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Is informality a barrier to economic growth in Uganda? Empirical analysis

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ABSTRACT

We apply autoregressive distributed lag modeling approach to investigate the short- and long-run relationship between economic growth and informality in Uganda. We use annual time series data, covering the period from 1991 to 2017. We find evidence of short- and long-run relationship between economic growth and informality. The results indicate that an increase in informality significantly reduces the rate of economic growth in both the long- and short-run. This evidence seems to indicate that in low income countries where informality is high, a large size of the shadow economy is correlated with low rates of economic growth. This arises from the fact that informal businesses rarely pay taxes for their operations leading to low revenue collection by governments, which affects the provision of essential social services. We argue that the results of a negative relationship between economic growth and informality in both the long- and short-run are possible given the income level of the country under investigation. The practical policy implication from these results is that tackling low rates of economic growth requires also addressing the key drivers of informality in the country.

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Underground economy; fiscal policy; informal sector; shadow economy; economic growth

1. Introduction

As the world progresses towards more integration, there is a recognition that a number of countries still lag behind in terms of economic growth. Recently, researchers and policymakers have devoted much effort into identifying and understanding the main drivers of long-run economic growth so as to align domestic policies towards harnessing the drivers of economic growth. The development of endogenous growth theory and experience of some successful countries, especially those in South East Asia, have helped shed light on the main determinants of economic growth (Lakhera 2016). Key among these determinants include; human capital, physical capital, innovation, technology, and sustainable infrastructure, among others (see Helpman 2004; Romer 1994). Although much work has been done to unearth the key determinants of economic growth across economies of the world, which has improved our understanding, a number of factors that could potentially influence economic growth are yet to be explored. One such under explored factor with the potential to influence economic growth is informality[1] or the size of the shadow economy.

Over the last two decades or so, activities in the shadow economy have risen tremendously in many economies of the world. Across many countries, the growth of the shadow economy has persisted and many policy makers are acknowledging its impact on the size and growth of the formal economy (Alm and Embaye 2013). This implies that any discussion of long-run determinants of economic growth will not be complete without incorporating the impact of the shadow economy into the analysis of long-run economic growth. Informal economy activities have far-reaching effects on social and economic growth in both developing and developed economies. For example, in developing countries where the size of the informal economy is increasing, there is a recognition that governments are struggling with revenue collection since most of the activities are concealed or are done underground to avoid being detected by regulators (Capasso and Jappelli 2013). The rise in informality undermines governments' ability to meet budget commitments which in turn affects its ability to provide public goods and services, such as security, infrastructure, and public healthcare, among others. Consequently, if governments cannot provide adequate public goods and services, this has a negative effect on economic growth and the welfare of the citizens.

Given that economic growth can be influenced by a number of variables, it is important to evaluate how

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informality influences economic growth. Specifically, is the increase in informal sector activities detrimental to economic growth or it spurs economic growth? Investigating this relationship is important because informality can influence economic growth either negatively or positively. Some studies have suggested that allowing activities in the shadow economy to crowd out the production and distribution of goods and services in the formal sector is detrimental to economic growth because of distortions injected by informality into the formal economy (Capasso and Jappelli 2013). Economies with a large size of the shadow economy cannot mirror the actual economic conditions in the country since most of the economic activities are done underground and not reflected in the national accounts. Consequently, concealed activities introduce bias into the economy wide indicators like unemployment, inflation, income, consumption expenditure, among others, which in turn distorts the real economic situation of the country. As suggested by Schneider and Enste (2000), because of the economic distortions caused by the shadow economy, relying on statistics from economies with a substantial size of the shadow economy could be misleading since not all economic activities have been fully accounted for. Thus, relying on data with the above distortions affect governments' planning processes (Capasso and Jappelli 2013).

In this paper, we examine whether informality is detrimental to economic growth in Uganda. Uganda, a small and landlocked country in the East African region is chosen because of two main reasons: first, it's a low income country which is trying to identify and exploit the main determinants of economic growth so to enhance its own economic growth. We suggest that studying this relationship in the context of Uganda will elicit appropriate policy recommendations that will inform policy formulation and enhance economic growth in the country. Second, Uganda shares most of the characteristics with a number of low income countries in Africa and other developing countries outside of Africa. In line with this, this paper's findings could also have important policy implications for most of the low income countries of the world. In this paper, we combine two strands of literature; economic growth and informality, to understand their relationship. There is a reason to believe that a large size of the shadow economy is detrimental to economic growth for a number of reasons. Firstly, the negative effect of the shadow economy on economic growth stems from reasons why entrepreneurs operate underground. The pressure of higher taxes imposed by governments has been cited as one of the reasons why businesses operate underground. Tanzi (1982) emphasizes that a higher tax burden imposes additional costs on businesses through its effect on the after-tax earnings. With higher taxes, the after-tax returns appear smaller making it nearly impossible for start-up businesses to operate past one year. This acts as an incentive for start-ups to operate underground. When businesses conceal their operations, it becomes nearly impossible for tax authorities to assess their tax liability, which affects revenue collection. Lower revenue collection affects the provision of public goods and services, which in turn undermines economic growth.

Relatedly, studies have also shown that excess regulation provides an incentive for businesses to operate underground (De Soto 1989). De Soto (1989) finds that a burdensome regulatory framework (excessive paper work required to formalize business, and inspections) could be viewed by start-up businesses as additional burden to be incurred to operate in the formal economy. This induces start-up businesses to go underground to avoid the additional burden of paper work and excess requirements needed to formalize business. Additionally, Loayza (1996) analyses data from Latin America and shows that a rise in the shadow economy is detrimental to economic growth because it reduces the availability of essential services available to economic agents in the overall economy. Johnson, Kaufmann, and Shleifer (1997) study the relationship between the shadow economy and economic growth in 25 transition countries and conclude that activities in the shadow economy are detrimental to economic growth. Correspondingly, Elgin and Birinci (2016) analyze the impact of informality on long-run economic growth in a panel of 161 countries from the period 1950–2010. These authors find an inverted-U shaped relationship between the shadow economy and economic growth, implying that countries with small or large size of the shadow economy register dismal rates of economic growth compared with countries that with a moderate size of the shadow economy. Furthermore, the income level of the country is also important in influencing this relationship. This implies that countries with high levels of income register positive rates of economic growth compared with those with low income levels.

