction. Mobile phones enabling financial ser-

vices through mobile money represent a novel advancement in finance aimed at reducing the number of unbanked individuals. Aron (2017) noted that this service leapfrogs the need for a formal banking system in developing countries. Moreover, Munyegera and Matsumoto (2016) asserted that mobile money services provide an opportunity for low-income segments of society and unbanked individuals to access flexible and cost-effective financial services.

In comparison to the conventional financial services, MOFISs demonstrate marked efficiency improvements by decreasing travel time, reinforcing safety, and improving ease of use by harnessing ICT (Aron 2017; Munyegera and Matsumoto 2016). This position was corroborated by Rangarajan (2008), who argued that suitable technological solutions like mobile money banking can be leveraged to effectively extend financial services to rural areas where the SE thrives at low operation costs, while Mishra and Bisht (2013) view it as a promising strategy to expedite reduced SE by incorporating unbanked populations. According to Bongomin and Ntayi (2020), in developing economies, the reach of financial inclusion has broadened, as mobile money has gained popularity and become more widely adopted, while Chinoda and Kwenda (2019) stated that the provision of mobile money services has enhanced financial inclusion and reduced informal economic activities across 49 countries. Akhter and Khalily (2017) investigated the effectiveness of MOFISs in Bangladesh and confirmed their positive impact. Evans (2018) demonstrated that the development of mobile phones and the internet is highly influential on the size of the SE, and that the upward trajectory of internet and mobile phone usage contributes to the rise in financial inclusion. Overall, MOFISs have generally been adjudged by researchers as having a negative impact on the SE, with financial technologies like mobile money, cards, and various other applications playing a crucial role. According to Demirgüç-Kunt et al. (2018), the benefits include reduced financial risk through remote collection of funds from different sources, decreased transaction costs, savings accumulation, and ability to store and transfer funds over long distances.

Regulations are usually put in place to maintain the integrity and soundness of the financial system. The relationship between the SE and financial regulation has not been widely explored. Nonetheless, there are some articles and reports that have examined the connection between these crucial components of the financial sector. Research has revealed that the ability of regulations to enhance the SE's financial inclusion differs in various circumstances. The impact of banking regulations on the SE's financial inclusion has been investigated by scholars, and there is no consensus on the direction of the impact. The conclusion by a section of researchers is that banking regulations exert a positive impact on the financial institutions' ability to foster the financial inclusion of the informal sector (Chortareas et al. 2013; Laeven and Levine 2009). Contrariwise, certain scholars argued that overly strict regulations can impede a financial institution's capacity to extend credit and may lead to discrimination against individuals of lower economic means compared to the affluent (Kodongo 2018; Levine 2012). Additionally, Anarfo et al. (2020), studying financial regulations and financial inclusion, found diverse outcomes, suggesting that banking regulations positively contribute to inclusive finance under conditions of financial stability. In another study, Barth et al. (2004) found that effective supervision plays a crucial role in enhancing a bank's stability and performance, particularly in countries where supervisory authorities operate independently. They also emphasise that an efficient control environment is essential for enhancing both bank performance and stability.

The study by Besong et al. (2022), which examined data from the Central African Economic and Monetary Community, demonstrated that banking regulations, particularly those governing external reporting and audits, financial sector entry, deposit insurance, and external reports and audits, positively influence financial inclusion and diminish the SE. On the other hand, varied results emanated from the research by Kodongo (2018). First, their results revealed that regulations concerning agency banking and enhanced financial literacy could enhance financial inclusion, and consequently reduce the size of the SE. Moreover, their findings further revealed that regulations requiring Know Your Customer

protocols and macro-prudential guidelines on capital and liquidity may pose obstacles to financial inclusion and further deepen the size of the SE. Furthermore, Sarma and Pais (2011) have found evidence supporting the idea that financial regulation could hinder the financial inclusion of the SE. Their research, based on data from 49 mainly developing countries, indicates a negative effect of the proportion of nonperforming assets to total assets and capital asset ratio on financial inclusion.

In a similar study, Yakubi et al. (2022) investigated data from 77 low-income economies and concluded that regulations negatively affect the SE, by enhancing financial inclusion. Their result was corroborated by Dima and Dima (2018), who also reported a positive impact of business regulatory architecture on financial inclusion. It has also been demonstrated that regulations and financial inclusion have a positive linkage by Chen and Divanbeigi (2019), who found that residents of countries with well-established regulatory standards generally have higher rates of bank account ownership than those in countries with weaker regulatory standards. This implies a diminished SE siz. Meanwhile, Reynolds et al. (2018) analysed the impact of regulations on digital financial services, specifically focusing on cash-in, cash-out (CICO) networks, and found limited effects on markets and financial inclusion. They attributed this restricted impact to the inadequate financial services infrastructure prevalent in many low-income countries, as evidenced by the scarcity of bank branches.

Based on this review, it is apparent that there is a lack of research investigating how regulatory quality influences the impact of MOFISs on the SE, especially in the context of developing countries like Southern African economies wherein informal enterprises and activities are widespread. This study aims to fill this gap in the existing literature.

3. Results and Discussion

The proposed estimation techniques facilitate estimation, provided that the variables in the model co-move in the long run (Chudik and Pesaran 2015; Mark et al. 2005). Towards ascertaining their cointegrating attribute, there is a need first to ascertain the variables' integration properties through unit root tests. But first, to determine whether there is CD in the data, a CD test following the approach of Pesaran (2004) was conducted and the results are displayed in Table 1. The results support the rejection of the null hypothesis that CD is absent for each of the variables, which implies that they are all characterised by CD. A key implication of this result is the need to conduct stationarity tests that mitigate CD in data to avoid misleading estimates. Therefore, the CADF and CIPS tests of Pesaran (2007) were applied considering their capacity to support variables with CD. Table 2 presents the unit root test results and the two tests agreed that the variables are stationary at first difference, indicating that they are all I(1) processes. Therefore, there is a need to assess cointegration among the variables.

The outcomes of the Westerlund (2007) cointegration tests are displayed in Table 3. The decision criteria for determining cointegration entail assessing the null hypothesis that there is no cointegration based on the four group and panel statistics of the Westerlund (2007) test. The probability values from the test affirm that the null hypothesis is rejected by all the four group and panel statistics. Based on this result, the cointegration of variables in the model is confirmed.

Table 1. Cross-sectional dependence test.

