AN ANALYSIS OF THE IMPACT OF DOMESTIC INVESTMENT ON ECONOMIC GROWTH IN SELECTED AFRICAN COUNTRIES

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DECLARATION

   I hereby declare that this work is the product of my research efforts undertaken under the supervision of Dr. Muhammad Aminu Aliyu and has not been presented anywhere for the award of degree or certificate. All sources have been dully acknowledged.

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CERTIFICATION

This is to certify that the research work for this dissertation and the subsequent write-up of (MAHMUD ABUBAKAR RUFA'I - SPS/15/MEC/00060) were carried out under our supervision.

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DEDICATION

I dedicate this work to my mother (may Almighty Allah grant her aljanatul firdaus, ameen).

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Abstract

This study analyzed the impact of domestic investment on economic growth, using a panel data sample of 5 African countries covering the periods 1985 – 2017. The Autoregressive Distributed Lag (Mean Group and Pooled Mean Estimation) and Generalized Least Square (GLS) modeling approaches have been applied. The results of the Mean Group modelrevealed that only FDI has negative significantly impact on economic growth in the longrun,whereaspublic domestic investment, private domestic investment, exports have and interest rate have insignificant impact on economic growth in the longrun. While in the shortrun public domestic investment, exports and interest rate have negative significant on economic growth; on the other hand private domestic investment and FDI have insignificant impact on economic growth. Error correction term has been found to be statistically insignificant and with correct sign. The empirical results of GLS model show that public domestic investment and FDI have negative significant impact on economic growth.However, private domestic investment and interest rate have positive significant impact on GDP; export has insignificant impact to economic growth. Public domestic investmentwas also found to have different impact on economic growth in the selected countries. Therefore the study concludes that private domestic investment is an important determinant of economic growth in the selected African countries. Hence policies that encourage private domestic investment should be prioritized.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The capacity of a nation to possess large share of investment is recognized as powerful instrument for achieving sustainable economic growthin various economic literaturesEpaphra and Massawe (2016);Tan and Tang(2016) and Aurengzeb and Ul-haq (2012).However, realizing sustainable growth to a large extend depends on the nation ability to generate domestic investment higher than foreign investment.Furthermore,there is no agreement about the relative influence of public domestic investment and private domestic investment components toeconomic growth.

Domestic investment is the aggregation of private domestic investment and public domestic investment. The summation of the above two category of investment formulate a vital component of total investment in the economy. Olise, Theresa, Moses and Kingsley (2013), recognized that the share of domestic investment for most developed countries is significantly large, often outweigh foreign investment; this is contrary to the characteristics for most developing countries where domestic investment is insufficient.

Despite the various structural and reform programms on investment by the African countries they remain entangled with low level domestic investmentKalu & Oyinye (2015) and Alfa and Garba (2012). This low level of domestic investment may be associated with the focused of enormous attention of developing countries on policies that attract foreign direct investment (FDI) at the detriment of domestic investment which result to neglect of crucial factor of growth. United Nations Conference on Trade and Development (UNCTAD) report, (2016) observed that most of the new investment policy

measures by developing countries continue to be geared towards investment liberalization and promotion. The report observed that 85 percent of the measures introduced in 2015 favour foreign investors.

The struggle of successive government in African countries to boost and attract more investment to their economies will produce profitable result such as job creation, increase in per capita income reduction in the level of poverty and increase in the gross domestic product, depends on their ability to formulate appropriate domestic investmentpolicies,that has more impact on the growth ofAfrican economies (Epaphra and Massawe 2016).

Similarly, Rodrik (1999) cited in Parris (2001) highlighted that countries with ability to formulate a domestic investment strategy are the ones that have perform efficiently in post war periods and had appropriate institution to handle negative external shocks not those that have open trade and capital flows openness.

UNCTAD, (2013) reveals that an empirical evidence from advance countries indicate that the contribution of FDI to host country development tend to be great in nations where domestic investment reach advance state. Therefore policies that promote domestic investment should be prioritized in designing policies that raise economic growth.

United Nations Industrial Development Organization (UNIDO), 2011 held a view that reaping the benefits of FDI is not automatic because it has both positive and negative effects. Hence maximizing the benefits by African countries depend largely on their ability to promote domestic investment.Domestic investment increase ownership of the development process whereby it could be used to fund countries owns priorities rather than those of the foreign investors, if they were properly utilized.

UNCTAD (2007) observed that investment gap in Africa must be bridged via domestic and external fund, though excessive dependence on external capital is associated with many obstacles. Tan and Tang(2016); Ugochukwu and Chinyere(2013) opined that the disparity that arise between the policy and investment gap in Africa would be resolved if they understand real relationship among public investment, private domestic investment and economic growth.

Presumably, understanding the relationship between domestic investment and economic growth will guarantee more policy space for African countries as well as enable them to implements strategies that reflect their growth priorities. UNCTAD (2007), highlighted that domestic atmosphere are less costly to expand compare with external environment. A better understanding of nexus between private domestic investment, public investment and economic growth in Africa is very essential because it will helps in proper tapping of investment benefit, accelerate economic growth and narrow resource gap between developed and developing countries.

African countries have been classified as low savings economies which result to lower investmentAlfa and Garba (2012). The low level of domestic investment in developing countries has become a source of worry to many African countries, despite policies made by the various government of African at different times to tackle the problem, the menace still persists.

Economics literature identifies investment as essential elements of economic growthKandenge (2007). Therefore, African countriesshould consider examining the impact of investment on economic growth frequently with a view of identifying the type of investment (public domestic investment and private domestic investment) that has

more impact on their economies to enable them formulate policies that are basic and have more contribution on their system.