Whilst previous studies have examined the relationship between economic growth and the size of the shadow economy, these studies have been largely cross-sectional and panel data regression approaches. One limitation of such studies is that they rely on the assumption of homogeneity on coefficients, that is, they assume that countries are the same and findings can be generalized to all these countries (Keho 2017).

However, this is not always the case since countries are heterogeneous with respect to institutions, level of economic development, business environment, technology and other factors. In line with this, the cross-sectional homogeneity assumption could be violated leading to policy recommendations that do not reflect the local economic conditions of individual economies. Furthermore, the findings of Elgin and Birinci (2016) seem to assign levels of informality rather arbitrarily. For instance, small, medium and large size of the shadow economy could be relative depending on the country's level of economic development. In economies with low levels of economic development, informality and formality seem to be intertwined and complement each other.

This paper attempts to fill the above gaps by investigating the relationship between informality and economic growth in a country-level analysis. Indeed the question of whether there is a relationship between economic growth and informal economy has previously been a subject of empirical investigation but not in the context of Uganda, to the best of our knowledge. Studies that have studied this relationship focused mainly on a cross section of countries. Little is known on how informality influences economic growth at the country level. Specifically, how does the size of the shadow economy influence economic growth in a less developed country like Uganda?

This paper makes three important contributions to the literature. Firstly, this study investigates an important relationship between informality and economic growth, which has many implications for policy. Economies across the world are trying to understand the key drivers and obstacles of economic growth so they can formulate policies that either consolidate economic gains or address bottlenecks to economic growth. Such obstacles may include the increase in informal sector activities which could potentially create economic distortions in the economy. Given the above, understanding whether the increase in informality is detrimental or helpful to economic growth is important. Secondly, this paper provides evidence of the relationship between informality and economic growth in the context of Uganda, and Africa in general. We believe that Uganda offers the best testing ground for our empirical ideas on account that it shares a number of characteristics with most countries in Africa. Thirdly, we use a robust econometric approach (autoregressive distributed lag, ARDL- bounds testing approach) for testing the long- and short-run relationship between the main variables. This econometric technique is considered robust for analyzing time series data regardless of whether the sample size is small or large (Tang 2004) and whether the variables are integrated of order zero and or one, that is, I (0)s and or I(1)s.

The remainder of the paper is sequenced as follows: Section 2 provides the review of related literature, while Section 3 presents the methodology and data. Section 4 reports the findings and discussion, while Section 5 concludes the paper.

2. Review of related literature

There is an acknowledgement that much of the economic activity across many countries takes place in both the formal and the informal sectors of the economy. Substantial level of economic activity in the shadow economy is done underground or at least outside the official business framework across many countries. The shadow economy, also known as the informal economy, provides a source of secure livelihood and financing for the production and distribution of goods and services, which could be only available to businesses and individuals operating in the formal economy (Mugoda et al. 2020; Schneider 2005). Its expansion has been associated with failure of the formal sector to create jobs that can absorb the increasing and sometimes unskilled labor force (Esaku 2019a, 2020b) and government inefficiencies (Schneider 2005; Schneider and Enste 2000). Recent evidence suggests that the rise of activities in the shadow economy could be either detrimental or helpful to economic growth. This implies that a larger size of the shadow economy can hinder economic growth due to a number of factors: firstly, shadow economy operates outside the regulated business framework and facilitates tax evasion, which affects government's ability to raise revenue (De Soto 1989). Failure to meet budgetary commitments due to short falls in revenue collection affects the provision of public goods and services, such as security, law and order, infrastructure, education and healthcare, among others. These public goods and services, if not adequately provided affect a country's effort to enhance economic growth. In this case, a larger size of the shadow economy becomes detrimental to economic growth.

Secondly, Johnson, Kaufmann, and Shleifer (1997) present a theoretical model which shows that the creation of new businesses by entrepreneurs drives economic growth. In their model, higher taxes on formal businesses provide incentives for them to operate in the underground economy to avoid tax liability. Hence, a fiscal regime that is viewed as repressive could induce businesses to conceal their operations from regulators leading to the rise in the size of the shadow economy. Consequently, a larger size of the shadow

economy affects economic growth in a negative manner due to tax evasion which reduces government revenue used for the provision of public goods and services. Additionally, Loayza (1996) using data from Latin American economies provides empirical evidence suggesting that expansion of the shadow economy limits the rates of economic growth through its negative effects on the provision of public goods and services. Similarly, Elgin and Birinci (2016) analyze the impact of the shadow economy on long-run economic growth in a panel of 161 countries and find evidence of an inverted-U shaped relationship. This implies that economies that have a small or large size of the shadow economy face reduction in the rates of economic growth resulting from inability of governments to provide the necessary infrastructure to drive economic growth.

