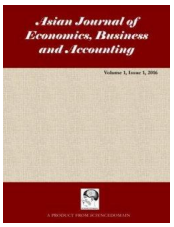

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Government Expenditure and Economic Growth in Lower Middle Income Countries in Sub-Saharan Africa: An Empirical Investigation

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Authors' contributions

This study was carried out in collaboration amongst the authors. Author KOD designed and performed the statistical / econometrics analysis of the study; in addition managed the analyses of the study. Author ED wrote the first draft of the manuscript and managed the literature searches while author AY wrote the protocol of the study. All of the authors read and approved the final manuscript.

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ABSTRACT

The aim of this study is to investigate the impact of government expenditure on economic growth in some selected countries in Sub-Saharan Africa (SSA). The study besides focusing on the lower middle income countries in the region such as Cape Verde, Cameroon, etc.; it further examined the significance of oil receipts on growth via public expenditure. As a result, oil exporting countries were entered as dummies. The period of the study spanned from 1980 to 2015. Gross domestic product per capita was used as a proxy of growth; while general government expenditure (totals), investment (totals) and interest rate were used as regressors instrumenting oil exports. The study employed both static panel and Arellano and Bond (1991) GMM estimators. Results found long run relationship amongst the variables used in the study. Government expenditure, investment and oil exports were equally found to have impacted on growth in the region. Although, government expenditure has not contributed positively to economic growth in the region as it was negatively

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signed. Therefore, the study recommends that government expenditure should be properly disaggregated as a matter of priority between capital and recurrent expenditures in order to carefully situate its role on growth.

Keywords: Sub-Saharan Africa; Lower middle income countries; Government expenditure; economic growth; GMM estimator.

1. INTRODUCTION

Some studies have argued that expansionary fiscal policy can be used as an effective tool not just to overcome recession period but also to contribute to growth of an economy. According to the Keynesian school, government spending is one veritable or unique and unprecedented way to reverse the economic contraction via multiplier effect and accelerator principle. Therefore, more government spending is expected to increase the disposable income of individuals; thereby cause a shift in aggregate demand and rise in employment and productivity in the economy. While productivity of government spending was studied by some prominent economist such as [1] and [2], endogenous growth models were also developed (like [3,4,5] to unveil the permanent growth effects of fiscal policy.

There are number of conflicting empirical studies about relationship between government expenditure and economic growth. Accordingly, it is almost commonly accepted that government expenditure on infrastructure, agriculture are seen as productive as they in turn generate income to the government. And spending on these areas will positively affect the economic growth especially by creating an investment environment for private sector [3,6].

Another approach to analyzing the impact of government expenditure on economic growth has been conducted by considering the level of income or development of the economies in question. Following the above, classifications of the countries include that of less developed, developing or developed countries. Whereas classification by income has four main groups such as low-income, lower middle income, upper middle income and high-income. This approach contributes to the previous literature by leveraging the concept of relationship between government expenditure and growth into the other aspect. It also provides an opportunity to identify the discrepant impacts on economic type.

Findings of the previous studies focused on the level of income or development show that there is no consistency between them. While some studies state the positive relation, others indicate the inverse relation between government expenditure and growth for individual or group of countries at same level of income or development.

This study aim is to analyze the relation between government expenditure and economic growth in some of selected countries in Sub-Saharan Africa (SSA). Furthermore this study will also contribute to the existing literature by focusing more specifically on lower middle income countries group of countries in SSA with reference to the oil exporters. It would further take into account the problem of potential endogeneity thereby employing the panel Generalized Methods of Moment (GMM) estimation method of analysis.

This paper is organized as follows: Section 2 presents the literature; section 3 examines briefly macroeconomic overview of the selected SSA countries. Section 4 introduces the model and theoretical framework, section 5 consists of result presentation and discussion and finally, section 6 concludes.

