Empirical Analysis of the Wagner Hypothesis of Government Expenditure Growth in Kenya: ARDL Modelling Approach

JOHN KIBARA MANYEKI
PHD STUDENT
UNIVERSITY OF SZEGED
e-mail: manyeki.john@eco.u-szeged.hu

BALÁZS KOTOSZ, Ph.D.
ASSOCIATE PROFESSOR
UNIVERSITY OF SZEGED
e-mail: kotosz@eco.u-szeged.hu

SUMMARY

Government spending patterns in developing countries have changed dramatically over the last several decades. This paper aims at analysing the relation between government expenditures (GE) and economic growth in Kenya. The study focuses on testing the various versions of Wagner's hypothesis using Kenya, data from 1967-2012 by an Autoregressive-Distributed Lag (ARDL) model. Overall, we conclude that the Musgrave version is best suited for Kenyan cases since it produced significant long-run and short-run results that were accepted by diagnosis and stability tests. The results rejected Wagner's hypothesis in Kenya.

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INTRODUCTION

Fiscal instruments are deemed to be essential in creating opportunities for widening the base from which developing countries such as Kenya could grow. Within the East Africa Community (EAC), the Kenyan economy is the anchor and is much more dynamic than those of other member countries. The bases for a strong economy are boosted by recent institutional reforms that have culminated in the adoption of a new constitution (GoK 2010) that provides for devolved governance, a strong private sector that has evolved under relatively market-friendly policies and a relative political stability with minimal negative dramatic ideology. Recent statistics show that Kenya's GDP (Gross Domestic Product) accounts for 40 per cent of the region's GDP, followed by Tanzania at 28 per cent, Uganda at 21 per cent, Rwanda at 8 per cent, and lastly Burundi at 3 per cent (IMF 2017). Although the Kenyan economy is the greatest in EAC, its trends in the growth of the GDP and government expenditures (GE) over the period of study (1967-2012) has been fluctuating. The trend in GDP growth was cyclical, depicting neither clear pattern nor responsiveness to the changes in government expenditure, characterized by a negative pattern on average. The economic performance of Kenya is fragile and prone to political and environmental shocks. Serious depression in the GDP growth coincides with the previous election periods (e.g. 1972/73, 1982/83, 1992/93, 2002/03 and 2007/08) and drought periods (e.g. 1980, 1984, 2009). Recently, from 2002 there has been remarkable economic performance that can be attributed to increased government expenditure in areas of infrastructure such as roads, railways, electricity and also due to the expansion of recurrent expenditure on vital services such as education, health and housing. The economy has progressively overcome negative shocks, posting a growth rate of 6% in the past five years.

Among the fiscal instruments, government spending, which is the focus of this study, is very important to the Kenyan economy. This study focuses on establishing whether there is relation between government expenditures and economic growth in the Kenya using several propositions that have been developed in relation to Wagner's hypothesis. The study focuses on addressing three questions:

1. Which amongst the available Wagner's hypothesis interpretation is relevant to Kenya case?
2. By how much do government expenditures change with GDP in the long run and by how much in the short run?
3. Is the relation between government expenditures and GDP robust over time?

According to Arpaia & Turrini (2008), better insight on the dynamic relationship between real GE and real GDP is relevant to policy in two major respects. First, it improves the understanding of long-term, structural public finance issues and second, a better understanding of the dynamic relation between government expenditure and GDP helps comprehension of policy-relevant issues over a short-to-medium term horizon. Judging whether expenditure policy is expansionary or contractionary requires some idea about how expenditure policy would look. These issues are treated in a wide theoretical view in Zagler & Dürnecker (2003) or in a post-crisis European perspective in Bartha & Sáfrányné Gubik (2012). Estimating the long-term relation between GE and GDP provides a benchmark for expenditure policy grounded on empirical evidence. Useful information for policymaking would also be provided by estimating the speed at which GE adjusts to its long-term relation with GDP after a shock in economic activity.

In terms of the notion of GE and GDP, there are two growing strands of research. The first one aims at explaining cross-country structural differences in the size of government on the basis of political fundamentals that shape the extent of the deficit bias related with free-riding in GE provision and governments' myopia. It has been shown that the size of government tends to be larger in parliamentary than in presidential regimes (Persson et al. 2000). However, the question of whether or not such expansion causes economic growth has divided policy makers into two distinctive theoretical camps, as proponents of either a big government or small government. Economic theory would suggest that on some occasions lower levels of public expenditure would enhance economic growth while on other occasions higher levels of public expenditure would be more desirable (e.g. Knoop 1999; Jiranyakul & Brahmasrene 2007). The second strand of literature examines the link between GE and economic growth over time. Some work aims at describing long-term tendencies in history (Tanzi & Schuknecht 2000) while the majority of research is more specifically focused at the empirical estimation of elasticity of GE with respect to GDP, often with the explicit aim of providing an empirical test of the so-called "Wagner law", that is, the hypothesis that GE increases more than proportionally with economic activity (e.g. Adil et al. 2016). The latter topic seemed to be ideal for the present study and therefore this paper aims at testing the different versions of Wagner's hypothesis that specifically purport the existence of long-run relationship between public expenditure (PE) and gross domestic product (GDP) using annual time series data in Kenya context using Autoregressive-Distributed Lag (ARDL) model.

The paper is organized as follows. In Section 1, the theoretical foundation of Wagner's hypothesis is discussed and we review the findings of the previous studies on the effects of government expenditure (GE) and gross domestic product (GDP). The data and methodological framework used in this study are presented in Section 2. In this section, measures of unit root tests are discussed together with the concept and rationale for using the ARDL modelling approach in this study. In Section 3, the empirical results are presented and interpreted along with their policy implications for the Kenya economy. Finally, concluding remarks are presented in Section 4.

THEORETICAL FOUNDATION OF WAGNER'S HYPOTHESIS

The theoretical foundation of Wagner's hypothesis was inspired by the rapid urbanization and industrialization in the late nineteenth century, during which Wagner observed that economic development in countries undergoing industrialization transformation was being accompanied by growing public activity relative to the economy growth. Motivated by rate of industrialization of European countries such as Britain and Germany, as well as the United States and Japan in the nineteenth century, he designed a research project that aimed at understanding the economic history of the industrialization. On the basis of his study, he proposed to explain the observed phenomenon of the growth in public activity relative to the economy growth in the context of industrializing economies. In his study, Wagner writes as follows: *"Historically there exists a clear tendency for an expansion of public activity together with the progress of the economy…"* (Biehl 1998, p. 107). This concept formed the ideal premises of many subsequent scholars in this field and provided scope for a range of different interpretations in the existing literature (e.g. Peacock & Wiseman 1961; Gupta 1967; Goffman 1968; Pryor 1968; Musgrave 1959; Goffman & Mahar 1971; Mann 1980; Florio & Colautti 2005).