Additionally, income level is also important in influencing this relationship, implying that economies with high levels of income do achieve positive rates of economic growth compared with those with low income levels (Elgin and Birinci 2016). Baklouti and Boujelbene (2020) in a dynamic simultaneous equation framework analyze the relationship between informality and economic growth in a sample of 50 countries and find a negative unidirectional relationship for the MENA region (running from shadow economy to economic growth) and bidirectional for OECD countries. At the micro-level, De Soto's (1989) shows that the fear of being discovered by regulators provides impetus for firms to keep a low profile by scaling down their operations. This prevents them from achieving economies of scale, which in turn reduces economic growth. This argument is supported by empirical evidence by Benjamin and Mbaye (2010) who examine productivity differences between informal and formal firms in Senegal, Benin ad Burkina Faso. They find evidence that informal firms experience low levels of productivity growth due to technological inefficiencies compared with formal firms. Further, micro-level evidence is provided by Byiers (2009) who finds that formal firms achieve high levels of productivity because they are able to access information and technology from formal sources which facilitates their productivity compared to firms that operate underground. Moreover, firms that operate underground cannot access financing that could help them acquire advanced technology to enhance productivity growth. Failure to acquire required financing imposes technology limitations on these firms, reducing their productivity hence affecting the overall performance of the economy.

While a number of studies show that a larger size of the shadow economy is detrimental to economic growth, some studies have argued for a positive relationship. For instance, La Porta and Shleifer (2008) show that informal sector firms are a source of livelihood for poor members of society. Being a source of livelihood implies that vulnerable members of society are able to improve their welfare by engaging in the production and distribution of goods and services. Similarly, Nabi and Drine (2009) find that a rise in informality may result into economic growth in situations where informality raises productivity levels that feed into the formal economy. Although informal firms are less productive, work with less capital and employ most of the unskilled labor force, they play an important role in creating jobs and generating incomes for the poorest and most vulnerable members of society (ILO 2002; Mugoda et al. 2020). The earnings from the informal firms also feed into the formal sector thereby raising the level of output and productivity hence raising economic growth.

Overall, although some studies have argued for a positive relationship between the size of the shadow economy and economic growth, their arguments are not so direct and clear. The possibility of a positive impact of the shadow economy on economic growth seems to be implied. In this paper, we investigate whether the shadow economy hinders or spurs economic growth. We test the hypothesis that a larger size of the shadow economy reduces economic growth, all else equal.

3. Methodology

3.1. Data and descriptive statistics

To facilitate empirical exercises, we collected data from a number of internationally recognized sources. These data cover the period from 1991 to 2017. The variables of interest include economic growth, measured using the rate of growth of gross domestic product (GDP) per capita; the size of the shadow economy, estimated using the multiple indicator-multiple cause (MIMIC) procedure; physical capital measured using gross fixed capital formation; human capital measured using primary school enrollment, foreign direct investments, measured using inflows of foreign capital, institutional quality, measured using the legal framework (law), and trade openness, measured using exports plus imports as a share of GDP. For our main dependent variable, economic growth (growth), the data are from the World Bank (2020). Data for the main explanatory variable, the size of the shadow economy (Se), are from Medina and Schneider (2019). The above authors generate estimates for the size of the shadow economy for 157 countries, for years 1991–2017, using the MIMIC procedure. Similarly, data on gross fixed capital formation (invest), primary school enrollment (enroll), foreign direct investment (fdi), and trade openness (open) all come from the World Bank

Table 1. Summary statistics and correlation matrix of main variables.

	Growth	Shadow	invest	Enroll	Fdi	Law	open
Panel (a): Descriptive statistics							
Mean	3.137	36.738	20.824	109.362	3.319	3.571	37.218
Median	3.020	34.682	20.984	117.718	3.189	3.750	36.278
Maximum	8.140	54.689	27.935	138.275	6.480	4.000	56.260
Minimum	0.030	21.368	12.412	63.976	0.030	1.000	27.839
Std. Dev.	2.286	10.026	4.004	24.023	1.558	0.729	6.482
Skewness	0.436	0.154	−0.288	−0.8419	−0.009	−2.627	0.977
Kurtosis	2.271	1.730	2.266	2.297	3.134	9.273	4.050
# Obs.	27	27	27	27	27	27	27
Panel (b): Correlation matrix							
Growth	1.000						
Shadow	−0.095	1.000					
Invest	−0.283	0.699	1.000				
Enroll	−0.052	0.362	0.488	1.000			
Fdi	0.216	0.703	0.641	0.568	1.000		
Law	0.326	0.161	0.174	0.527	0.499	1.000	
Open	0.201	0.681	0.605	0.456	0.752	0.150	1.000

Source: Author's calculations.

(2020). Additionally, we include institutional quality (law) in the main estimation equation. These data come from International Country Risk Guide (ICRG 2017) published by Political Risk Services (PRS).

We report summary statistics and correlation matrix of the main variables in Table 1, panels (a) and (b), respectively. In panel (a), the average values of the key variables are; growth (gw) is 3.137; the size of the shadow economy (Se) is 36.738; gross fixed capital formation (invest) is 20.824; primary school enrollment (enroll) is 109.362; foreign direct investment inflows (fdi) is 3.319; institutional quality (law) is 3.571, and trade openness (open) is 37.218. In Panel (b) our main variable of interest, the size of the shadow economy is negatively correlated with economic growth. This may imply that a large size of the shadow economy leads to a reduction of economic growth, all else equal. However, negative correlation may not necessarily imply a long- and short-run relationship between economic growth and the shadow economy. To find out whether this relationship exists, a formal analysis is required.

3.2. Model specification

This section presents the model specification and estimation technique for analyzing the long- and short-run relationship between informality and economic growth.