2. LITERATURE

There are number of empirical studies have been focused on to unveil the relationship between government expenditure and economic growth for different countries. Results of the previous studies shows that there is no consistency between the findings. Some studies state that government expenditure to be a leading indicator of economic whereas the others indicate that there is an adverse relation between them.

Studies which can be classified by considering income level or development level of group of countries suggest that government expenditure to be a leading indicator of economic growth include: [7] models the dynamic interactions between government size and economic growth using data on ten OECD countries. The analysis shows that government size Granger-causes growth in all the countries, also an innovation

shock at the growth rate of government size generates a permanent effect on the growth rate of GDP. [8] finds a positive elasticity of output with respect to public expenditure capital for OECD countries. [9] analyzed the public capital expenditure and growth relationship for 52 developing countries. Result shows that public capital expenditure is an important determinant of economic growth. However, finding from [10] was not similar for 15 developing countries on the impact of capital expenditure on growth. According to the result, capital spending exhibited negative but significant relationship on the growth, contrary to commonly held views.

Finding of [11] for 30 developing countries was similar to the previous studies. It illustrates that share of government capital expenditure on GDP is positively and significantly correlated with economic growth and government investment in education with total expenditures in education being the only outlays that are significantly associated with growth. [12] also found similar results for 83 countries where it analyzed the impact of government spending on growth. Finding of the study unveils that there is a robust positive relationship between education expenditures and growth for rich countries but no significant relationship for poor and middle-income countries.

[13] investigate the impact of infrastructure on output by developing an index of infrastructure stocks for South Asian countries. Finding shows that infrastructure development contributes significantly to output growth. Furthermore, there is a two-way causality between total output and infrastructure development. Robles (1998) also find similar results of the impact of infrastructure on growth for Latin American countries.

[14] focused on empirical assessment of the impact of infrastructure development on growth and inequality for Sub-Saharan Africa. Using the quantitative and qualitative indicators spanning the years 1960–2005, finding of the study illustrates the potential contribution of infrastructure development to growth and equity across Africa. In another study [15] also analyzed the impact of telecommunications infrastructure in for Sub-Saharan Africa spanning from 1993 to 2012. It is found out that development of telecommunications infrastructure fosters economic growth in Sub-Saharan Africa. Specifically internet and mobile phones have contributed to economic growth in Sub-Saharan Africa. Furthermore one percentage point increase in internet and mobile phone usage raises growth by 0.12 and 0.03 percentage points, respectively. In another study for Sub-Saharan Africa [16] also finds similar results. They examined the effects of mobile phones on economic growth in the selected countries and found that investment on mobile cellular phones cause economic growth.

In another study related with communication expenditure and growth in 22 members of OECD carried out by [17] shows that investments on telecommunication sector have a significant effect on economic productivity and growth. Also analyzed were the possible effects of telecommunications investment in 21 OECD countries over a 20-year time. Finding shows that necessary amount of telecommunication infrastructure will cause an increase in production.

[18] found out that there is a tremendous expansion in economies of 39 low-income countries where the government spending concentrated on capital and nonwage goods and services.

There are also some supportive time series analyses in accordance with the panel analyses such as [2] also examined the effect of public expenditure on growth for the US by classifying public expenditure as military expenditures and non-military expenditures covering the period between 1949 and 1985. Result shows that public infrastructure investments such as streets, roads, airports, drinkable water and sewerage, play an important role in economic growth and efficiency.

In another study these linkages for South Africa by applying the Auto-Regressive Distributed Lag model (ARDL)-(bounds testing approach). According to the empirical findings of the study, there is a bilateral causality between government expenditure and economic growth in the short run, but in the long run, it is economic growth that causes government expenditure. [19] examines the role of government revenue and expenditure in economic output of agriculture, industrial and services sectors in Sudan. The study analyses the impact of government expenditure components on sectoral output for the period 1960-2013 by applying ARDL and bound approach for co-integration as the methods of estimation. The results show that the government expenditure components have long-run effect in

agriculture and industrial GDP but not supporting the services sector output in Sudan.

