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The Size of the Informal Sector and Tax Revenue in Kenya

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Abstract

In Kenya very little research has been carried out on the effect of the size of the informal sector on tax performance. Failure to raise adequate tax revenue from the increasing informal sector implies the government should either resort to unpopular tax rates increases or public debt. Each of these approaches has ramification on the economy. To come with relevant policies, it is important to understand the link between size of the informal sector and tax revenue performance. This paper estimates the effect of the size of the informal sector on tax revenue performance in Kenya for the period 1970-2018. On testing for stationarity, the study establishes a mixture of I (0) and I (1) variables thus suggesting the use of Autoregressive Distributed Lag model. The finding indicates that the size of the informal sector negatively influences tax revenue in Kenya. This implies that the informal sector's output may be increasing but little tax is generated from it. The finding also has implications for the conduct of the Kenya Revenue Authority (KRA). To reduce the size of the informal sector, KRA should increase surveillance to identify economic activities that fall within the tax bracket and tap tax revenue from them.

Keywords

Kenya, informal sector, Autoregressive Distributed Lag, tax revenue

1. Introduction

The informal sector is a type of economy that applies to all income classes and all sectors of the economy. It is comprised of various types of economic activities, spanning from the self-employed such as second-hand clothes dealers, hawkers, dressmakers, wage workers, housekeepers, security

guards, carpenters to the registered businesses for example law firms, private hospitals, private schools that underestimate their incomes and overestimate their expenditure (Ngui, Muniu, & Wawire, 2014; Greenidge, Holder, & Mayers, 2009). In Kenya, the sector provides 77 percent of the job opportunities. However, it is argued that economic agents choose to operate in the informal sector to evade taxes (Muchiri, 2014). On one hand the size of the informal sector is said to be increasing accounting for between 20 and 40 percent of GDP (Medina, Jonelis, & Cangul, 2017). On the other hand, budget deficit in Kenya has been increasing over time reaching 7.4 percent of GDP in 2018 (Republic of Kenya, 2020). Though the sector may be important for the Kenyan economy in terms providing employment opportunities, its expansion may not be good due to tax evasion. In addition, its expansion may imply that the government impose high tax burden on the few individuals in the formal sector. Such action may lead to reduced morale to work in the country thus exacerbating the problem of inadequate tax revenue. Carrying out an exhaustive analysis of the effect on tax revenue performance in Kenya will serve as a basis for the making and evaluation of effective guidelines to support the transition from informality to formality.

This paper estimates the effect of the size of informal sector on tax revenue in Kenya using ARDL model. This procedure was chosen since the stationarity results revealed a mixture of variables that were integrated of order zero I (0) and one I (1). This model provides a useful link between long run equilibrium relationships and short run disequilibrium dynamics. The model is also good while dealing with small data samples (Pagan, 1995). Muchiri (2014) has estimated the effect on informal sector on tax revenue in Kenya. This earlier study used the number of people employed in the informal sector as measure of the size of the informal sector. However, the literature shows that using value of the goods and services produced in the sector is a better measure as opposed to the use of the number of people employed in the sector. This is because such measure does not just focus on the magnitude of the informal work as the case of using the number of people employed in the sector but also the reflects the conditions found in the employment patterns (Alfredo, 2001; ILO, 2002). To the best of our knowledge, this is the first time such an approach has been used to estimate the effect of the size of the informal sector on tax revenue performance in Kenya.

The next sections present a review of the tax policy and budgets deficits in Kenya, an overview of the informal sector in Kenya and the statement of the problem. Section 2 deals with some of the studies that were conducted on the topic and gives a review of their results. Methodology used to achieve the study's objective is discussed in section 3. In section 4, the effect of size of the informal sector on tax revenue performance in Kenya is estimated. The paper concludes with policy implications.

1.1 A Review of Tax Policy and Budget Deficits in Kenya

Tax Modernization Programme guidelines of 1986 and the Kenya vision 2030, shows that Kenya's tax policy came about as a result of the country's tax structure failing to raise adequate tax revenue to meet the desired government expenditure. The inadequacy in tax revenue collection has resulted to increased domestic and external borrowing by the government, which are not sustainable ways of deficit

financing. While domestic borrowing crowds out private investments, external funds come with conditions that may lead to unpopular policies being formulated (Omondi, Wawire, Manyasa, & Thunku, 2014; Kharusi & Ada, 2018). Further, consideration of grants as a measure of deficit financing reduces a country's economic and political independence. According to Wawire (2017), tax revenue is the most sustainable source of government's revenue. However, the effort of government of Kenya to raise adequate tax revenue has been adversely affected by the growing size of the informal sector. The sector is characterized by poor book keeping making it difficult for tax authorities to tax them. Muchiri (2014) asserts that individuals consider to operate in this sector so as to evade taxes.

Historically, government of Kenya has had mixed fortune in terms of fiscal performance. The budget deficit steadily increased from 6.85 percent of GDP in 2017/2018 to 7.8 percent in 2019/2020 (Ouma, 2019; Republic of Kenya, 2020). Trends in the budget deficit are as shown in Figure 1.