3.2.1. Estimation techniques

We posit that economic growth is a function of variables that can be expressed as follows:

$$gw = F(se,\ invest,\ enroll, fdi, law,\ open) \qquad (1)$$

Where gw is the rate of economic growth per capita, se denotes the size of the shadow economy, invest is physical capital, proxied by gross fixed capital formation as a proportion of GDP, enroll is human capital, proxied by primary school enrollment, fdi denotes foreign direct investment inflows as a share of GDP, law represents institutional quality and open is trade openness. We chose the independent variables based on our review of the literature and in line with previous studies. For instance, the extant literature emphasizes the importance of foreign direct investment and trade, institutional quality, physical and human capital as key determinants of economic growth (see Helpman 2004). According to the above authors, these factors are not proximate causes, but rather 'deeper' determinants of economic growth and should be prioritized by countries for long-run economic growth to take place. Additionally, Sachs and Warner (1995) emphasized the importance of trade openness to international trade for developing countries. These authors show that countries that are more open to international trade improve their growth rates leading to convergence. Indeed, Esaku and Krugell (2020) show that trade openness helps firms to improve their productivity. This implies that countries that are more open to foreign trade also benefit through improvement in productivity growth and increased level of export market participation (Esaku 2019b, 2020c), and learning mechanism (Esaku 2020a). Finally, we include primary school enrollment as a proxy measure for stock of human capital in the country. As in the literature, a more educated and skilled population is important in understanding the programs and governance structure in the country. In what follows, we present the econometric methodology in the next section.

3.2.2. Econometric methodology

To facilitate the empirical exercises, we use a novel econometric procedure, autoregressive distributed lag

(ARDL) bounds testing approach to cointegration introduced by Pesaran, Shin, and Smith (2001), to test for long- and short-run relationship among the main variables. The ARDL bounds testing approach to cointegration has benefits over traditional cointegration techniques. Firstly, this econometric technique can correct for any possible endogeneity among the independent variables (Wolde-Rufael 2010). Secondly, it is considered a more robust econometric approach for examining level relationships among variables and can be applied even in cases where the sample size is small (Tang 2004). Thirdly, compared with traditional cointegration tests, the capability of the ARDL bound test is not limited in finite samples when invalid restrictions are imposed (Banerjee, Dolado, and Mestre 1998). Fourthly, this method can be employed regardless of the order of integration of the variables.

We can formally express the ARDL model for the empirical estimation of Equation (1) as follows:

$$\begin{aligned}\Delta gw =& \beta_0 + \sum_{i=1}^{n} \beta_{1i}\Delta gw_{t-i} + \sum_{i=0}^{n} \beta_{2i} se_{t-i} \\ &+ \sum_{i=0}^{n} \beta_{3i}\Delta invest_{t-i} + \sum_{i=0}^{n} \beta_{4i}\Delta enroll_{t-i} \\ &+ \sum_{i=0}^{n} \beta_{5i}\Delta fdi_{t-i} + \sum_{i=0}^{n} \beta_{6i}\Delta law_{t-i} \\ &+ \sum_{i=0}^{n} \beta_{7i}\Delta open_{t-i} + \psi_1 gw_{t-1} + \psi_2 se_{t-1} \\ &+ \psi_3 invest_{t-1} + \psi_4 enroll_{t-1} + \psi_5 fdi_{t-1} \\ &+ \psi_6 law_{t-1} + \psi_7 open_{t-1} + \mu_t \end{aligned} \quad (2)$$

Where $\beta_0$denotes the constant term while $\beta_1, \ldots, \beta_7$ *and* $\psi_1, \ldots, \psi_7$ denote the short- and long-run coefficients, respectively, and $\mu_t$denotes the error term.

To implement ARDL bounds testing procedure, we first test for cointegration relationship among variables, using the F-statistic, to ascertain the existence of a long-run relationship among the variables. The null hypothesis of no cointegration (H_0:$\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$) is then tested against the alternative hypothesis that there is cointegration among variables-(H_1:$\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$). The result of the F-statistic is compared to the critical values specified in Pesaran, Shin, and Smith (2001). The decision rule is: if the calculated values of F-statistic are above the upper critical bound values, the H_0 (the null hypothesis) is rejected and vice versa. But, if the F-statistic values fall within the bounds, then it means that the test result is inconclusive. Before conducting ARDL bounds testing procedure, the optimal lag length for the ARDL model is first ascertained. We ascertained this according to the appropriate lag length selection criteria based on the Schwartz-Bayesian criterion (SBC).

Based on the results of the cointegration test on Equation (2), we can proceed to express the error correction model (ECM), if there is a long-run relationship, as follows:

$$\begin{aligned}\Delta gw_t =& \beta_0 + \sum_{i=1}^{n} \beta_{1i}\Delta gw_{t-i} + \sum_{i=0}^{n} \beta_{2i}\Delta se_{t-i} \\ &+ \sum_{i=0}^{n} \beta_{3i}\Delta invest_{t-i} + \sum_{i=0}^{n} \beta_{4i} enroll_{t-i} \\ &+ \sum_{i=0}^{n} \beta_{5i}\Delta fdi_{t-i} + \sum_{i=0}^{n} \beta_{6i}\Delta law_{t-i} \\ &+ \sum_{i=0}^{n} \beta_{7i}\Delta open_{t-i} + \lambda ECT_{t-1} + \mu_t \end{aligned} \quad (3)$$

Where λ denotes the coefficient of the ECT (error correction term) capturing the long-run adjustment to the equilibrium after deviations, while μ_t is the residual error term. The importance of the ECT coefficient is in its size and sign, which denotes the speed of adjustment and validity of the results. Thus, the coefficient of the error correction term (λ) should be negative, less than 1 and statistically significant.

4. Results and discussion

In this section, we conduct stationarity tests, ARDL bounds tests, and empirical analysis of the long- and short-run relationship among the variables.

4.1. Stationarity tests

We tested the variables to determine whether they are integrated of order zero, I (0), and or order one, I (1) using Augmented-Dickey-Fuller (ADF) and Phillip-Perron (PP) tests, with intercept and with trend and intercept, before implementing ARDL bounds testing. The results of these tests are reported in Appendix, Table A1. Table A1 shows that the main variables are either stationary in levels or after first differencing, and vary according to the type of stationarity test used. After stationarity tests, the ARDL bounds testing procedure is conducted and results reported in Table 2.