[20] used six sub-headings under the infrastructure index to unveil the impact on growth for China for the period 1975-2007. These sub-heading are electric power consumption per capita, energy consumption per capita, telephone lines per thousand, railway line per thousand, the number of people using airway and the percentage of sidewalks to the total roads length. Findings of the study illustrate that developing infrastructure has a strong effect on growth. Infrastructure investments have a greater impact than the investments of public and private sector. There is a unilateral causality link from infrastructure to growth. [21] also used transportation infrastructure to examine its impact on growth for China. Result show that highway and drinkable water infrastructure investments had significant effects on growth. It is found out that there is a growth although highway infrastructure investments were low. Furthermore water infrastructure investments also have positive effect to growth when a certain amount of investment was actualized. But the effect of airways infrastructure investments was not sufficient. Findings equally support previous studies that used infrastructure index. Accordingly public capital is shown to be a significant long-term determinant of output growth and also a substantial growth payoff from public investment for Portugal. Also it is found out that transportation investment such as roads, railways, and airports is more productive than public investment in other major categories.

[22] analyze the relationship between economic growth productivity to budget share ratios of government expenditures in Bolivia. Results show that defense expenditures, decentralized expenditures, and education have the potential for generating significant growth. Therefore government should spend more on these areas.

Whereas some studies state the negative effect of government expenditure on economic growth considering country groups include: [23] for OECD countries.

[23] applied OLS method for sample of 13 OECD countries for the period of 1959 to 1984. Findings of the study illustrates that growth of government spending has significant negative impact on economic growth.

[15] examined the effect of government expenditure on its disaggregated level on economic growth for 20 Sub-Saharan African Countries. The result from Generalised Method of Moments (GMM) indicates the inverse relationship between productive government expenditure and economic growth in sub-Sahara Africa. Unproductiveness is explained by corresponding source of the mode of financing in the study. [24] also examined the effect of government expenditure on economic growth for 16 developed countries for the years from 1952-76. Using the Ordinary Least Squares (OLS), instrumental variable (IV) techniques, an adverse impact of total government expenditure on growth rate is observed. Landau (1986) for 96 least developed countries and developed countries over various time periods between 1961 and 1976. Finding of the study supports his previous analyses by indicating the negative relationship between the share of government consumption expenditure in GDP and the growth of per capita GDP.

These studies were also supported by time series analysis such as [25] for Ethiopia. In their analysis existence of Wagner's Law for Ethiopia is approved. Finding of the study reveals that there is a unidirectional causality running only from GDP to government expenditure. Evidence for Ethiopia case suggests that the Keynesian view that government expenditure can be an effective policy instrument for promoting economic growth was not supported.

3. A BRIEF MACROECONOMIC OVERVIEW OF THE SELECTED SSA COUNTRIES

The aim of this section is to provide a brief overview of the key macroeconomic conditions of the 13 SSA countries considered in this study. This allows for better understanding of the relationship between income, expenditure and growth thereby offers a template for appropriate policy responses. [26] noted that economic activity in sub-Saharan Africa in 2015 declined to its lowest level in some 15 years; resulting in output growth of about 3.4 percent, just slightly above population growth, down from 5 percent in the previous year 2014. The outlook in 2016 isn't different either as growth remains grim for oil exporters and a number of other commodity exporters. For instance, it is projected that growth in oil-exporting countries is expected to decline to 2.2 percent in 2017 [27]. In particular, growth in forecasts in Angola and Nigeria are expected to slow down further due to limited foreign exchange supply and lower levels of

public spending, lower oil prices compounded by interferences in private sector activities through exchange rate restrictions etc. Other reasons for the stunted growth in the region include sharp decline in commodity prices, drought particularly in eastern and southern Africa regions. Similarly, for non-oil commodity exporters like Zambia, growth is also expected to remain depressed due to fall in copper prices, electricity shortages, and weak domestic demand.