Variable	SE	MOFIS	RQ	MOFIS∗RQ	GDP	FD	PS
CD test	8.139 **	12.126 ***	9.629 ***	17.503 ***	20.934 **	11.024 ***	9.376 ***
p-value	0.029	0.000	0.000	0.000	0.017	0.000	0.000

Note: *** and ** indicate 1% and 5% levels of significance, respectively.

Table 2. Unit root tests.

Variable	CADF		CIPS	
	Level	First Difference	Level	First Difference
SE	−2.492	−3.296 ***	−1.218	−4.772 **
MOFIS	0.821	−5.339 ***	−1.241	−4.249 ***
RQ	−2.318	−6.380 ***	1.383	−7.437 ***
MOFIS∗RQ	0.957	−3.721 ***	−2.406	−6.132 **
GDP	1.319	−4.117 ***	0.738	−3.225 ***
FD	2.427	−5.194 **	0.859	−8.312 ***
PS	−2.697	−4.820 ***	−2.018	−7.275 **

Note: *** and ** indicate 1% and 5% levels of significance, respectively.

Table 3. Westerlund panel cointegration test.

Statistic	Value	z-Value	*p*-Value
Gt	−12.072 ***	−5.670	0.000
Ga	−10.661 ***	8.061	0.000
Pt	−9.904 **	−7.689	0.014
Pa	−14.350 ***	9.431	0.000

Note: *** and ** indicate 1% and 5% levels of significance, respectively.

After confirming that the variables in the models co-move in the long run, we used the DCCE estimator to examine the long-run effects of the independent variables on the shadow economy. Additionally, the DSUR approach was utilised to check the robustness of estimates. Table 4 presents the results, which are in two sections. The DCCE estimates are in the top section, while the DSUR results are in the compartment beneath DCCE. Juxtaposing the results across the two estimation techniques for models 1 and 2 reveals that the estimates are overall consistent across DSUR and DSUR. Consequently, similar interpretations and discussion of findings apply across the board. For model 1, the DCCE results show that the impact of MOFISs is negative and significant at 1%. Specifically, the result implies that, ceteris paribus, a 1% increase in the uptake and development of MOFISs results in a decline in the size of the SE by 0.042%. The expansion of MOFISs could rein in the size of the SE by enhancing transparency through the creation of a digital record of transactions, making it harder for informal or shadow enterprises to go untracked, while also deepening accessibility and convenience, thereby attracting more people into the formal financial system, encouraging them to conduct their businesses within the regulated economy (GSMA 2018). This research outcome is consistent with the result of Jacolin et al. (2021), who investigated 101 countries and concluded that a rise in MOFISs adoption reduced the size of the SE by a substantial magnitude.

Table 4. DCCE and DSUR estimation results.

Variables	Model 1	Model 2
Dynamic common-correlated effect (DCCE):		
Mobile financial services	−0.042 *** (−5.420)	−0.116 *** (−3.529)
Regulatory quality	−0.095 *** (−4.550)	−0.173 *** (−2.926)
MOFIS∗RQ		−0.088 *** (−4.304)
GDP per capita	−0.134 * (−1.921)	−0.106 ** (−2.048)
Financial development index	−0.068 ** (−2.133)	−0.017 ** (−2.311)
Government expenditure	0.035 *** (−2.913)	0.008 *** (4.138)
Dynamic seemingly unrelated regression (DSUR):		
Mobile financial services	−0.191 *** (−2.855)	−0.110 ** (−2.101)
Regulatory quality	−0.006 *** (−3.232)	−0.058 *** (−4.673)
MOFIS∗RQ		−0.367 ** (−6.621)
GDP per capita	−0.093 ** (−2.137)	0.049 (1.308)
Financial development index	−0.130 *** (−5.913)	−0.008 * (−1.911)
Government expenditure	0.062 * (1.922)	0.065 ** (2.112)

Note: All variables are in logarithmic forms; t-Statistics are in parentheses; ***, ** and * indicate 1%, 5% and 10% levels of significance, respectively.

The coefficient of regulatory quality (RQ) is negative and significant at the 1% level. This implies that improvement in the quality of regulation tends to stymie the expansion of the SE. Specifically, an improvement of 1% in RQ reins in the SE size by 0.095%. Intuitively, the high quality of regulations tends to diminish the size of the SE because it increases compliance and stifles corruption, which encourages the SE to flourish. This finding is consistent with the result of Canh et al. (2021), according to which institutional and regulatory quality have a strong diminishing effect on the size of the SE, in their investigation of 112 countries. On the other hand, the result is contradictory to the finding on 25 OECD countries by Enste (2010), according to which increased regulations encourage the development of the SE, in line with the argument that a high level of regulation risks limiting individual freedom and the operational flexibility of enterprises, as well as potentially impairing market operations (Conway and Nicoletti 2006; Enste and Hardege 2006). GDP per capita exhibits a negative and significant coefficient, indicating that, as economic development increases, the size of the SE declines. In the face of continuous economic development, there is a high tendency to rein in the size of the SE because people in the informal sector usually transition into the formal sector to take advantage of the economic development-induced access to financial services, improved social safety nets, and increased formal job and business opportunities (Schneider 2010). The outcome aligns with the result of Jacolin et al. (2021), according to which GDP per capita has a negative impact on the SE.

Financial development index is negative and significant, which indicates that more development of the financial sector stifles the SE. According to the DCCE result, ceteris paribus, a 1% increase in the development of the financial system is associated with a decline in the SE by 0.068%, and vice versa. An improvement in the financial sector development is usually expected to engender increased financial inclusion, improved credit availability, and enhanced financial transactions' transparency, which could attract more SE participants into the formal sector. This result is consistent with some extant studies that an advancement in financial sector development is linked to a decrease in the size of the SE (Blackburn et al. 2012; Capasso and Jappelli 2013; Jacolin et al. 2021). The coefficient of government expenditure is positive and significant at the 1% level. This indicates that the size of the public sector exerts a positive impact on the size of the SE. Going by the DCCE result, ceteris paribus, a 1% increase in government expenditure leads to an increase in the size of

the SE by 0.035%. This result aligns with the argument that increased government spending may produce a crowding-out effect on private initiative and promote the SE, particularly in situations wherein the resulting fiscal deficits and government debt raise anticipations of a heavier tax burden in the future (Berdiev and Saunoris 2018). Moreover, Jacolin et al. (2021) argued that the nature of government expenditure determines the impact on the SE, with positive (negative) impacts from unproductive (productive) government expenditure.