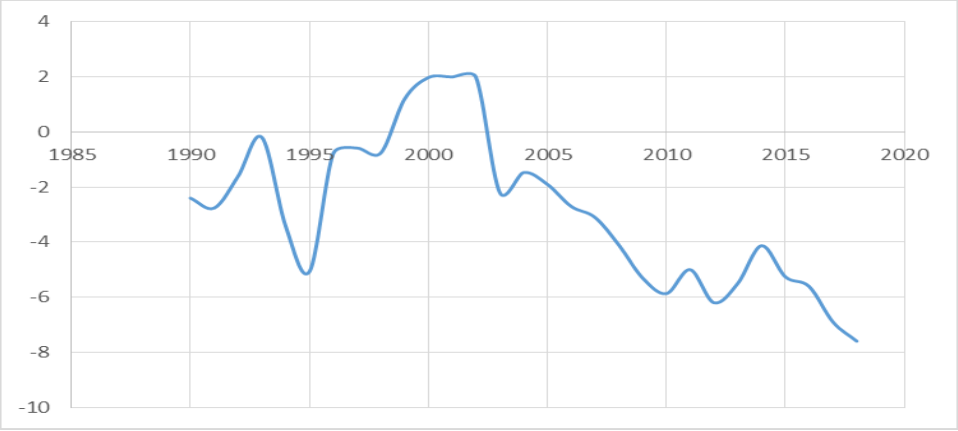

Figure 1. Budget Deficits (% of GDP) Trends (1990-2018)

Source: International Monetary Fund (2019)

From Figure 1, it is evident that Kenya recorded a balanced budget in 2003. In 2014, the budget deficit averaged 4.2 percent of GDP. Kenya's budget deficit was at 6.91 percent of GDP and 7.62 percent of GDP during 2017 and 2018. In the fiscal year 1990/91, the budget deficit stood at 2.8 percent of GDP. This balance improved to 0.19 percent GDP in fiscal year 1993. The tax system's inability to support Kenya's expansionary fiscal policy has led to a steady increase in public debt, rising from 48 percent of GDP in June 2014 to 65.6 percent of GDP in June 2020 (Republic of Kenya, 2020).

1.2 Overview of Informal in Kenya

In Kenya, informal sector employs 77 percent of total workforce. Of this, 50 percent are women (Republic of Kenya, 2017). The growth of this sector can be linked to liberalization and privatization policies that led to reduced job opportunities in the formal public sector. The formal private sector could not absorb the increasing number of job seekers. Therefore, the informal industry emerged as an alternative source of employment to a growing number of individuals moving from educational institutions. Thus, the informal sector should be supported due to its role in the Kenyan economy

(Muchiri, 2014). However, it is argued that economic agents choose to operate in the informal sector to evade taxes. Tapping tax revenue from this expansive tax base would have a significant contribution to country's economic prosperity, thus alleviating poverty and consequently improving living standards of the citizens. However, the sector pose tax administrative and compliance challenges. For instance, it is argued that the wealthy individuals in Kenya are gradually shifting their wealth to this sector by purchasing motorcycles and hiring youth to ferry passengers at a commission (Wawire, 2020). Though the industry is suitable for creating job opportunities, its expansion can lead to low tax revenues, thus negatively impacting the provision of public goods by the government of Kenya (Peters, 2017). Figure 2 shows the trends in size of the informal sector in Kenya.

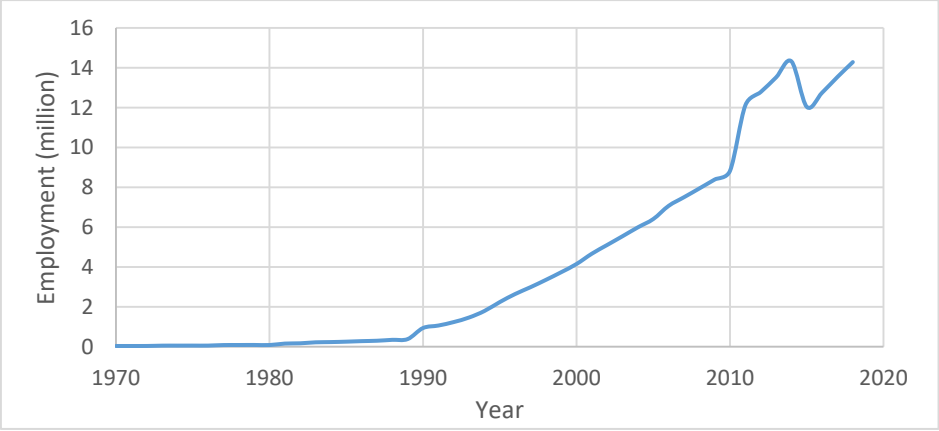

Figure 2. Trends of Size of Informal Sector (1970-2018)

Source: Republic of Kenya; Various Issues of Economic Survey

The trends in Figure 2 corroborate the assertion that liberalization and privatization policies are enshrined in the Structural Adjusted Programmes (SAPs). From Figure 2, it can be observed from 1970 to 1988, the number of individuals employed in informal sector was low. A drastic increase in number of people employed in the industry is observed from 1989 onwards. This coincided with 1988 and especially 1991 when the Kenyan government embraced these SAPs. The number of people employed in the informal sector adopted a positive trajectory to 2018. This can be linked to an increasing number of individuals exiting tertiary institutions and universities who the formal sector cannot absorb fully, thus turning to the informal sector.

1.3 The Statement of the Problem

The Kenya's informal sector has been rising overtime. Medina, Jonelis and Cangul (2017) has shown that the sector accounts for between 20 and 40 percent of GDP. Since the informal sector is hard to tax sector Kenyan government has continued to fail meeting her tax revenue targets. This has led to rising budget deficit as the government try to meet the increasing public goods needs of the increasing population. To finance the budget, the budget deficit, the government has resorted to public debt. For example, the government borrowed about KES 600 billion in 2019/2020 increasing total public debt to

KES 5.3 trillion. High debt may be harmful to the economy since it can cause an unexpected exchange rate devaluation, thus increasing the actual value of debt interest payments denominated in dollars. In addition, servicing foreign debt negatively impacts a country's GDP since the money that could be used in the provision of public goods flows out of the country.