Although, in Ghana, non-oil growth was stable, albeit at a low level, even as GDP growth picked up slightly on account of increased oil production activities. Study has shown that the most exposed countries by far are the oil exporters. For instance, the income loss from price fluctuations due to the commodity terms-of trade shock has been particularly obvious since mid-2014. On average, the commodity terms-of-trade index fell by 20 percent of GDP in a matter of a few years, after a steady gain of about 45 percent during periods 2000-2014. No doubt that negative terms of trade shock of this size would typically triggers a slowdown in annual growth of about 3 to 3.2 percentage points for several years after the shock. In a number of large non-oil commodity exporters, growth is also expected to remain depressed. Indeed, activity is expected to further slow in Zambia because of depressed copper prices, electricity shortages, and weak domestic demand.

Oil exporters, such as Angola, Cameroon, the Republic of Congo, and Gabon, experienced particularly large increases (17 to 33 percentage points between the 2010–13 average and 2015) to levels up to 65 percent of GDP. The rise in debt in other resource-intensive countries was smaller, with some exceptions (Ghana, Zambia). Although, in some countries, a depreciating exchange rate has also contributed to rising debt levels (Angola, Tanzania) with a few exceptions (Cape Verde, Gambia, Mozambique, and Seychelles), which increases were much more smaller in most non-resource-intensive countries. The sources of debt increases therefore vary, but public infrastructure investments appear to be a common denominator. Relatedly, indicators of financial soundness have also deteriorated; leading to significant increases in nonperforming loans as been observed in some oil exporters (Angola, Equatorial Guinea) and in small and fragile states such as Cape Verde, Gambia, Malawi, São Tomé and Príncipe, Sierra Leone, Zimbabwe etc. giving rise to recapitalization needs. The report further predicts that given the current shocks the region experiences, her macroeconomic conditions with the accompanying deterioration of these indicators could worsen further.

4. MODEL AND THEORETICAL FRAME-WORK

$$y = AX^{\beta}\varepsilon^{\mu} \quad (4.1)$$

where y is GDP per capita, A is total factor productivity, X is composite of capital stock, which is given as X = γκφψ, where γ is investment, κ is government expenditure, φ is interest rate (nominal) and ψ is oil exporting countries; and μ is usual error following the underlying classical assumption of *iid*.

As earlier noted, the study deliberately employed pooled, LSDV, RE and Arellano and Bond GMM. This is to enable us capture the peculiarities due to the cross country differentials or otherwise. Similarly, heterogeneity bias is also eliminated by assuming random effects where for the

Table 1. SSA: Real GDP growth (percent change)

Year	2004-08	2009	2010	2011	2012	2013	2014	2015	2016	2017
SSA	6.8	4.0	6.6	5.0	4.3	5.2	5.1	3.4	3.0	4.0
Oil exporting countries	9.2	.0	8.5	4.6	3.8	5.	5.9	2.6	2.2	3.4
Low Income countries[1]	7.9	6.3	7.6	7.6	6.2	7.0	7.2	7.2	5.6	6.5
SSA resources intensive[2]	7.0	3.9	6.7	4.9	3.9	3.0	4.7	2.6	2.4	3.4
SSA frontier and emerging market economies[3]	7.1	4.4	6.8	5.0	4.5	5.1	5.0	3.5	3.0	3.9

Source: IMF, World Economic Outlook database.
1 Excluding fragile states.
2 Includes oil exporters: Angola, Cameroon, Chad, Republic of Congo, Equatorial Guinea, Gabon, Nigeria, South Sudan; and nonrenewable resource exporters: Botswana, Burkina Faso, Central African Republic, Democratic Republic of Congo, Ghana, Guinea, Liberia, Mali, Namibia, Niger, Sierra Leone, South Africa, Tanzania, Zambia, and Zimbabwe.
3 Includes Angola, Cameroon, Côte d'Ivoire, Ethiopia, Gabon, Ghana, Kenya, Mauritius, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda, and Zambia