In Table 2 panel (a), we formally express the equation to be tested, while panel (b) reports the results of the ARDL bounds test for cointegration. As shown in Table 2, the calculated F-statistic is higher than the asymptotic critical value bounds given in Pesaran, Shin, and Smith (2001). This leads us to reject the null

Table 2. Results of the ARDL Bounds test.

Panel (a): The equation to be tested					
Equation	Dependent variable	Function			
Equation (1)	Growth	F(growth | se, invest, enroll, fdi, law, open)			
Panel (b): Results of ARDL bounds test					
Model	ARDL	F-Stat.	Diagnostics		
			X^2(Normality)	X^2 (Heteroscedasticity)	X^2 (Correlation)
Equation (1)	(1,2,0,0,0,2,1)	11.519	0.810	0.375	0.723
	Actual sample size (T = 23)				
	Critical values				
	Lower Bound I(0)			Upper Bound I(1)	
10%	2.12			3.23	
5%	2.45			3.61	
2.5	2.75			3.99	
1%	3.15			4.43	

Source: Author's calculation.

hypothesis of no cointegration and conclude that the variables are cointegrated. Additionally, our diagnostic tests show that these results are reliable and not driven by any bias. After conducting the ARDL bounds test, we proceeded to estimate the long- and short-run coefficients for the model by first determining the optimal lag length according to the Schwartz information criterion (SIC), which selected ARDL (1,2,0,0,0,2,1) model for Equation (1).

4.2. The long-run relationship between informality and economic growth

This section presents and discusses the results of the long-run relationship between informality and economic growth. We carry out a number of empirical exercises; using ARDL approach, Fully-modified ordinary least squares (FMOLS), and Dynamic ordinary least squares (DOLS) methods. The results are reported in Table 3. First, we report the ARDL results in columns 2, and then use FMOLS and DOLS techniques to check the robustness of the results of ARDL model. We report the results of FMOLS and DOLS estimation in columns 5 and 8 respectively. In Table 3, column 2, the results of the long-run relationship between informality and economic growth show empirical evidence of a statistically significant long-run relationship between these two variables, all else equal. The results indicate that an increase in informality significantly reduces economic growth by 0.272 units, statistically significant at 1% level.

These results are expected given that in low income countries, a rise in the size of the shadow economy reduces the rate of economic growth (see Elgin and Birinci 2016). This is possible given the fact that in such economies (low income) there is evidence of wide spread informality which has kept on expanding over the past decades. For example, estimates from Medina and Schneider (2019) show that low income

Table 3. Long run relationship between informality and economic growth.

	Dependent variable: Growth								
	ARDL model			Fully Mod. OLS (FMOLS)			Dynamic OLS (DOLS)		
Explanatory	Coeff.	t-stat.	Prob.	Coeff	t-stat	Prob.	Coeff.	t-stat.	Prob.
Shadow	−0.272***	−3.005	0.003	−0.310***	−4.290	0.000	−0.272**	−3.408	0.003
Invest	0.080	0.382	0.707	0.126	0.792	0.881	0.080	0.927	0.652
Enroll	−0.081***	−3.468	0.003	−0.077***	−3.746	0.001	−0.081***	−3.326	0.004
Fdi	0.949***	2.937	0.007	0.918***	3.373	0.003	0.949***	2.990	0.008
Law	1.425**	2.775	0.013	1.339*	2.016	0.061	1.425**	2.148	0.046
Open	0.159***	3.011	0.008	0.197***	2.925	0.009	0.159**	2.133	0.047
Constant	7.554***	3.970	0.001	6.335**	2.699	0.128	7.554***	3.271	0.004
R-sq.	0.626			0.595			0.626		
R-bar-sq.	0.472			0.418			0.472		
Durb. W.	1.888								
Residual diagnostics									
Breusch-Godfrey serial correlation LM		F-stat	0.740						
		Obs*R	0.674						
Heteroskedasticity- Breausch-Pagan-G		F-stat	0.863						
		Obs*R	0.798						
Normality test		J-Bera	1.351						
		Prob.	0.509						

Note: *,**,***, indicate statistical significance at 10%, 5% and 1% levels respectively.
Source: Author's calculation.

countries, on average, had the highest percentage of informality between 1991 and 2017, compared to emerging economies and advanced economies. Between 1991 and 1999, informality in low income countries averaged 43.3% as a share of GDP, compared to 34.8% and 17.9% for emerging and advanced economies. This evidence seems to give credence to the view that informality in low income countries is associated with low levels of economic growth because of a number of reasons. First, informal businesses operate underground making it easy to conceal their incomes from tax authorities (Schneider 2005). If tax authorities cannot assess their tax liability, then these businesses do not pay tax which impacts negatively on revenue collection. Second, short-falls in tax revenue undermines governments' effort to provide essential public goods and services, like security, healthcare, education and infrastructure, among others. Third, any acts of tax evasion that undermine effort of governments to provide essential services are sources of underdevelopment resulting into inferior livelihood outcomes among the citizens. Consequently, the results of a negative relationship between economic growth and the size of the shadow economy in long-run are possible given the income level of the country under investigation.

The above results of the long-run relationship are important for policy. These results suggest that the sluggish rate of economic growth in the country could partially be attributed to an increase in the size of the shadow economy which has negative consequences for economic growth over the long-run, all else equal. These results seem to agree with the findings of Baklouti and Boujelbene (2020) who also find evidence of a negative relationship between economic growth and the size of the shadow economy for the MENA region.

From the practical policy view point, the above results suggest that tackling low rates of economic growth should also involve addressing the key drivers of informality in the country. These drivers include high taxation, overregulation, costs of registering new businesses, infrastructure like electricity, and corruption among others (see Mugoda et al. 2020). This implies that any improvements in the business and regulatory environment could also increase formalization of businesses and translates into reduction in shadow activities in the long-run, all else equal.