Thus in the face of expanding the annual budget occasioned by rising wage bills and development projects, the tax system should be evaluated to improve tax collection. The answer to improving tax collection lies in the untapped tax base, the informal sector. The effect of the size of the sector on tax revenue remains largely under-explored. Carrying out an exhaustive analysis of the effect on tax revenue performance in Kenya serves as a foundation for not only the formulation but also the evaluation of effective policies that can support the transition from informality to formality. Muchiri (2014) investigated effect of growing size of informal sector on tax revenue. However, this study used number of workers as the measure of the size of the informal sector. The literature shows that such approach focus on magnitude of the sector as opposed to the conditions of such employment. The literature therefore suggest use of the sector's output as opposed to the number of workers. Therefore, this study estimates the effect of the size of the informal sector on tax revenue performance by adopting ARDL model for period 1970 to 2018. The size of the informal sector is measured by the value of transactions generated by the economic agents in the informal sector.

2. Empirical Literature Review

Using time-series methodology, Teera (2002) investigated factors that influence Uganda's tax ratio between 1970 and 2000. Apart from the informal sector, per capita GDP, ratios of agriculture, manufacturing, imports and foreign aid to GDP were considered as the independent variables. The study measured the informal sector as the error term resulting from the regression of nominal currency on GDP. A positive error could imply that people are holding more money than expected, given the economy's characteristics. The study findings revealed that the informal sector had a negative effect on tax revenue in Uganda. Share of agriculture in GDP, Per capita GDP and import share in country's output were also revealed to affect tax revenue in Uganda negatively. Share of manufacturing in GDP and tax revenue in Uganda were found to have a positive relationship. The study's shortcoming is on the measurement of the informal sector. According to economic theory, GDP is not the only determinant of holding currency. The study could have included other explanatory variables, for instance, inflation, deposit interest rate and financial innovation. This current study's strength lies in choice of monetary value of the economic activities in informal sector as measure of informal sector.

Muchiri (2014) studied size of informal sector and tax revenue in Kenya using ECM on data beginning 1980 to 2011. Size of informal sector was measured by individuals employed in the sector. The other regressors included per capita GDP, openness of the economy, FDI, inflation and contribution of the agricultural sector in GDP. This study results found that informal sector negatively impacts performance of tax revenue in Kenya. In addition, GDP per capita, FDI, and trade openness positively

impacted tax revenue. According to Alfredo (2001), the study may not have captured the actual value added by the sector. Alfredo (2001) asserted that the size of the informal sector could best be captured by considering value of commodities produced by informal sector in terms of money. In another study, Peters (2017) studied informal sector and Rwandese tax revenue between 1980 and 2015. The study included other explanatory variables, namely FDI, government consumption, inflation and real interest rate. The study findings showed a direct relationship between the increase in the informal sector and Zimbabwe tax revenue. Control variables were established to be important in influencing tax revenue in Zimbabwe. The study's results may not be reliable due to methodological errors. For instance, the study revealed variables integrated of different orders, thus ruling out the use of OLS on the variables at levels. Though Muchiri (2014) study may have pointed effect of size of informal sector on Kenya's tax revenue, the results could have improved had the study used output of informal sector as its measure. The use of the number of people to measure the size of the informal sector is not good since it only focuses on magnitude of employment in sector as opposed to conditions of the employment. In this light, this study investigated the effect of the size of the informal sector on tax revenue using the monetary value of the goods produced in the informal sector.

Using Panel Data, Dioda (2012) studied structural factors of tax revenue in the Caribbean and Latin America using data from 1990 to 2009. The study's results showed that per capita GDP, trade openness, female labour participation, people education measured by years of schooling were essential factors influencing Latin America's and Caribbean's tax revenues. The findings further revealed that the shadow economy negatively affects tax revenue among the countries. Tedika and Mutascu (2013) studied the impact of the shadow economy on tax revenue in Africa between 1999 and 2007. The study considered Kenya and other 22 countries in Africa. An inverse relationship was established between the shadow economy, contribution of agriculture in GDP, and tax revenue in Africa. Import share in GDP was revealed to impact tax revenue among the selected African countries positively. Governance as a measure of institutional quality was shown to be positive but not crucial in Africa. Though the study used informal sector GDP to measure the informal sector as suggested by Alfredo (2001), policy recommendations founded on the aggregated data may be misleading.

3. Methodology

The study began by estimating the size of the informal sector using the currency model. This was performed because the study sought to use output of the informal sector as opposed to the number of individuals employed in the sector.

3.1 Theoretical Framework

Currency demand model was adopted in the estimation of the size of the informal sector. This was premised on the notion that use output of the informal sector gives a better measure of the informal sector as opposed to the number of individuals employed in the sector. The currency demand model argues that individuals will keep their money out of banks if the tax rate is high. Thus, the estimation of

the size of the informal sector is anchored on Hibbs and Peculescu (2013) theoretical framework. It is postulated that the prevailing tax rate determines the number of output firms decides to produce in the informal sector. The relationship between tax rate and output in an economy is shown in the Figure 3.

