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Economic Growth of West African Countries and the Validity of Wagner's Law: A Panel Analysis

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Abstract

The volume of public expenditure has been on the rise especially in the developing economies and this has renewed the argument among economists on the validity of Wagner's law. Whereas for Keynes, the increase is needed to stimulate aggregate demand for economic growth to take place, Wagner opine that public expenditure is a consequence rather than cause of national productivity hence; it plays no role in the growth of an economy. For the West African Economies, which of these economic concepts prevails? This study seeks to determine the validity of these theories in the sixteen countries that make up West African region using a panel analysis. The result reveals that, first, there is a bidirectional effect or relationship between government spending and economic growth in five West African countries, unidirectional causality flowing from government expenditure to economic growth in four countries, while unidirectional causality from economic growth to government expenditure were in two countries. However, there were no causal relationship between government expenditure and economic growth in the remaining five countries in West Africa. Secondly, using different versions of Wagner's law, we observed that only Goffman version is truly validated in the West African economies given the value of more than one per cent marginal effect of per capita growth on expenditure. Therefore, for the countries that respond to Keynes theory, there is need for appropriate policies with respect to government spending knowing that it affects the level of growth.

Keywords: Government expenditure, Economic growth, Wagner law, Granger causality, Panel analysis and West Africa.
JEL Classification: H50.

Contents

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1. Introduction

The volume of public expenditure has been on the rise in the developing economies if not almost all Countries of the world because of the continuous expansion in the activities of the nations and other public agencies on several fronts. Since the twentieth century, the increase in the functions of the state in social matters such as education, public health, commercial and industrial undertakings and so on, has increased public expenditure to a large extent. This increase in State expenditure is as a result of socio-political, economic and historical differences between developed and developing countries. However, the involvement of government in the activities of the State is dependent on the structure of economic development prevalent in the country under consideration. For countries that have gone pass primary and secondary level of production, the level of government expenditure will be high if compared with countries at the tertiary level of production where government spends less since the level of economic activities at this level is determine by the private sector. By and large, irrespective of production level and structure of the economy, the government is highly involved in providing an enabling environment for investors as well as provision of social amenities as a means of improving the standard of living of her citizens. This government effort towards provision of public goods which led to increase public expenditure and in the long-run economic growth is attributed to a German economist Wagner. Wagner (1883) observed that there is a strong relationship between economic growth and public spending which was later formulated as 'Wagner's Law of Increasing State Activities'. The fundamental idea behind this relationship is based on the fact that growth in public expenditure is a natural consequence of economic growth. This implies that, the percentage share of public expenditure increases with an increase in gross domestic product. This shows that, the growth elasticity of public expenditure is greater than one. According to Wagner, the reason behind the expansion of state activities is a practical approach and is not based upon any formula but rather on the expectation that government will always provide social amenities and economic goods for industrial development.

In West African countries, government over the years has made significant efforts towards welfare maximization. Therefore, the increase in State Expenditure in West African countries is needed because of three main reasons. Wagner himself identified these as (i) social activities of the state, (ii) administrative and protective actions, and (iii) welfare functions. These factors are further segment into socio-political, i.e., the state social functions expands over time: retirement insurance, natural disaster aid (either internal or external), environmental protection programs, etc., economic which involves science and technology advance, consequently there is an increase of state assignments into the sciences, technology and various investment projects, etc. and historical were the state resorts to government loans for covering contingencies, and thus the sum of government debt and interest amount grow; i.e., it is an increase in debt service expenditure.

African countries generally have a blotted public expenditure as a result of the existing low per-capita GDP, hence, the involvement of government in almost every sector of their economy. This informs the continuous yearly increase in public expenditure especially on recurrent expenditure. Despite these increases in public expenditure in the West African economies, growth has not accelerated as expected in this region and as such poverty remains widespread and pervasive, particularly in the rural areas. This calls for argument among economists to find out; what is the role of fiscal policy in inducing economic growth, redistributing income and reducing poverty in the West African economies? Could fiscal policy be designed so as to ensure economic growth and reduce poverty while maintaining macroeconomic stability in this region? Furthermore, does government spending in the West African countries contribute to economic growth and development? These are critical questions to ask given the renewed interest of targeting poverty alleviation and given that fiscal policy is the arrowhead of the policy package of most of the African countries. This study intend to focus specifically on one side (government expenditure) in achieving the following objectives; 1. To determine the nature and direction of causality between government spending and economic growth in West Africa, by testing for the Wagner's hypothesis and its reverse (Keynesian approach). 2. Determining the relationship between governments spending and economic growth in these countries. This will help to decide if the current pace of public spending in these economies is productive and should be encouraged or not. The paper has five sections; section one is the Introduction, section two contains the Literature review, section three is the Methodology, section four is Empirical results and discussion while section five is conclusion and policy recommendations.

2. Literature Review

Eberts and Gronberg (1992) in an attempt to test Wagner's hypothesis of an expanding public sector as an economy develops, made use of pooled time-series cross-sectional data for U.S. States from 1964-1986. They did a comparison of government size among fiscal jurisdictions within a single nation to reduce the problems of data comparability and of controlling for cultural and institutional differences that plague the more common international test of this theory. They concluded that the results were inconsistent with Wagner's hypothesis due to the negative relationship between public sector size and output, though they opined that some empirical support is found in the protective service and public welfare components of government activity. Lamartina and Andrea (2008) analyzed the joint development of government expenditures and economic growth in 23 OECD countries using panel co-integration. Their empirical evidence provides indication of a structural positive correlation between public spending and per-capita GDP which is consistent with the so-called Wagner's law. According to them, long-run elasticity larger than one suggests a more than proportional increase of government expenditures with respect to economic activity. Furthermore, they maintained that the correlation is usually dominant in countries with lower per-capita GDP, suggesting that the catching-up period is characterized by a stronger development of government activities with respect to economies in a more advanced stage of development.

Verma and Arora (2010) examine the validity of Wagner's law in India over the period 1950/51 to 2007/2008 by considering the six versions of Wagner's hypothesis given by different economists. The result supports the existence of long-run relationship between economic growth and growth of public expenditure. They made use of two structural breaks to test the impact of structural changes in Indian economy on the growth of public expenditure.

They also discovered that the first structural break given for mild-liberalization period causes insignificant changes in the growth elasticity of public expenditure. Also, they maintained that change in the elasticity due to the second phase of intensive liberalization is statistically significant. They concluded that empirical evidences regarding the short-run dynamics refute the existence of any relationship between the economic growth and size of the government expenditure.

Magazzino (2010) assess the empirical evidence of Wagner's law in Italy for the period 1960-2008 at a disaggregated level using a time series approach. He found a co-integration relationship for three out of five items. According to the granger causality test results, evidence exist in favour of Wagner's law only for spending for passive interests in the long-run, and for spending for dependent labour income in the short-run. Kuckuck (2012) using historical data, test for the validity of Wagner's law of increasing State of activity at different stages of economic development for five industrialized European countries of United Kingdom, Denmark, Sweden, Finland and Italy. To enable him investigate the coherence between Wagner's law and development stage, he classify every country into three individual stages of income development and apply advanced co-integration and vector error correction analyses. He discovered that the relationship between public spending and economic growth in these countries has weakened with advancement in stage of development. Therefore, evidence from the research supports the notion that Wagner's law in its pure form may have reached its limit in recent decades.