This paper made use of four interpretations, namely Peacock & Wiseman (1961), Gupta, (1967), Goffman (1968) and Musgrave (1959) to investigate which among them best explains the relationship between government expenditures (GE) and economic growth in reference to the Kenyan economy. The four were selected for their wide application and consistency in explaining the short- and long-run relation between GE and GDP (e.g. Magableh 2006; Gisore et al. 2014; Adil et al. 2016). The interpretations, functional form and empirical model specifications are summarized in Table 1 below. It is worth noting that except for Gupta, who adopted a double logarithmic functional form, the researchers opted for a linear relationship between the two economic variables. In order to verify the long run relations between GE and GDP in Kenya, the general specifications have formed the basis for testable models of the Wagner's hypothesis in the existing study, as shown in the fourth column. The double logarithm technique was adopted in order to estimate the effect of GDP on GE in terms of responsiveness.

Table 1
Versions of Wagner's law

Model	Wagner's hypothesis interpretation	General form	Empirical model
Peacock & Wiseman (1961)	*"The proportion of public expenditures to gross national product must be expected to rise over the foreseeable future"*	*GE = f(GNP)*	$LnRGE_t = = \beta_1 + \beta_2 LnRGDP_t + \mu_t$
Gupta (1967)	*"Government expenditure must increase at a rate faster than that of the national income"*	*GE/P = f(GNP/P)*	$Ln\left(\frac{RGE_t}{p_t}\right) = = \beta_1 + \beta_2 Ln\left(\frac{RGDP_t}{p_t}\right) + \mu_t$
Goffman (1968)	*"As a nation experiences econo-mic development and growth, an increase must occur in the activity of the public sector and the ratio of increase, when converted into expenditure terms, would exceed the rate of increase in output per capita"*	*GE = f(GNP/P)*	$LnRGE_t = = \beta_1 + \beta_2 Ln\left(\frac{RGDP_t}{p_t} + \mu_t\right)$
Musgrave (1959)	*"The proposition of expanding scale, obviously, must be inter-preted as postulating a rising share of the public sector in the economy. An absolute increase in the size of the budget can hardly fail to result as the economy expands"*	*GE/GNP = f (GNP/P)*	$Ln\left(\frac{NGE_t}{NGDP_t}\right) = = \beta_1 + \beta_2 Ln\left(\frac{RGDP_t}{p_t}\right) + \mu_t$

Source: Own construction from Magableh 2006; Adil 2016
Notes: RGE – Real Government Expenditure; RGDP – Real Gross Domestic Product; P – Population; NGE – Nominal Government Expenditure; NGDP – Nominal Gross Domestic Product

The importance of GE in enhancing economic growth cannot be underestimated. There have been numerous studies on the role of government spending in long-term growth in Kenyan economies (e.g. Musyoki 2010; Muthui et al. 2013; Simiyu 2015). A review of the recent studies found conflicting results about the effects of government spending on economic growth. For instance, Musyoki (2010), examined the case for Kenya by analyzing the relationship between government expenditure and GDP growth using historical annual data for Kenya from 1963-2008 obtained from published government documents, mainly the annual economic surveys and statistical abstracts. The authors used a multivariate time series analysis with emphasis on the shape of impulse response functions under VAR and causal patterns established using Granger causality tests were adopted to show how government expenditure and size of government interact with GDP growth. The results of the analysis show that even though GDP level in one period determines its own level in future periods, government expenditure actually influences GDP in the medium and long term. Similarly, government size has a positive influence on GDP only in the short run but this effect becomes negative in the long run. Thus, government must continue to spend more in productive areas to ensure economic growth.

However, the rapid growth in public expenditure experienced in Kenya since independence has caused concern among policy makers regarding its implications for economic growth. Motivated by this concern, Muthui et al. (2013) developed a study that aimed at investigating the impact of expanding public expenditure composition on economic growth in Kenya from 1964 to 2011. To ensure appropriateness of the time series date, these authors conducted a stationarity test, causality test and cointegration tests before applying vector error correction model to estimate the long-run and short-run relationship between government expenditure (particularly on health and education) and GDP. The study found that though government expenditure on education is positively related to economic growth it does not spur any significant change to growth. Based on this study, investing more and better-distributed education in the labor force will help create conditions that could lead to higher productivity and higher economic growth. For health, the authors found that increased government expenditure on improving health could also be justified purely on the grounds of its impact on labor productivity. This supports the case for investments in health as a form of human capital.

A similar study was recently conducted by Simiyu (2015) in Kenya. The motive behind this study was to investigate whether there exists a relationship between economic growth on key public expenditure (health, education, military and infrastructure) in Kenya. The study used a time series data collected between 1963 and 2012. The Johansen Cointegration Test and Vector Error Correction Model (VECM) were applied on the time series data to estimate the short-run and long-run relationships between public expenditures and economic growth in Kenya. The study found that public expenditure components and economic growth co-move towards a long-run equilibrium with a speed of adjustment of approximately 3.6% after short-run fluctuations in the equilibrium. Furthermore, the results show no causal relationship between public expenditure and economic growth in Kenya. However, a unidirectional causation was found between military and health expenditures – military expenditures "Granger Cause" health expenditures. Hence, a change in military expenditures causes a change in Health expenditures. These findings suggest that the Government of Kenya should switch military expenditures for health expenses in Kenya, but not vice versa.

In summary, this section has presented the various theories that explain public expenditure and economic growth of the countries. The review carried out above has also presented the various effects of public expenditure on economic development of Kenya. As can be observed, studies have found mixed results on the causal relationship between public expenditure and economic growth. Further, the econometric method employed in most studies was the VAR or VEC model, which require a priori determination of order of integration and can be only be applied to series that are integrated of the same order.

METHODOLOGICAL FRAMEWORK AND DATA

Data

Secondary data was used in this study to analyze the effect of the Wagner's hypothesis in the context of government expenditure on economic growth in Kenya (for available data sources, see Arasa & K' Obonyo 2012). We collected annual time series data of the government expenditures and GDP in Kenya ranging from 1967 to 2012. This type of data was obtained from international organization databases: World Bank (Global Development Data) and International Monetary Fund (International Financial Statistics database). All the data obtained were converted to real data for ease of analysis using STATA.

Stationarity Tests

The stationarity of the variables was examined to avoid the existence of spurious estimation results. Stationarity tests allow us to verify whether a series is stationary or not. Stationarity can be done in twofold; 1) the null hypothesis H_0 that the series is stationary (e.g. KPSS test for stationarity) and 2) unit root tests, such as the Dickey-Fuller test and its augmented version, the augmented Dickey-Fuller test (ADF) (Dickey & Fuller 1979), or the Phillips-Perron test (PP) (Phillips & Perron, 1988), for which the null hypothesis H_0 is on the contrary that the series possesses a unit root and hence is not stationary. In this study unit root test was done by conducting both the ADF and PP test. In both ADF and PP tests the null hypothesis of a unit root is present in a time series sample. The alternative hypothesis is different depending on which version of the test is used, but is usually stationarity or trend-stationarity. If a series is stationary without any differencing, it is said to be $I(0)$ or integrated of order 0. On the other hand, if a series is stationary after first-difference it is said to be $I(1)$ or integrated of order 1. However, the advantage of the PP over the ADF test is that the PP test is robust to general forms of heteroskedasticity in the error term and also the user does not have to specify a lag length for the test regression.

