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Economic growth and government expenditures in Africa: panel data analysis

Abstract

The main aim of this paper is to investigate whether Wagner's law holds in African countries. The authors use panel data for 30 African countries for the period from 1990 to 2005. The models used in this paper include the pooled ordinary least square (OLS), fixed effect model (FE) the random effect model (RE). Based on the results of the models, the study confirms that there is a strong support for Wagner's law in African countries under investigation. This finding was robust to different estimation techniques used.

Keywords: economic growth, government expenditure, Wagner's law, Keynesian theory, panel data analysis.
JEL Classification: O41.

Introduction

There has been an intense debate about the relationship between public expenditure and national income. Two main approaches have characterized this debate. On the one hand, Wagner's Law states that an increase in government spending is the result of an expansion of national income. On the other hand, the Keynesians view claims that increase in national income is the result of government expenditures. This paper focuses on the former view which states that, when the economy of any given country develops, the activities of the government also increase significantly (Henrekson, 1993). According to Arora and Verma (2010), Wagner's law is an important instrument that explains complementarity that exists between economic growth of a given country and a significant increase in the demand for public services which include, among others, basic accommodation, education, defence, wages and salaries, government owned vehicles, water and electricity, waste disposal, transport infrastructure including road maintenance, safety and security that is under-taken by the government.

Despite the extensive empirical studies that have examined the validity of Wagner's law in different countries, the results have been mixed, inconsistent and inconclusive. For example, empirical analyzes by Peacock and Wiseman (1961), Mussgrave (1969), Michas (1975), Mann (1980), Ram (1987), Olomola (2004), Chang (2002), Aregbeyen (2006) as well as Goffman and Mahar (1971), Bayrak and Esen (2014), Bagdigenand and Cetintntas (2003), Singh and Sahni (1984) confirmed strong support for Wagner's law. In his paper, Chang (2002) focused on both emerging and industrialized countries for the period of 1951-1996, and found supports the validity of Wagner's Law.

For example, Ibok and Bassey (2013) investigated whether state expenditure in the Nigerian agricultural sector supported Wagner's law. The authors used annual data from the Nigerian agricultural sector for the period 1of 961-2012. Using Johansen and Juselius co-integration test, they found evidence of a long run relationship between various items of agricultural capital expenditure in Nigeria – revealed a strong support of Wagner's law in the Nigerian agricultural sector.

Reaching a similar conclusion, Verma and Arora (2010) investigated the validity of Wagner's law for the period of 1950/51 to 2007/08 in India. Accounting for the structural breaks, they found support for the Wagner's law.

On the other hand, there have been emerging threads of studies that have provided no evidence in the existence of Wagner's law. These studies include the works of Vatter and Walker (1986), Henrekson (1993), Ganti and Kolluri (1979), Hayo (1994), Murthy (1994), Babatude (2008), Chrystal and Alt (1979), Yuk (2005), Ram (1986), Bagdigen and Cetintas (2003). For example, Hondroyiannis and Papapetrou (1995) used the Johansen co-integration method for Greece, again failed to confirm support for Wagner's law. Similarly, evidence from three African countries, Ghana, Kenya, and South Africa, also find no evidence supporting Wagner's Law (Ansari et al., 1997), Rodrik (1998). Ram (1986) examines 63 countries for the period of 1950-1980 and finds limited support for Wagner's law.

In his study, Henrekson (1993) conducted an empirical analysis using two-stage co-integration for Sweden, but did not find support for the law in the case of Sweden. The author criticized studies that have found support for Wagner's law, especially those applying time-series framework, saying that these findings are likely to be spurious as they have been performed on non-stationary variables which are likely not to be co-integrated.

Afzal and Abbas (2010) investigated the applicability of Wagner's law in Pakistan for the period from

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1960 to 2007 using time-series econometrics techniques. After including the fiscal deficit and population growth, their results varied across time. More specifically, while the study did not find support for Wagner's law for the period (1961-2007, 1973-1990, 1991-2007), Wagner's law was supported during period of 1981-1991.

Halicioglu (2003) examined the validity of Wagner's law for Turkey over the period of 1960-2000. The author employed time-series econometrics procedure to investigate the hypothesis that in the course of economic development, there is an increase in government expenditures. Similar to other studies, Halicioglu (2003) did not find any support for Wagner's law in Turkey. Similarly, using the autoregressive distributive lag approach to co-integration in South Africa, Ziramba (2008) found no support for Wagner's law.

According to Babatude (2008), the conflicting and mixed results obtained by different studies mentioned above can be attributed to the use of different statistical methods, various datasets and the impact of different stages of economic development of countries under investigation. A large number of these studies used time-series and cross-section data analyzes when investigating the existence of Wagner's law. Some of these studies used the two-step Engle-Granger co-integration test, the Johansen maximum likehood procedure, McKinnon-White-Jack-Knife technique as well as the Dickey-Pentula sequential test. Another reason that might have contributed to the inconsistent and inconclusive results can also be attributed to the sample size and the number of controlled variables used, and these factors have created a very big gap in the literature.