Constantinos and Persefoni (2013) attempted to analyze the causal relationship between income and government spending in the Greek economy for such a long period (1833-1938), to enable them gains some insight into Wagner and Keynesian hypotheses. According to them, the time period of the analysis represents a period of growth, industrialization and modernization of the economy, a condition which is not only conducive for Wagner's law but also to the Keynesian hypothesis. Autoregressive Distributed Lag (ARDL) co-integration method and tests for the presence of possible structural breaks were used for analysis. From their results, it was revealed that a positive and statistically significant long run causal effect exist, running from economic performance towards the public size which affirms Wagner's law in Greece, whereas for the Keynesian hypothesis some doubts arise for specific time sub-periods. Oyinlola and Akinnobosun (2013) examine the relationship between public expenditure and economic growth in Nigeria in the period 1970-2009. A disaggregated public expenditure level was employed using the Gregory-Hansen structural break co-integration technique. Their outcome confirms Wagner's law in two models in the long run and that there was a break in 1993 in which the political crisis that engulfed the nation was accountable. They also discovered that economic growth and development are the main objectives of government, especially investment in infrastructure and human resources all of which falls under social and community services, hence, there is need to maintain adequate levels of investment in social and economic infrastructure.

As indicated by Richter and Dimitrios (2012) and quoted in Udo and Effiong (2014) there are six (6) different versions of Wagner's law: Peacock and Wiseman (1967);Gupta (1967);Goffman (1968);Pryor (1968);Musgrave (1969);Goffman and Marhar (1971) and Mann (1980). These are listed below;

1. Peacock-Wiseman version

$$\boldsymbol{LGt}=\boldsymbol{a0}+\boldsymbol{a1LYt}+\boldsymbol{eta1}>1 \qquad \textbf{(1)}$$

Notes: LG is the log of real government expenditures, LGC is the log of real government consumption expenditure, LP is log of population, L(G/Y) is the log of the share of government spending in total output, L(Y/P) is the log of the per capita real output, L(G/P) is the log of the per capita real government expenditures ,L Y is the log of real GDP.

2. Peacock-Wiseman share version (Mann version)

$$(\boldsymbol{G/Y})=\boldsymbol{\beta 0}+\boldsymbol{\beta 1LYt}+\boldsymbol{et\beta 1}>0 \qquad (2)$$

3. Musgrave version

$$(\mathbf{G/Y})\mathbf{t}=\boldsymbol{\gamma 0}+\boldsymbol{\gamma 1}\ (\mathbf{Y/P})/+\boldsymbol{et\gamma 1}>0 \qquad (3)$$

4. Gupta version

$$(\mathbf{G/P})\mathbf{t}=\boldsymbol{\delta 0}+(\mathbf{Y/P})\mathbf{t}/+\boldsymbol{et\delta 1}>1 \qquad (4)$$

5. Goffman version

$$\boldsymbol{LGt}=\boldsymbol{\lambda 0}+\boldsymbol{\lambda 1}\ (\mathbf{Y/P})/+\boldsymbol{et\lambda 1}>1 \qquad (5)$$

6. Pryor version

$$\boldsymbol{LGCt}=\boldsymbol{\theta 0}+\boldsymbol{\theta 1LYt}+\boldsymbol{et\theta 1}>1 \qquad (6)$$

2.1. Structure of Public Expenditure in West African Countries: Some Stylized Facts

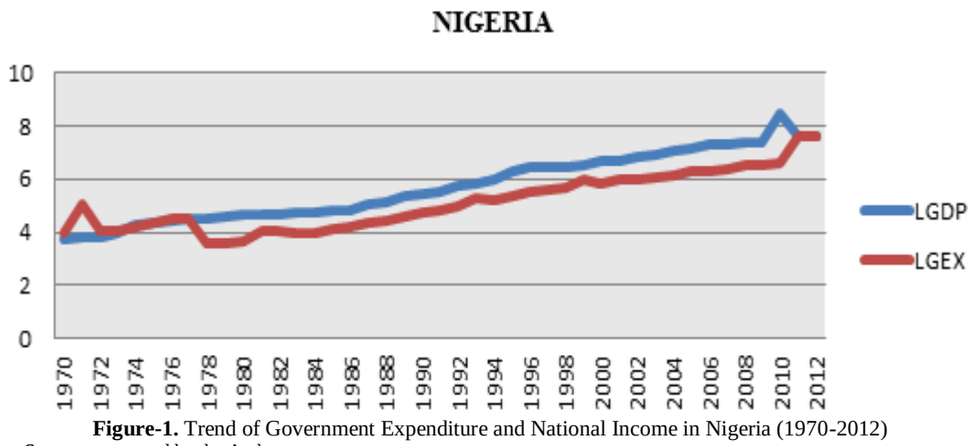

Figure-1. Trend of Government Expenditure and National Income in Nigeria (1970-2012)
Source: computed by the Authors

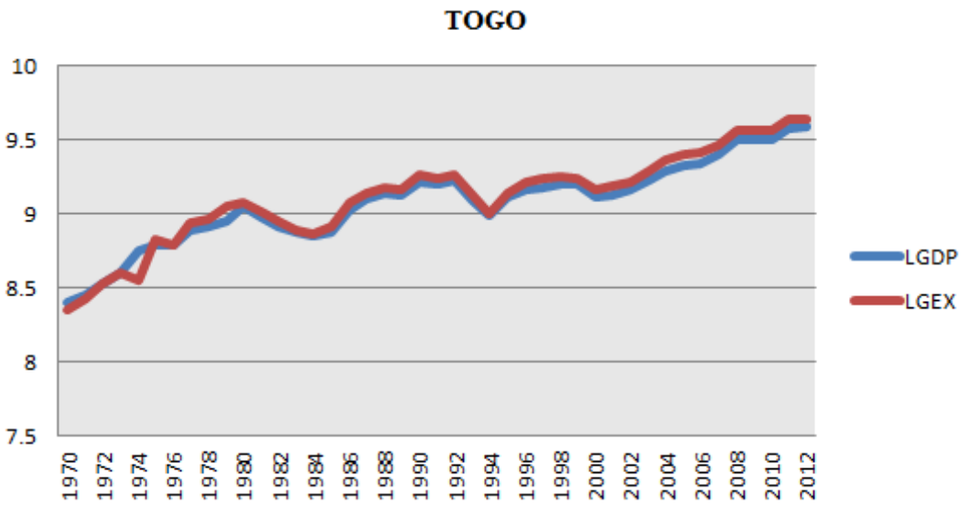

Figure-2. Trend of Government Expenditure and National Income in Togo (1970-2012)
Source: computed by the Authors