1.2 Statement of the Problem

A number of African countries have initiated economic reforms aimed at improving their economic growth, however one of the reasons why most these countries failed to achieve Millennium Development Goals (MDGs) target for member States to halve their levels of absolute poverty by 2015 is its relatively low rate of economic growth. Despite the recent achievements made by a number of countries, the growth rate in sub-Saharan Africa as a region continues to fall short of the 7–8 per cent necessary to achieve the MDGs Target (UNCTAD, 2007).

However, the policy actions taken so far to enhance the level of economic growth do not sufficiently recognize the relevance of domestic investment hence; African countries need to step up their efforts at enhancing domestic resource mobilization. The share of domestic investment as percentage of gross domestic product in Africa is inadequate since 1970. UNCTAD (2013) report indicated that domestic investment in 1970 was 19.43% in Africa and improved to 25.47% in 1980 but decrease to 16.67% in 2000. In 2007 it increased slightly to 19.58%. In 2010 it stood at 20.65%. It worth noting that domestic investment as percentage of GDP is below in Africa compare with other developing countries in some continents such as Asia. For instance in 2010 domestic investment as percentage of GDP in Asia developing countries was 34.64% while Africa it stood at 20.65%.

The attention of African countries heavily depends on attraction of foreign investors, for the fact that most of the new investment policy measures by these countries continue to be geared towards the support of foreign investors. The United Nation report

observed that eighty five percent (85%) of the investment measures introduced in 2015 by developing countries favour foreign investors (UNCTAD, 2016).

The presumed relation between domestic investment and economic growth in developing countries require frequent and regional evaluation. Theoretically, the impact of domestic investment on economic growth has been invariably assumed to be positive. However, the relationship amongpublic domestic investment, private domestic investment and economic growth is a matter of empirical investigation.

1.3 Research Questions

The study addresses the following research questions:

i-   What is the impact of public domestic investment on economic growth in selected African economies?

ii-   What is the effect of Private domestic investment on economic growth in selected African countries?

iii-   Does Public domestic investment have similar individual effect on economic growth in the selected African countries?

1.4 Research Objectives

An assessment of the Impact of domestic investment on economic growth in selected African countries is the main objective of the study. The specific objectives include the following:

i-   to examine the contribution of Public domestic investment on economic growth in selected African economies;

ii-   to investigate the impact of Private domestic investment on economic growth in selected African countries;

iii-   to examine the individual effect of Public domestic investment on economic growth in the selectedcountries.

1.5Significance of the Study

This study analyses the contribution of private and public domestic investment on economic growth; this would contribute to the better appreciation of the relationship among the study variables by the government of selected African countries to enable them design appropriate policy instruments that might accelerate growthrates. It will also guide private investors and non-governmental institutions such as World Bank and International Monetary Fund in achieving better understanding of which type of investment; either public domestic investment or private domestic investment can positively change the gross domestic product in the selected countriesas well as identify appropriate investment component that accelerates economic performanceto enable them recognize areasto support the selected African countries. The study will likewise add to the existing body of knowledge and source of reference for future researches to student by employing dynamic panel data approach to fill the gap in the existing literature.

1.6Scope and Limitations of the Research

The study selected five (5) African countries with highest gross domestic product based on 2017 World Bank ranking for the period of 1985-2017. The focus of the research is on the impact ofprivate domestic investment and public domestic investment on economic growth.

Six variables were employed in this research namely; economic growth, public domestic investment, private domestic investment, foreign direct investment, export and interest   rate.   Economic   growth,   private   domestic   investment   and

publicdomesticinvestment were given priority as variables of interest. Due to the nature of the study comprising various African economies with different currency, United State (US) dollar was used as denomination for uniformity.

The study is constrained by some limitations such as inability to extend the period below1985 and the number of countries is restricted five to (5), hence future research should involve more countries and period.

1.7Organization of the Study

The research was organized into five chapters. The first chapter, introduction include; background to the study, statement of the problem, objective of the research, research question, significance of the research, scope and limitation and organization of chapters.

The second chapter review related conceptual, empirical and theoretical literatures. Chapter three capture methodology adopted in the study. The fourth chapter presents the results and discussion of the findings. Chapter five give summary of findings, conclusions and proffers recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews conceptual literature, empirical literature and theoretical framework on the impact of domestic investment on economic growth. The first section define key concepts used in this study, which include; domestic investment, private domestic investment, public domestic investment.

2.2 Definition of Concepts

2.2.1 The Concepts of Domestic Investment

Domestic investment is defined by Kanu and Ozurumba (2014) as component of total expenditure of an economy that measure how much of the new capital created in the economy are invested rather than consumed. Domestic investment is also defined as the acquisition of income-producing assets within the boundary of a country rather than abroad (Adegbite & Adetiloye, 2013). Domestic investment is a method of acquiring additional production and income breeding assets within the economy (Ugochukwu & Chinyere, 2013).

While Adekunle and Aderemi (2012) explained domestic investment as the expenditure made to increase the total capital stock in the economy. Adetiloye and Adeyemo (2012) defined domestic investment as the sum of new investment made in an economy at any given time, which usually comes from aggregate domestic savings. Kanu and Ozurumba (2014) definition of domestic investment is adopted in this study.

2.2.2 The Concepts of Private Investment

According to Epaphra and Massawe (2016) private investment is define as investment that enhance productivity through transmitting technology, creation of

employment, adoption of new methods of production and inducing new competition in an economy. Anwulika (2010) cited in Aliyu (2015) defined private domestic investment as investment within the domestic economy by the profits maximizers.

Moses et al. (2013) defined private investment as type of investment that is complimentary to public investment executed by private entities. Everhart and Sumlinsk (2004) defined private investment as the difference between total gross domestic investment and consolidated public investment. The research adopted Moses et al. (2013) definition of private investment.

2.2.3 The Concepts of Public Investment

Epaphra and Massawe (2016) defined public investment as investment in basic infrastructures which benefit the society and provide conducive environment that is essential pre-condition for capital accumulation in the private sector but for which profit motive are lacking.