Including the interaction term between MOFISs and RQ in Equation (2) enables the assessment of the moderating impact of RQ on the relationship between MOFISs and the SE, and the result is captured in Model 2. The DCCE result shows that the interaction term exhibits a negative coefficient at the 1% level of significance. Explicitly, this result implies that, ceteris paribus, a 1% increase in the application of regulatory framework to the operation of MOFISs leads to a 0.088% decline in the size of the SE. This result confirms that RQ has a moderating impact on the relationship between MOFISs and the SE, such that the diminishing impact of MOFISs on the SE is reinforced and made more effectual by improvement in the quality of regulatory architecture. This research outcome aligns with the argument that high-quality regulatory frameworks ensure better oversight, reduce transaction costs, and enhance trust in financial systems (Claessens and Rojas-Suarez 2016). These frameworks can facilitate the formalisation of enterprises that typically occur in the underground economy by making formal financial services more accessible and reliable (Kelmanson et al. 2019). For instance, clear and enforceable regulations can mitigate risks associated with MOFISs, such as fraud and cybercrime, which are often barriers to their widespread adoption (Donovan 2012). Moreover, this finding supports the position that effective regulation can bolster innovation and promote consumer protection (World Bank 2014). This balance is crucial because it enables MOFIS providers to offer secure and user-friendly services that attract users from the SE. This finding also corroborates the argument that regulatory improvements can enhance interoperability between different MOFIS platforms and traditional banking systems, further integrating the SE into the formal economy (Beck et al. 2007). The previous result by Canh et al. (2021), according to which strong regulations impact the SE negatively, is consistent with this finding, while it is contradicted by Enste (2010), who found that enhanced regulations is associated with deepened SE.

Table 5 presents the results of the panel causality test. The results show that unidirectional causality runs from each of the MOFISs, regulatory quality, and financial development to the SE. Moreover, there are unidirectional causalities from regulatory quality to MOFISs and from MOFISs to GDP. However, a bidirectional causal linkage was found between the SE and GDP. These findings are vital for Southern African governments and policymakers in their efforts to build a robust mobile financial system, reduce the size of the SE, and promote inclusive growth.

Table 5. Dumitrescu–Hurlin panel causality test.

Variable	SE	MOFIS	RQ	GDP	FD	PS
SE		0.397	0.537	0.435 ***	1.221	0.773
		(0.152)	(1.904)	(6.917)	(0.717)	(1.393)
MOFIS	0.038 ***		0.192	0.337 ***	0.139	0.227
	(4.076)		(1.116)	(3.916)	(0.843)	(1.108)
RQ	0.094 ***	0.437 **		1.641	0.911	0.310
	(6.115)	(2.110)		(1.304)	(1.005)	(1.49)
GDP	0.371 **	0.523	1.024		2.172	1.874
	(2.376)	(1.394)	(1.338)		(0.193)	(1.397)
FD	0.081 ***	0.078 ***	0.070	0.371		0.315
	(5.316)	(4.661)	(1.351)	(1.119)		(1.294)
PS	0.288	0.534	0.302	0.004	0.219	
	(1.079)	(0.284)	(1.937)	(1.497)	(1.937)	

Note: z-statistics are in parentheses; *** and ** indicate 1% and 5% levels of significance, respectively.

4. Materials and Methods

4.1. Data Description

To achieve the objectives of this study, annual panel data for Southern African countries covering the period of 1993–2022 were analysed. The data availability influenced the choice of 1993–2022 as the study period. The Southern African countries investigated comprised Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe. Table 6 describes the study's data. The size of the SE is the dependent variable, and the data were collected from Elgin et al. (2021). To derive the estimates of the SE as a percentage of GDP, the authors used a Multiple Indicators Multiple Causes (MIMIC) model, which is a specific form of structural equation model (SEM) that utilises relationships between various observable factors and effects of an unobservable variable; in this case, the SE. Due to its merits in empirical research, SE data derived from MIMIC models were employed by researchers in several extant studies (for example, Ajide and Dada 2024; Jacolin et al. 2021; Younas et al. 2022). The main explanatory variables are MOFISs and regulatory quality. This study employed mobile cellular subscriptions (per 100 people) to measure MOFISs, and the data were sourced from the World Development Indicators. Regulatory quality was measured by the regulatory efficiency component of the Economic Freedom Index, provided by the Heritage Foundation. The regulatory efficiency score for each country was measured on a scale from 0 to 100, with 100 representing the highest level of business freedom. The score is derived from the following equally weighted four sub-factors: access to electricity, business environment risk, regulatory quality, and women's economic inclusion. A composite index of the sub-factors was computed to derive the regulatory efficiency data of each country.

Table 6. Description of variables.

Variables	Acronym	Measurement	Source
Shadow economy	SE	SE as a % of GDP	Elgin et al. (2021)
Mobile financial services	MOFISs	Mobile cellular subscriptions	WDI
Regulatory quality	RQ	Regulatory efficiency	Heritage Foundation
Economic development	GDP	GDP per capita	WDI
Financial development	FD	financial development index	IMF
Size of the public sector	PS	Government expenditure as a % of GDP	WDI

The control variables comprised GDP per capita, financial development, and size of the public sector. GDP per capita was incorporated into the model to account for the potential influence of economic development on the size of the SE. Including this variable is justified, as it has been demonstrated that the long-term shrinking of the SE is driven by economic development and that the variable inherently reflects the business cycle (Medina and Schneider 2018). For example, Schneider (2010) showed that individuals and firms are more motivated to transition from the underground economy to the formal sector during the business cycle's peak to leverage job and business openings. Financial development was measured by the new financial development index of the International Monetary Fund (IMF), prepared by Svirydzenka (2016). This index has the advantage of accounting for the multidimensionality of financial development by encompassing all its facets, namely depth, accessibility (financial inclusion), and efficiency. Extant studies revealed that enhancing the financial sector's development is linked with a decrease in the size of the SE (Blackburn et al. 2012; Capasso and Jappelli 2013). The size of the public sector was represented by government expenditure. This variable could potentially affect

the SE either positively or negatively. For example, government spending could enhance the availability of infrastructure, which could strongly incentivise transitioning into the formal sector (D'Hernoncourt and Méon 2012; Rud 2012). On the other hand, it may crowd out private investment endeavours and encourage SE activities (Berdiev and Saunoris 2018).