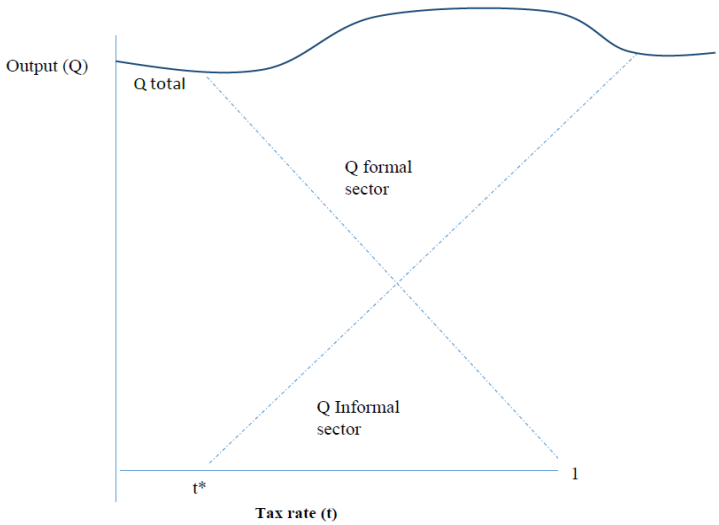

Figure 3. The Relationship between Tax Rate and Output in an Economy

Patterns of production options as tax rates oscillate around a threshold tax rate t* are illustrated in Figure 3. From the figure, total output (Q total) represents output produced by formal and informal sectors. From the figure, a region where t < t* illustrates a situation where all production takes place in the formal sector since total output in an economy (Q total) is equal to formal sector output/GDP (Q formal sector). This means the informal sector's output is equal to zero. As the tax rate t increases beyond t*, firms start to find activities in the informal sector profitable. It can be observed that as the tax rate is beyond t*, production in the formal sector begin to decline and reaches zero (0) when the tax rate reaches one (1). The stage between t* and t =1 is comprised of the informal production sector (Q formal sector) and informal sector (Q informal sector) simultaneously. From Figure 3, it is seen that once the tax rate reaches one (1), all economic activities occur in the informal sector; that is, total output in an economy (Q total) is equal to the informal sector output/GDP (Q informal sector). This means the informal output sector is equal to zero implying that the government obtains zero tax revenue.

The same idea can be linked to currency demand. The Keynesian theory states that individuals hold money due to three motives: transaction, precautionary, and speculative (Blanchard, 2017). According to Hindriks and Myles (2013), most of transactions in informal sector are in cash. Currency outside the bank can be used to measure output in the informal sector. From Figure 3, it's observed that tax rate is the primary determinant of the output in the informal sector and, therefore, must be incorporated in the model. An estimate of currency outside the bank is first obtained when the tax rate is included in the model to estimate output in the informal sector. This can be denoted by C_1. Secondly, an estimate of

currency outside the bank is again obtained when the model assumes the tax rate to be zero. This can be denoted by C_2. From Figure 3, we expect currency outside the bank to be high when there is a tax rate in the model than when it is assumed to be zero. The difference between C_1 and C_2 gives currency circulating in the informal sector (C_{inf}), as shown in equation 1.

$$C_{inf} = C_1 - C_2 \quad (1)$$

Assuming that velocity of money circulating in informal sector (C_{inf}) is similar to that of the formal sector, an estimate of informal sector output ($GDPinf$) is obtained by getting the product of currency circulating in the informal sector (C_{inf}) and velocity of money (V) as shown in equation 2.

$$GDPinf = V * C_{inf} \quad (2)$$

To estimate effect of size of informal sector on tax revenue, tax evasion expected utility theory was considered. The theory shows that the choice to evade taxes is made by weighing the gains and losses involved. The theory envisages a preference for a dominant alternative that produces greater utility. This theory makes assumption of decision-makers being aware of multiple outcomes, and can determine one that will yield them greater utility (Sebora & Cornwall, 1995). Thus, the individuals who play a part in the informal sector act rationally. Their primary interest is maximizing the expected benefit from economic activities they do. For a rational individual who evades tax, the income understated, will maximize their net anticipated revenue. This evader compares net gain expected from tax evasion with what would be obtained by doing legal activities the formal sector.

3.2 Empirical Models

In estimating the size of informal sector, currency demand method, as suggested by Tanzi (1983), was adopted. The approach involves specifying currency equations that can infer the effect of tax on demand for currency. The fundamental assumptions made is that high taxes act as an incentive for individuals to shift their economic activities to informal sector and that currency is the main form of carrying out day to day transactions or used as a store of wealth. In the equation, the natural logarithm of currency outside banks denoted as c is dependent variable while tax ratio, tax, is independent variable. The control variables are per capita GDP, deposit rate of interest, inflation, and financial innovation denoted as $pgdp$, $\mathrm{int}r$, inf and $finnov$, respectively. The currency demand function is shown in equation 3.

$$lnc_t = \beta_0 + \beta_1(1 + tax)_t + \beta_2 \ln(pgdp)_t + \beta_3 \mathrm{inf}_t + \beta_4 \mathrm{int}r_t + \beta_5 finnov_t + \varepsilon_t \quad (3)$$

Where ln, subscript t and ε are natural logarithms, time components, and error terms. β_0, β_1, β_2, β_3, β_4 and β_5 are coefficients to be estimated. One (1) is added to independent variable tax to estimate when the tax ratio is assumed to be minimum that is zero. The natural logarithm of the independent variable is then obtained. This is cognizant that the natural logarithm of one is zero.

Once equation 3 has been estimated for 1970-2018, currency demanded can be obtained, assuming that tax variable assumes a value of zero. The difference between the currencies in the two models gives the currency that circulates in the informal sector. As discussed in the analytical framework section, the informal sector's size can be estimated by getting the product of excess currency and velocity of money.