ARDL Cointegration Approach

After establishing whether the series is stationary in levels or first-difference (and if the series are integrated of the same order), then a cointegration test needs to be conducted to determine whether the variables are cointegrated or not. Several methods are available for conducting the cointegration test and the most commonly and widely used methods include the residual based Engle-Granger (Engle & Granger 1987) test, the maximum likelihood based on Johansen (1991; 1995) and Johansen-Juselius (Johansen & Juselius 1990) tests. Due to the low power and other problems associated with these test methods, the OLS based autoregressive distributed lag (ARDL) approach to cointegration was applied. The main advantage of ARDL modelling lies in its flexibility, as it can be applied when the variables are of different order of integration (Pesaran & Pesaran 1997). Compared to other cointegration test approaches that requires order of integration of the variables to be determined first, which may lead to misclassification of variables as $I(0)$ or $I(1)$, an ARDL uses a bounds testing procedure to draw conclusive inference without knowing whether the variables are integrated of order zero ($I(0)$) or one ($I(1)$) (Pesaran et al. 2001). Examples of integration order problems can be found in the analysis of the Hungarian case (see Mellár 2001; Kotosz 2006; Kotosz & Peák 2013). Another advantage of this approach is that the model takes a sufficient numbers of lags to capture the data generating process in a general-to-specific modelling framework (Laurenceson & Chai 2003). Its popularity also stems from the fact that cointegration of nonstationary variables is equivalent to an error-correction (EC) process (for the linear transformation see e.g. Banerejee et al. 1993), and the ARDL model has a reparameterization in EC form (Engle & Granger 1987; Hassler & Wolters 2006). The EC integrates the short-run dynamics with the long-run equilibrium without losing long-run information and the existence of a long-run cointegrating relationship can be tested based on the EC representation. In addition, it is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson & Chai 2003).

In practice, ARDL involves three distinct steps: first, the determination of the existence of the Long Run Relationship of the variables, second, choice of the appropriate lag length for the ARDL Model/Estimation of the Long Run Estimates of the Selected ARDL model, and third, reparameterization of ARDL model into the Error Correction Model. At the first stage the existence of the long-run relation between the variables under investigation is tested by computing the Bound *F* or *t*-statistic (bound test for cointegration) in order to establish a long-run relationship among the variables. This bound *F* or *t*-statistic is carried out on each of the variables as they stand as endogenous variable while others are assumed as exogenous variables. This approach is illustrated by using an ARDL (*p, q*) regression with an *I*(*d*) regressor as follows

$$LnRGE_t = C_0 + \beta_1 LnRGE_{t-1} + \cdots + \beta_p LnRGE_{t-p} + \alpha_0 LnRGDP_t + \alpha_1 LnRGDP_{t-1} + \cdots + \alpha_q LnRGDP_{t-q} + \mu_t \quad (1)$$

or

$$LnRGDP_t = C_0 + \beta_1 LnRGDP_{t-1} + \cdots + \beta_p LnRGDP_{t-p} + \alpha_0 LnRGE_t + \alpha_1 LnRGE_{t-1} + \cdots + \alpha_q LnRGE_{t-q} + \mu_t \quad (2)$$

where i =1, 2, … *T* and $\mu_t \sim iid(0, \sigma^2)$, C_0 is the drift and $\mathrm{LnRGDP_t}$ and $\mathrm{LnRGE_t}$ are the log of gross real domestic product (RGDP) and the log of real government expenditure (RGE), respectively and are an *I*(*d*) process generated by

$$LnRGE_t = LnRGE_{t-1} + \varepsilon_t \quad (3)$$

or

$$LnRGDP_t = LnRGDP_{t-1} + \varepsilon_t. \quad (4)$$

Note u_t and ε_t are uncorrelated for all lags such that $LnRGE_t$ (or $LnRGDP_t$) is strictly exogenous with respect to u_t. ε_t is a general linear stationary process. In practice the ARDL (p, q_1, q_2 ... q_k) model for cointegration testing is expressed as

$$\Delta LnRGE_t = C_0 + \sum_{i=1}^{k} \beta_i \Delta LnRGE_{t-i} + \sum_{j=0}^{k} \alpha_j \Delta LnRGDP_{t-j} + \delta_1 LnGE_{t-1} + \delta_2 LnRGDP_{t-1} + v_{1t} \quad (5)$$

or

$$\Delta LnRGDP_t = C_0 + \sum_{i=1}^{p} \beta_i \Delta LnRGDP_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta LnRGE_{t-j} + \delta_1 LnRGDP_{t-1} + \delta_2 LnRGE_{t-1} + v_{1t}. \quad (6)$$

Here, *k* is the ARDL model maximum lag order and chosen by the user. The *F*-statistic is carried out on the joint null hypothesis that the coefficients of the lagged variables ($\delta_1 LnGE_{t-1}$, $\delta_2 LnGDP_{t-1}$ or$\delta_1 LnGDP_{t-1}$, $\delta_2 LnGE_{t-1}$) are zero. The null of non-existence of the long-run relationship is defined by; H_0: $\delta_1 = \delta_2 = 0$ (null, i.e. a long-run relationship does not exist) H_1: $\delta_1 \neq \delta 2 \neq 0$ (Alternative, i.e. a long-run relationship exists). The model is "autoregressive" in the sense that $LnGE_t$ or $LnGDP_t$ is explained (in part) by lagged values of itself.

Pesaran et al. (2001) provide lower and upper bounds for the asymptotic critical values depending on the number of regressors, their order of integration, and the deterministic model components based in *F*-test or *t*-test. Based on Pesaran et al. (2001), we fail to reject the null H_0^F or H_0^t respectively if the test statistic is closer to zero than lower bound of the critical values and reject the null H_0^F or H_0^t respectively if the test statistic is more extreme than the upper bound of the critical values. The existence of a (conditional) long-run relationship is confirmed if both null H_0^F or $H_0^t$are rejected. If a long-run relationship exists between the underlying variables, while the hypothesis of no long-run relations between the variables in the other equations cannot be rejected, then the ARDL approach to cointegration can be applied.

Step two involves determining the appropriate lag length for each of the underlying variables in the ARDL model. This is because we want to have Gaussian error terms (i.e. standard normal error terms that do not suffer from non-normality, autocorrelation, heteroskedasticity, etc.). The optimal lag orders *p* and *q* (possibly different across regressors) can be obtained with proper model order selection criterion, e.g. the Akaike information criterion (AIC) or the Bayesian information criterion (BIC) or Hannan-Quinn Criterion (HQC). For this case, we adopted AIC criteria expressed as

$$AIC_p = -n/2(1 + log2\pi) - n/2log\delta^2 - p \quad (7)$$

where δ^2 is the Maximum Likelihood (ML) estimator of the variance of the regression disturbances and n is the number of estimated parameters, *p*=0, 1, 2......P, where P is the optimum order of the model selected.