We also explain the remainder of the results of the long-run relationship between informality and economic growth. We can observe that investment in physical capital results into increased economic growth, but the coefficient on investment is insignificant. We also find evidence that foreign direct investment inflow into the country is a primary determinant of economic growth. We can observe that an increase in foreign direct investment significantly increases the rate of economic growth by 0.949 units, statistically significant at 1% level. This is in line with the suggestion by Helpman (2004) who views foreign direct investment as an important driver of economic growth in the long-run. Furthermore, we find evidence of the importance of institutional quality on increasing the rate of economic growth. The results show that an improvement in the quality of institutions results into an increase in the rate of economic growth, all else equal. Specifically, we find that an improvement of the quality of institutions increases the rate of economic growth by 1.425 units, statistically significant at 5% level. This bodes well with the suggestion that institutions are fundamental determinants of economic growth (see Helpman 2004).

As suggested by Sachs and Warner (1995) and Esaku and Krugell (2020) that trade openness plays a key role in advancing economic growth and firm productivity, we also find evidence of the importance of trade openness. These results show that an increase in the country's openness to world trade increases the rate of economic growth by 0.159 units, statistically significant at 1% level. However, on primary school enrollment, we find results that are contrary to previous studies. We find that an increase in primary school enrollment significantly reduces the rate economic growth by 0.089 units, statistically significant at 1% level. This may be attributed to the fact that primary school enrollment might not be an appropriate measure for human capital in the long-run since high primary school enrollment may also be offset by high school drop outs

To check the robustness of the above findings on the long-run relationship among variables, we follow Menegaki (2019) who proposes to use DOLS and or FMOLS to verify the robustness of the findings. The two econometric approaches generate asymptotically efficient coefficients while at the same time addressing the issue of endogeneity and serial autocorrelation (Menegaki 2019). We report these results in Table 3 columns 5 and 8. From these columns, we can observe that the above results are qualitatively and quantitatively similar to the ARDL model results. We conclude that an increase in the size of the shadow economy significantly reduces long-run economic growth, in the case of Uganda. Further, we conduct residual diagnostics to ensure that these results are not driven by any bias. Specifically, we carried out Breusch–Godfrey Serial correlation LM, Heteroskedasticity-Breusch–Pagan-Godfrey (BPG), and Normality tests. The results of these tests show no evidence of any bias in the empirical estimation of the ARDL model. In sum, we conclude that a large size of the shadow economy could also result into low rates of economic growth, all else equal.

4.3. The short-run relationship between informality and economic growth

In this section, we present the short-run results of empirical analysis of the above relationship. We report the short-run results in Table 4, column 2. We find evidence of a short-run relationship between informality and economic growth. Specifically, we find that an increase in the size of the shadow economy reduces significantly the rate of economic growth by 0.285 units, statistically significant at 5% level. This implies that, in the short-run an increase in the size of the shadow economy reduces the rate of economic growth, all else equal. Consequently, this paper establishes that the rate of economic growth per capita and the size of the shadow economy are negatively related both in the long-run and short-run. This could be expected given the fact that an increase in informality is detrimental to economic growth in low income countries (see Elgin and Birinci 2016). This implies that at the policy level, governments should devise short-term policies that address the factors that drive informality so as to increase the rate of economic growth. This is because any changes in the size of the shadow economy also translate into changes in the rate of economic growth, at least for low income countries.

We also explain the remainder of the results for the short-run relationship. From Table 4, column 2, we can observe that an increase in physical capital investment also increases economic growth, but the coefficient on investment is insignificant. The findings also show that, in the short-run, primary school enrollment and foreign direct investment are significant drivers of the rate of economic growth in Uganda. Specifically, the results indicate that an increase in primary school enrollment and foreign direct investment increase the rate of economic growth by 0.096 and 1.016 units, statistically significant at 1% and 5% respectively. This seems to augur well with the findings of Helpman (2004) that show the importance of human capital and foreign direct investment in driving economic growth. Relatedly, we also find evidence that the quality of institutions and trade openness are important in driving economic growth in the short-run. Specifically, we find that an increase in the quality of institutions and trade openness increase the short-run rate of economic growth by 1.974 and 0.027 units, statistically significant at 5% and 10% levels respectively. These results are in line with the suggestions of Helpman (2004) and Sachs and Warner (1995) who show evidence of the importance of these factors in influencing the rate of economic growth.

Finally, when we analyze how the economy adjusts to any deviations from long-run equilibrium. We find that the lagged coefficient of the error correction term (ECT) is negative and statistically significant at 1% level. The ECM results imply that economic growth adjusts to any deviations from long-run equilibrium at a speed of adjustment that is shown by the coefficient of the lagged error correction term which is 90.0% and statistically significant at 1% level. In sum, these findings suggest that tackling factors that hinder economic growth in Uganda should be preceded by addressing underlying drivers of informality in both the long-run and short-run, in the country. This seems to be a viable policy option since an increase in formality has a negative impact on the rate of economic growth in both the long-run and short-run. The practical implication of the short-run results is that to cause economic growth requires addressing simultaneously the drivers of informality and underdevelopment in the country.

We also conducted residual diagnostics to ascertain whether these findings are reliable. Both the results of Breusch–Godfrey serial correlation LM, Heteroskedasticity; Breusch–Pagan-Godfrey (BPG), and Normality tests show no evidence of any bias in the empirical estimation of the ARDL model. In sum, these results establish a negative long-run and short-run relationship between economic growth and the size of the shadow economy in a low income country, Uganda.

Table 4. Short-run relationship between informality and economic growth.