After estimating size of informal sector, this study proceeded to estimate its impact on tax revenue. The specific model was coined from the tax evasion expected utility theory discussed in the theoretical framework section. Apart from size of informal sector, the study incorporated more explanatory variables in specified model as suggested by previous studies (Teera, 2002; Muchiri, 2014; and Peters, 2017). The specific model for estimating effect of size of the informal sector and tax revenue in Kenya is shown in equation 4.

$$\text{lntaxrev}_t = \beta_0 + \beta_1 \text{lninfsectorgdp}_t + \beta_2 agricshare_t + \beta_3 lnmanushare_t + \beta_4 lnfaidshare_t + \beta_5 Duminsq_t + \varepsilon_t \quad (4)$$

Where lntaxrev represents the natural logarithm (log) of tax revenue, lninfsectorgdp represents natural log of informal sector output or GDP, $agricshare$ represents the share of agricultural sector in the country's GDP, $lnmanushare$ represents the natural log of share of manufacturing sector in Kenya's GDP, $lnfaidshare$ represents the natural log of foreign aid share in GDP, $Duminsq$ is dummy variable to measure institutional quality in fighting corruption and ε_t is error term and β_0 … β_5 are parameters to be estimated.

3.3 Description of the Variables, Their Measurement and the Expected Signs

Variables, descriptions, measurements, and a priori expected signs are discussed in Table 1.

Table 1. The Variables Definition, Measurement and Priori Expected Signs

The Variable and Abbreviation	Definition and Measurement	Unit of Measurement	Priori Expected Signs and Source
Currency outside a bank at time t (c_t)	The variable measures amount of notes and coins circulating adjusted for inflation.	KES	Dependent Variable
Per capita GDP at time t ($pgdp_t$)	The variable measures individual person contribution to the country's GDP.	KES	+ Greenidge (2010)
tax ratio at time t (tax_t)	This measures incentive to participate in the informal sector. It is measured as a ratio of tax revenue in GDP.	Ratio	+ Ouma et al. (2007)
Rate of interest at time t (intr_t)	The variable measures the returns one gets by investing money in interest yielding bonds.	Percent	+ Faal (2003)
$faidshare_t$manufacturing sector share in GDP at time t ($manushare_t$)	This measures the value of manufacturing sector output or GDP. It is measured by taking the value of manufacturing sector output divided by GDP.	Ratio	+ Amoh, & Adom (2017) Murunga, Muriithi & Kiiru (2016).
Foreign aid in GDP at time t ($faidshare_t$)	This is the amount of foreign aid received in the country. The variable is measured by taking the amount of the foreign aid received per year divided by that year's GDP	Ratio	- Teera(2002)

Institutional quality at time t ($Duminsq_t$)	The variable for institutional quality takes the value 1 when there were institutional changes and zero otherwise. The variable value 1 started from 2010 when the 2010 constitution was promulgated, making the judiciary independent.	Binary	+ Dioda (2012)
Financial innovation at time t ($finnov_t$)	This variable shows the strides made to creating and making new financial instruments popular, technology introduced in finance, new financial institutions and new financial markets. It is measured by the ratio of broad money to narrow money.	Ratio	- Hassan and Schneider (2012)
Inflation at time t. ($\inf_t$)	The CPI measures inflation. It captures proportionate variation in cost of obtaining some specified commodities by an average consumer during a given year.	Percent	+ Ouma et al. (2007)
Tax revenue (taxrev_t)	This is forced payment imposed by the government on employee's income, profits made by business entities. It can also be in the form of an addition to the cost commodities.	KES	Dependent Variable Teera (2002)
Size of informal sector at time t (infsectorgdp_t)	This measures the monetary value of commodities produced in informal sector.	KES	- Castro & Aranda (2018)
Agriculture share in GDP at time t ($agricshare_t$)	This measures the value of agricultural sector output. It is measured by taking the value of the agricultural sector output divided by GDP.	Ratio	- Ahlerup, Baskaran and Bigsten (2015)

3.4 Data Source and Type

Time series data over the 1970 to 2018 period was used to carry out estimation in the study. This period was preferred due to consistently recorded data on variables. In addition, the observations are enough to handle time-series tests and methods. Data on currency outside banks, tax revenue, per capita GDP, inflation, the interest rate on bank deposits and financial innovation were obtained from KNBS Economic Surveys and Abstracts of various years. Data on agriculture share in GDP, manufacturing output, foreign aid were obtained from WDI database. Data on informal sector's GDP was computed in this study.

3.5 Pre-estimation Tests

To avoid cases of spurious regression, the study performed unit root tests. Appropriate methods for testing the presence of unit roots in the data series is the Augmented Dickey Fuller (ADF) test, the Phillips-Peron (PP)-test and Zivot-Andrews (Z-A) test. PP test is the most used alternative to ADF since it is non-parametric. It does not require model specification and lagged parameter in the test

regression. However, PP may not be the best test because it is based on asymptotic theory. In other words, PP test is designed to test the unit root in the long time series, which is not possible in reality. Zivot and Andrews (1992) and Pesaran and Pesaran (1997) showed that both ADF and PP tests are asymptotically equivalent. These authors further asserted that both tests have lower power, and invalid null hypothesis is not rejected in the situation where the coefficient in AR (1) process is close to one. Further, these conventional unit root tests do not account for structural breaks in the data. The unit root that overcomes all these drawbacks is Z-A unit root test. The nature of aggregate time series data requires that unit root tests be conducted before any regression is carried out. If data is non-stationary, this would lead to spurious or inconsistent regression results. The unit roots tests were performed using the ADF test, the PP test and Z-A test, where the null hypothesis is that the series tested contains at least a unit root. Having established the nature of the stationarity of the variables, the study investigated for presence of long run relationship using the ARDL bounds test (Enders, 2015).