According to Rabnawaz and Jafar (2015) public investment is define as a consumption good that reduce the saving and capital investment of an economy. Choudhry and Tariq (2015) defined public investment as investment made by the ruling class to improve the life of the populace of a particular nation in the form of roads, dams or any form of infrastructure which can be utilized by the citizen in the future and improve their welfare.

Lea and Suruga (2005) defined public investment as investment used to compliment the holes that are neglected in the capitalist economy which also serve as important instrument for control by the government. Epaphra and Massawe (2016) definition of public investment is adopted in this study.

2.3Empirical Literature Review

Various studies have investigated the relationship between domestic investment and economic growth using different conceptual and methodological viewpoint, but their findings fail to achieve consensus. These studies include:-

2.3.1 Domestic Investment and Economic Growth

Awolusi and Adeyeye(2016) and Agbelenko(2015) used robust generalized method of moment approach to analyzed the nexus domestic investment and economic growth.Their result indicates that an increase in domestic investment will lead to an increase in economic growthin some countries, while the former also found that in one of the countries, Central African Republic domestic investment has negative significant impact on economic growth. The paper second selected five (5) African countries randomly and failed to employ panel data models in the study.

Studies such as Tan and Tang (2016) and Adams (2009) assessed the impactof domestic investment on economic growth and they found that domestic investment exert strong and direct positive impact on economic growth. It was observed by the latter that even in China and other Asian countries where FDI was established to be more effective, domestic investment is more effective than FDI in promoting growth.While the first paper was commended for employing cointegration test in the presence of breaks but failed to decomposed domestic investment into private and public.

Ibrahim and Okunade (2015) analysed FDI, domestic investment and economic growth in Nigeria using data from 1980 to 2013 using Johansen and Juselieus approach. Their variables of study are real gross domestic product, FDI, domestic investment, credit to private sector, exchange rate and national income. The result revealed that domestic Investment has stable longrun relationship with economic growth in Nigeria. Using

similar approach Ullah, Shah and Khan(2014) found a contrary result of long run relationship in Pakistan.They also identified a bi-directional causality between domestic investment and GDP with Toda-Yamamoto causality test.

Ruranga, Ocaya and Kaberuka (2014)examined Economic Growth, Domestic Investment, Foreign Direct Investment, Domestic Savings and Trade in Rwanda using VAR analysis for the period 1970 to 2011. Their result found domestic investment to impact positively on economic growth. Unidirectional causality from GDP to domestic investment is found in the short run in Rwanda, this finding concurred with(Mehrara &Musai, 2013)who analyzed the causal relationship between domestic investment and GDP for Middle East and North Africa (MENA) region countries using panel cointegration and error correction model.

Omri and kahouli (2013) examined the causal links among FDI, domestic investment and economic growth in MENA countries from 1990-2010 using generalized method of moment robust technique. The result indicates that domestic investment has positive insignificant impact on economic growth and identified a bi-directional causality between the variables of interest.

Kojo, Emedem and Ogala (2012);Ghazali, (2010);Tawiri, (2010); Louzi and Abadi(2011)examined the impact of domestic investment on economic growth. These studies have used different variables and uses varying methods of analysis,their findings indicate thatdomestic investmenthas positive impact on economic growth in the long runbut the positive influence of domestic investment is not independent anda bi-directional causality was identified between domestic investment and economic growth.

However, their finding is in contrast to the work ofLean and Tan(2011) who found that domestic investment is negatively and significantly related to economic

growth in the long run and no causality is running from either economic growth to investment or from investment to GDP using Johansen cointegration method and granger causality.

Tang, Selvanathan and Selvanathan (2008) examined the causal link between foreign direct investment, domestic investment and economic growth for the period 1988-2003 in China, by applying a multivariate VAR system with error correction model (ECM). Their findings show that domestic investment and economic growth are positively correlated, as such great economic growth spurs large domestic investment, and vice versa. By implication, it means China's domestic investment has a greater impact on growth than FDI. Equally, they also found that China's domestic investment and GDP do not have much impact on FDI inflows in the long run.

2.3.2 Private and Public Domestic Investment on Economic Growth

Epaphra and Massawe (2016) empirically analysed the relationship between investment and economic growth in Tanzania from 1970 to 2014. The result revealed a positive relationship between private domestic investment and GDP, while public investment apparently does not exert a significant effect on theeconomic growth.Furthermore, the results show that public investment crowds out domestic private investment. This implies that any increase in public investment more than its proper level would only reduce the positive effect of domestic private investment on economic growth. The result is in line with the findings of Swaby (2007) using the data from Jamaican economy.

Ilegbinosa, Micheal and Watson (2015) examined the Impact of domestic Investment on Economic Growth in Nigeria from 1970 – 2013 using multiple regression analysis. They found that private investment and public domestic investment have insignificant impact on GDP. The study was able to disintegrate public domestic

investment into various components.Aurangzeb and Ulhaq (2012) Kandenge (2007) used similar technique and found an opposing result.

Phetsavong and Ichihashi (2012), Lea and Suruga (2005) These studies used varying methods of analysis and different variables to examine the Impact of Public and Private Investment on Economic Growth. Their results show that private domestic investment and public investment expenditure impact positively on economic growth, also assert that even in Asian countries where FDI has been known to be more effective, domestic investment is more effective than FDI in promoting growth.

Khan and Reinhart (1990) used Solow growth model to examine the impact ofPrivate investment, public investment, growth of labour, growth of export and growth of imports on economic growth in 24 developing countries. They found private domestic investment to have positive significant impact on economic growth, while public investment has negative insignificant impact on GDP. Their study failed to employ any econometrics model.