4.2. Model Specification

This study set out to estimate the following baseline model:

$$SE_{it} = \beta_1 + \beta_2 MOFIS_{it} + \beta_3 RQ_{it} + \beta_4 X_{it} + \varepsilon_{it} \quad (1)$$

where SE is shadow economy, MOFIS is mobile financial services, RQ is regulatory quality, X is a set of control variables comprising GDP per capita, financial development and the size of the public sector, $\beta(\beta_1, \beta_2, \beta_3, \beta_4)$ is a set of parameters to be estimated, t is time indicator, and ε is the error term.

Since this study also aimed to investigate the moderating effect of RQ on the relationship between the SE and MOFISs, an interaction term combining RQ and MOFIS is included in Equation (1) to consider the distinct impact of their interaction. This adjustment was made with reference to extant studies (Arogundade et al. 2022; Hassan 2021, 2023b), and it yields the following:

$$SE_{it} = \beta_1 + \beta_2 MOFIS_{it} + \beta_3 RQ_{it} + \beta_4 (MOFIS * RQ)_{it} + \beta_5 X_{it} + \varepsilon_{it} \quad (2)$$

As articulated in previous studies (Hassan et al. 2019; Hassan and Meyer 2021; Hassan 2023a), the moderating role of RQ in the impact of MOFISs on the SE can be estimated by conducting a differentiation of Equation (2) with respect to MOFISs to derive Equation (3):

$$\frac{\partial SE_{it}}{\partial MOFIS_{it}} = \beta_2 + \beta_4 RQ_{it} \quad (3)$$

The way RQ moderates the impact of MOFISs on the SE is assessed through the estimates of β_2 and β_4. Aligning with previous studies (Arogundade et al. 2022; Hassan 2021, 2023b), the estimates can result in four potential outcomes, each of which is interpreted as follows:

If $\beta_2 > 0$ and $\beta_4 > 0$, it suggests that MOFISs increase the SE and RQ enhances the positive impact of MOFISs on the SE.

If $\beta_2 > 0$ and $\beta_4 < 0$, it implies that MOFISs contribute to the increase in the SE, while RQ dampens the positive impact of MOFISs on the SE.

If $\beta_2 < 0$ and $\beta_4 > 0$, it indicates that MOFISs contribute to the decline in the SE, while RQ reduces the impact of MOFISs on the SE.

If $\beta_2 < 0$ and $\beta_4 < 0$, then MOFISs negatively affect the SE and this impact is reinforced by RQ.

Logarithmic representations of all the variables are used to estimate Equations (1)–(3).

4.3. Methods

4.3.1. Cross-Sectional Dependence and Unit Root Tests

In panel data analysis, concern over cross-sectional dependence (CD) has gained increased attention recently due to its potential to engender misleading estimates. Panel data are usually characterised by CD arising from spatial dependence, individual-specific dependence, and error term (Pesaran 2004). Additionally, according to De Hoyos and Sarafidis (2006), globalisation-driven financial integration cum increased relations among countries have also increased the potential for CD in panel data, to the extent that CD is now widely acknowledged as fundamental attribute among the cross-sections in a panel (Turkay 2017). Therefore, we began the econometric analysis with in-series CD test following the Pesaran (2004) approach.

A key implication is that, if CD is present, traditional unit root tests could produce misleading results. This is because they are deficient in handling the scale-related aspects of data and may wrongly dismiss the null hypothesis due to CD (Banerjee et al. 2001). To mitigate these concerns in this study, the Pesaran (2007) CADF and CIPS panel stationarity tests were implemented, with the null hypothesis that the variables are not stationary. The CADF is formulated as follows:

$$\Delta Z_{it} = \beta_i + a_i z_{i,t-1} + \alpha_i \overline{z}_{t-1} + \sum_{j=0}^{k} b_{ij} \Delta \overline{z}_{t-j} + \sum_{j=1}^{k} \delta_{ij} \Delta z_{i,t-j} + \varepsilon_{it} \quad (4)$$

where $\overline{z}_{t-1}$ represents the lagged average level across sections, while $\Delta \overline{z}_{t-j}$ signifies first-order integration across each section.

Furthermore, the following CIPS was derived from CADF:

$$CIPS = N^{-1} \sum_{i=1}^{N} CADF_i \quad (5)$$

4.3.2. Panel Cointegration Test

To determine whether the variables cointegrate, the ECM-based Westerlund (2007) test was employed. This is because conventional tests could produce misleading estimates because they do not accommodate crucial issues such as heteroscedasticity, serial correlation, and CD. The test accommodates these issues and is suited for the heterogeneous panel. It requires calculating four statistical measures, which are grouped into two. G_t and G_a rely on group-level statistics, while P_t and P_a are based on statistics derived from the panel. The model is expressed as follows:

$$\Delta Z_{it} = \rho_i' d_t + \delta_i \left(Z_{it-1} - \alpha_i' x_{it-1} \right) + \sum_{j=1}^{pi} \delta_{ij} \Delta z_{it-j} + \sum_{j=-p_i}^{pi} \theta_{ij} \Delta x_{i,t-j} + \varepsilon_{it} \quad (6)$$

The derivation of (G_t and G_a)'s t-statistics is

$$G_t = \frac{1}{N} \sum_{i=1}^{N} \frac{\Psi_i}{SE(\hat{\Psi}_i)} \quad (7)$$

$$G_a = \frac{1}{N} \sum_{i=1}^{N} \frac{TY}{\Psi_i'(1)} \quad (8)$$

The derivation of (P_t and P_a) 's t-statistics is

$$P_t = \frac{\Psi_i}{SE(\Psi_i)} \quad (9)$$

$$P_a = T\Psi \quad (10)$$

where Ψ_i denotes the rate at which long-run convergence occurs.