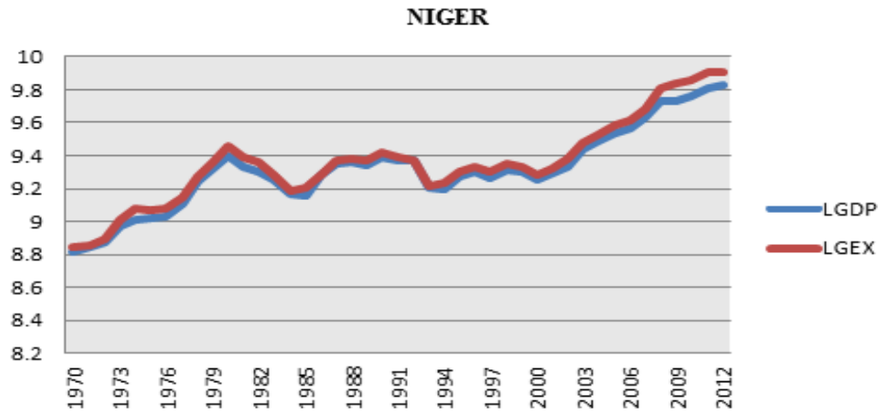

Figure-3. Trend of Government Expenditure and National Income in Niger (1970-2012)
Source: computed by the Authors

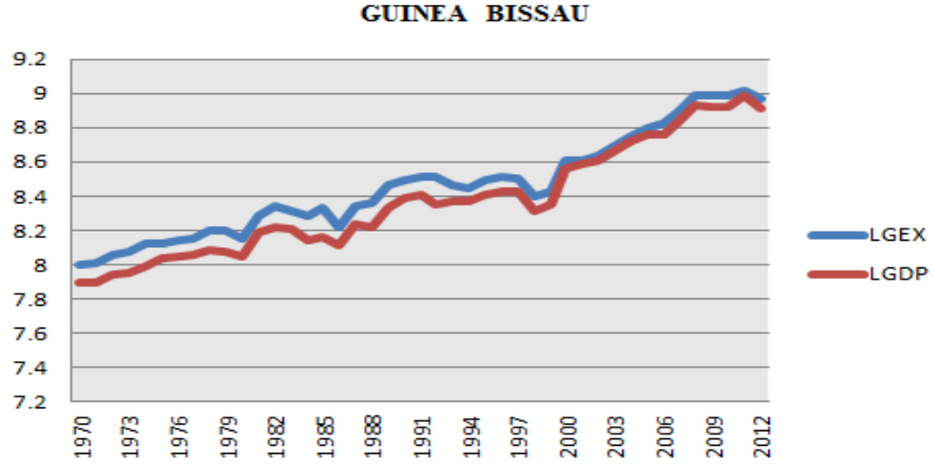

Figure-4. Trend of Government Expenditure and National Income in Guinea Bissau (1970-2012)
Source: computed by the Authors

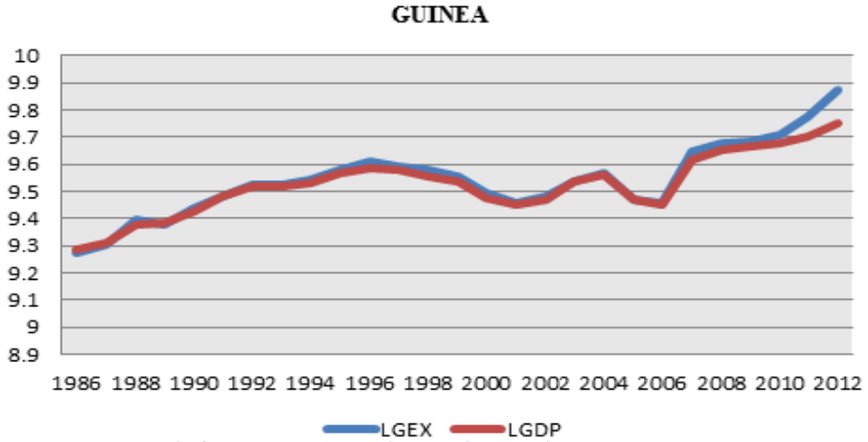

Figure-5. Trend of Government Expenditure and National Income in Guinea (1970-2012)
Source: computed by the Authors

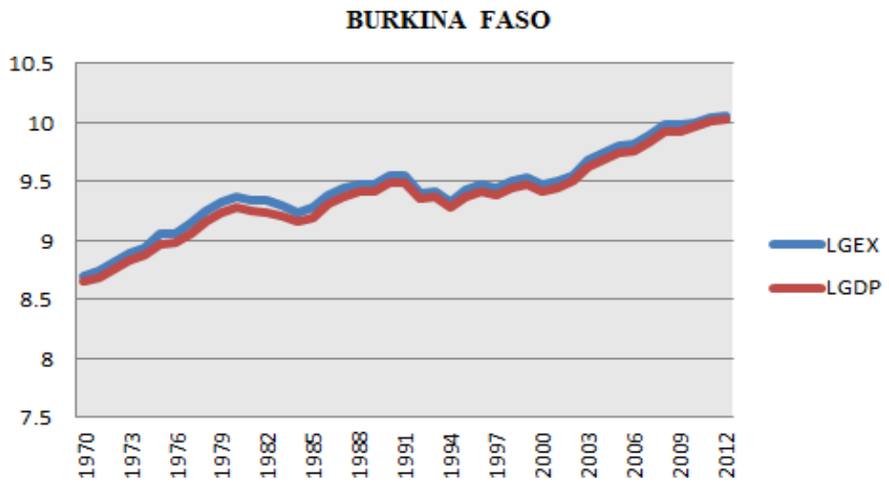

Figure-6. Trend of Government Expenditure and National Income in Burkina Faso (1970-2012)
Source: computed by the Authors

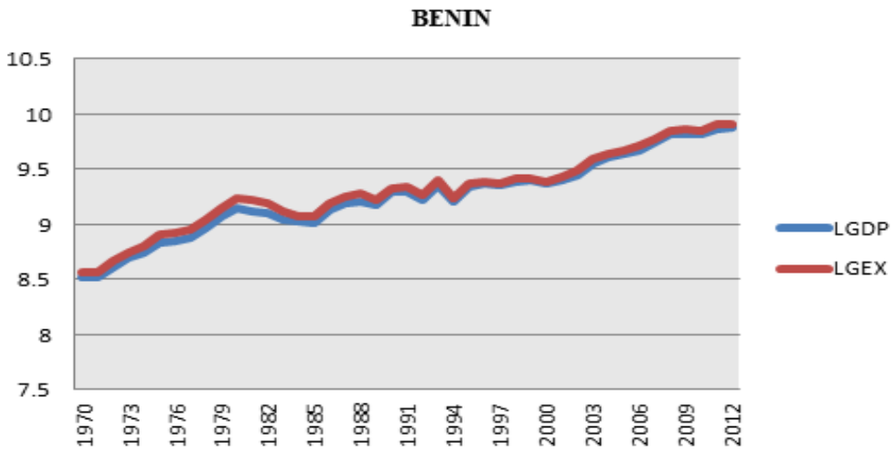

Figure-7. Trend of Government Expenditure and National Income in Benin (1970-2012)
Source: computed by the Authors