unobserved heterogeneity effects are subsumed into the disturbance term. Lastly, in order to get rid of any time-invariant regressor and also eliminates any endogeneity that may arise due to the correlation between the regressors and the effects we employed Arellano and Bond GMM. We therefore specify a dynamic panel regression model as below:

$$y_{it} = \delta y_{i,t-1} + X'_{it}\beta + \mu_i + v_{it} \quad (4.2)$$

The consideration of the dynamic model above is characterized by two sources of persistence over time [28]. These are autocorrelation resulting from the inclusion of a lagged dependent variable among the explanatory variables and the unobserved main effects and interaction effects characterizing the heterogeneity among the countries we intend to study. Applying either OLS or FE estimator may render the estimates biased and inconsistent for a number of reasons. First, y_{it} is a function of the countries specific effects (μ_i). This then follows that $y_{ij,t-1}$ is also a function of these effects. Thus, $y_{i,t-1}$ is correlated with the error term $\left(\text{i.e. } E\left(y_{i,t-1}v_{it}\right)\right)$. This undoubtedly will render the OLS estimator biased and inconsistent even if the error term (v_{it}) is not serially correlated. Again, in the case of FE estimator, although the within transformation might have eliminated the effects, however, $\left(y_{i,t-1} - \bar{y}_{i.-1}\right)$ where $\sum_{t=2}^{T} y_{i,t-1}/(T-1)$ will still be correlated with $\left(v_{it} - \bar{v}_{i.}\right)$ even if the error term (v_{it}) is not serially correlated. By construction, $y_{i,t-1}$ is correlated with $\bar{v}_{i.}$ since the latter average contains $v_{i,t-1}$ which is obviously correlated with $y_{i,t-1}$. Similarly, v_{it} is correlated with $\bar{y}_{i.-1}$ since the latter average contains y_{it}. This correlation also renders the FE estimator inconsistent particularly when N is large and T is small. Therefore, to overcome these econometric problems inherent in the use of OLS, FE (LSDV) and/or RE (GLS) estimators; Arellano and Bond (1991) differenced GMM estimator was employed as below:

$$y_{it} = w_{it}'\delta + X'_{it}\beta + u_{it} \;; i = 1,\ldots,n \;;\; t = 1,\ldots,T \quad (4.3)$$

$$u_{it} = \mu_i + v_{it}$$

Where w_{it} is a vector of predetermined covariates (which may include the lag of y) and endogenous covariates, all of which may be correlated with the μ_i. Of course, predetermined variables are potentially correlated with past errors. As earlier explained, this is not unconnected with the fact that endogenous ones are potentially correlated with past and present errors. Other variables have been earlier defined.

Note the following:

(a) $E\left(\mu_i\right) = E\left(\upsilon_{it}\right) = E\left(\mu_i\upsilon_{it}\right) = 0$;
$E\left(\upsilon_{it}\upsilon_{js}\right) = 0$ for each i, j, t, s

(b) Strictly exogenous variables are uncorrelated with current and past errors.

Recall, by first-differencing the equation removes the μ_i, thus eliminating a potential source of omitted variable bias in estimation. However, differencing variables that are predetermined but not strictly exogenous makes them endogenous since the w_{it} in some $\Delta w_{it} = w_{it} - w_{i,t-1}$ is correlated with the $\upsilon_{i,t-1}$ in $\Delta\upsilon_{it}$.