2.3.3 Public Domestic Investment and Economic Growth

Biyase and Zwane (2015) Nuruddeen and Usman (2010) used different method of analysis and variables to examine the relationship between public domestic investment and economic growth. They identified that public investment has negative significant impact on economic growth, which indicate that a one percent increase in domestic investment will cause a decrease in economic growth. Contrarily, the study conducted by Rabnawaz and Jafar (2015) on the relationship between public investment and economic growth in Pakistan using OLS with iterative process from 1980-2009,found a positive relationship between public investment and economic growth.

Younis (2014) examined the impact of infrastructure investment on economic growth in Pakistan using Principle Component Analysis and VECM, they found that infrastructure investment can have negative impact on economic growth if marginal product of such investment falls below price of capital. They also found that public domestic investment affects economic growth negatively in the longrun, while in the short-run, public domestic investment does not have any significant impact on economic growth.

Chude and Chude (2013) determined the effect of public expenditure on economic growth in Nigeria using Error Correction Model (ECM), they found that economic growth is clearly impacted by factors both exogenous and endogenous to the public expenditure in Nigeria.

Usman, Mobolaji, Kilishi, Yaru and Yakubu (2011) used multivariate time series framework to examine the impact of public expenditure on economic growth in Nigeria and they found a long run relationship between public expenditure and economic growth, while in the short run public spending has no impact on economic growth.

2.3.4 Private Domestic Investment and Economic Growth

Shuaib and Ndidi (2015) examined the impact private domestic investment on economic in Nigeria, they found that private domestic investment has a stronger, more favorable effect on growth rather than public domestic investment probably because private capital formation is more efficient and less closely associated with corruption.

Kanu and Ozurumba (2014) conducted a research to ascertain the impact of private domestic investment on economic growth in Nigeria using vector autoregressive model for the period of 1981-2011. Their findings revealed that private domestic investment has positive insignificant impact on GDP in the short run, while in the long

run it has positive significant impact on GDP and the direction of causality between the variable of interest is unidirectional. There is no justification for using VAR model because the variables are stationary at different level. Another study by Ugochukwu and Chinyere (2013) supported the findings.

Ajide and Lawanson (2012) employed Auto-Regressive Distributed Lag (ARDL) econometric technique to examine the determinants of domestic private investment in Nigeria over the period 1970 to 2010, Emanated from the estimated models are intriguing findings which showed clearly that difference exist between long and short run determinants but Public investment and real GDP are found to be statistically significant in both short run and long run. These researchers fail to conduct causality test among the variables of interest.

Asante (2000) analyzed the determinants of private investment in Ghana using a time series analysis for the period 1970-1992. The results showed that a positive change in private investment will result to decrease in gross domestic product.

2.3.5. Research Gap

It is acknowledged that various studies have made useful contribution to understand the nexus between domestic investment and economic growth;mostly using aggregate domestic investment and their results are diverse and inconclusive. Kanu and Ozurumba (2014), Ogochukwu and Chinyere (2013) used only private domestic investment in their study and found a positive relationship between private domestic investment and GDP. In contrary, Rabnawaz and Jafar (2015) employed public investment and established a positive relationship between public domestic investment and economic growth while Nuruddeen and Usman (2010) found negative relation between public domestic investment and economic growth.

However, many of these studiesAwolusi and Adeyeye (2016); Agbelenko (2015) applied cumulative domestic investment,Studies that divide domestic investment into private and public domestic investment such as Epaphra and Massawe (2016); Ilegbinosa, Micheal and Watson (2015);kandenge(2007)are time series bias and their result are inconclusive.Moreover, the limited papers that used panel data such as Phetsavong and Ichihashi (2012)Ndumbiri, Ritho, Ng'ang'a, Kubowon, Mairura, Nyangweso, Muiruri and Cherotwo, (2012)employed static panel data models.

Therefore, this study fill the gap upon previous researches by employing Mean Group (MG) and Pooled Mean Group (PMG) dynamic panel data models to examine the relationship among private domestic investment, public domestic investment and economic growth in selected African countries to complement the previous findings.

2.4 Theoretical Literature Review

Priority given to the growth has consequently led to the development of various theories of growth each making effort to explain the process of growth.

2.4.1 Harrod and Domar Growth Model

Harrod (1948) and Domar (1946), focused on determining the rate of growth from one period to another, which is enough to maintain full employment. Harrod-Domar model defined the growth rate which is required to maintain full employment as follows:

$$G=S/Y.1/K \qquad\qquad (2.1)$$

where:

G = Rate of Growth.

S = saving in a period.

Y = National Income.

1/K = Coefficient of Capital.

According to this model, the savings rate (S/Y), and inverted of capital/income are the factors which determine the rate of growth. The Coefficient of capital/income shows the relationship between what is invested and the resulting income. That means what we need to invest capital to achieve a given increase in income.

Through the above model highlights the importance of determining the rate of investment (S/Y), which is necessary to achieve a certain rate of economic growth. This model also shows the possibility of increasing the rate of growth, by either reducing a factor (capital/income), or increase the rate of investment (savings/income).

2.4.2 Exogenous Growth

Solow is considered the founder of this theory, which assumes that the growth rate is determined by the rate of population growth and technical progress:

$$Y=Af(K, L) \tag{2.2}$$

Where Y = the level of output

K = the stock of physical capital

L = labour output

A = measures the factor of productivity which assume to be exogeneously determine.

Capital to GDP ratio can take on any positive value, that is

$K=k/y \geq 0$

The justification is that the return on capital is decreased due to an increase in the proportion of the capital stock to output. This occurs even up to the equilibrium level which cannot increase the proportion of capital to production beyond. Also, it is not possible to invest in productivity in the long-term, but it will increase and then return temporarily to stability. Therefore, investment and employment are not affecting factors in long-term growth. The reason is, the countries with low per capita income have a weak

capital formation, and therefore, investment will achieve growing returns contrary to the countries with high per capita incomes. This leads to the conclusion that developing countries are able to converge in income with developed countries if they succeed in increasing domestic and foreign investment.