4.3.3. Estimation of Parameters

The parameters were estimated using the dynamic common-correlated effects (DCCE) approach of Chudik and Pesaran (2015). Relative to traditional methods, this approach is more effective because it takes care of several crucial econometric issues that are usually ignored. In the forefront of these issues is CD which DCCE accommodates by incorporating the mean and logarithms across cross-sectional units. It also makes room for heterogeneous slopes and generates accurate results even with small sample sizes through the application of recursive mean adjustment (Chudik and Pesaran 2015). Moreover, according to Chudik and Pesaran (2015), the DCCE method addresses non-stationarity in the data and removes asymptotic distortion resulting from the endogeneity of the independent variables. Additionally, in both static and dynamic panel data models, the DCCE technique constructs an instrument set by leveraging the lagged variables, ensuring robustness against endogenous regressors. In dynamic panel models, whether the regressors are strictly exogenous, weakly

exogenous, or endogenous, they notably enhance the small sample properties of the estimator (Chaudhry et al. 2022). Furthermore, DCCE is suitable for panels with structural breaks (Kapetanios et al. 2011) and unbalanced data (Ditzen 2016). In line with Chudik and Pesaran (2015), the DCCE model is expressed as follows:

$$\ln SE_{it} = \alpha_i \ln SE_{it-1} + \delta_i X_{it} + \sum_{p=0}^{P_T} \gamma_{xip} \overline{X}_{t-p} + \sum_{p=0}^{P_T} \gamma_{yip} \overline{X}_{t-p} + \mu_{it} \quad (11)$$

where lnSE is SE's log, with its lag serving as an explanatory variable; X_{it} represents a collection of the remaining explanatory variables; and P_T represents the lagged average of cross-sections.

Additionally, to evaluate the reliability of the results, we utilised the dynamic seemingly unrelated regression (DSUR) method as outlined by Mark et al. (2005). This method builds upon the single-equation DOLS by extending it to panel data settings wherein the time dimension exceeds the number of cross-sections. It effectively addresses issues related to CD, endogeneity, and heterogeneity (Mark et al. 2005).

The last step in the estimation process focuses on exploring causality between the variables. Engle and Granger (1987) stressed the importance of testing for causality among variables, arguing that, if cointegration is observed, it indicates the presence of at least one-way causality between them. Moreover, understanding the causal links between the SE and the explanatory variables in this study can support policymakers in crafting effective strategies to rein in the SE. To assess causality between the variables, we implemented the Dumitrescu and Hurlin (2012) causality test, which effectively handles the issues of heterogeneity and CD in panel data.

5. Conclusions

The advent of the fourth industrial revolution has amplified the importance of the MOFIS platform as a tool for easing the SE into the formal sector. However, despite the increased diffusion of MOFISs and their potential impact on the size of the SE, empirical studies on the relationship between the two variables have been sparse. Thus, this study aimed to explore the linkage between MOFISs and the SE in Southern Africa. Additionally, the moderating impact of regulatory quality on the relationship between MOFISs and the SE was examined. To realise this study's objectives, we estimated panel data from 1993 to 2022, using the Westerlund test for cointegration, and DCCE and DSUR methods to estimate long-run parameters.

This study confirmed that all variables in the model exhibit a long-run relationship, as demonstrated by unit root and cointegration tests. The results of the DCCE and DSUR estimators show that MOFISs exert a diminishing impact on the size of the SE, as increased diffusion of MOFISs is linked with a decline in the size of the informal sector in Southern Africa. Likewise, improvement in RQ, economic development, and financial sector development are also found to contribute to a reduction in the size of the SE. On the other hand, the size of the public sector was found to have a positive impact on the SE, which implies that a bloated size of the public sector tends to increase the size of the SE. Another crucial result from this study is the establishment of the moderating role of RQ in the MOFIS-SE nexus, as it was found that improvements in RQ reinforce the effectiveness of MOFISs, thereby enhancing transparency and accessibility, which encourages formal economic participation. Overall, the results consistently show that the uptake and development of MOFISs, coupled with high-quality regulatory frameworks, significantly diminish the size of the SE.

Considering these research outcomes, some policy recommendations are deemed necessary. First, government at all levels and financial institutions should increase support for the expansion of MOFISs. As such, investing in MOFIS infrastructure and user-friendly services should be a key policy focus. This is because expanding MOFISs can enhance financial inclusion and transparency, making it more difficult for SE activities to remain untracked. This can be achieved with aggressive investment by governments and private companies on infrastructure aimed at expanding mobile network coverage, regulators cre-

ating an enabling environment for healthy competition among mobile network providers to engender lower costs, and public–private partnerships to drive innovation and investment. Second, policies that enhance financial inclusion, such as providing incentives for MOFISs adoption and improving financial literacy, should be prioritised. These measures can attract more SE participants into the formal financial sector. Third, policymakers should focus on improving the quality of regulations governing MOFISs. Effective regulatory frameworks can facilitate the formalisation of financial transactions, reduce fraud and cybercrime, and increase public trust in formal financial systems. The quality of regulations should be fine-tuned in such a way that it is not excessive or impose a heavy burden on financial institutions and their customers, and in a way that does not discourage innovation. Moreover, given the positive relationship between the size of the public sector and the SE, it is crucial to ensure that government spending is productive and does not inadvertently encourage the SE. Transparent and efficient allocation of resources can mitigate the risk of expanding the SE due to bloated government expenditures.

While this study explored a significant and underexplored subject, it is not without its limitations. First, the findings from Southern Africa may not be generalisable to other regions due to variations in the structure of the SE, financial infrastructure, and regulatory environments across regions. Southern Africa's unique socio-economic and historical context, particularly South Africa's apartheid legacy, may limit broader applicability. Second, this study discussed conflicting views on the role of regulation in MOFIS-SE dynamics. However, capturing the nuances of how different regulatory frameworks affect SE activities across countries could be challenging, especially given the variations in enforcement and the informal nature of the SE. Lastly, much of this study relies on secondary data from reliable sources like the World Bank, GSMA, and Findex databases. While reliable and valuable, these sources may not fully capture the on-the-ground realities of SE activities or the nuanced impacts of MOFISs across different sectors.

Moving forward, future studies can extend the analysis to a broader set of countries with varying regulatory environments and levels of MOFISs to provide more comprehensive insights. Also, investigating the impact of MOFISs and RQ on specific sectors within the shadow economy could reveal more targeted policy interventions. Moreover, future research efforts could be directed towards exploring the role of digital literacy in the effectiveness of MOFISs to provide valuable insights for policy design, especially in developing countries. Lastly, consideration could be given to how emerging technologies, such as blockchain and artificial intelligence, can be integrated with MOFISs and regulatory frameworks to rein the activities of the SE.