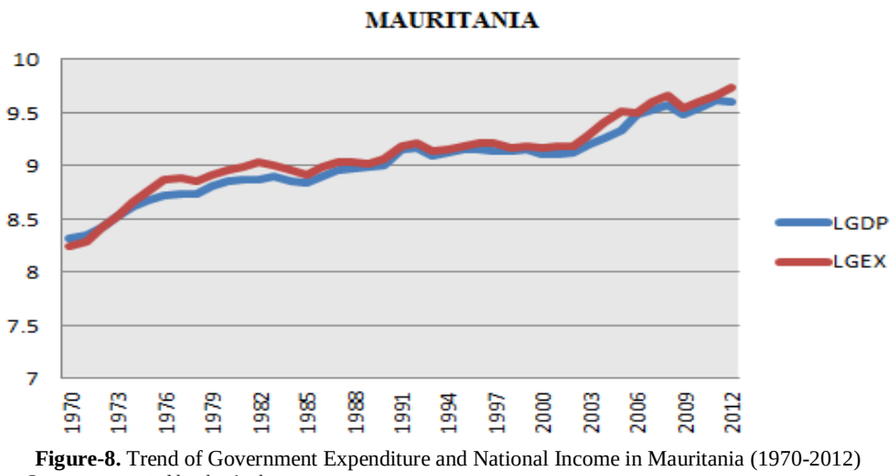

Figure-8. Trend of Government Expenditure and National Income in Mauritania (1970-2012)
Source: computed by the Authors

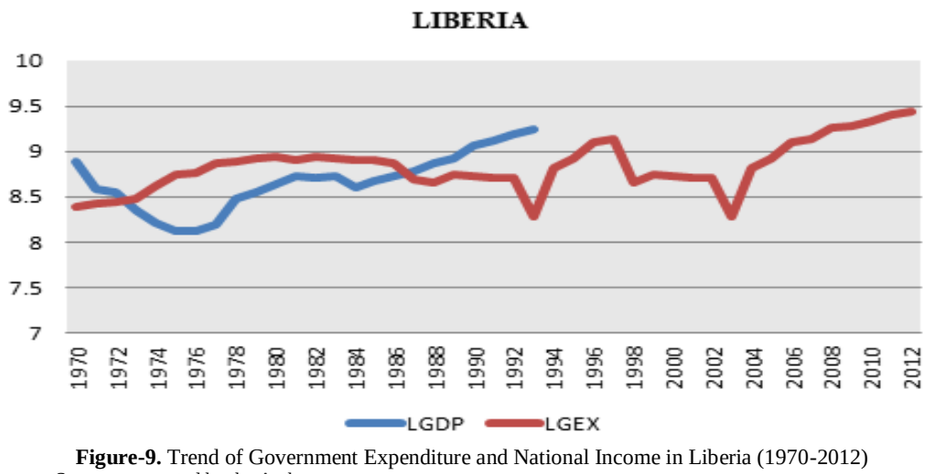

Figure-9. Trend of Government Expenditure and National Income in Liberia (1970-2012)
Source: computed by the Authors

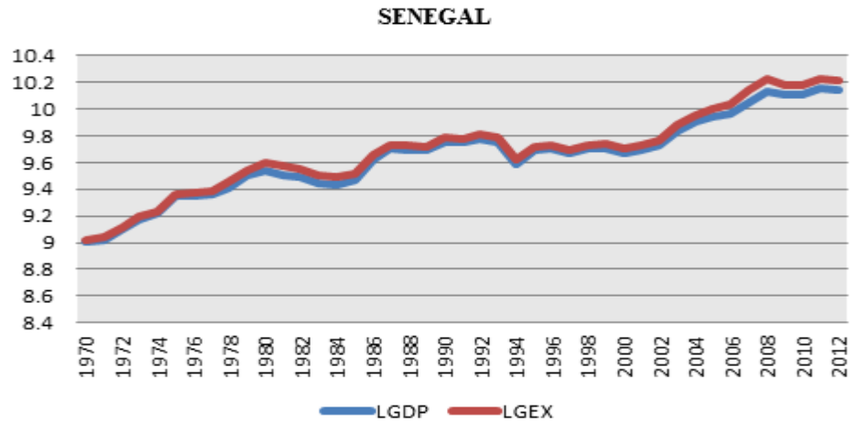

Figure-10. Trend of Government Expenditure and National Income in Senegal (1970-2012)
Source: computed by the Authors

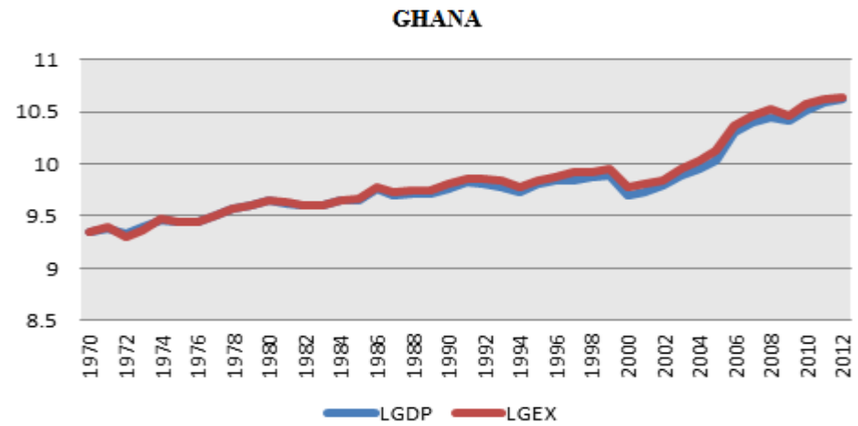

Figure-11. Trend of Government Expenditure and National Income in Ghana (1970-2012)
Source: computed by the Authors

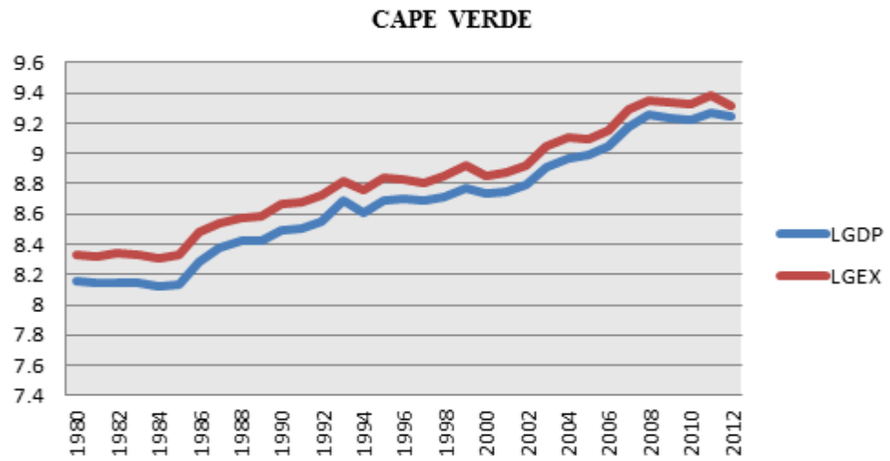

Figure-12. Trend of Government Expenditure and National Income in Cape Verde (1970-2012)
Source: computed by the Authors