2.5 Theoretical Framework

Solow exogenous growth theory provides a useful framework for analysing the relationship between domestic investment and economic growth. The theory has been used by among others (Ndumbiri et al., 2016) (Phetsavong & Ichihashi, 2012) (Kandenge, 2007) (Khan and Reinhart, 1990).

The theory originates from the idea of production functions which related output to factor inputs and variable known as total factor productivity.

$$Y = Af(K, L) \tag{2.3}$$

Where Y = the level of output

K = the stock of physical capital

L = labour output

A = measures the factor of productivity which assume to be exogenously determine. Capital to GDP ratio can take on any positive value, that is

$K = k/y \geq 0$

Which implies that factors must be available to avoid zero output.

The proponents of this theory postulate that only exogenous factors; population growth and technological progress determine the long run growth rate. Hence, the influence of public policy can only be alerted in the growth path when the economy is moving towards steady growth rate. They affirm that sustainable growth rate will only be influence by investment in physical and human capital.

Khan and Reinhart (1990) observed that the failure of the model to identify the individual impact of private and public investments on economic growth as the major limitation of the theory. Accordingly, to ascertain the independence impact investment has to be decompose into private and public domestic investment, that is I= Ip+Ig (Kandenge, 2007).

Where Ip= private sector investment

Ig= public sector investment

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section contains the methods and procedures employed in assessing the impact of domestic investment on economic growth in selected African economies. It comprises research design, type and sources of data, technique of data analysis, model specification and description of variables.

3.2 Research Design

The study examined the impact of domestic investment on economic growth for five (5) selected African countries with highest gross domestic product based on World Bank ranking namely; Nigeria,South Africa, Egypt, Algeria, Angola, covering 33 years, that is the period of 1985-2017.

3.3 Type and Sources of Data

The study used secondary data and the data on Gross Domestic Product, public domestic investment, private domestic investment, foreign direct investment export and interest rate were sourced from sourced World Bank (World Development Indicators). While data fact and figures data were sourced from United Nation Conference on trade and development.

3.4 Method of Data Analysis

The study used a dynamic panel data model that is Mean Group (MG) and Pooled Mean Group (PMG) estimators suggested by Pesaran, Shin and Smith (1999) to analyze the relationship among economic growth, public domestic investment and private domestic investment. The justification is that panel data models have the capacity to capture the dynamic nature of the data; they also possess several advantages over cross-

sectional or time series data (Hsiao, 2000). This include; ability to combine both time series and cross-sectional dimensions (which provide more number of data points, minimizing collinearity among explanatory variables and increasing degree of freedom). It also controls for individual heterogeneity as well as addresses economic problems which cannot be examined under time series or cross-sectional data.

3.5 Model Specification

Mean Group and Pooled Mean Group estimators are specified by employing Autoregressive Distributed Lag (ARDL) model. The ARDL models especially PMG and MG includes lags of dependent and independent variables which enable the models to Provides consistent coefficients despite the possible presence of endogeneity (Pesaran et al. 1999) cited in Samargandi, Fidrmuc, and Ghosh (2013).The model was subjected to hausman test to select most appropriate model between MG and PMG. The null of this test is that the difference between PMG and MG estimation is not significant. If the null is not rejected, the PMG estimator is recommended since it is efficient.

3.5.1 Mean Group (MG) Estimator

MG estimator allows for estimating the longrun parameters for the panel from the separate regression of the ARDL models. It allows for all coefficients to vary and be heterogeneous in the long-run and short-run. However, the necessary condition for the consistent and validity of this approach is to have a sufficiently large time series dimension of the data. The model can be specified in the following equation as:

$$Y_{i,} = \alpha_i + \gamma_i Y_{i,-1} + \beta_i X_{i,t} + \varepsilon_{i,t} \qquad (3.1)$$

For country i, where i=1,2,……N, the longrun parameters θ_i for country i is:

$$\theta_i = \frac{\beta i}{1 - \gamma_i} \qquad (3.2)$$

For whole panel the MG estimators will be as follows:

$$\hat{\theta} = \frac{1}{N}\sum_{i-1}^{N}\theta_i \tag{3.3}$$

$$\hat{a} = \frac{1}{N}\sum_{i-1}^{N}a_i \tag{3.4}$$

3.5.2 Pooled Mean Group (PMG) Estimator

The PMG is an intermediate estimator which combines both pooling and averaging. The PMG estimator constrains the long term coefficients to be the same across countries and allows only the short term coefficients to vary. The estimator allows short-run coefficients, including the intercepts, the speed of adjustment, and error variances to be heterogeneous across cross section, while the long-run slope coefficients are restricted to be homogeneous across countries. The short-run adjustment is allowed to be heterogeneous, as a result of diverse impact of the external shocks, financial crises, and monetary policies e.t.c. The PMG model can be specified as:

$$Y_{it} = \sum_{j=1}^{p}\lambda ij\, Y_{i,t-j} + \sum_{j=1}^{q}\delta' ij\, X_{i,t-j} + \mu_i\, i + \varepsilon_{it} \tag{3.5}$$

When above equation is reparametrized it will became error correction equation as follows:

$$\Delta Y_{it} = \left(\theta_i Y_{i,t-1} - \beta'_i X_{i,t-1}\right) + \sum_{j-1}^{p-1}\gamma ij\Delta Y_{i,t-j} + \sum_{j-1}^{q-1}\gamma ij\Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3.6}$$

Where, i is indexes of countries is 1, 2,………….., 10

t is indexes of time dimension is 1985, 1986…..,2017

Y is the dependent variable;

X_{it} is a *Kx1* vector of explanatory variables;

γ_{ij} represent the short-run coefficients of lagged dependent and independent variables

β_i are the long-run coefficients

θ_i is the coefficient of speed of adjustment to the long run- equilibrium.