4. Empirical Results

4.1 Estimating the Size of Informal Sector in Kenya

The study used the long run ARDL results to estimate the size of the informal sector. The choice of this model followed stationarity characteristics of the variables shown in equation 3. The study established that some of the variables were integrated of order zero while others were integrated of order one. Further, the ARDL bounds test for cointegration revealed presence of long run relationship. The study then began by estimating currency demand model shown by equation 3 by including tax variable. Later minimum tax (assuming tax ration is zero) was estimated and currency outside bank determined by getting the difference between the estimated currency outside banks. This is the currency that circulates in the informal sector. The currency circulating in the informal sector was then multiplied by the velocity of money to give informal sector's GDP. The ARDL results for model 3 and the subsequent computed size of the informal sector are shown in Tables A.1 and A.2 in the appendix respectively.

4.2 Estimating Effect of Size of Informal Sector on Kenya's Tax Revenue

Having obtained the estimates of the size of the informal sector, the study proceeded to estimate its effect on tax revenue in Kenya. The descriptive statistics to check for quality of data used, unit root tests, cointegration test and the empirical results are discussed in the following sections.

(a) Descriptive Statistics

Descriptive statistics or summary statistics show measures of central tendency and measures of spread. These statistics are illustrated in Table 2.

Table 2. Summary Statistics

Variables	Observations	Average	Standard Deviation	Minimum value	Maximum value
Natural log of Tax revenue	49	10.93	2.29	5.62	14.30
Natural log of Size of Informal sector	49	11.34	1.99	5.62	14.42
Natural log of manufacturing share in GDP	49	-2.21	0.17	-2.62	-1.87
Agriculture share in GDP	49	0.30	0.04	0.24	0.37
Natural log of foreign aid share in GDP	49	-2.93	0.43	-3.63	-1.84
Institutional Quality	49	0.49	0.51	0	1

Source: Author's Computations based on data from KNBS

The results showed that 49 observations were used in the study. The agriculture share in GDP has the least standard deviation among the variables considered in the model. The implication of this is that a small change in the value of agriculture shares in GDP from one year to the other. The natural log of size informal sector in GDP showed a minimum of 5.62 and a maximum of -14.42. Most of values of the natural log of tax revenue deviated from its mean by has a mean of 10.93 by 2.29.

(b) The Unit Root Results

The study investigated stationarity of variables using ADF, PP and Z-A tests. The results for ADF, PP are presented in Table 3.

Table 3. The Augmented Dickey Fuller and Phillips-Perron Unit Root Tests

Augmented Dickey Fuller					Phillips-Perron		
		Statistic	Critical value (5%)	Order of Integration	Statistic	Critical value (5%)	Order of Integration
Natural log of Tax Revenue	Level	-1.056	-2.936	One	-0.970	-2.936	One
	1st D	(-10.665)	(-2.938)		(-13.05)	(-2.938)	
Natural log of the size of informal sector GDP	Level	-1.556	-2.936	One	-1.269	-2.936	One
	1st D	(-9.413)	(-2.938)		(-10.50)	(-2.938)	
Natural log of manufacturing share in GDP	Level	-2.184	-2.936	One	-2.421	-2.938	One
	1st D	(-7.213)	(-2.938)		(-7.206)	(-2.938)	
Agriculture share in GDP	Level	-3.329	-2.936	Zero	-3.368	-2.938	One
Natural log of foreign aid share in GDP	Level	-1.589	-2.936	One	-1.667	-2.936	One
	1st D	(-7.961)	(-2.938)		(-7.885)	(-2.938)	

Source: Author's Computations based on data from KNBS

The ADF stationarity test and PP stationarity test revealed that all variables were stationary at the first difference, I(1), except the share of agriculture in GDP. However, just like the PP test, ADF tends to accept the H0 in case of a structural break. There is a need to take into consideration structural breaks in econometric modelling. Failure to investigate this may result in model misspecification and spurious regressions (Allaro et al., 2011; Perron, 1997). In this light, the study adopted the Z-A unit root test, which accounts for the presence of structural breaks and the results are shown in Table 4.

Table 4. Zivot Andrews Unit Root Test

Trend and intercept						
Variables	Year of structural break			First difference (Second difference)		Order of integration
		t-statistics	5% critical value	t-statistics	5% critical value	
Natural log of Tax Revenue	1997	-6.206	-4.80	-	-	Zero
Natural log of informal Sector GDP	1999	-5.406	-4.80	-	-	Zero
Natural log of share of manufacturing in GDP	1996	-3.573	-4.80	-7.698	-4.80	Zero
Agriculture share in GDP	1996	-3.902	-4.80	-7.596	-4.80	Zero
Natural log of share of foreign aid in GDP	1996	-2.882	-4.80	-8.862	-4.80	one

Source: Author's Computations based on data from KNBS

The test revealed that other than the share of agriculture in GDP, which was integrated of order one, all other variables were integrated of order zero. Since the three tests for testing unit root have revealed some stationary variables at level or I (0) and others at the first difference or I (1), the study adopted ARDL instead of OLS. The ARDL suitable methodology since it does not require variables being integrated of the same order. However, the methodology is only relevant to stationary variables at levels and those integrated into order 1, I (1). Before adopting the ARDL model, there was need for testing whether variables were cointegrated. The ARDL bounds test for cointegration are presented in the following section.

(c) Cointegration Results

The ARDL bounds test was carried out, and the results obtained are as indicated in Table 5.

Table 5. ARDL Bounds Test

ARDL Bounds Test	
F-statistic	0.715
I(0) at a 5% level (95 % confidence level)	2.931
I(1) at a 5% level (95 % confidence level)	4.306

Source: Author's Computations based on data from KNBS

The ARDL bounds test results revealed the absence of long-run relationship between natural log of tax revenue, natural log of size of informal sector GDP and other variables used in study since F statistic is less than I (1). This implied that study could not estimate the Error Correction Model (ECM) but short run ARDL model only. The ARDL model results are discussed in the following section.

