THE ROBUSTNESS OF WAGNERS LAW: EVIDENCE FROM AFRICA

Mduduzi Biyase

University of Johannesburg, economics department

E-mail: mbiyase@uj.ac.za

and

Talent Zwane

University of Johannesburg, economics department

E-mail: Tzwane@uj.ac.za

Abstract

The main aim of this paper is to investigate whether Wagner's law holds in African countries. We use panel data for 30 African countries for the period 1990 to 2005. The models used in this paper include the pooled ordinary least square (OLS), fixed effect model (FE), random effect model (RE), and the Generalised Method of Moments (GMM). 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.

JEL Codes: O41

Key words: economic growth, government expenditure, Wagner's law, Keynesian theory, panel data analysis

1 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, is Wagner's Law which 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 expenditure. 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 exist 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 undertaken 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, inconsistence and inconclusive. For example, empirical analyses 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) confirmed strong support for Wagner's law. In his paper Chang (2002) focused on both emerging industrialized countries for the period 1951-1996, and found supports the validity of 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 researchers such as Henrekson (1993) conducted empirical analyses using two-stage co-integration but did not find support for the law in the case of Sweden. Similarly, Hondroyiannis and Papapetrou (1995) used the Johansen co-integration method for Greece, again failed to confirm support for Wagner's law. Furthemore, evidence from three

African countries, Ghana, Kenya, and South Africa, also find no evidence supporting Wagner's Law Ansari *et al*. (1997). Ram (1986) examines 63 countries for the period 1950-1980 and finds limited 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, different 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 analyses when investigating the existence of Wagner's law. Some of these studies used the two-step Engle-Granger cointegration 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 variable 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, RE, 2SLS and GMM. In recent years, no studies have used the abovementioned models in investigating the validity of Wagner's law in Africa. The remaining sections are organised as follows: Section 2 provide 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.

2. Analytical framework

As pointed out earlier the crux of the Wagner's law is that a change in economic activity leads to a change in government spending . More specifically, according to this law there is a positive relationship between government spending and economic activity. However, given its ambiguity Wagner's law is not easy 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 the it. Reaching a similar conclusion, Dutt and Ghosi (1997) pointed out that, Wagner's frailer 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+bLN(GDP/P)+ut**
4	Pryor (1969),	**LNGCE=a+bLNGDP+ut**
5	Musgrave (1969),	**LN(NGE/NGDP)=a+bLN(GDP/P)+ut**
6	Mann (1980),	**LN(NGE/NGDP)=a+bLNGDP+ut.**

Source: Demirbas, 1999

Where: GE = government expenditure, GDP = (gross domestic product), GCE = government consumption expenditure and P = population.

3 Empirical methodology

As pointed out in the previous section there are various formulations of the wagner's law hypothesis. Based on Gupta (1967) among others in testing the wgner's law we express government expenditure as function of GDP per capita. Using Panel data analysis we begin with the simplest specification which assume homogeneity across country and over time. This allows all observations to be pooled, and the model estimated is shown below:

3.1 Pooled OLS model

$GOV/Pit = \beta o + \beta 1(GROWTH)/Pit + \gamma it$……..…….1

Where i represents each country and t represents each time period , GOVit represents the government consumption expenditure of country i during period t, and ; Growthit is average annual growth per capita for country i during period t; and the βs are the estimated coefficients and the γit is the error term.

3.2 Fixed Effect model

The pooled OLS is clearly unrealistic as it assumes all countries have the same set of coefficients. To account for this, the fixed effects model where the country-specific effects are considered is given by equation 2. The αi 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.

GOV/Pit = βo + β1(GROWTH)/Pit + αi+ Ɣit……...…2

3.4 Random Effect model

The random effect is estimated by equation 3, where αi is the random disturbance characterizing the *i*th country and constant through time and w_t is the random disturbance characterizing the *t*th period and constant across countries. The major disadvantage of this model is driven by the assumption that, the unobserved effect is uncorrelated with the regressor variable. Following the assumption, if there is a high correlation between these terms, the estimated coefficients will be inconsistent, even though they may still yield efficient results.

GOV/Pit = βo + β1(GROWTH)/Pit + αi+ w_t + Ɣit……3

3.5 Generalised Method of Moments

When estimating the wagners law hypothesis it is important to note the possibility of endogeneity. This is because there is an alternative Keynesian theory which suggest a positive relationship between growth and government spending with the causality running from government expenditure to economic activity. Given this possibility, the association between the variables might reflect reverse causality. In order to alleviate this problem, this paper uses system GMM which is dynamic panel technique proposed by Arellano and Bover (1995). This method utilize instrumental variables in the dynamic panel analysis for lagged dependent model (Arellano and Bond, 1991). Arellano and Bond (1991) present an estimation technique that weakens the endogenous problem among variables such as lagged dependent variables. Such method takes advantage of all the lagged level variables as possible instrumental variables. In other words, as shown in the equation (4) it can mitigate

the problem of omitted variable since it can remove the individual effect with the differencing.

ΔGOV/Pit = βoΔ(Gov)it-1 +β1Δ(GROWTH)it + ΔУit……...…4

4. Empirical results

Table 2 shows the estimation results of the panel analysis discussed above. The pooled-OLS estimation result which is contained in column 2 shows that growth has a positive impact on government spending and statistically significant at 5% level. Even although the OLS estimators are biased and inconsistent we nonetheless report the results of the OLS, because we use it as a benchmark model and OLS results do give us a sense of the relationship between government spending and growth

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 result which we performed, H0 is rejected. This means that fixed effect model is more appropriate and preferred model. The results of the Hausman specification test result are shown in Table 2 below.