μ_i is the group specific effect

3.5.3 Empirical Model

The study adopted Lee and Wang (2015) and Samargandi, Fidrmuc, and Ghosh (2013) MG and PMG models to examine the relationship among private domestic investment, public domestic investment and economic growth with modification.

The functional form of the modified models is stated as follows:

GDP=F(PUDI, PRDI, FDI, EXP, INTR)   (3.7)

The empirical model is stated as follows:-

$GDP_{it} = \beta_0 + \beta_1 PUDI_{it} + \beta_2 PRDI_{it} + \beta_3 FDI_{it} + \beta_4 EXP_{it} + \beta_5 INTR_{it} + \varepsilon_{it}$ (3.8)

Where GDP   =   Gross Domestic Product

PUDI   =   Public Domestic Investment

PRDI   =   Private Domestic Investment

FDI   =   Foreign Direct Investment

EXP   =   Export

INTR   =   Interest rate

β_o =   Constant

$\beta_1, \beta_2, \beta_3, \beta_{4\&} \beta_{5=}$ are the unknown parameters to be estimated

And i is the cross-country dimension, t is the country's time series dimension, ε is the random disturbance term.

The variables were transformed into log to alleviate the problem of heteroscedasticity and achieve convergence.

$LogGDP_{it} = \beta_0 + \beta_1 LogPUDI_{it} + \beta_2 LogPRDI_{it} + \beta_3 LogFDI_{it} + \beta_4 LogEXP_{it} + \beta_5 Log\ INTR_{it} + \varepsilon_{it}$ (3.9)

3.5.4 Panel Unit Root Test

Panel unit root tests is use to check the stationarity or otherwise of the series. The tests increase the power of tests over the individual unitroot tests due to the span of the observations. Levin, Lin and Chu (LLC) and Im, Pesaran and Shin (IPS) tests were employed in the study to check for unit root in the series. The two tests assume the null hypothesis of non-stationarity series. LLC assume common unitroot process while IPS assumes individual unitroot process. These tests are based on the following equation:

$$y_{it} = \rho_i y_{it-1} + X_{it} \delta_i + \varepsilon_{it} \qquad (3.10)$$

3.5.5 Panel Cointegration Test

Cointegration test was used to examine the presence or otherwise of longrun relationship among the variables of the study. Padroni (1999, 2004) Kao (1999) panel cointegration test were employed in this study to determine if the variables of the study share common stochastic trend. The test is based on the following equation:

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + ... + \beta_{ki} x_{kit} + e_{it} \qquad (3.11)$$

3.5.6 Diagnostic Tests

The variables were subjected to autocorrelation test to ensure that the estimated coefficients are unbiased and consistent. In view of the fact that one of the advantage of employing panel data model as highlighted by Hsiao (2000) is minimizing collinearity among explanatory variables. Similarly, heteroscedasticity is not an issue in panel data models analysis because the model increases the total number of observations and their variation but also reduces the noise coming from the individual time series.

Equally, the ARDL models especially PMG and MG includes lags of dependent and independent variables which enable the models to Provides consistent coefficients

despite the possible presence of endogeneity (Pesaran et al. 1999) cited in Samargandi, Fidrmuc, and Ghosh (2013).

3.6. Variables Measurement

3.6.1 Economic Growth

Economic growth will be proxy by Gross Domestic Product and is expected to capture the effect of increase or decrease of domestic investment(Kanu & Ozurumba, 2014)

3.6.2 Private Domestic Investment

Private investment is responsible for the enhancement of economic condition in the country, is one of the key variables in the study and expected to have positive impact on GDPShuaib and Ndidi (2015). The variable is proxy by gross capital formation as percentage of GDP.

3.6.3 Public Domestic Investment

Public investment is considered as prerequisite foundation of economic growth because is responsible for increasing the infrastructure of the country. It is also a variable of primary interest in the study and proxy by general government consumption expenditure as percentage of GDP. Public domestic investment is expected to influence economic growth positively based on the theory (Rabnawaz and Jafar, 2015).

3.6.4 Foreign Direct Investment (FDI)

FDI play significant role as a primary source of technology transfer and fund supply. FDI inflows results in an increase the level of investment finance and also raises the level of gross domestic product. Thus, a positive relationship exists between FDI and GDP based on apriori expectationAgbelenko (2015). It is measured as FDI net inflows as percentage of GDP.

3.6.5 Export

Export is an important source of foreign exchange and expected to have positive impact on GDP based on apriori expectation and is measured by export of goods and services as percentage of GDP(Kanu & Ozurumba, 2014).

3.6.6 Interest rate

It is expected that higher interest rates will discourage borrowing, and hence result in lack of funds to invest, which makes such an economy to become less productive and competitive. The variable is measured by real interest rate. Therefore from apriori expectation this variable has inverse relation with economic growth(Adegbite & Adetiloye, 2013).

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter present and analyzed the empirical results from the estimation procedures stated in the methodology. Relevant tests such as the unit root test on all the study variables was conducted both at level and first difference in order to ascertain the stationarity of the variables or otherwise. While co-integration test was executed to determine the existence of longrun relationship prior to estimation of the models using mean group and pooled mean group. Discrimination test was also conducted to select appropriate model while diagnostic tests was performed to ensure consistency and reliability of the estimates.

4.2 Descriptive Statistics

The descriptive statistics are presented in Table 4.1. This table reports the overall mean, standard deviation, minimum and maximum values for all the variables used in the analysis.