(d) Regression Results of the ARDL Model

The Short-run results of the ARDL model are presented in Table 6.

Table 6. ARDL Short Run Results

First Lag of Natural log of Tax Revenue	-0.639***
	(0.139)
Second Lag of Natural log of Tax Revenue	-0.198*
	(0.107)
Natural log of Informal Sector GDP	-0.511***
	(0.075)
First Lag of Natural log of Informal Sector GDP	0.328***
	(0.097)
Natural log of manufacturing share in GDP	-0.130
	(0.343)
Agricultural share in GDP	-0.174
	(1.561)
Natural log of foreign aid share in GDP	0.067
	(0.185)
Institutional Quality	-0.009
	(0.332)
Constant	0.153
	(0.998)
Observations	45
R-squared	0.981
Jarque Bera Test	0.09

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Computations based on KNBS data

Apart from the explanatory variables in the study, the ARDL model incorporates lagged tax ratio (the dependent variable) as an additional explanatory variable. Inclusion of lagged dependent variable may lead to serial correlation rendering the estimates inconsistent, thus leading to severe implications for the findings by introducing autocorrelation. This could lead to statistically invalid coefficients and confidence intervals (Gujarati & Porter, 2009). Recursive residuals from the time series regression were obtained to test for model stability, and the cumulative sum of squares denoted as CUSUM was generated. The graphical plot of CUSUM is presented in Figure A in the appendix. For a model to be stable, the CUSUM should lie within a 5 percent significance level. The graph revealed that the specified model was stable since the CUSUM was observed to be within the 5 percent boundary. The J-B test results of 0.09 implied that the null hypothesis of normality of variables used in the study was not rejected at a 5 percent significance level.

The short-run results revealed significant coefficients of first and second lags of natural log of tax revenue. These results revealed a negative and significant coefficient of the natural log of the size of informal sector GDP. This showed that in short run, the natural log of size of informal sector GDP is essential in influencing the natural log of tax revenue in Kenya. The results revealed that a rise in the natural log of the size of informal sector GDP by one percent results in a decline in the natural log of tax revenue by 0.511 percent on average, holding all other factors constant. These results can be attributed to increased tax dodging and evasion that is associated with the informal sector. Improved tax evasion implies that the Kenyan government loses some tax revenue due to some untaxed incomes among the economic agents in the informal sector. The government could also be losing tax revenue as a result of evading indirect taxes, for instance, excise tax and VAT. The results are in agreement with an earlier study by Muchiri (2014), which found that the growth of informal sector had a significant adverse effect on Kenya's tax revenue. The results also conform to an earlier study by Teera (2002), which found the coefficient of shadow economy to be negative and significant. The author was studying determinants of tax ratio in Uganda. The difference between the current study and Teera (2002) is how size of informal sector was measured. Unlike this present study which used the currency demand method to estimate size of informal sector, Teera (2002) used increases in money supply as a measurement of size of informal sector with an assumption that participants in informal sector prefer to carry out their transactions in cash form. The study results also agree with Dioda (2012) study while studying the structural determinants of tax revenue in Latin America and the Caribbean.

However, the results revealed that a percentage change in first lag of natural lag of the size of the informal sector leads to an increase in the natural log of tax revenue by 0.328 percent on average ceteris paribus. The coefficient was significant, implying this variable was an essential determinant of natural log of tax revenue. This finding can be attributed to currency hidden by the informal sector players getting into the economy through the purchase of commodities. The government then manages to tap VAT tax from these transactions.

The coefficient of the share of natural log manufacturing share in GDP was found to be negative and insignificant. This implies that the natural log manufacturing share in GDP is not an essential determinant of Kenya's natural log of tax revenue. These results do not conform to economic theory. The results also contradict those of Amoh and Adom (2017). However, this finding in Kenya could be attributed to the liberalization policy that allowed cheaper imports compared to locally manufactured goods, thus leading to the collapse of the sector.

The short-run coefficients of agriculture share in GDP were negative and insignificant. This suggests that the agriculture share in GDP is not an essential determinant of the natural log of tax revenue in Kenya in short run. The findings showed that holding all factors fixed, increasing agricultural sector's contribution in GDP by one unit results in a decrease in the natural log of tax revenue by 17.4 percent. The results conform to economic theory. Musgrave and Musgrave (1989) asserted that land titling had not been embraced in developing countries, making it difficult for tax authorities to impose taxation. Secondly, a large portion of the agricultural sector in Kenya is small scale having few taxpayers who pay tax on their proceeds. Thirdly, in Kenya substantial part of agricultural produce is consumed and not sold. Lastly, most of the agricultural products that are sold are to a large extent exempted from taxation. Therefore, this implies that though the agriculture sector is the mainstay of the Kenyan economy by contributing 26 percent of the GDP, much of the sector's income is untaxed.

The coefficient of share of foreign aid in GDP was found to be positive though insignificant. This means that foreign aid is not an essential determinant of the tax ratio in Kenya. This could be attributed to policymakers' decisions to substitute foreign aid for domestic taxes. This approach may be used as a political strategy to free more private sector resources, thus resulting in increased investment. The findings are consistent with Addison and Levin (2012) results.

5. Policy Implications

Based on this study's findings, the government ought to take action to control the increasing size of informal sector in Kenya. The informal sector accounting for 32 percent of the country's GDP, impose a significant weight on official GDP for a developing country like Kenya. Such size can lead to some negative externalities, thus hampering the economic development of the country. The study has found that informal sector partly explains the poor performance of Kenya's tax revenue.