Having confirmed that a long-run relationship exists among variables and having identified the number of lags to include for each variable, then the long-run model for *LnRGE* can be describe in the ARDL (*p, q*) model as:

$$LnRGE_t = C_0 + \sum_{i=1}^{p} \beta_i LnRGE_{t-i} + \sum_{j=0}^{q} \alpha_j LnRGDP_{t-j} + \mu_t. \quad (8)$$

In its basic form, this ARDL regression model looks like this:

$$LnRGE_t = C_0 + \beta_1 LnRGE_{t-1} + \cdots + \beta_p LnRGE_{t-p} + \alpha_0 LnRGDP_t + \alpha_1 LnRGDP_{t-1} + \cdots + \alpha_q LnRGDP_{t-q} + \mu_t \quad (9)$$

where μ_t is a random "disturbance" term (white noise error term) and C_0, *LnGDP* and *LnGE* are as earlier defined.

If we allow the variables in $(LnGDP_t, LnGE_t)'$ to be purely *I*(0), purely *I*(1), or mixed cointegrated then the ARDL model can be reparameterized in conditional ECM form as follows;

$$\Delta LnRGE_t = C_0 - \gamma(LnRGE_{t-1} - \vartheta LnRGDP_{t-1}) + \sum_{i=1}^{p-1} \varphi_{LnGE_i} \Delta LnRGE_{t-i} + \sum_{j=0}^{q-1} \varphi_{LnGDP_i} \Delta LnRGDP_{t-j} + \mu_t \quad (10)$$

with the speed-of-adjustment coefficient

$$\gamma = \sum_{j=1}^{p} \varphi_i \quad (11)$$

and the long-run coefficients

$$\theta = \frac{\sum_{j=0}^{q} \beta_i}{\gamma} \quad (12)$$

where $\varphi_{LnGE_i}$and φ_{LnGDP_i} are the short-run dynamic coefficients of the model convergence to equilibrium. If the value of speed of adjustment is zero, it means that there exists no long-run relationship. If it is between −1 and 0, there exists partial adjustment; a value smaller than −1 indicates that the model over-adjusts in the current period; a positive value implies that the system moves away from equilibrium in the long run (Oktayer & Oktayer 2013).

The model was further subjected to diagnostic and the stability tests to ascertain the appropriateness of the ARDL model. The diagnostic tests check for normality (Shapiro-Wilk W test for normal data: H_0: Normal), serial correlation (LM Test – Breusch-Godfrey LM test for autocorrelation: H_0: no serial correlation), the autoregressive conditional heteroscedasticity (ARCH Test – Breusch-Pagan/Cook-Weisberg test for heteroskedasticity: H_0: Constant variance), and finally the functional form of the model (Ramsey (1969) RESET test using powers of the fitted values: H_0: model has no omitted variables). In addition, the stability tests of ARDL model for long-run and short-run parameters were conducted by using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares (CUSUM square) of recursive residuals.

EMPIRICAL RESULTS

Unit Root Test

Summary statistical results of the unit root test in real terms of GE and GDP are presented in this section. The test was carried out in order to eliminate any possibility of spurious regressions and erroneous inferences. This involved determining the order of integration of the time series through a unit root test. Accordingly, ADF and PP test were conducted at level and at first difference and the results of the two are reported in Table 2 below. As indicated in the table, the ADF test failed to reject the null hypothesis of unit root at level, implying that variables are non-stationary at levels. But at first difference, the null hypothesis is rejected implying that the variables become stationary at first difference. To complement the ADF results, we also performed the PP test, which is more robust for measuring autocorrelation and heteroskedasticity. The PP test also supports the ADF test for the ratio of nominal GE to GDP ($Ln(NGE/NGDP)$) but disagrees for other variables, implying that they are stationary at levels, which perhaps could be explain by the different lag length applied in the two statistical test methods. However, since first order differencing in all cases eliminates the unit root of most of the variable under consideration, the maximum order of integration can be concluded to be *I*(1).

Table 2
Summary result of Unit Root Test

	Augmented Dick Fuller Test				**Phillips-Perron test**			
	Level – *I*(0)		1st Difference *I*(1)		Level – *I*(0)		1st Difference *I*(1)	
Variable	t-statistics	lags	t-statistics	lags	t-statistics	lags	t-statistics	lags
$LnRGDP$	-2.384 (0.1463)	0	-9.399*** (0.0000)	0	3.485*** (0.0084)	3	-9.200*** (0.0000)	3
$LnRGE$	-1.685 (0.4390)	5	-2.893*** (0.0461)	5	-3.892*** (0.0021)	3	-7.489*** (0.0000)	3
$Ln(RGDP/Pop)$	-2.625* (0.0880)	0	-9.655*** (0.0000)	0	-3.328** (0.0137)	3	-9.531*** (0.0000)	3
$Ln(RGE/Pop)$	-2.314 (0.1674)	5	-2.974*** (0.0374)	5	-3.835*** (0.0026)	3	-7.601*** (0.0000)	3
$Ln(NGE/NGDP)$	-2.069 (0.2572)	0	-6.463*** (0.0000)	0	-2.157 (0.2224)	3	-6.463*** (0.0000)	3

Source: Own computation
p-values in parentheses, * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level

Table 3
Result of the cointegration test using ARDL Approach

	*10% Sign. level		**5% Sign. level		***2.5% Sign. level		****1% Sign. level	
K	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F_c	4.04	4.78	4.94	5.73	5.77	6.68	6.84	7.84

Models	Dependent variable	Independent variable	F-test Statistic	Cointegration
Peacock-Wiseman	$LnRGDP$	$LnRGE$	5.428*	YES
	$LnRGE$	$LnRGDP$	4.578	NO
Gupta	$Ln(RGDP/Pop)$	$Ln(RGE/Pop)$	4.994*	YES
	$Ln(RGE/Pop)$	$Ln(RGDP/Pop)$	4.955*	YES
Goffman	$LnRGE$	$Ln(RGDP/Pop)$	3.104	NO
	$Ln(RGDP/Pop)$	$LnRGE$	0.423	NO
Musgrave	$Ln(NGE/NGDP)$	$Ln(RGDP/Pop)$	5.073*	YES
	$Ln(RGDP/Pop)$	$Ln(NGE/NGDP)$	10.571****	YES

Source: Own computation

ARDL Modelling Approach to Cointegration Analysis

The next step was to examine the existence of cointegration. Since the variables are of different order of integration (based of PP test), we used ARDL modelling due to its flexibility that allows it to be applied when the variables are of different orders of integration (Pesaran & Pesaran 1997).