	Outcome variable: Growth		
Explanatory variable	Coefficient	t-statistic	Probability
ΔShadow	−0.285**	−2.939	0.010
ΔInvest	0.177	1.110	0.284
ΔEnroll	0.096***	2.965	0.009
ΔFdi	1.016**	2.684	0.017
ΔLaw	1.974**	2.583	0.020
ΔOpen	0.027*	1.836	0.074
ECM(−1)	−0.900***	−3.355	0.004
Constant	−0.074	−0.210	0.836
R-squared	0.805		
R-bar-sq.	0.701		
Durbin W.	1.816		
Residual diagnostics			
Breusch-Godfrey serial correlation LM Test	F-statistic	0.280	
	Obs*R-squared	0.119	
Heteroskedasticity Test Breausch-Pagan-Godfrey	F-statistic	0.753	
	Obs*R-squared	0.656	
Normality test	J-Bera	0.773	
	Probability	0.679	

Note: *,**,***, indicate statistical significance at 10%, 5% and 1% levels respectively.
Source: Author's calculation.

4.4. Diagnostic tests

After the estimation of the long- and short-run coefficients of the relationship between the size of the

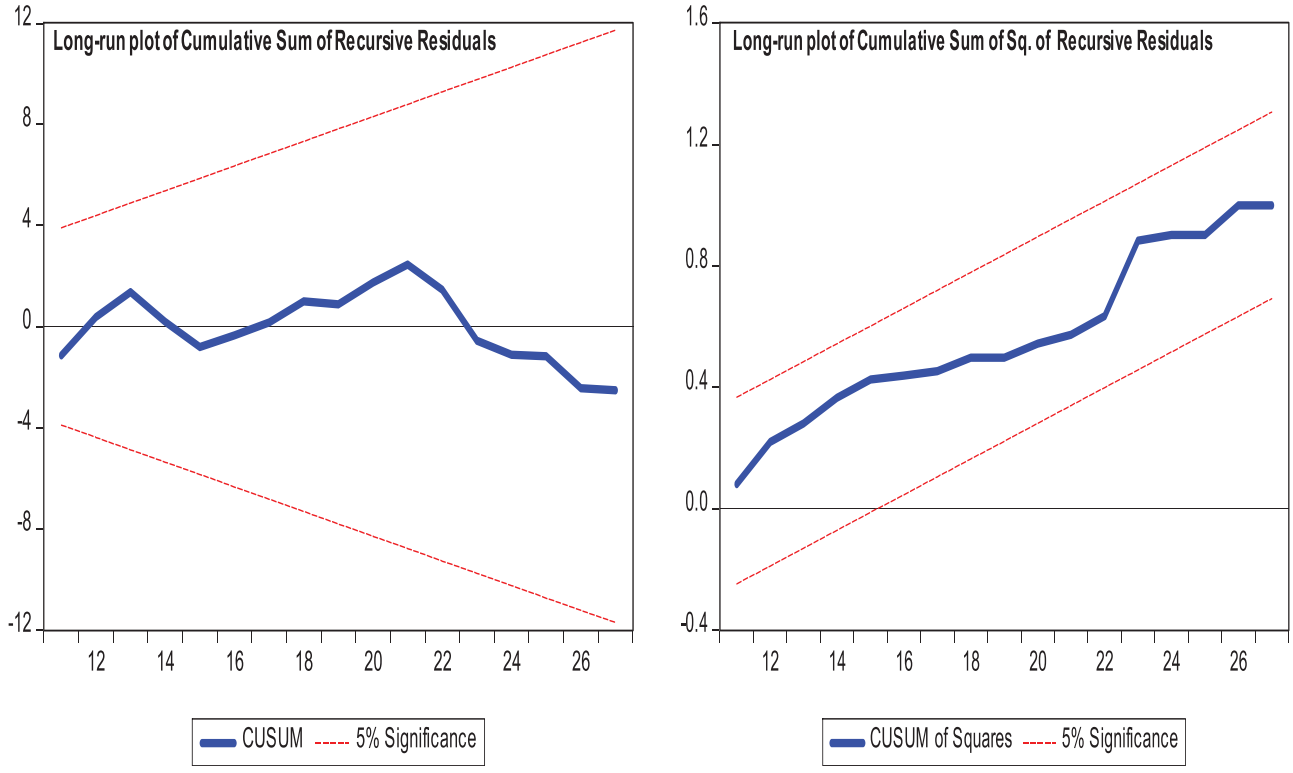

Figure 1. Plots for CUSUM and CUSUMQ for long-run coefficients.