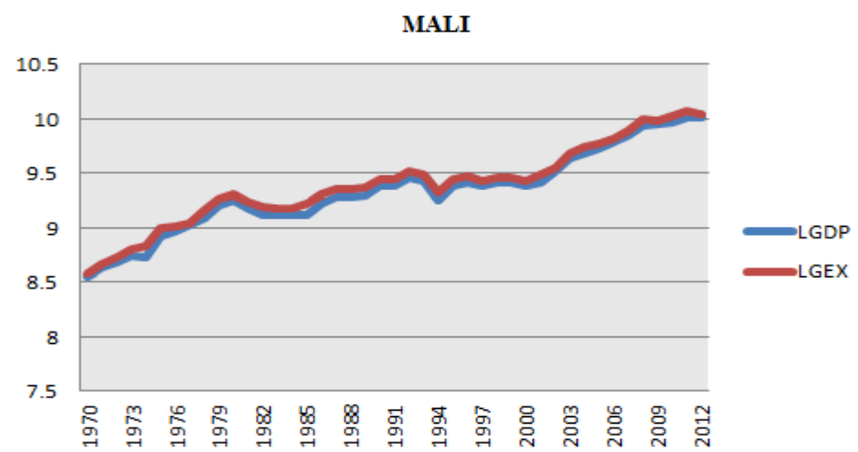

Figure-13. Trend of Government Expenditure and National Income in Mali (1970-2012)
Source: computed by the Authors

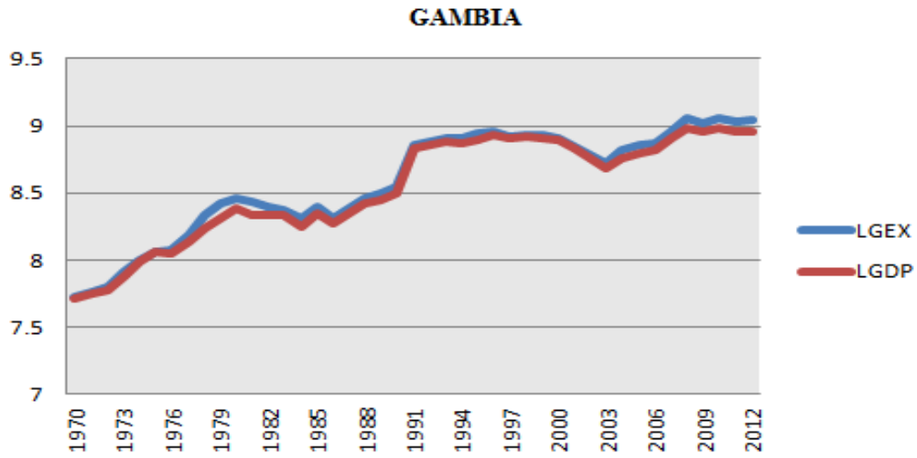

Figure-14. Trend of Government Expenditure and National Income in Gambia (1970-2012)
Source: computed by the Authors

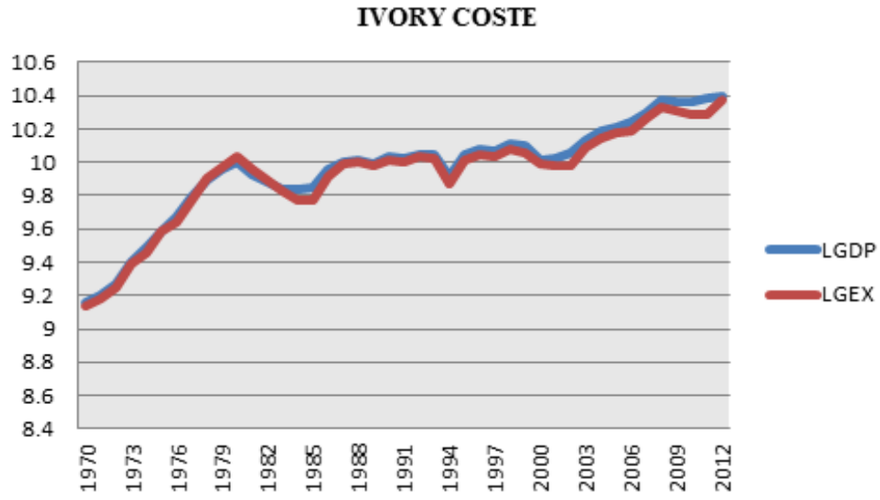

Figure-15. Trend of Government Expenditure and National Income in Ivory Coste (1970-2012)
Source: computed by the Authors

In Nigeria, national income raise above total expenditure from 1978 to 2008 and move in the same direction except from 1977 to 1980 when they move in opposite direction (negatively related). For Togo, Niger, Benin, Mauritania and Senegal the figure indicates that public expenditure exceeds their outputs but have direct relationship while Liberia shows a non correlated pattern between economic growth and government intervention.

In Ghana economy, public expenditure and economic growth have positive relationship. This is applicable to Cape Verde economy, Mali and Gambia. The figure also reveals that most of the African economies are dominated by public activities even to the extent of having fiscal deficit in a good number of West African economies.

3. Methodology and Data

This study adopts a quantitative method to evaluate the empirical evidence of the relationship between government expenditure and economic growth in West African economies to elucidate the evidence of either Wagner or Keynes theory. The method of analysis has been an econometric technique using panel regression models that is derived from various versions of Wagner's model. The data used in this study is secondary annual time series covering 1970 – 2012. The basic data for this analysis are rate of; Gross Domestic Product (GDP), government total expenditure, income per capita, population and per capita expenditure. These data were collected from the World Bank statistical record for these countries under review.

Based on the specific objectives of this study, we approached the methodology thus:

Objective 1 was analysed by using the Granger causality test to ascertain the causal relationship between government spending and economic growth in West African countries.

Objective 2 was analysed by using Panel regression analysis. This is a statistical method, widely used in social science, and econometrics, which deals with two-dimensional (cross sectional/times series) panel data. The data were collected over time and over the cross sectional individuals (West Africa) and then a regression is run over these two dimensions.

3.1. Model Specification

In this section, we postulate different models that seek to examine the existence of Wagner's hypothesis in an economy. These models will be used to examine the existence of this hypothesis in the West African economies. Our specifications of these models are based on the different versions of Wagner's hypothesis that was listed in the literature. The models are symbolically represented below:

Given a common panel data regression model to be

$$y_{it} = a + bx_{it} + \epsilon_{it}, \qquad (7)$$

Where

y is the dependent variable,
x is the independent variable,
a and *b* are coefficients,
i and *t* are indices for individuals and time,
ϵ_{it} is the error.
We experimented with the different version of Wagner's equation relating fiscal and economic growth.