The bounds test approach on all four alternative versions of Wagner's hypothesis was used to examine the long-run relationship between the variables. The maximum lag length of the variables in ARDL model was selected using the AIC. Based on the results (Table 3), there is strong evidence of cointegration at different level of significance between real GE and real GDP for three versions of Wagner's hypothesis, because the calculated *F*-statistic is greater than the critical values of upper bound (given in Pesaran et al. 2001) for Peacock and Wiseman and Gupta at the 10% level of significance and for Musgrave at the 1% level of significance. Gupta and Musgrave demonstrate a bi-direction relationship while Peacock and Wiseman show a unidirectional relationship. The *F*-statistic of the Goffman model is insignificant at all levels, implying the variables are not cointegrated.

Long-run and Shortrun Estimation of the Model

Long-run relationship

Presented in Table 4 are the results of the long-run coefficient of the four versions of Wagner's hypothesis. The result shows that the government expenditure coefficient for the Peacock and Wiseman model is significant at the 1% level while that of Musgrave model is significant at the 5% level. Two versions (Peacock-Wiseman and Gupta) have positive sign coefficients. Based on two versions, a 1% increase in GDP (per capita GDP) would result in a 0.92% and 0.46% increase in the GE (per capita GE) for the Peacock-Wiseman and Gupta models, respectively. The first one suggests that with increasing GDP, GE also increases, but GE is inelastic to GDP. In the Musgrave model, the impact is negative, showing a *contradicting* result to the Wagner's hypothesis (but it conforms to the inelastic GE from Peacock-Wiseman model). In the model of Goffman the long-run coefficient is insignificant at all levels, which confirms the earlier results of the cointegration test.

Table 4
Estimated Long-Run Statistic Using ARDL Approach

Model	Dependent variable	Independent variable	Coefficient	Std. Error	p-value
Peacock-Wiseman	*LnRGE*	*LnRGDP_ L1.*	0.9183***	0.0824	0.000
Gupta	*Ln(RGE/Pop)*	*Ln(RGDP/Pop)_L1.*	0.4550	0.2848	0.118
Goffman	*LnRGE*	*Ln(RGDP/Pop)_ L1.*	-19.9596	333.2296	0.953
Musgrave	*Ln(NGE/NGDP)*	*LnRGDP_ L1.*	-0.1845**	0.0781	0.023

Source: Own computation
* Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level

Table 5
Estimated Short Run Statistic Using ARDL Approach

Model	Dependent variable	Independent variable	Coefficient	Std. Error	p-value
Peacock-Wiseman	*LnRGE*	*LnRGE_LD.*	0.05244	0.0779	0.505
		LnRGE_ L2D.	0.05444	0.0774	0.486
		LnRGE_L3D.	0.17038**	0.0744	0.028
		LnRGDP_D1.	0.94613***	0.0818	0.000
		ADJ_LnRGE_L1.	-0.23340***	0.0792	0.006
		_cons	-0.23824	0.2205	0.287
Gupta	*Ln(RGE/Pop)*	*Ln(RGDP/Pop)_ D1.*	0.85642***	0.0777	0.000
		ADJ_Ln(RGE/Pop)_L1.	-0.15423**	0.0713	0.037
		_cons	-0.90208***	0.2893	0.003
Goffman	*LnRGE*	*Ln(RGDP/Pop) _D1.*	0.84657***	0.0870	0.000
		ADJ_LnRGE_L1.	-0.00357	0.0543	0.948
		_cons	-0.48070	1.2486	0.702
Musgrave	*Ln(NGE/NGDP)*	*LN_RGDP _D1.*	-0.03693**	0.0152	0.020
		ADJ_Ln(NGE/NGDP) _L1	-0.20019**	0.0768	0.013
		_cons	0.00256	0.1462	0.986

Source: Own computation
* Significant at 10% level; **5% Significant at level; *** Significant at 1% level

Short-Run Error Correction Model (ECM)

In this section, we present the short-run dynamics of the variables in ECM. Accordingly, the short-run versions of ARDL models were estimated and the respective results are reported in Table 5. Note that the ECM coefficient is reported as adjustment variable in STATA. The ECM model has two important parts: estimated short-run coefficients and the adjustment variable coefficient. The adjustment variable provides the feedback and/or speed of adjustment from short-run to long-run equilibrium. There are two important things about the adjustment variable. The coefficient should be significant and it must be negative, so that it provides further proof of a stable long-run relationship (Shahbaz & Rahman 2010). The results of the short-run model show that adjustment is acceptable in all versions except that of Goffman, which has the expected negative sign but is not significant at any usual level of significance. In the case of Peacock-Wiseman the coefficient is positive and significant, implying divergence from the long run equilibrium. In case of Goffman, the adjustment coefficient is negative as well as insignificant, thus we cannot rely on adjustment for short-run adjustment.

Diagnostic Tests

The model was further subjected to diagnostics to ascertain the appropriateness of the ARDL model. The diagnostic tests (see Table 6) involved checking for normality (Shapiro-Wilk W test for normal data), serial correlation (Breusch-Godfrey LM test), the autoregressive conditional heteroskedasticity (ARCH Test – Breusch-Pagan/Cook-Weisberg test) and finally the functional form of the model for omitted variables (Ramsey RESET test). Based on the results of different diagnostic tests, the statistics reported depict that the models (except for the otherwise insignificant Goffman model) are fit to be used for the estimation purpose since the model show that there is an absence of autocorrelation, functional form misspecification, and heteroskedasticity in the models and the errors follow the normal distribution, since the p-values in all tests are greater than 0.05.