The main aim of this paper is to close the research gap by critically evaluating the validity of Wagner's law in 30 African countries using panel data analysis. The paper attempts to improve the quality of the results by using the most recent and advanced econometric models. These models include the OLS, FE and RE. In recent years, no studies have used the abovementioned models in investigating the validity of Wagner's law in Africa. The remaining sections are organized as follows: section 2 provides a brief mathematical formulation of Wagner's hypothesis. section 3 of the paper provides a detailed analysis of the research methodology used in evaluating the validity of the hypothesis, and section 4 presents the empirical finding and section 5 provides the summaries and then the conclusion.

1. Ways of testing Wagner's law

Wagner's law is not easy to test. This point has been noted by a number of scholars in this field. For example, Gandhi (1971) has argued that the imprecise nature of the Wagner's law has led to the development of five different versions of it. Reaching a similar conclusion, Dutt and Ghosi (1997) pointed out that, Wagner's fail to express his hypothesis in a mathematical form, has necessitated a large number of researchers to use different mathematical models to test the validity of his hypothesis. Six versions of the Wagner's law that have been empirically investigated are presented in Table 1 below:

Table 1. Versions of Wagner's law

	Version	Regression equation
1	Peacock-Wiseman (19961)	*LNGE = a + bLNGDP + ut*
2	Gupta (1967)	*LN(GE/P) = a + bLN(GDP/P) + ut*
3	Goffman (1968)	LNGE = *a* + *b*LN(GDP/P) + *ut*
4	Pryor (1969)	LNGCE = *a* + *b*LNGDP + *ut*
5	Musgrave (1969)	LN(NGE/NGDP) = *a* + *b*LN(GDP/P) + *ut*
6	Mann (1980)	LN(NGE/NGDP)= *a* + *b*LNGDP + *ut*

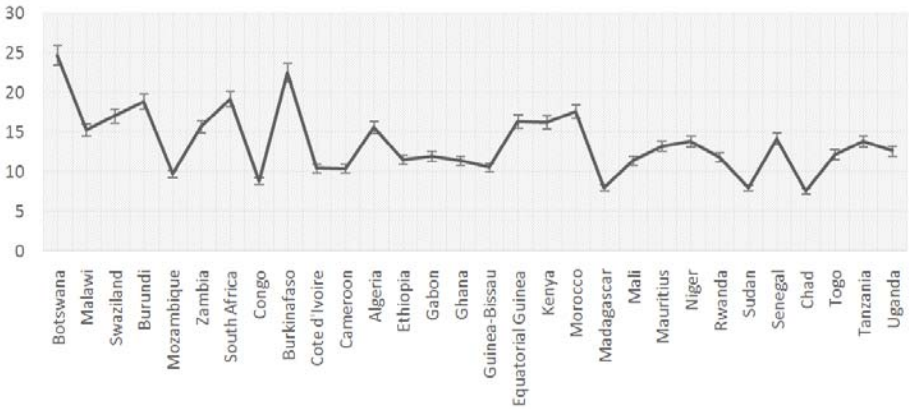
Source: Demirbas, 1999.

Where: *GE* = government expenditures, *GDP* = Gross Domestic Product, *GCE* = government consumption expenditures, *LN* = Natural logarithm, *NGE/NGDP* = share of real total Government expenditures in real *GDP, GE/P* = Government Expenditures per capita, *ut* = error term and *P* = population. Although there is no consensus regarding the most appropriate functional form, some important scholars in this field, such as Ram (1987), Khan (1990), Murthy (1993), Henrekson (1993), Hsieh and Lai (1994) have used the Musgrave (1969) version, which is considered the most appropriate functional form by Michas (1975). Following the existing literature in this field we test the Wagner's Law by using the Musgrave version.

2. Amount of government spending in African economies

It can be reasonably argued that the amount of government spending as a percentage of GDP reflects underlying expectations about the role that government plays in an economy. Perhaps unsurprisingly spending as a share of GDP varies significantly across African countries as shown in Figure 1. Chad, Sudan and Madagascar are at the low end with government spending at 7.5, 8.0 and 8.0 percent of GDP respectively, while Botswana is on the high end with 24.7 percent government spending as a share of GDP.

Fig. 1. Average Government spending as a % of GDP, 1990-2005



Source: Own derived from the African Development Indicators database.

Placing these countries into two categories – low (less than 15%) and high (more than 15%) levels of government spending as a share of GDP for the period in question reveals that Malawi, Algeria, Zambia, Kenya, Equatorial Guinea, Swaziland, Morocco, Burundi, South Africa, Burkina Faso and Botswana are in the high spending category. Whereas, Chad, Sudan, Madagascar, Congo, Mozambique, Cameroon, Cote d'Ivoire, Guinea-Bissau, Ghana, Mali, Ethiopia, Rwanda, Gabon, Togo, Uganda, Mauritius, Niger, Tanzania and Senegal are in the low category.