One policy implication to reduce the loss of tax revenue is to formalize the informal sector. Though most of the informal sector participants may operate small enterprises for survival, there is a considerable number who run large business enterprises whose income falls within the taxable bracket. For instance, apart from small scale businesses, the growth of informal sector in Kenya can be linked to large businesses for instance law firms, landlords and private hospitals that transact mainly in cash. KRA should increase surveillance to identify individuals who are dodging and evading tax. KRA can bring more individuals into the tax bracket by using the Kenya power database to identify multiple electricity metre holders who may be potential landlords and may not be paying tax. Some individuals

may be operating in both sectors and reporting incomes from the registered business only. KRA can identify the possibility of such individuals working in the informal sector by matching the returns filed with other databases, for instance, cash trails in banks and import records, motor vehicle registration details and supplier dealings.

Another policy implication necessary to reduce size of informal sector in Kenya is deregistering taxpayers involved in tax evasion. Given that most of the services in Kenya are tied to KRA PIN, such a move can act as a deterrence to those who may want to practice tax evasion. The things connected to KRA PIN in Kenya include registration of land title deeds, registration and transfer of vehicles, registration of business names and companies, underwriting of insurance policies, supplying commodities to the state, customs clearing and forwarding. In addition, if the person is employed in formal sector but has businesses in informal sector, deregistering him as a taxpayer would imply he will lose the job. This is because employers are not allowed to wire salaries to bank accounts of individuals that do not have KRA PINs.

In addition, the government should revisit the plan to consider the cashless transaction in the transport sector. According to Findex (2017), Kenya is a role model of financial inclusion in Sub-Saharan Africa, where 79 percent of population above age of 18 make or receive digital payments courtesy of successful mobile money services. This means the government of Kenya should leverage commendable financial inclusion to introduce a cashless payment system. Such action can bring public transport operators commonly known as matatu, public motorbike operators commonly known as bodaboda, large scale shoe shiners, unregistered construction site contractors, timber merchants and vehicle garages into the tax net. Other individuals who can be added to the tax net by adopting a cashless system are professional service providers, for instance, law firms and private health facilities. Some of these enterprises could be making substantial sales turnover that could be within the thresholds of VAT registration.

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Appendix

Table A.1: ARDL Results for Estimating the Size of Informal Sector

Dependent variable (Currency outside Banks)	Currency Demand function	Currency Demand function
Regressors	With tax	where tax is assumed to be zero
Error Correction Term	-0.53***	-0.058***
	(0.16)	(0.027)
Natural log of per capita GDP	1.12***	1.28***
	(0.021)	(0.025)
Inflation	-0.03***	0.033***
	(0.0039)	(0.0057)
interest rate	0.002***	0.046***
	(0.0055)	(0.00823)
Natural log of Tax ratio	5.26***	
	(0.69)	
Financial Innovation	-0.83***	0.291***
	(.082413)	(.082413)
Constant	0.47	1.66
	(-)	(-)
Observations	48	48
R-squared	0.7101	0.7101

In parenthesis are standard errors

*** p<0.01, ** p<0.05, * p<0.1

Table A.2: The Size of the Informal Sector in KES B, 1970-2018

Year	Size of the Informal Sector (KES B)	Year	Size of the Informal Sector (KES B)
1970	2.62	1995	225.29
1971	2.23	1996	255.35
1972	3.20	1997	296.08
1973	3.48	1998	334.96
1974	4.14	1999	163.66
1975	3.48	2000	129.96
1976	3.91	2001	159.70
1977	7.09	2002	144.66
1978	6.39	2003	185.20
1979	8.57	2004	245.18
1980	13.87	2005	199.30
1981	20.23	2006	272.11
1982	26.76	2007	287.56
1983	32.13	2008	319.96
1984	25.00	2009	369.58
1985	22.80	2010	369.70
1986	29.27	2011	489.35
1987	23.10	2012	619.88
1988	44.66	2013	594.91
1989	85.35	2014	551.52
1990	79.57	2015	782.31
1991	102.52	2016	1080.40
1992	94.89	2017	1427.90
1993	102.51	2018	2067.99
1994	193.24		

Source: Author's Computations based on data from KNBS

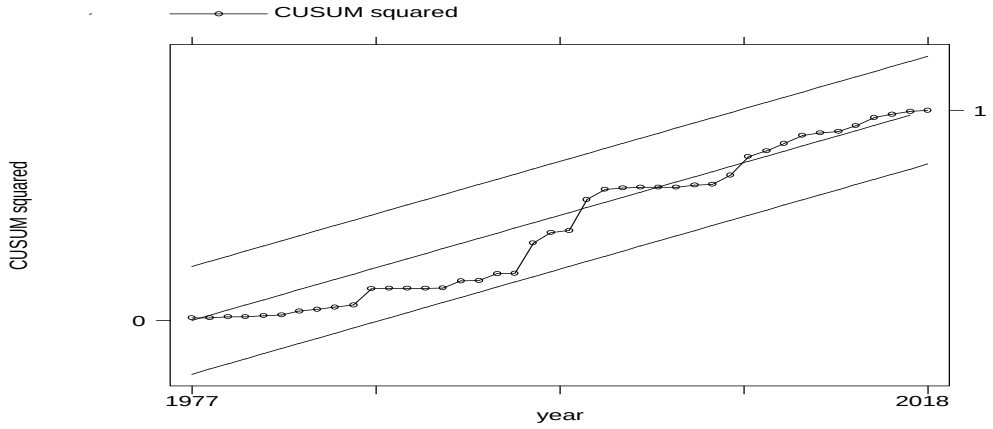

Figure A: CUSUM of Squares Parameter Stability of Tax Function Model

Source: Author's Computations based on data from KNBS