Table: 2, *regression results: what affect the coefficient on government spending?*

VARIABLES	POOLED-OLS	FIXED EFFECT	RANDOM EFFECT	GMM
GROWTH	1.4036371 (0.085)	1.309085 (0.000)	1.353511 (0.000)	1.24286 (0.000)
Government Expend.(-1)				0.0063592 (0.884)
Hausman Test		Prob>Chi2=0.0151		
Countries	30	30	30	30
Observations	480	480	480	420
Period	1990-2005	1990-2005	1990-2005	1990-2005

Looking at the estimation results of the fixed effects model in column 3, the growth rate has a positive effect on the government expenditure with statistical significance and the size of the impact is similar to that of Pooled OLS model. Column 4 which show the results of random effect model also present positive and significant estimate of growth on government spending. The estimation results of a dynamic panel analysis, i.e difference GMM, as discussed earlier, was used here to control for the possibility of reverse causality, between government spending and economic activity. The results show that government spending and growth are positively related – increase in growth will lead to an increase in government spending. Our study is consistent with other studies which have found strong support for the Wagner's law hypotheses. these studies include, 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).

Conclusion

This paper analyzed the relationship between Government expenditure and economic growth. The paper applied four panel data models: pooled ordinary least square (OLS), fixed effects model (FE), random effects model (RE), and generalized methods of moments (GMM) to investigate the link between growth and government spending. The results provide support for the validity of the law, and are in line with other studies such as Wiseman (1961), Mussgrave (1969), Michas (1975), Mann (1980), Ram (1987), Olomola (2004), Chang (2002), Aregbeyen (2006) as well as Goffman and Mahar (1971) which have examined the relationship between government spending and economic growth. The findings probably indicate that Wagner's law is valid for economies which are in their early phase of development.

References

Ansari, M.I., Gordon, D.V., and C. Akuamoach (1997), "Keynes versus Wagner: Public Expenditure and National Income for Three African Countries," *Applied Economics*, 29, 543-550.

Arellano, M. and O. Bover (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics 68* (1), 29–51.

Arellano, M. and S. Bond (1991, April). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *Review of Economic Studies 58* (2), 277–97.

Hsieh E, Lai KS (1994). Government Spending and Economic Growth: The G-7 Experience, Appl. Econ., 26(6): 535–542.

Babatunde, M.A. (2008), "Establishing Wagner;s Law in the West Africa Monetary Zone: Investigation Using Bounds Test," The Indian Economic Journal, Vol. 56, No. 3, pp 110-124.

Bagdigen, M. and Cetintntas, H. (2003), "Casuality between Public Expenditure and Economic Growth: The Turkish Case," Journal of Economic and Social Research, Vol. 6, No. 1, pp. 53-75.

Chang, T. (2002), "An Econometric Test of Wagner's law for six countries, based on Cointegration and Error-Correctional Modelling Techniques," Applied Econometrics, 34, 1157.

Chrystal, A. and Alt, J. (1979), Endogenous government Behaviour: wagner's law of Gottter Dammerung.

Dutt, S.D. and Ghosi, D. (1997), "An Empirical Examination of the Public Expenditure-Economic Growth Correlations," Southwest Oklahoma Economic Review, Vol. 12, No. 4, pp15-30.

Goffman, I.J. and Mahar, D.J. (1971), " The Growth of Public Expenditure in Selected Developing Nations: six Caribbean Countries 1940-1965," Public Finance , Vol. 1, pp, 58-76.

Henrekson, M. (1993), "Wagner's law – a spurious relationship," Public finance, Finances Publiques, 48 (2),423-450).

Hondroyiannis, G. and Papapetrou, E. (1995), "An Examination of Wagner's Law for Grece: a co-integration analysis. Public Finance/Finances Publiques, 50 (1), 68-80.

Mann, A.J (1980), "Wagner's law: An Econometric Test for Mexico, 1925-76" National Tax Journal, Vol.33, No. 2, pp, 201.

Michas, N.A. (1975), Wagner's law of public expennditures: What is appropriate measurement for a valid test. Public Finance/Finaces Publiques, 30 (1), 77-90.

Murthy, V.N.R. (1993), Wagner's law, spurious in Mexico or mis-specification: Public Finance/Finances Publiques, 49, (2), 295-300.

Musgrave, R.A. (1969), Fiscal Systems, New Haven and London: Yale University Press.

Olomola, P.A. (2004) "Cointegration Analysis Casuality Testing and Wagner's law; The case of Nigeria, 1970-2001" Journal of Social and Economic Development, Vol, VI, No. 1, pp, 76-90.

Peacock, A.T. and Wiseman, J. (1961), "The Growth of Public Expenditure in the United Kingdom," Cambridge: NBER and Princetown University Press.

Pryor, F.L. (1969), "Public Expenditure in Communist and Capitalist Nations. London: George Allen and Unwin Ltd.

Ram, R. (1986). "Causality between Income and Government Expenditure: A Broad International Perspective," Public Finance, 41, 393-400.

Ram, R. (1987), Wagner's hypothesis in time of series and cross section perspective: evidence from "Real" data for 115countries. Review of Economics and Statistics, 69, (2), 350-390.

Islam, A.M. (2001), "Wagner's Law Revised: Cointegration and Exogeneity tests for USA", Applied Econometric

Wagner, R.E. (1890), "Finanzwissenchaft, Leipzig: Winter, C.F.