1. Peacock-Wiseman version

$$\boldsymbol{LGex_{it}=a0+ a1LY_{it}+e_{it}a1>1} \quad \textbf{(1)}$$

2. Mann version

$$\boldsymbol{(Gex/Y)_{it}= \beta_0+ \beta_1 LY_{it}+e_{it}\beta 1>0} \quad \textbf{(2)}$$

3. Musgrave version

$$\boldsymbol{(Gex/Y)_{It}= \gamma_0+ \gamma_1 (Y/P)_{it} +e_{it}\gamma 1>0} \quad \textbf{(3)}$$

4. **Gupta version**

$$\boldsymbol{(Gex/P)_{it} =\delta_0 + (Y/P)_{it}+ e_{it}\delta 1>1} \quad \textbf{(4)}$$

5. Goffman version

$$\boldsymbol{LGex_{it}= \lambda_0 + \lambda_1 (Y/P)_{it} + e_{it}\lambda 1>1} \quad \textbf{(5)}$$

Where:
LGex is the log of real government expenditures of each country under review,
LP is log of population of each country under review,
L(Gex/Y) is the log of the ratio of government expenditure to total output, (GDP)
L(Y/P) is the log of per capita real output, (per capita income)
L(Gex/P) is the log of per capita real government expenditures,
LY is the log of real GDP.

4. Empirical Analysis and Discussion of Findings

4.1. Granger Causality Result

The table below shows the result of pair wise Granger causality test. From the result, it is observed that there exist a unidirectional relationship flowing from government expenditure to national output in Togo, Mauritania, Liberia and Sierra Leone economies while the opposite is the case in Guinea and Cape Verde economies. These imply that Keynes theory concerning stimulation of aggregate demand by the government holds in Togo, Mauritania, Liberia and Sierra Leone economies. Also, in Guinea and Cape Verde economies, Wagner's hypothesis exists as shown in the causality test result.

However, in Nigeria, Mali, Ghana, Gambia and Ivory Coast, the result shows that there is a bidirectional effect existing between national output (GDP) and government expenditure (GEX). According to this result, government spending influence the level of output and the growth of output in turn influence the level of government spending in these economies. Lastly, the rest of the economies in West Africa show no relationship between these key macroeconomic variables as shown in Table 1.

Table-1. Summary of Granger Causality Test

GEX → GDP	GEX ← GDP	GEX ↔ GDP	NO EFFECT
Togo	Guinea	Mali	Benin
Mauritania	Cape Verde	Ghana	Guinea Bissau
Liberia		Nigeria	Senegal
Sierra Leone		Gambia	Burkina Faso
		Ivory Coast	Niger

Source: *Computed by the Authors*
Note: GEX → GDP= unidirectional effect flowing from government expenditure.
GEX ← GDP= unidirectional effect flowing from GDP to government expenditure.
GEX ↔ GDP= bidirectional effect between the two variables.

Table-2. Summary of Panel Analysis Clarifying The Existence of Wagner's Hypothesis in West African Economies

VERSION	HYPOTHESIS	EMIRICAL RESULT	DECISION
WISEMAN	$a1>1$	$a1<0$	NO VALIDATION
MANN	$\beta 1>0$	$\beta 1<0$	NO VALIDATION
MUSGRAVE	$\gamma 1>0$	$\gamma 1<0$	NO VALIDATION
GUPTA	$\delta 1>1$	$\delta 1<1$	NO VALIDATION
GOFFMAN	$\lambda 1>1$	$\lambda 1>1$	VALIDATED

Source: Computed by the Authors
Note: see details of the results in the appendix

From the result, the Peacock (Mann version of Wagner's shows that there is an inverse (negative) relationship between national income and the share of government expenditure on national income in these economies under review. This shows that economic growth (increase in the output) will cause a reduction in the level of government expenditure in the West African economies, whereas Wagner postulated a positive (greater than one) impact. This

implies that this version of Wagner's law does not hold in the West African economies. For the Wiseman version of Wagner, the impact of GDP to government expenditure is positive, showing that an increase in the level of GDP will cause a corresponding increase in government expenditure. But according to Wagner's law the coefficient of α must be greater than one while in the analysis it is less than one meaning that this law does not hold in West African economies.

Also, the Musgrave version shows a negative impact of income per capita on per capita expenditure. Since the coefficient is less than zero it implies that this version of wagner's law is not validated in the West African economies. Gupta also is not validated in West African economies given its less than one coefficient of per capita income though it has a positive effect on per capita expenditure. Lastly, the effect of per capita GDP on government expenditure in Goffman version of Wagner's law shows a validity of this law in the West African economies; given its coefficient to be more than one in the result (see detailed result in appendix).

4.2. Policy Implication of Findings

Based on the empirical findings in this study, we have the following policy implications;

- From the granger causality result which shows the causal relationship between economic growth, measured by gross domestic product (GDP) for all the West African countries, it's depicts that Togo, Mauritania, Liberia and Sierra Leone are strongly influence by the public sector. This is evidence in the unidirectional effect (flowing from government expenditure) between expenditure and economic growth. Therefore it implies that the Keynesian theory is applicable in these economies and hence prudent spending is needed to achieve desired growth. For Guinea and Cape Verde, the results show that Wagner's law is applicable, as such, private sector should be encouraged to achieve economic growth which will affect the level of government expenditure. In the case of the giant of Africa (Nigeria), Ghana, Mali, Gambia and Ivory coast the results show a mixed economy implying the respond of some sectors of the economy to the Keynesian theory while wagner's hypothesis holds in others. Also, this means that the level and nature of government spending will affect the rate of economic growth and the rate of growth too will in turn affect the level of government spending. Government expenditure should be increased in the economy since this macroeconomic variable directly influences the economy to promote economic growth.
- From the panel analyses, economic growth reduces the share of government expenditure to total output in all the West African economies. In the case of Wiseman version, there is a direct effect of economic growth on the level of government expenditure whereas; per capita income does not promote the growth of share of government expenditure to output. However, it promotes the share of government expenditure on population in these economies and also government expenditure itself. This implies that when there is increase in the per capita income it will cause an increase in government expenditure and also the ratio of government expenditure to population. Explaining the validity of Wagner's hypothesis in Goffman version.

5. Conclusion

This study sought to appraise the nature and direction of causality to establish the relationship between government spending and economic growth in the West African economies. Also, five econometric models were formulated and analyzed, base on different versions of Wagner's law, to further test for the validity of Wagner's hypothesis and its reverse (Keynesian approach)spanning from 1970-2012. Accordingly, starting from the nature and direction of causation, Granger pair wise causality model was used while a panel regression model was used to estimate the equations, to evaluate the inherent connectivity between government spending and economic growth.

In the analyses, firstly, there is a bidirectional effect or relationship between government spending and economic growth in five West African countries, unidirectional causality flowing from government expenditure to economic growth in four countries, while unidirectional causality from economic growth to government expenditure were in two countries. However, there were no causal relationship between government expenditure and economic growth in the remaining five countries in West Africa. Secondly, using different versions of Wagner's law, we observed that only Goffman version is truly validated in the West African economies given the value of more than one per cent marginal effect of per capita growth on expenditure. Whereas, Wiseman version shows a positive marginal effect of economic growth on government expenditure but the value is not greater than one to fulfill the condition for its validity.