TABLE 4.1: Descriptive Statistics of the Variables

Variables	Mean	Standard Deviation	Minimum	Maximum
LGDP	25.04229	1.138166	22.21354	27.06627
LPUDI	2.596048	.6757347	0	4.045554
LPRDI	2.679663	.8874304	0	3.926105
LFDI	.2324624	1.662524	-7.524326	3.693052
LEXP	3.230578	.8049945	0	4.496313
LINTR	.9765773	1.177178	-2.312374	3.561367

Source: Researcher's computation using econometric software package STATA 14

Table 4.1 shows that all the variables are relatively closer to their mean values. The mean of LGDP for the selected countries over the study period is $25.04229. LPUDI and LPRDI have relatively similar mean with 2.596048 and 2.679663 respectively within the study period FDI has mean of 0.2324624 and

recorded minimum and maximum value of -7.524326 and 3.693052 respectively. The standard deviation confirms that the dispersion of LGDP and LINTR which is 1.662524 and 1.138166 as well as LPRDI 0.8874304 and LEXP 0.8049945 are insignificant.

4.3 Panel Unit Root Test

This involves testing the order of integration of the individual series under consideration.The study employed LLC and IPS panel unit root tests to determine the stationarity of the study variables, because it is very likely for macroeconomic variables to follow unitroot process.

Table 4.2 presents the summary of the unit root tests results at level and at first differences using LLC and IPS tests. The tests employed in this study have a null hypothesis stating that the series contain unit root against alternative hypothesis that the variables have no unit root.

TABLE 4.2 Summary of Unit Root Test Result

	LEVEL		1st DIFFERENCE	
VARIABLES	LLC	IPS	LLC	IPS
LGDP	0.0646	2.1627	-3.0801***	-4.1329***
	(0.5257)	(0.9847)	(0.0010)	(0.0000)
LPUDI	-1.8273**	-1.7849**	-3.9395***	-5.6341***
	(0.0338)	(0.0371)	(0.0000)	(0.0000)
LPRDI	-0.7502	-0.8468	-5.8468***	-7.1950***
	(0.2266)	(0.1985)	(0.0000)	(0.0000)
LFDI	-2.1713***	-1.9300**	-5.4197***	-6.6910***
	(0.0150)	(0.0268)	(0.0000)	(0.0000)
LEXP	-0.1275	0.5479	-1.7649**	-4.2768***
	(0.4493)	(0.7081)	(0.0388)	(0.0000)
LINTR	-3.6169***	-3.7572***	-8.3039***	-11.9409***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)

Source: Researcher's computation using econometric software package STATA 14
Note: **'***indicates stationarity at 5% and 1% level of significance.

In the above Table 4.2 the results show that three of the variables LPUDI, LFDI and LINTR are stationary at level I(0) and at first difference I(I) at 5% level of significance, while some variables such as LGDP, LPRDI, LEXP were stationary at first difference I(I) at 5% level of significance in both LLC and IPS tests. These results satisfy the pre-condition of MG and PMG model that is some variables are stationary at level while some are stationary at difference.

4.4 Panel Cointegration Test

The purpose of cointegration test is to determine whether groups of non-stationary series are cointegrated. Pedroni (2004) and Kao (1999) cointegration tests were employed to confirm the existence of longrun relationship among the variables of the study.

Table 4.3: Pedroni (2004) Panel Cointegration Test

Tests without deterministic trend				Test with deterministic intercept & trend			
	Statistics		Statistics		Statistics		Statistics
Panel v Stat.	-1.046286 (0.8523)	Group rho Stat.	1.088095 (0.8617)	Panel v Stat.	-1.353231 (0.9120)	Group rho Stat.	1.920424 (0.9726)
Panel rho Stat.	0.078169 (0.5312)	Group PP Stat.	-2.646528*** (0.0041)	Panel rho Stat.	1.045409 (0.8521)	Group PP Stat.	-3.065300*** (0.0011)
Panel PP Stat.	-3.042600*** (0.0012)	Group ADF Stat.	-2.205842*** (0.0137)	Panel PP Stat.	-3.273212*** (0.0005)	Group ADF Stat.	-2.199833*** (0.0139)
Panel ADF Stat.	-3.152825*** (0.0008)			Panel ADF Stat.	-3.351149*** (0.0004)		

Source: Researcher's computation using econometric software package EVIEWS 9
Note: **' *** indicates cointegration at 5% and 1% level of significance.

Table 4.3 present the Pedroni, (2004) co-integrations test without deterministic trend in the first part of the table, the results indicates that 4 out of 7 outcomes do reject null hypothesis of no co-integration. The second part of the table shows panel co-integration test with deterministic intercept and trend, the results indicates that 4 out of 7

outcomes also reject the null hypothesis of no co-integration. Therefore it is shown that variables of the study are co-integrated for the group of selected countries.

Table 4.4 :Kao, 1999 Panel Cointegration Test

ADF t-statistics	Probability
-3.743801***	0.0001

Source: Researcher's computation using econometric software EVIEWS 9
Note: **'***indicates cointegration at 5% and 1% level of significance.

Table 4.4 presents Kao (1999) residual co-integration test. The result shown that co-integration was found among the variables which implies an existence of a long run relationship among the variables. The test is based on long run residuals resulting from estimating long run static regression. Hence, the null hypothesis of no co-integration is rejected.

4.5 Estimation Results

In order to identify the impact of public and private domestic investment on economic growth as well as to examine effect of public domestic investment on growth domestic product in the individual countries, Autoregressive Distributed Lag (ARDL) was used with focus on MG and PMG models.