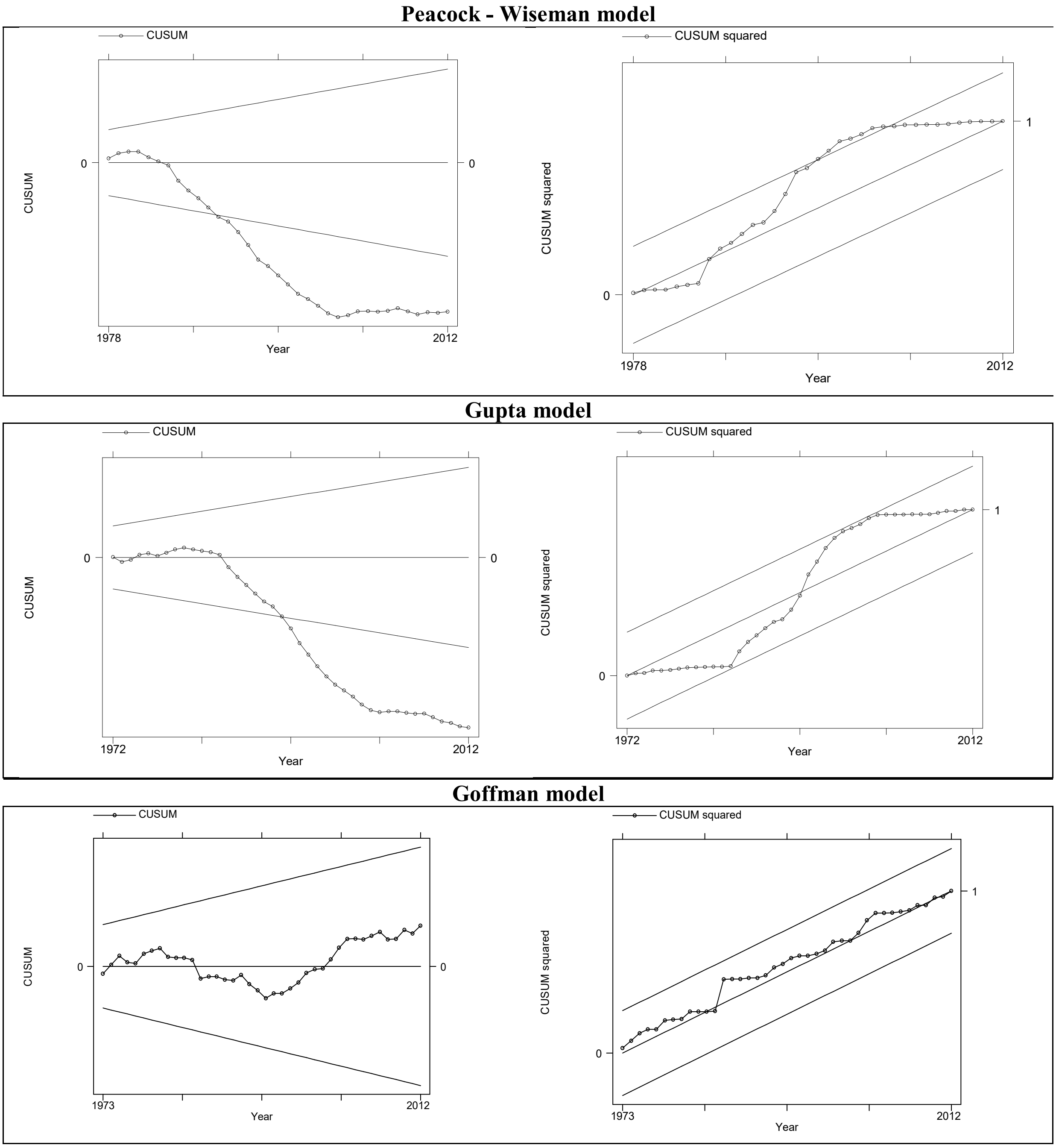
Table 6
Results of Diagnostic Tests at constant prices

Model	Dependent variable	Normality test	LM test	ARCH test	RESET test
Peacock-Wiseman	$LnRGE$	0.95684 (0.11373)	0.006 (0.9385)	0.018 (0.8931)	1.62 (0.2046)
Gupta	$Ln(RGDP/Pop)$	0.96124 (0.13615)	0.012 (0.9145)	0.051 (0.8220)	1.33 (0.2787)
Goffman	$LnRGE$	0.93566** (0.01494)	0.319 (0.5722)	0.17 (0.6801)	1.23 (0.3121)
Musgrave	$Ln(NGE/NGDP)$	0.97699 (0.50302)	0.017 (0.8950)	1.33 (0.2487)	0.51 (0.6747)

Source: Own computation
* Significant at 10% level; **5% Significant at level; *** Significant at 1% level

Stability Test Using CUSUM and CUSUM Square

The coefficient stability of any model is considered to be crucial (Adil et al. 2016). The coefficient stability is tested by plotting the CUSUM and CUSUM squares. Under the null hypothesis, the statistic is drawn from a distribution called the CUSUM distribution. If the calculated CUSUM statistics appear to be too large to have been drawn from the CUSUM distribution, we reject the null hypothesis (of model stability). The output will be a graph of the CUSUM statistics and bands representative of the bounds of the critical region for a test at the 5% significance level. In all the graphs shown in Figure 1, the straight lines represent critical bounds at the 5% significance level and since the plots of these two tests do not cross the critical value line in the Goffman and Musgrave models, this implies that there is a stable long-run relationship between GE/GDP ratio and per capita GDP.



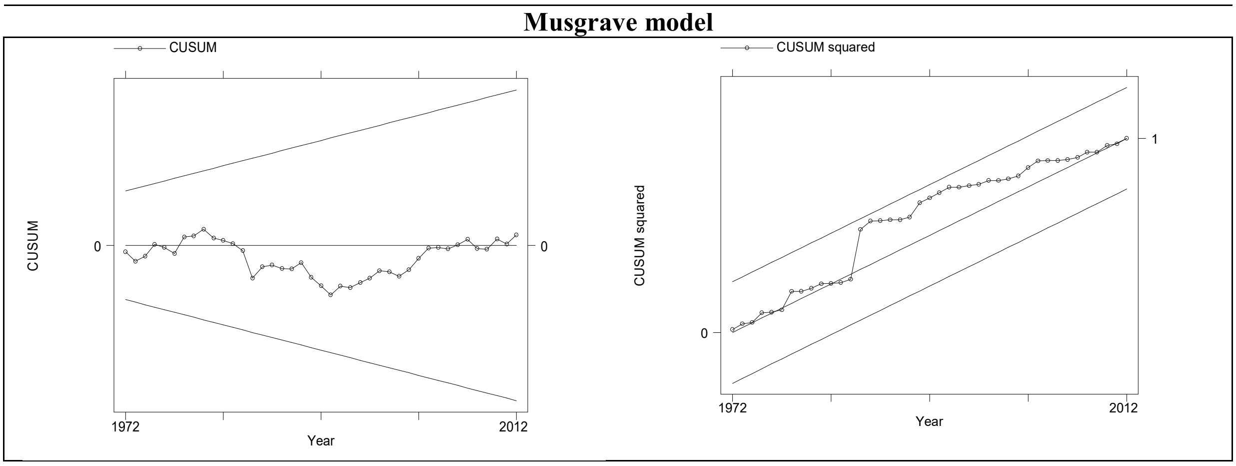


Figure 1. CUSUM and CUSUM square test results

CONCLUSION

This paper focuses on analyzing the relationship between government expenditures (GE) and economic growth in Kenya. More specifically, the study focuses on addressing the questions of whether the available Wagner hypothesis interpretations are relevant to the case of Kenya, by how much government expenditures change with GDP in the long run and by how much in the short run, and whether the relation between government expenditures and GDP is strong over time. An Autoregressive-Distributed Lag (ARDL) model that combines long and short run into a single equation was adopted. The ARDL approach was selected because of its flexibility and because it can be applied when the variables are of a different order of integration. The ARDL model for real GE and real GDP was fitted and results were subjected to various statistical and stability tests. Only the Musgrave model survived all significance and diagnostic tests, suggesting the rejection of Wagner's hypothesis for the economy of Kenya. The Peacock-Wiseman model's parameters also suggest the inelasticity of government expenditures on GDP in the long run.