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References

Ajide, Folorunsho M. 2021. Shadow economy in Africa: How relevant is financial inclusion? *Journal of Financial Regulation and Compliance* 29: 297–316. [CrossRef]

Ajide, Folorunsho M., and James T. Dada. 2024. Globalization and shadow economy: A panel analysis for Africa. *Review of Economics and Political Science* 9: 166–89. [CrossRef]

Aker, Jenny C., Rachid Boumnijel, Amanda McClelland, and Niall Tierney. 2016. Payment mechanisms and antipoverty programs: Evidence from a mobile money cash transfer experiment in Niger. *Economic Development and Cultural Change* 65: 1–37. [CrossRef]

Akhter, Nahid, and Baqui Khalily. 2017. Impact of Mobile Financial Services on Financial Inclusion in Bangladesh. Institute for Inclusive Finance and Development. Institute for Inclusive Finance and Development Working Paper No. 52. Available online: https://inm.org.bd/wp-content/uploads/2017/07/Working-paper-52.pdf (accessed on 7 November 2024).

Alm, James, and Abel Embaye. 2013. Using dynamic panel methods to estimate shadow economies around the world, 1984–2006. *Public Finance Review* 41: 510–43. [CrossRef]

Anarfo, Ebenezer Bugri, Joshua Yindenaba Abor, and Kofi Achampong Osei. 2020. Financial regulation and financial inclusion in Sub-Saharan Africa: Does financial stability play a moderating role? *Research in International Business and Finance* 51: 101070. [CrossRef]

Arogundade, Sodiq, Adewale Samuel Hassan, and Santos Bila. 2022. Diaspora income, financial development and ecological footprint in Africa. *International Journal of Sustainable Development & World Ecology* 29: 440–54. [CrossRef]

Aron, Janine. 2017. *'Leapfrogging': A Survey of the Nature and Economic Implications of Mobile Money*. Oxford: University of Oxford. Available online: https://ideas.repec.org/p/csa/wpaper/2017-02.html (accessed on 15 April 2024).

Álvarez-Herránz, Agustin, Daniel Balsalobre, Jose Maria Cantos, and Muhammad Shahbaz. 2017. Energy innovations-GHG emissions nexus: Fresh empirical evidence from OECD countries. *Energy Policy* 101: 90–100. [CrossRef]

Banerjee, Anindya, Lynne Cockerell, and Bill Russell. 2001. An I (2) analysis of inflation and the markup. *Journal of Applied Econometrics* 16: 221–40. [CrossRef]

Barth, James R., Gerard Caprio, Jr., and Ross Levine. 2004. Bank regulation and supervision: What works best? *Journal of Financial Intermediation* 13: 205–48. [CrossRef]

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 2007. Finance, inequality and the poor. *Journal of Economic Growth* 12: 27–49. [CrossRef]

Beck, Thorsten, Haki Pamuk, Ravindra Ramrattan, and Burak R. Uras. 2018. Payment instruments, finance and development. *Journal of Development Economics* 133: 162–86. [CrossRef]

Berdiev, Aziz N., and James W. Saunoris. 2018. Does globalisation affect the shadow economy? *The World Economy* 41: 222–41. [CrossRef]

Besong, Susan Enyang, Telma Longy Okanda, and Simon Arrey Ndip. 2022. An empirical analysis of the impact of banking regulations on sustainable financial inclusion in the CEMAC region. *Economic Systems* 46: 100935. [CrossRef]

Blackburn, Keith, Niloy Bose, and Salvatore Capasso. 2012. Tax evasion, the underground economy and financial development. *Journal of Economic Behavior & Organization* 83: 243–53. [CrossRef]

Bongomin, George Okello Candiya, and Joseph Ntayi. 2020. Trust: Mediator between mobile money adoption and usage and financial inclusion. *Social Responsibility Journal* 16: 1215–37. [CrossRef]

Buehn, Andreas, and Friedrich Schneider. 2012. Shadow economies around the world: Novel insights, accepted knowledge, and new estimates. *International Tax and Public Finance* 19: 139–71. [CrossRef]

Canh, Phuc Nguyen, Christophe Schinckus, and Su Dinh Thanh. 2021. What are the drivers of shadow economy? A further evidence of economic integration and institutional quality. *The Journal of International Trade & Economic Development* 30: 47–67. [CrossRef]

Capasso, Salvatore, and Tullio Jappelli. 2013. Financial development and the underground economy. *Journal of Development Economics* 101: 167–78. [CrossRef]

Chaudhry, Imran Sharif, Zulkornain Yusop, and Muzafhar Shah Habibullah. 2022. Financial inclusionenvironmental degradation nexus in OIC countries: New evidence from environmental Kuznets curve using DCCE approach. *Environmental Science and Pollution Research* 29: 5360–77. [CrossRef]

Chen, Rong, and Raian Divanbeigi. 2019. Can Regulation Promote Financial Inclusion? World Bank Policy Research Working Paper 8711. Available online: https://documents1.worldbank.org/curated/en/689111547822970149/pdf/WPS8711.pdf (accessed on 7 November 2024).

Chinoda, Tough, and Farai Kwenda. 2019. Do mobile phones, economic growth, bank competition and stability matter for financial inclusion in Africa? *Cogent Economics & Finance* 7: 1–20. [CrossRef]

Chortareas, Georgios E., Claudia Girardone, and Alexia Ventouri. 2013. Financial freedom and bank efficiency: Evidence from the European Union. *Journal of Banking and Finance* 37: 1223–31. [CrossRef]

Chudik, Alexander, and M. Hashem Pesaran. 2015. Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors. *Journal of Economics* 188: 393–420. [CrossRef]

Claessens, Stijn, and Liliana Rojas-Suarez. 2016. Financial regulations for improving financial inclusion. *Center for Global Development* 2: 44–53.

Conway, Paul, and Giuseppe Nicoletti. 2006. *Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurements and Highlights*. OECD Working Papers, Nr. 530. Paris: OECD.

De Hoyos, Rafael E., and Vasilis Sarafidis. 2006. Testing for cross-sectional dependence in panel-data models. *Stata Journal* 6: 482–96. [CrossRef]

Dell'Anno, Roberto. 2016. Analysing the determinants of the shadow economy with a "separate approach". An application of the relationship between inequality and the shadow economy. *World Development* 84: 342–56. [CrossRef]

Demirgüç-Kunt, Asli, and Leora Klapper. 2012. *Measuring Financial Inclusion: The Global Findex Database*. Washington, DC: The World Bank. [CrossRef]

Demirgüç-Kunt, Asli, Leora Klaper, Dorothe Singer, and Saniya Ansar. 2022. *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. Washington, DC: World Bank Publications.