Table 2. Panel estimation result

Dep.var=gdp_per capita

Var.	OLS	LSDV	IV	Fixed	Random
lnGovt.expt	-0.5475*	-0.3119	-0.3980*	-0.3119	-0.3949*
Lnt_Invest	0.4750*	0.4325*	0.4614*	0.4325*	0.4479*
Interest_rate	0.0028	-0.0020	0.0031	-0.0020	-0.0002
Oil_export	0.0014	-0.1587	0.1239*	-	0.1623*

Source; Compiled by the authors; 2017

Note: Country effect is significant but time effect isn't. The esthetics (*) = estimator significant at 0.05 SL. The non-rejection of (H0-diffrences in coefficients isn't systematic) from the Haussmann test led to the adoption of random effect model. Meaning that the coefficients would normally include both the within-entity and between-entity effects refer to Appendix 1

5. PRESENTATION AND DISCUSSION OF RESULTS

The least square dummy variable model (LSDV) provided us with a good way to understand fixed effects by controlling for the unobserved heterogeneity. We equally instrumented growth by oil exporting countries in the region. The rationality here is that, the more country exports crude at the international market receive more foreign exchange than the others hence, earn more revenue, grows more and enhances her people's living conditions. Similarly, the rationale behind the choice of random effects model is that, unlike the fixed effects model, the variation across entities is seen to be random and uncorrelated with their predictors included in the model. Therefore, it denotes the significance of cross countries differentials in estimators measured on growth. The major merit of the RE is that it allows us to generalize inferences beyond the scope of the study and equally to include those presumed time-invariant variables such as: culture, gender composition, religion, ethnicity etc.

It can be seen from the results that OLS, which ignores the specific effects, yields the highest short-run elasticities for all the variables considered. More so, the coefficient of interest rate suggests evidence of serial correlation. This is an indication of potential correlations between the variable and the regression error thus rendering the use of the OLS invalid for estimation. Although, the coefficients of government expenditure and total investment are both significant in OLS and Random effect models but doesn't erase the fact that countries specific effects impacts growth. It's also pertinent to state that there is growth differential between oil exporters and non-oil exporters in the region. Surprisingly, government expenditure in all cases was wrongly signed however statistically significant. Others such as total investment, oil exports elasticities are correctly signed as well as statistically significant within the framework of random effect model. The diagnostic tests also indicate that the instruments are valid and strictly orthogonal with the regression disturbance term. Results equally showed long run relationship amongst the variables included in the model.

Therefore, a 10% change in government expenditure will rather bring about 3.9% average decline on growth taking into account the between countries effects while holding other variables constant. But a 10% change in total investment and revenue from oil export will bring about 4.5% and 1.6% average rise in growth including taking in cognizance between countries effects ceteris paribus. Similarly, inter class correlation due to differences across countries panel accounts for 9.9 percent. No doubt the finding above is consistent with [29].

6. CONCLUSION

The literature that examines the impact of government expenditure on economic growth; particularly, instrumenting or controlling for oil exporters amongst developing countries is a significant one. Our aim was to contribute to the existing literature but from a stand point of view of regional growth paradigm. We examined this relationship by including four variables including oil exporters used for control; namely government expenditure, total investment, interest (cost of capital), oil exports within a panel data framework. Various diagnostics such as Philip-Peron, ADF, Im Pesaran and Shin panel unit roots and Pedroni panel cointegration with instrument breaks were employed in the analysis [30]. The results are attached in appendix two and three respectively. Subsequently, we were able to unravel both of the short and long-run impact of government expenditure and investment on growth in the region for a panel of 13 SSA countries of over the period 1980–2015.

Our main findings were that: (1) per capita growth, government expenditure, investment, interest rate and exports were cointegrated. (2) While consistent with theory both expenditure of the government, investment, oil exports were statistically significant except that government expenditure was wrongly signed. As a result, an immediate policy implication that emerged directly from our empirical analysis suggests that this study is able to establish that government expenditure has not contributed positively to economic growth in the region. This does not imply that government expenditure does not have the potential to contribute to growth; rather, government expenditure should be properly disaggregated as a matter of priority between capital and recurrent expenditures in order to carefully situate its role on growth.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