With respect to the Musgrave version, the relationship between government spending and real GDP was found to be negative and significant with the causality running from real GDP to the relative value of nominal government expenditure, meaning that the results contradict Wagner's hypothesis. One of the reasons for this finding is poor governance and the persistence of high levels of corruption (Kempe 2014) that tend to have become more common in the Kenyan economy in the recent past three decades. Another possible cause for the negative relation could be associated with what Mitchell (2005) referred to as 'extraction cost'. The Kenyan government has been experiencing costly financing choices (especially for long-term infrastructural facilities such as roads, standard rail gauge, etc., constitutional implementation of a devolved system of government, and free primary education and health services), but all of the options used to finance government spending, such as increasing taxes, internal and external borrowing have adverse consequences in the short run (GoK 2007; Mutua 2012). Although Kenya has been showing progressively positive economic growth, posting a growth rate of 6% in the past five years, the gap between the GDP growth and GE expenditure has been widening, hence the negative relationship.

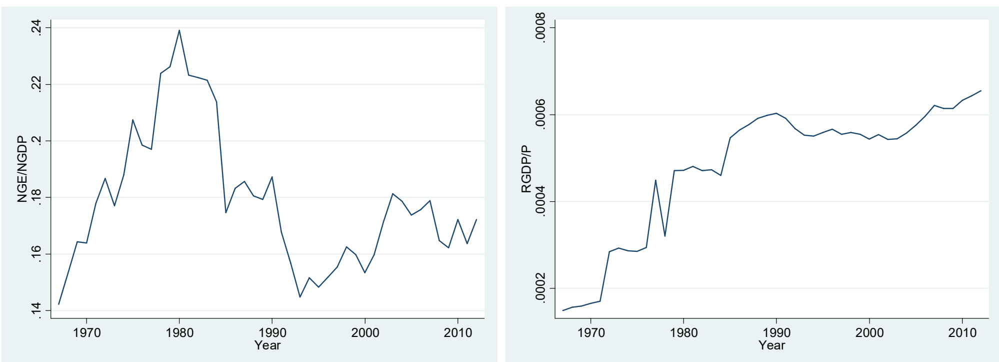


Figure 2. Government expenditures/GDP and real per capita GDP in Kenya

From 1967 to 1990 the per capita GDP increase was positive, which could be associated to moderate population growth, but the high population growth rate currently experienced in Kenya has exerted pressure on the economic performance of Kenya, causing widespread economic distortion. The high population growth creates pressures on limited natural resources, reduces private and public capital formation, and diverts additions to capital resources to maintaining rather than increasing the stock of capital per worker. As a result, the ratio of real GDP to real GE growth is modestly incomparable to the per capita GDP in the short term, but faster growth in the longer term is predicated on the assumption that the present infrastructure push will successfully addresses key bottlenecks (IMF&IDA 2016). Clearly, Figure 2 shows the increase in the ratio of government expenditure to GDP from the 1970s to around 1990, but due to population pressure against limited resources, a negative sign switch was experienced from early 1990s. A policy intervention requires a proper measure of cost and benefits of various governments spending in this respect and a clear set of specified criteria for deciding the allocation of resources to avoid arbitrary allocations and rent seeking by promoting transparency and accountability.

From the findings of this study, it is important to explore further what portfolio of government spending outlays would be ideal for growth to support resource constrained governments in optimal resource allocation and prioritization of expenditure. Thus, an important avenue for future research could be to extend the ARDL regression framework so as to account for the effect on economic growth of government spending choices on key Kenyan economic sectors, namely agriculture, defense, education, health, social security, transportation and communication (as Dritsakis & Adamopoulos 2004 did). Such research should also be extended to compare other interpretations of the Wagner hypothesis.

REFERENCES

ADIL M. H., GANAIE A. A. & KAMAIAH B. (2016). Wagner's Hypothesis: An Empirical Verification. IIM Kozhikode Society & Management Review, 6(1), 1–12. http://dx.doi.org/10.1177/2277975216667095

ARASA, R. & K' OBONYO, P.K. (2012). The relationship between strategic planning and firms Performance. International Journal of Humanities and Social Sciences, 2(22), 201-213.

ARPAIA, A. & TURRINI, A. (2008). Government expenditure and economic growth in the EU: long-run tendencies and short-term adjustment. Economic paper 300. http://dx.doi.org/10.2765/22776

BANEREJEE, A., GALBABRAITH, W., DOLADO, J.J., & HENDRY, D.F. (1993). Cointegration, error-correction, and econometric analysis of nonstationary data. London: Oxford University Press.

BARTHA, Z., & SÁFRÁNYNÉ GUBIK, A. (2012). The significance of fiscal space in Europe's response to the crisis. In: B. Farkas, & J. Mező (Eds.), Crisis Aftermath: Economic policy changes in the EU and its Member States. (pp. 170-181.) Szeged: Faculty of Economics and Business Administration, University of Szeged.

BIEHL, D. (1998). Wagner's Law: An Introduction to and a Translation of the Last Version of Adolph Wagner's Text of 1911. Public Finance / Finances Publiques, 53(1), 102-111.

DICKEY, D. A., & FULLER, W.A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. Econometrica, 49(4), 1057-1072. http://dx.doi.org/10.2307/1912517

DICKEY, D., & FULLER, W. (1979). Distribution of the estimators for autoregressive time series with a Unit Root. Journal of the American Statistical Association, 75(2), 427-431. http://dx.doi.org/10.2307/2286348

DRITSAKIS, N., & ADAMOPOULOS, A. (2004). A causal relationship between government spending and economic development: an empirical examination of the Greek economy. Apllied Economics, 36(5), 457-464.

ENGLE, R. F., & GRANGER, C. W. (1987). Co-integration and error correction: Representation, estimation, and testing. Econometrica: Journal of the Econometric Society, 55(2), 251–276. http://dx.doi.org/10.2307/1913236

FLORIO, M., & COLAUTTI. S. (2005). A logistic growth theory of public expenditures: A study of five countries over 100 years. Public Choice, 122(3), 355-393. http://dx.doi.org/10.1007/s11127-005-3900-y

GISORE N., KIPROP S., KALIO A., OCHIENG J., & KIBET L. (2014). Effect of government expenditure on economic growth in east Africa: A disaggregated model. European Journal of Business and Social Sciences, 3(8): 289 – 304. Retrieved: May 2017: http://www.ejbss.com/recent.aspx-/

GOFFMAN, I. J. (1968). On the Empirical Testing of Wagner's Law: A Technical Note. Public Finance, 23, 359-364.

GOFFMAN, I. J., & MAHAR D. J. (1971). The Growth of Public Expenditures in Selected Developing Nations: Six Caribbean Countries 1940-1965. Public Finance/ Finances Publiques, 26, 57-74.