3. Data and mehodology

We use the African Development Indicators data for the period of 1990-2005. Based on the availability of data, a list of 30 African countries was chosen, namely, Algeria, Zambia, Kenya, Equatorial Guinea, Swaziland, Morocco, Burundi, South Africa, Burkina Faso and Botswana, Chad, Sudan, Madagascar, Congo, Mozambique, Cameroon, Cote d'Ivoire, Guinea-Bissau, Ghana, Mali, Ethiopia, Rwanda, Gabon, Togo, Uganda, Mauritius, Niger, Tanzania and Senegal. Given the nature of the data set and previous studies on Wagner's Law, three panel data methods (i.e., pool OLS, fixed effect and random effect estimator) were used in this study. There are important reasons for using Panel models. Firstly, panel data allow both the cross-section and the time-series aspects of the data to be incorporated into the estimation. It also allows the researcher to account for any country and time invariant variables, which is not possible with a time-series study or a cross-section analysis. The dependent variable used in our paper is the natural logarithm of government expenditures as a % of GDP. More formally, the link between government expen-ditures and economic growth is specified by the following representations of the panel models:

$$lnGovt\ exp_{it} = \beta_0 + \beta_1 Economic\ growth_{it} + \pi_{it}, \quad (1)$$

$$lnGovt\ exp_{it} = \alpha_0 + \alpha_1 Economic\ growth + \pi_{it}, \quad (2)$$

$$lnGovt\ exp_{it} = \varnothing_0 + \varnothing_1 Economic\ growth_{it} + \partial_i + \pi_{it}. \quad (3)$$

In all the above three equations i represents each country and t represents each time period; $Economic\ growth_{it}$ is average annual growth for country i during period t and $lnGovt\ exp_{it}$ is the government expenditure as a % of GDP for country iduring period t. The βs are the estimated coefficients and the π it is the error term. Equation 1 was estimated using pooled OLS estimation.

One of the problems that many researchers encounter when modeling Wagners Law using pooled OLS is that it does not allow for the heterogeneity of countries. Further, it also fails to estimate country specific effects and assumes that all countries are homogenous. To account for this, the fixed effects model where the country-specific effects are considered is given by equation 3. The ∂_i are individual specific constants capturing country-specific effects. The presence of country-specific effects allows for the presence of any number of unspecified country-specific, time-invariant variables that influence the government levels.

Unspecified country-specific, time-invariant variables can also be controlled for by using the random effect method. This method differs from the fixed effect because while it acknowledges unspecified country-specific, time-invariant variables, it treats them as a random error. It may be reasonably argued that from the econometric standpoint the fixed effect is preferable to the random effects simply because it is hard to empirically imagine that the unobserved specific random effects are uncorrelated with the explanatory variables.

4. Empirical results

Table 2 presents the results for the pooled OLS, fixed effects, and random effects models. The pooled OLS model shows that the economic growth has the expected (positive) sign but does not enter the government spending regression significantly. Having reported the results based on the pooled OLS, we now turn to fixed and random effect results. Employing fixed and random effect models requires one to check which of the two models is most appropriate, because as indicated earlier on, these models are not the same – they are underpinned by different assumptions. To check the most appropriate model between fixed effects model and random effects we use Hausman specification test which compares the fixed versus random effects under the null hypothesis that the individual effects are not correlated with the other explanatory variables in the model (Hausman, 1979). If correlated (H0 is rejected), a random effect model produces biased estimators, violating one of the Gauss-Markov assumptions (Park, 2009). According to Hausman specification test results which we performed, H0 is rejected. This means that fixed effect model is more appropriate and preferred one. The results of the Hausman specification test result are shown in Table 2 below.

Table 2. Pooled OLS, random effects and fixed effects, regression results

Variables	Pooled OLS	Fixed effect	Random effect
Growth	1.4036371 (0.085)	1.309085 (0.000)	1.353511 (0.000)
Hausman test		Prob > Chi2 = 0.0151	
Countries	30	30	30
Observations	480	480	480
Period	1990-2005	1990-2005	1990-2005

Looking at the estimation results of the fixed effects model in column 2, the growth rate has a positive effect on the government expenditures with statistical significance and the size of the impact is larger than that of pooled OLS model. The results of the random effects model also suggest a positive and statistically significant effect of economic growth on government spending. Thus, our empirical results provide evidence to support the proposition in the literature that the government plays an important role in economic development.

Conclusion

In this paper, we examined Wagner's law for 30 African countries using panel data for the period of 1990 to 2005. The pooled OLS, fixed effects, and random effects models were used and all the methods of estimation provided consistent results regarding the impact of economic growth on government spending. More specifically, the results based on the fixed effects and random effects models indicate that effect of economic growth on government spending is positive and statistically significant at 1 percent level. Thus, our empirical results provide evidence to support the proposition in the literature that the government plays a crucial role in economic development. This finding is similar to those found by Cheng et al. (1997), Chang (2002) and Aregbeyen (2006). Therefore, governments in these countries need to thoroughly investigate the unnecessary expenditure – focus on specific activities which have more developmental effect.

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