Demirgüç-Kunt, Asli, Leora Klaper, Saniya A. Dorothe, and Jake Hess. 2018. *Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution*. Washington, DC: World Bank, CC BY 3.0 IGO. [CrossRef]

D'Hernoncourt, Johanna, and Pierre-Guillaume Méon. 2012. The not so dark side of trust: Does trust increase the size of the shadow economy? *Journal of Economic Behavior and Organization* 81: 97–121. [CrossRef]

Dima, Bogdan, and Stefana Maria Dima. 2018. Do Business Regulations Promote Growth in Low-income Countries? *Economic Analysis* 51: 33–56. [CrossRef]

Ditzen, Jan. 2016. *xtdcce: Estimating Dynamic Common Correlated Effects in Stata*. SEEC Discussion Papers, 1601. Tokyo: SEEC.

Donovan, Kevin. 2012. Mobile money for financial inclusion. *Information and Communications for Development* 61: 61–73.

Dumitrescu, Elena-Ivona, and Christophe Hurlin. 2012. Testing for Granger non-causality in heterogeneous panels. *Economic Modelling* 29: 1450–60. [CrossRef]

Elgin, Ceyhun, and Oguz Oztunali. 2012. *Shadow Economies Around the World: Model Based Estimates*. (Bogazici University Department of Economics Working Papers 5). pp. 1–48. Available online: http://ideas.econ.boun.edu.tr/RePEc/pdf/201205.pdf (accessed on 10 July 2024).

Elgin, Ceyhun, M. Ayhan Kose, Franziska Ohnsorge, and Shu Yu. 2021. *Understanding Informality*. CEPR Discussion Paper 16497. London: CEPR.

Engle, Robert F., and C. W. Granger. 1987. Co-integration and error correction: Representation, estimation, and testing. *Econometrica: Journal of the Econometric Society* 55: 251–76. [CrossRef]

Enste, Dominik H. 2010. Regulation and shadow economy: Empirical evidence for 25 OECD-countries. *Constitutional Political Economy* 21: 231–48. [CrossRef]

Enste, Dominik H., and Stefan Hardege. 2006. *IW-Regulierungsindex: Methode, Analyse und Ergebnisse eines internationalen Vergleichs*. Köln: IW-Analyse.

Evans, David S., and Alexis Pirchio. 2014. An empirical examination of why mobile money schemes ignite in some developing countries but flounder in most. *Review of Network Economics* 13: 397–451. [CrossRef]

Evans, Olaniyi. 2018. Connecting the poor: The internet, mobile phones and financial inclusion in Africa. *Digital Policy, Regulation and Governance* 20: 568–81. [CrossRef]

Fritz, Thomas, and Sven Hilbig. 2019. *Global Justice 4.0: The Impacts of Digitalisation on the Global South*. Berlin: Brot für die Welt, Evangelisches Werk für Diakonie und Entwicklung eV.

Gomis-Porqueras, Pedro, Adrian Peralta-Alva, and Christopher Waller. 2014. The shadow economy as an equilibrium outcome. *Journal of Economic Dynamics and Control* 41: 1–19. [CrossRef]

GPFI. 2018. G20 Policy Guide: Digitisation and Informality—Harnessing Digital Financial Inclusion for Individuals and MSMEs in the Informal Economy. Available online: https://www.gpfi.org/sites/gpfi/files/documents/G20_Policy_Guide_Digitisation_and_Informality.pdf (accessed on 2 March 2024).

GSMA. 2018. *2017 State of the Industry Report on Mobile Money*. London: GSMA.

GSMA. 2021. *State of the Industry Report on Mobile Money 2021*. London: GSMA.

Hart, Keith. 2008. Informal Economy. In *The New Palgrave Dictionary of Economics*. Edited by Steven N. Durlauf and Lawrence E. Blume. London: Palgrave Macmillan, vol. 10, pp. 6481–84.

Hassan, Adewale Samuel. 2021. Foreign aid and economic growth in Nigeria: The role of institutional quality. *Studies of Applied Economics* 39. [CrossRef]

Hassan, Adewale Samuel. 2023a. Coal mining and environmental sustainability in South Africa: Do institutions matter? *Environmental Science and Pollution Research* 30: 20431–49. [CrossRef]

Hassan, Adewale Samuel. 2023b. Modeling the linkage between coal mining and ecological footprint in South Africa: Does technological innovation matter? *Mineral Economics* 36: 123–38. [CrossRef]

Hassan, Adewale Samuel, and Daniel Francois Meyer. 2021. Moderating effect of institutional quality on the external debt-economic growth nexus: Insights from highly indebted poor countries (HIPC). *African Journal of Business and Economic Research* 16: 7–28. [CrossRef]

Hassan, Adewale Samuel, Daniel Francois Meyer, and Sebastian Kot. 2019. Effect of institutional quality and wealth from oil revenue on economic growth in oil-exporting developing countries. *Sustainability* 11: 3635. [CrossRef]

Hoskins, Sean M., and Marc Labonte. 2015. *An Analysis of the Regulatory Burden on Small Banks*. Congressional Research Service (CRS) Report 7–5700. Washington, DC: Congressional Research Service (CRS).

Ihrig, Jane, and Karine S. Moe. 2004. Lurking in the shadows: The informal sector and government policy. *Journal of Development Economics* 73: 541–57. [CrossRef]

Izaguirre, Juan Carlos. 2020. *Making Consumer Protection Regulation More Customer-Centric*. Washington, DC: CGAP. Washington, DC: World Bank.

Jacolin, Luc, Joseph Keneck Massil, and Alphonse Noah. 2021. Informal sector and mobile financial services in emerging and developing countries: Does financial innovation matter? *The World Economy* 44: 2703–37. [CrossRef]

Kaffenberger, Michelle, Edoardo Totolo, and Matthew Soursourian. 2018. *A Digital Credit Revolution: Insights from Borrowers in Kenya and Tanzania*. Financial Sector Deepening Working Paper. Washington, DC: Consultative Group to Assist the Poor.