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Variable	Obs	Mean	Std. Dev.	Min	Max
country	0				
code	0				
codeid	455	7	3.745776	1	13
year	455	1997	10.11062	1980	2014
gdp_percap~a	455	3.634615	5.222995	-13.468	62.2
govt_exp	455	15.95095	15.64431	0	67.415
total_invest	455	21.01374	14.33251	-3.636	76.12
interest_r~e	455	69.51004	563.4246	-11.094	9796.9
oilexport	455	.5384615	.4990672	0	1
lngdp_per	366	1.357078	.8449874	-3.218876	4.130355
lngovt	290	3.086078	.558412	.7640715	4.210867
lnt_inve	403	3.012333	.5955914	.6770178	4.332311
lnintr	392	2.384392	1.384574	-2.488915	9.189821
lnoil	455	1	0	1	1
_Icodeid_2	455	.0769231	.2667627	0	1
_Icodeid_3	455	.0769231	.2667627	0	1
_Icodeid_4	455	.0769231	.2667627	0	1
_Icodeid_5	455	.0769231	.2667627	0	1
_Icodeid_6	455	.0769231	.2667627	0	1
_Icodeid_7	455	.0769231	.2667627	0	1
_Icodeid_8	455	.0769231	.2667627	0	1
_Icodeid_9	455	.0769231	.2667627	0	1

```
--more--
```

(Appendix 1)

```
. hausman fixed random

Note: the rank of the differenced variance matrix (0) does not equal the number of coefficients
      being tested (2); be sure this is what you expect, or there may be problems computing
      the test.  Examine the output of your estimators for anything unexpected and possibly
      consider scaling your variables so that the coefficients are on a similar scale.
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnt_inve	.16834	.16834	0	0
lnintr	-.1359007	-.1359007	0	0

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(0) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        0.00
            Prob>chi2 =           .
            (V_b-V_B is not positive definite)

.
```

(Appendix 2)

Results of panel unit root tests

	Level			First difference		
Test Var.	**PP**	**ADF**	**IPS**	**PP**	**ADF**	**IPS**
lngdp_per capita	-4.6931	-9.0133	-2.9285	107.743***	132.229***	-7.0736***
lnGovt_expt	-96.7468***	-89.5273***	5.9856***	463.660***	331.572***	-18.7210***
Lnt_invest	-636.457***	-632.049***	-39.4497***	331.572***	363.845***	-20.2581***
Interest_rate	-254.721***	-251.337***	-14.7965***	575.906***	334.307***	-17.878***
Oil export	-64.4655	-37.5486	-1.5249	353.330***	13.4044***	-11.444***

*Note: Probabilities for ADF test is based on asymptotic Chi-square distribution; while the rest follow asymptotic normality. *** denotes significance at 1%. Lag length selection is based on modified Schwarz information criteria automatic selection*

(Appendix 3)

Pedroni panel cointegration test results

Within dimension	***lnGovt_expt***	***Lnt_invest***	***Interest_rate***	***Oil_export***
Panel V-statistics	5.891	8.112***	1.752***	6.821***
Panel rho- statistics	7.45***	4.35***	9.32***	4.99***
Panel PP-statistics	9.72***	3.72***	10.02***	3.77***
Panel ADF-statistics	5.67***	7.67***	6.12***	12.06***
Between Dimension				
Group rho- statistics	6.88***	9.44***	7.23	5.23
Group PP-statistics	8.78***	11.79***	7.98***	7.09***
Group ADF-statistics	4.12***	6.23***	5.09***	4.10***

*Lag length automatically selected on the basis of SBC. ***, denotes statistical significance at 1%.*

Note: The Pedroni tests allowed for heterogeneity among cross-sectional elements by using idiosyncratic parameters, which are allow differing among the cross-section units. Accordingly, Pedroni suggested four within-dimension and three between-dimension test statistics. Although, Panel v-stat. and Group rho-tests consistently accept the null of no co-integration at panel v-stat (govt.expt) and Group rho (interest_rate and oil_ export). However, this is not worrisome; since a Monte Carlo simulation by Pedroni (2004) shows that the two tests are inclined to underestimating the rejection of null hypothesis, when N and/or T is small, as is the case of this study. Therefore, it is held that cointegrating relationship prevail among the variables

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