Given the outcome of our regression result, we came up with the following recommendations for policy reforms:

(a) In the economies with unidirectional effect, flowing from government expenditure to economic growth (Togo, Mauritania, Liberia and Sierra Leone) the achievement of rapid economic growth will be gotten through their governments identifying the sectors that are productive, so as to channel their expenditure to these sectors. This can be done by stimulating the aggregate demand through increase in government expenditure for rapid economic growth.

(b) For Guinea and Cape Verde economies, if government expenditure is increase it will rather fuel inflation instead of economic growth. Therefore, Wagner's law should be promoted in these countries to achieve economic growth.

(c) In the case of economies with bidirectional causality between economic growth and government expenditure, it is very pertinent for governments in these economies to identify the sectors that respond to Wagner's law and those that responds to Keynesian theory. This is because the economic sectors that respond to Keynesian theory will increase their total productivity when there is increase in public expenditure allocated to them while the ones that respond to Wagner's theory will not, but fuel inflation. However, the economic sectors that respond to Wagner's law will respond to private investment to increase their total output. In doing this, total productivity will be increase from both sectors and hence rapid economic growth achieve.

6. Recommendation for Further Studies

This study left behind another gap to be filled. This is; there should be a study for countries with bidirectional effect between government expenditure and economic growth in a sectoral form to further identify; the productive sectors in these economy; the sectors that respond to Keynesian and those that respond to Wagner's.

This will help the policy makers to make policies that will fit in these sectors in order to increase their total productivity.

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Appendix

Peacock share version (Mann version)

Dependent Variable: GEXGDP?
Method: Pooled Least Squares
Date: 07/25/14 Time: 13:40
Sample: 1970 2012
Included observations: 43
Number of cross-sections used: 14
Total panel (balanced) observations: 602

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.551965	0.488541	5.223646	0.0000
NIG--LOG(GDPNIG)	-0.066301	0.020064	-3.304507	0.0010
TOGO--LOG(GDPTOGO)	-0.069884	0.023549	-2.967561	0.0031
MALI--LOG(GDPMALI)	-0.065637	0.022882	-2.868523	0.0043
BURK--LOG(GDPBURK)	-0.064552	0.022795	-2.831857	0.0048
GAM--LOG(GDPGAM)	-0.073256	0.025005	-2.929714	0.0035
GUIB--LOG(GDPGUIB)	-0.068441	0.025529	-2.680879	0.0075
SEN--LOG(GDPSEN)	-0.065059	0.022165	-2.935141	0.0035
SIER--LOG(GDPSIER)	-0.071285	0.023767	-2.999365	0.0028
IVOR--LOG(GDPIVOR)	-0.070332	0.021464	-3.276772	0.0011
GHA--LOG(GDPGHA)	-0.064890	0.021791	-2.977795	0.0030
MAUR--LOG(GDPMAUR)	-0.065880	0.023667	-2.783584	0.0055
NIGR--LOG(GDPNIGR)	-0.067539	0.022951	-2.942700	0.0034
BENI--LOG(GDPBENI)	-0.067232	0.023098	-2.910782	0.0037
LIB--LOG(GDPLIB)	-0.048201	0.024473	-1.969579	0.0494
R-squared	0.125781	Mean dependent var		1.132804
Adjusted R-squared	0.104931	S.D. dependent var		0.439328
S.E. of regression	0.415640	Sum squared resid		101.4083
Log likelihood	-318.0890	F-statistic		6.032594
Durbin-Watson stat	0.488048	Prob(F-statistic)		0.000000

PEACOCK-WISEMAN VERSION

Dependent Variable: LOG(GEX?)
Method: Pooled Least Squares
Date: 12/05/14 Time: 17:38
Sample: 1970 2012
Included observations: 43
Number of cross-sections used: 14
Total panel (balanced) observations: 602

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.490849	0.213837	2.295435	0.0221
NIG--LOG(GDPNIG)	0.976607	0.008782	111.2058	0.0000
TOGO--LOG(GDPTOGO)	0.980419	0.010308	95.11590	0.0000
MALI--LOG(GDPMALI)	0.983196	0.010015	98.16751	0.0000
BURK--LOG(GDPBURK)	0.984000	0.009977	98.62231	0.0000
GAM--LOG(GDPGAM)	0.980232	0.010945	89.56299	0.0000
GUIB--LOG(GDPGUIB)	0.985160	0.011174	88.16311	0.0000
SEN--LOG(GDPSEN)	0.982395	0.009702	101.2575	0.0000
SIER--LOG(GDPSIER)	0.979603	0.010403	94.16742	0.0000
IVOR--LOG(GDPIVOR)	0.975733	0.009395	103.8580	0.0000
GHA--LOG(GDPGHA)	0.981785	0.009538	102.9330	0.0000
MAUR--LOG(GDPMAUR)	0.984046	0.010359	94.99201	0.0000
NIGR--LOG(GDPNIGR)	0.981597	0.010046	97.71055	0.0000
BENI--LOG(GDPBENI)	0.982163	0.010110	97.14818	0.0000
LIB--LOG(GDPLIB)	0.986790	0.010712	92.12152	0.0000
R-squared	0.984931	Mean dependent var		21.49009
Adjusted R-squared	0.984572	S.D. dependent var		1.464670
S.E. of regression	0.181928	Sum squared resid		19.42838
Log likelihood	179.2894	F-statistic		2740.523
Durbin-Watson stat	0.525412	Prob(F-statistic)		0.000000

MUSGRAVE VERSION RESULT

Dependent Variable: LOG(GEXGDP?)
Method: Pooled Least Squares
Date: 12/05/14 Time: 17:46
Sample: 1970 2012
Included observations: 43
Number of cross-sections used: 14
Total panel (balanced) observations: 602

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.525652	0.092344	5.692311	0.0000
NIG--LOG(GDPPERNIG)	-0.098174	0.015538	-6.318395	0.0000
TOGO--LOG(GDPPERTOGO)	-0.076686	0.016694	-4.593558	0.0000
MALI--LOG(GDPPERMALI)	-0.070999	0.017242	-4.117894	0.0000
BURK--LOG(GDPPERBURK)	-0.068167	0.017248	-3.952224	0.0001
GAM--LOG(GDPPERGAM)	-0.070759	0.016085	-4.398952	0.0000
GUIB--LOG(GDPPERGUIB)	-0.059515	0.017706	-3.361212	0.0008
SEN--LOG(GDPPERSEN)	-0.066699	0.015120	-4.411418	0.0000
SIER--LOG(GDPPERSIER)	-0.081858	0.017298	-4.732261	0.0000
IVOR--LOG(GDPPERIVOR)	-0.088437	0.014416	-6.134404	0.0000
GHA--LOG(GDPPERGHA)	-0.072986	0.015781	-4.625036	0.0000
MAUR--LOG(GDPPERMAUR)	-0.056171	0.014701	-3.820794	0.0001
NIGR--LOG(GDPPERNIGR)	-0.077609	0.017421	-4.454822	0.0000
BENI--LOG(GDPPERBENI)	-0.070951	0.016462	-4.310021	0.0000
LIB--LOG(GDPPERLIB)	-0.060411	0.017490	-3.454094	0.0006
R-squared	0.187596	Mean dependent var		0.096765
Adjusted R-squared	0.168220	S.D. dependent var		0.198410
S.E. of regression	0.180954	Sum squared resid		19.22091
Log likelihood	182.5208	F-statistic		9.681913
Durbin-Watson stat	0.525347	Prob(F-statistic)		0.000000