Kapetanios, G., M. H. Pesaran, and T. Yamagata. 2011. Panels with nonstationary multifactor error structures. *Journal of Economics* 160: 326–48. [CrossRef]

Kaufmann, D., Kraay A., and Mastruzzi M. 2011. The worldwide governance indicators: Methodology and analytical issues1. *Hague Journal on the Rule of Law 3*, 220–46. [CrossRef]

Kelmanson, M. Ben, Koralai Kirabaeva, Leandro Medina, Borislava Mircheva, and Jason Weiss. 2019. *Explaining the Shadow Economy in Europe: Size, Causes and Policy Options*. Washington, DC: International Monetary Fund.

Kiaga, Annamarie, and Vicky Leung. 2020. *The Transition from the Informal to the Formal Economy in Africa*. Global Employment Policy Review Background Paper No. 4. Geneva: Internation Labour Organisation.
Klapper, Leora. 2017. How digital payments can benefit entrepreneurs. *IZA World of Labor* 396: 1–9. [CrossRef]
Kodongo, Odongo. 2018. Financial regulations, financial literacy, and financial inclusion: Insights from Kenya. *Emerging Markets Finance and Trade* 54: 2851–73. [CrossRef]
La Porta, Rafael, and Andrei Shleifer. 2014. Informality and development. *Journal of Economic Perspectives* 28: 109–26. [CrossRef]
Laeven, Luc, and Ros Levine. 2009. Bank governance, regulation and risk taking. *Journal of Financial Economics* 93: 259–75. [CrossRef]
Levine, Ross. 2012. The governance of financial regulation: Reform lessons from the recent crisis. *International Review of Finance* 12: 39–56. [CrossRef]
Manduna, Kennedy. 2023. Zama Zamas: Victims, Not Criminals. *The Sunday Times (SA)*. August 16. Available online: https://www.timeslive.co.za/sunday-times-daily/opinion-and-analysis/2023-08-16-kennedy-manduna-zama-zamas-victims-not-criminals/ (accessed on 25 June 2024).
Mark, Nelson C., Masao Ogaki, and Donggyu Sul. 2005. Dynamic seemingly unrelated cointegrating regressions. *Review of Economic Studies* 72: 797–820. [CrossRef]
Medina, Leandro, and M. Friedrich Schneider. 2018. *Shadow Economies Around the World: What Did We Learn over the Last 20 Years?* Washington, DC: International Monetary Fund.
Mishra, Vishal, and Shailendra Singh Bisht. 2013. Mobile banking in a developing economy: A customer-centric model for policy formulation. *Telecommunications Policy* 37: 503–14. [CrossRef]
Munyegera, Ghombe Kasim, and Tomoya Matsumoto. 2016. Mobile money, remittances, and household welfare: Panel evidence from rural Uganda. *World Development* 79: 127–37. [CrossRef]
Neaime, Simon, and Isabelle Gaysset. 2018. Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters* 24: 230–37. [CrossRef]
North, Douglass C. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
Pesaran, M. Hashem. 2004. *General Diagnostic Tests for Cross Section Dependence in Panels*. CESifo Working Papers No 1233. Munich: CESifo, pp. 255–60.
Pesaran, M. Hashem. 2007. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Economics* 22: 265–312. [CrossRef]
Rangarajan, C. 2008. Report of the Committee on Financial Inclusion. FinDev Gateway. Available online: https://www.findevgateway.org/paper/2008/01/report-committee-financial-inclusion (accessed on 25 June 2024).
Reynolds, Travis W., Marieka Klawitter, Pierre E. Biscaye, and C. Leigh Anderson. 2018. Mobile money and branchless banking regulations affecting cash-in, cash-out networks in low-and middle-income countries. *Gates Open Research* 2: 64. [CrossRef]
Rogerson, C. M. 1988. The underdevelopment of the informal sector: Street hawking in Johannesburg, South Africa. *Urban Geography* 9: 549–67. [CrossRef]
Rud, Juan Pablo. 2012. Electricity provision and industrial development: Evidence from India. *Journal of Development Economics* 97: 352–67. [CrossRef]
Sarma, Mandira, and Jesim Pais. 2011. Financial inclusion and development. *Journal of International Development* 23: 613–28. [CrossRef]
Schneider, Friedrich. 2010. The influence of public institutions on the shadow economy: An empirical investigation for OECD countries. *Review of Law & Economics* 6: 441–68. [CrossRef]
Schneider, Friedrich, and Dominik H. Enste. 2000. Shadow economies: Size, causes, and consequences. *Journal of Economic Literature* 38: 77–114. [CrossRef]
Schneider, Friedrich, and Dominik H. Enste. 2013. *The Shadow Economy: An International Survey*. Cambridge: Cambridge University Press.
Stats SA. 2020. *Quarterly Labour Force Survey*. Pretoria: Statistics South Africa.
Sujee, Zain Jadewin. 2016. Anti-Money Laundering Framework in South Africa the United States and the United Kingdom. Master's thesis, University of Pretoria (South Africa), Pretoria, South Africa.
Svirydzenka, Katsiaryna. 2016. *Introducing a New Broad-Based Index of Financial Development*. (IMF Working Paper 16/15). Available online: https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Introducing-a-New-Broad-based-Index-of-Financial-Development-43621 (accessed on 1 April 2024).
Turkay, Mesut. 2017. Heterogeneity across emerging market central bank reaction functions. *Central Bank Review* 17: 111–16. [CrossRef]
Ulyssea, Gabriel. 2018. Firms, informality, and development: Theory and evidence from Brazil. *American Economic Review* 108: 2015–47. [CrossRef]
Westerlund, Joakim. 2007. Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics* 69: 709–48. [CrossRef]
Williams, Colin C., and F. Schneider. 2016. *Measuring the Global Shadow Economy: The Prevalence of Informal Work and Labour*. Cheltenham: Edward Elgar Publishing.
World Bank. 2014. *Global Financial Development Report 2014: Financial Inclusion*. Washington, DC: World Bank.
World Bank. 2020. *Doing Business 2020: Comparing Business Regulation in 190 Economies*. Washington, DC: World Bank.

Yakubi, Yusef Ali Yusef, Basuki Basuki, Rudi Purwono, and Idrianawati Usman. 2022. The impact of digital technology and business regulations on financial inclusion and socio-economic development in low-income countries. *Sage Open* 12: 1–15. [CrossRef]
Younas, Zahid Irshad, Atiqa Qureshi, and Mamdouh Abdulaziz Saleh Al-Faryan. 2022. Financial inclusion, the shadow economy and economic growth in developing economies. *Structural Change and Economic Dynamics* 62: 613–21. [CrossRef]

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