GOK (Government of Kenya). (2007). Employer's guide to pay as you earn tax. Government printer, Kenya revenue authority 57p. Retrieved: May 2017: http://www.kra.go.ke/incometax/pdf/PAYEGUIDE11-1-07.pdf

GOK (Government of Kenya). (2010). The Constitution of Kenya, 2010. Published by the National Council for Law, Kenya. Retrieved: June 2017: http://www.icla.up.ac.za/images/constitutions/kenya_constitution.pdf

GUPTA, S. P. (1967). Public Expenditure and Economic Growth: A Time-Series Analysis. Public Finance Review, 22, 423-471.
HASSLER, U., & WOLTERS J. (2006). Autoregressive distributed lag models and cointegration. Allgemeines Statistisches Archiv, 90(1), 59–74. http://dx.doi.org/10.1007/s10182-006-0221-5
IMF (International Monetery Fund). (2017). Report by the International Monetary Fund for Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda on Population, GDP, GDP per capita. Retrieved: June 2017: http://www.imf.org/external/country
JOHANSEN, S. (1991). Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models. Econometrica, 59(6), 1551–1580. http://dx.doi.org/10.2307/2938278
JOHANSEN, S. (1995). Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. Oxford: Oxford University Press.
JOHANSEN, S., & JUSELIUS, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration-With Applications to the Demand for Money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210. http://dx.doi.org/10.1111/j.1468-0084.1990.mp52002003.x
KEMPE, R. H. (2014). Kenya's corruption problem: causes and consequences. Journal of Commonwealth & Comparative Politics, 52(4), 493–512. http://dx.doi.org/10.1080/14662043.2014.955981
JIRANYAKUL, K., & BRAHMASRENE, T. (2007). The relationship between Government Expenditure and Economic Growth in Thailand. Journal of Economics and Economic Education Research, 14, 93-104.
KNOOP, T. A. (1999). Growth, Welfare, and the Size of Government. Journal of Economic Inquiry, 37(1), 103-119. http://dx.doi.org/10.1111/j.1465-7295.1999.tb01419.x
KOTOSZ, B. (2006). Fiscal expenditures and the GDP – Interdependencies in transition. Statisztikai Szemle, 84(10), 18-40.
KOTOSZ, B., & PEÁK, A. (2013). Economic Growth and Fiscal Expenditures in Hungary – Stylized Facts Based on VAR Modelling. Tér-Gazdaság-Ember. 1(3), 55-73.
KOTOSZ, B. (2016). Transzformáció, recesszió és költségvetési politika Kelet-Európában. Saarbrücken: GlobeEdit. (Transformation, recession, and Fiscal Policy in Eastern Europe)
LAURENCESON, J. & CHAI, J. (2003). Financial Reform and Economic Development in China. Cheltenham: Edward Elgar.
MAGABLEH, M. A. (2006). A theoretical and empirical analysis of the Wagner hypothesis of public Expenditure growth. A thesis submitted to the School of economics and finance, University of Western Sydney. Retrieved: May 2017: http://researchdirect.westernsydney.edu.au/islandora/object/uws:3718
MANN, A. J. (1980). Wagner's Law: An Econometric Test for Mexico: 1925-1976. National Tax Journal, 33, 189-201.
MELLÁR, T. (2001). Kedvezményezett vagy áldozat: A GDP és a költségvetési kiadások kapcsolata. Statisztikai Szemle, 79(7), 573–586. (Predator or prey? The relationship of the GDP and the government expenditures)
MUSGRAVE, R. (1959). The theory of public finance. New York: McGraw-Hill
MITCHELL, D. J. (2005). The Impact of Government Spending on Economic Growth no. 1831, published by heritage foundation. Retrieved: May 2017: http://www.heritage.org/budget-and-spending/report/the-impact-government-spending-economic-growth.
MUSYOKI, H. K. (2010). Government expenditure and economic growth in KENYA: 1963-2008. Thesis submitted to University of Nairobi, School of Economics. http://erepository.uonbi.ac.ke/bitstream/handle/11295/3426/MUSYOKI%20_Government%20expenditure%20and%20economic%20growth%20in%20Kenya%3A%201963-2008?sequence=1&isAllowed=y
MUTHUI, J. N., KOSIMBEI G., MAINGI J., & THUKU G. K. (2013). The Impact of Public Expenditure Components on Economic Growth in Kenya 1964-2011, International Journal of Business and Social Science, 4(4), 233-253.
MUTUA, J. M. (2012). A citizen's handbook on taxation in Kenya. Nairobi: Institute of Economic Affairs.
IMF&IDA (International Monetary Fund and the International Development Association). (2016). Kenya second reviews under the stand-by arrangement and the arrangement under the standby credit facility, and requests for a new twenty-four month stand-by arrangement, and a new twenty-four month arrangement under the standby credit facility – debt sustainability analysis update. Retrieved: May 2017: https://www.imf.org/external/pubs/ft/scr/2016/cr1685.pdf
OKTAYER, A., & OKTAYER, N. (2013). Testing Wagner's law for Turkey: Evidence from a trivariate causality analysis. Prague Economic Papers, 2, 284–301. http://dx.doi.org/10.18267/j.pep.452
PEACOCK, A. T., & J. WISEMAN (1961). The Growth of Public Expenditure in the United Kingdom. Princeton: Princeton University Press.
PERSSON, T., ROLLAND G., & TABELLINI G (2000). Comparative Politics and Public Finance. Journal of Political Economy, 108, 1121–1161. http://dx.doi.org/10.1086/317686
PESARAN, M. H., & PESARAN, B. (1997). Working with Microfit 4.0: Interactive Econometric Analysis. Oxford: Oxford University Press.

PESARAN, M. H., SHIN, Y., & SMITH, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289–326. http://dx.doi.org/10.1002/jae.616

PHILLIPS, P. C. B., & PERRON, P. (1988). Testing for a Unit Root in Time Series Regression. Biometrika. 75 (2): 335–346. http://dx.doi.org/10.1093/biomet/75.2.33.

PRYOR, F. L. (1968). Public Expenditures in Communist and Capitalist Nations. London: George Allen & Unwin Ltd.

RAMSEY, J. B. (1969). Tests for specification errors in classical linear least squares regression analysis. Journal of the Royal Statistical Society, 31(2), 350−371.

SHAHBAZ, M., & RAHMAN, M. M. (2010). Foreign capital inflows growth nexus and role of domestic financial sector: An ARDL co-integration approach for Pakistan. Journal of Economic Research, 15(3), 207–231.

SIMIYU C. N. (2015). Explaining the Relationship between Public Expenditure and Economic Growth in Kenya using Vector Error Correction Model (VECM). International Journal of Economic Sciences, 4(3), 19-38. http://dx.doi.org/10.20472/ES.2015.4.3.002.

TANZI, V., & SCHUKNECHT, L. (2000). Public Spending in the 20th Century: A Global Perspective. Cambridge: Cambridge University Press.

ZAGLER, M., & DÜRNECKER, G. (2003). Fiscal Policy and Economic Growth. Journal of Economic Surveys, 17(3), 397-418. http://dx.doi.org/10.1111/1467-6419.00199