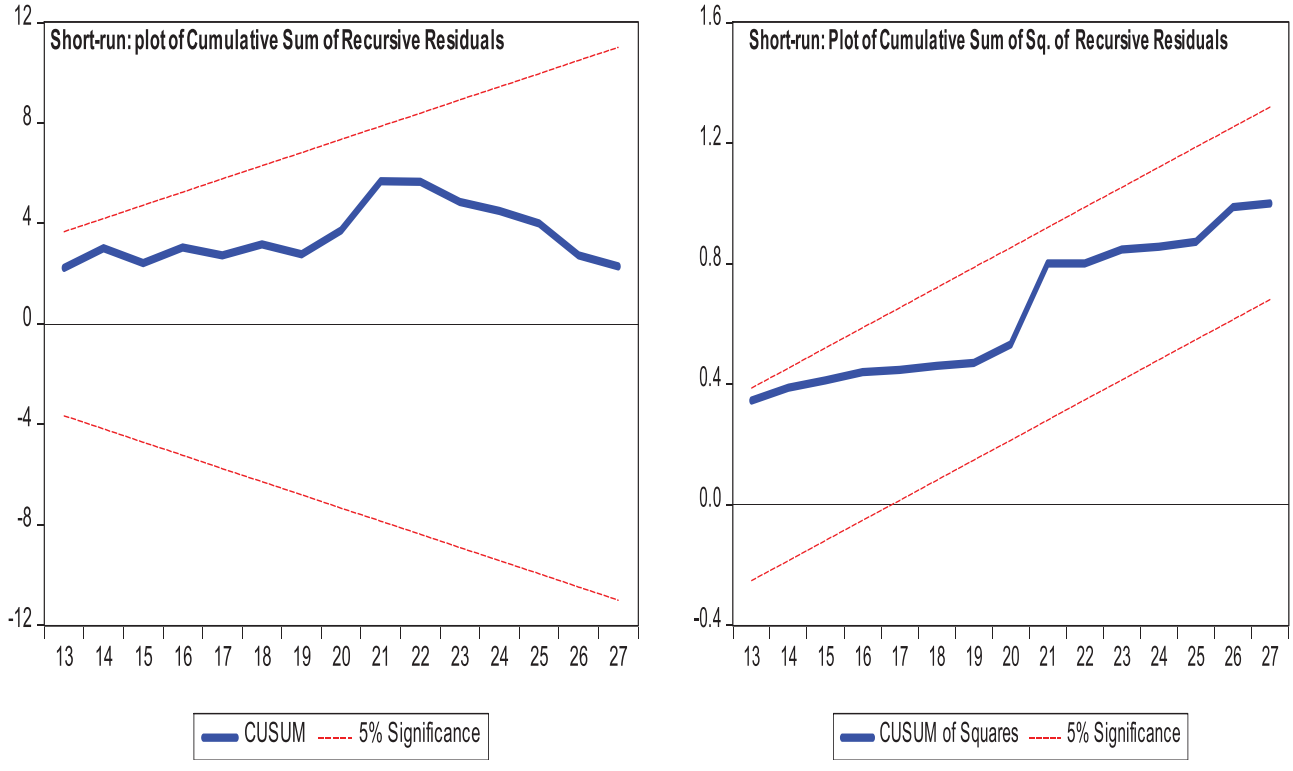

Figure 2. Plots for CUSUM and CUSUMQ for short-run coefficients.

shadow economy and income inequality, we conducted stability diagnostics by analyzing recursive residuals. We report the plots of cumulative sum of recursive residuals (CUSUM) and the plots of cumulative sum of squared residuals (CUSUMQ) for both long- and short-run coefficients. Figures 1 and 2 report both the CUSUM and

CUSUMQ plots and provide further evidence on the validity of the estimated ARDL model. In Figure 1, we observe that there is a slight deviation from the boundary, but this is followed by a quick adjustment to the boundaries at 5% level. In sum, all these plots present evidence showing that the ARDL model estimated is stable. As shown in these two figures, the results of the residual plots do not cross the boundaries at 5% level of significance which confirms that there is stability in the parameters of the ARDL model.

5. Conclusion

Applying the ARDL econometric approach, we investigated the long- and short-run relationship between informality and economic growth in Uganda. To facilitate the empirical analysis, we used annual time series data, covering the period from 1991 to 2017, drawn from a variety of internationally recognized data sources. We find evidence of both the long- and short-run relationship between informality and economic growth. In the long-run, the results indicate that an increase in the size of the shadow economy significantly reduces the rate of economic growth. This evidence seems to line up with the literature which shows that in low income countries where informality is high, a large size of the shadow economy is correlated with low rates of economic growth. This arises from the fact that informal businesses rarely pay taxes for their operations leading to low revenue collection by governments, which in turn has a negative effect on the provision of essential social services like roads, security, and healthcare, among others. Any revenue short-falls hinder the proper functioning of governments and retards economic growth as these governments cannot afford investments that cause changes in the economy, hence an increase in informality. We argue that the results of a negative relationship between economic growth and the size of the shadow economy in both the long- and short-run are possible given the income level of the country under investigation.

These results have practical policy implications. The above results suggest that tackling underdevelopment also involves addressing the key drivers of informality in the country. These drivers include high taxation, overregulation, costs of registering new businesses, infrastructure like electricity, and corruption among others. This implies that any improvements in the business and regulatory environment could also increase formalization of businesses, hence reducing the size of the shadow economy in both the long- and short-run. Second, these results could also suggest that tackling factors that spur informality could be an effective policy option for addressing low rates of economic growth in the country. One limitation of this paper is that it has relied on empirical analysis. Future work could be directed towards developing a tractable theoretical framework to explain channels through which informality influences the rate of economic growth.

Note

1. In this paper, we use informality to also mean shadow economy, informal economy, informal sector, underground economy, and unofficial economy. We use these words interchangeably.

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Appendix

Table A1. Results of stationarity tests for all the variables.

	In Levels				First difference:			
	ADF		PP		ADF		PP	
	Intercept	Trend & Inter.	Intercept	Trend & Inter.	Intercept	Trend & Inter.	Intercept	Trend & Inter.
Growth	−3.740***	−3.999**	−3.740***	−3.959**	−5.496***	−5.512***	−10.481***	−17.476***
Shadow	−1.227	−2.017	−1.141	−2.091	−6.725***	−6.838***	−6.722***	−6.874***
Invest	−1.095	−4.680***	−1.333	−4.635***	−7.625***	−6.305***	−15.898***	−14.106***
Enroll	−2.235	−1.033	−1.720	−1.082	−4.145***	−4.702***	−4.145***	−4.702***
Fdi	−2.404	−1.884	−2.401	−1.892	−4.448***	−4.749***	−4.401***	−4.931***
Law	−9.321***	−17.948***	−5.242***	−12.743***	–	–	–	–
Open	−2.149	−2.158	−2.118	−2.224	−5.346***	−5.247***	−5.603***	−5.605***

Source: Author's calculation. **,***, denote statistical significance at 5% and 1% levels, respectively.