GUPTA VERSION RESULT

Dependent Variable: LOG(GEXPER?)
Method: Pooled Least Squares
Date: 12/05/14 Time: 17:50
Sample: 1970 2012
Included observations: 43
Number of cross-sections used: 14
Total panel (balanced) observations: 602

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.539177	0.112802	4.779874	0.0000
NIG--LOG(GDPPERNIG)	0.899647	0.018980	47.40003	0.0000
TOGO--LOG(GDPPERTOGO)	0.920972	0.020392	45.16234	0.0000
MALI--LOG(GDPPERMALI)	0.926582	0.021061	43.99472	0.0000
BURK--LOG(GDPPERBURK)	0.929413	0.021069	44.11335	0.0000
GAM--LOG(GDPPERGAM)	0.926984	0.019649	47.17723	0.0000
GUIB--LOG(GDPPERGUIB)	0.938001	0.021629	43.36775	0.0000
SEN--LOG(GDPPERSEN)	0.931179	0.018469	50.41815	0.0000
SIER--LOG(GDPPERSIER)	0.915715	0.021130	43.33742	0.0000
IVOR--LOG(GDPPERIVOR)	0.909541	0.017610	51.64844	0.0000
GHA--LOG(GDPPERGHA)	0.924800	0.019276	47.97553	0.0000
MAUR--LOG(GDPPERMAUR)	0.892518	0.017958	49.69970	0.0000
NIGR--LOG(GDPPERNIGR)	0.919947	0.021281	43.22926	0.0000
BENI--LOG(GDPPERBENI)	0.926740	0.020109	46.08665	0.0000
LIB--LOG(GDPPERLIB)	0.937135	0.021364	43.86432	0.0000
R-squared	0.859886	Mean dependent var		5.951108
Adjusted R-squared	0.856545	S.D. dependent var		0.583600
S.E. of regression	0.221041	Sum squared resid		28.68041
Log likelihood	62.05595	F-statistic		257.3182
Durbin-Watson stat	0.370839	Prob(F-statistic)		0.000000

GOFFMAN VERSION RESULT

Dependent Variable: LOG(GEX?)
Method: Pooled Least Squares
Date: 12/05/14 Time: 17:55
Sample: 1970 2012
Included observations: 43
Number of cross-sections used: 14
Total panel (balanced) observations: 602

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.78146	0.214687	64.19329	0.0000
NIG--LOG(GDPPERNIG)	1.733100	0.036123	47.97774	0.0000
TOGO--LOG(GDPPERTOGO	1.253460	0.038811	32.29610	0.0000
MALI--LOG(GDPPERMALI)	1.418781	0.040084	35.39496	0.0000
BURK--LOG(GDPPERBURK)	1.433884	0.040099	35.75895	0.0000
GAM--LOG(GDPPERGAM)	1.010583	0.037396	27.02352	0.0000
GUIB--LOG(GDPPERGUIB)	1.056679	0.041165	25.66944	0.0000
SEN--LOG(GDPPERSEN)	1.342827	0.035151	38.20176	0.0000
SIER--LOG(GDPPERSIER)	1.262261	0.040215	31.38785	0.0000
IVOR--LOG(GDPPERIVOR)	1.363682	0.033516	40.68722	0.0000
GHA--LOG(GDPPERGHA)	1.463489	0.036688	39.89064	0.0000
MAUR--LOG(GDPPERMAUR	1.092683	0.034179	31.96985	0.0000
NIGR--LOG(GDPPERNIGR)	1.407208	0.040502	34.74427	0.0000
BENI--LOG(GDPPERBENI)	1.313191	0.038271	34.31270	0.0000
LIB--LOG(GDPPERLIB)	1.193189	0.040661	29.34460	0.0000
R-squared	0.919423	Mean dependent var		21.49009
Adjusted R-squared	0.917501	S.D. dependent var		1.464670
S.E. of regression	0.420692	Sum squared resid		103.8881
Log likelihood	-325.3613	F-statistic		478.4244
Durbin-Watson stat	0.140245	Prob(F-statistic)		0.000000

Pairwise Granger Causality Result

Pairwise Granger Causality Tests
Date: 12/06/14 Time: 19:37
Sample: 1970 2012
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GEXTOGO does not Granger Cause GDPTOGO	41	2.45870	0.09979
GDPTOGO does not Granger Cause GEXTOGO		0.65505	0.52550
GEXBENI does not Granger Cause GDPBENI	41	0.09762	0.90723
GDPBENI does not Granger Cause GEXBENI		0.51928	0.59934
GEXMAUR does not Granger Cause GDPMAUR	41	2.74196	0.07791
GDPMAUR does not Granger Cause GEXMAUR		1.87801	0.16757
GEXGUIB does not Granger Cause GDPGUIB	41	1.57422	0.22110
GDPGUIB does not Granger Cause GEXGUIB		1.93410	0.15928
GEXMALI does not Granger Cause GDPMALI	41	4.83944	0.01376
GDPMALI does not Granger Cause GEXMALI		6.64144	0.00351
GEXLIB does not Granger Cause GDPLIB	41	5.29277	0.00966
GDPLIB does not Granger Cause GEXLIB		0.06431	0.93783
GEXGHA does not Granger Cause GDPGHA	41	2.78491	0.07507
GDPGHA does not Granger Cause GEXGHA		4.35500	0.02024
GEXSEN does not Granger Cause GDPSEN	41	0.01863	0.98155
GDPSEN does not Granger Cause GEXSEN		0.23697	0.79024
GEXSIER does not Granger Cause GDPSIER	41	8.47960	0.00096
GDPSIER does not Granger Cause GEXSIER		0.31558	0.73136
GEXBURK does not Granger Cause GDPBURK	41	1.90593	0.16339
GDPBURK does not Granger Cause GEXBURK		1.71907	0.19362
GEXNIGR does not Granger Cause GDPNIGR	41	0.66533	0.52031
GDPNIGR does not Granger Cause GEXNIGR		0.07138	0.93124
GEXGUI does not Granger Cause GDPGUI	41	1.73594	0.19066
GDPGUI does not Granger Cause GEXGUI		2.46001	0.09968
GEXNIG does not Granger Cause GDPNIG	41	9.54827	0.00047
GDPNIG does not Granger Cause GEXNIG		6.26149	0.00464
GEXCAPE does not Granger Cause GDPCAPE	41	0.94201	0.39924
GDPCAPE does not Granger Cause GEXCAPE		6.09568	0.00525
GEXGAM does not Granger Cause GDPGAM	41	6.11617	0.00517
GDPGAM does not Granger Cause GEXGAM		6.43422	0.00408
GEXIVOR does not Granger Cause GDPIVOR	41	10.0163	0.00035
GDPIVOR does not Granger Cause GEXIVOR		6.28571	0.00456