4.5.1 Mean Group and Pooled Mean Group

Table 4.5: MG and PMG Estimation Result Model

VARIABLES	MEAN GROUP MODEL	POOLED MEAN GROUP MODEL
Long-run Coefficients		
CONSTANT	-.1171808 (.9805329) [0.905]	.653715 (.108161) [0.000]
LPUDI	1.63003 (1.536419) [0.289]	-7.34106 (3.643274) [0.044]
LPRDI	-.1205763 (1.969674) [0.951]	-.0335319 (1.017562) [0.974]
LFDI	-.4224776* (.2303015) [0.067]	-.1463067 (.2574647) [0.570]
LEXP	-1.954565 (2.647453) [0.460]	6.245512 (2.953017) [0.034]
LINTR	.3675819 (.3030909) [0.225]	-.5663376 (.3932069) [0.150]
ECT_{t-1}	-.0045798 (.0395854) [0.908]	-.0233234 (.0039956) [0.000]
Long-run Coefficients		
ΔLPUDI	-.2138243* (.1141394) [0.061]	-.1601257 (.0977855) [0.102]
ΔLPRDI	-.0777173 (.1047184) [0.458]	-.0868426 (.1341477) [0.517]
ΔLFDI	-.0743002 (.0568928) [0.192]	-.0774556 (.0452295) [0.087]
ΔLEXP	-.3364759* (.1875492) [0.073]	-.2805682 (.1727341) [0.104]
ΔLINTR	-.0104189* (.0056163) [0.064]	-.0101125 (.0099227) [0.308]
Observation	160	160
No. of Cross Unit	5	5
Hausman Test 132.0116 [0.0356]		
Autocorrelation 48.183 [0.0023]		
Log Likelihood 132.0116		

Source: Researcher's computation using econometric software STATA 14

Note: ***' **'*****indicates significance at10%, 5% and 1% level.

() standard error was in the parenthesis and [] probability in brackets

The estimation result MG and PMG models were presented in Table 4.5.Based on the Hausman test with chi-square value of 132.0116 and probability of0.0356, which is lower than 5% indicating that MG model is more appropriate to use, hence our discussion was focus on the MG model. As can be seen from table 4.5 only the coefficient of LFDI has negative significance impact in the long-run at 10% level of significance, meaning that 1% increase in foreign direct investment will result to 0.422% decrease economic growth.This result is consistent with findings of (Ilegbinosa, Micheal & Watson, 2015) and is in contrast with findings of (Epapira & Massawe, 2016) and (Kanu & Ozurumba, 2014).

The coefficient of public domestic investment has negative significance impact on economic growth in the short run at ten per cent level of significance that is a 1% increase in public domestic investment in the short-run will result to decrease in growth domestic product0.214%This result is consistent with previous studies of Phetsavong and Ichihashi(2015).It implies that an increase in public domestic investment will lower the level of employment, which results to lowerproductivity;this will reduce the profit of producers and force some firms to leave the market resulting to reduction in economic growth. This may be attributed to the behaviour of African countries of allocating large percentage of their budget to recurrent expenditure rather than on capital expenditure that reduces the cost facing private sector firms, using the domestic loan supposed to be borrowed by private investors.

The coefficient of export was found to have negative statistically significance impact on GDP in the shortrun at ten per cent level and this implies that a 1% increase in export in the short-run will result to decrease in economic growth by 0.34%. The result is contrary to economic theory, indicating that increasing export by the selected African

countries will lower GDP in the period under review, because the foreign exchange from export was used to import cheaper consumer goods manufactured by local firms at higher price, which eliminate them out of the market and increase unemployment level. The result is contrary to the previous studies of Ndumbiri et al. (2012).

The result also shows that LINTR is statistically significant at 10% with correct negative sign in the shortrun, which implies that a 1% increase in the interest rate, will lead to a decrease in economic growth by 010% which is consistent with apriori expectation. The implication of this result is that high interest rate may discourage investment, more especially when government deficit is financed with banking sector loan this will result to increase in unemployment. This result is consistent with previous studies ofTan and Tang (2016).

While the coefficient of public domestic investment, private domestic investment, export, and interest rate are statistically insignificant in the long run at all levels and this implies that increase or decrease in these variables will not influence economic growth in the selected countries, this may be attributed to over dependence on single commodity export such as crude oil. The coefficient of private domestic investment and FDI was found to be statistically insignificant in the shortrun at all levels,meaning that the two variables as the instrument of macroeconomic policy do not provide any significant increase to economic growth.

The error correction terms as expected has negative sign but statistically insignificant. The coefficient of error correction term has a value of -.0045798 meaning that system corrects its previous period disequilibrium at a speed of 0.458% annually, indicating that the system is correcting disequilibrium very slowly.The negative value of the error term supports the establishment of the long-run cointegration relationship among variables.

TABLE 4.6: MGEstimation Result for Individual Countries

VARIABLES	NIGERIA	SOUTH AFRICA	EGYPT	ALGERIA	ANGOLA
Long-run Coefficients					
CONSTANT	-3.2986***	2.220691	-3.158082*	-1.82549*	1.104172
	(1.112606)	(1.602658)	(1.86635)	(1.126754)	(1.57718)
	[0.003]	[0.166]	[0.091]	[0.105]	[0.484]
LPUDI	.3025771	8.399829***	1.39738	1.332242	-4.081674
	(.914738)	(2.494351)	(2.565127)	(1.162371)	(6.087596)
	[0.741]	[0.001]	[0.586]	[0.252]	[0.503]
LPRDI	.6330031	3.405212**	-3.855508***	2.810545***	.7105816
	(.9503472)	(1.453114)	(1.32136)	(.7466714)	(1.107529)
	[0.505]	[0.019]	[0.004]	[0.000]	[0.521]
LFDI	-1.003476	.0215809	.3579389	-.0461836	-1.075817
	(.7406478)	(.1308181)	(.3441509)	(.0875549)	(1.237212)
	[0.175]	[0.869]	[0.298]	[0.598]	[0.385]
LEXP	-1.144294	.0958583	-3.683651*	-.3778225	2.983149
	(1.093048)	(1.53264)	(1.962641)	(.9493353)	(4.627146)
	[0.295]	[0.950]	[0.061]	[0.691]	[0.519]
LINTR	.5117859	.2174263	-.2043528	.2334833	-.3097713
	(.3353975)	(.1856639)	(.2006419)	(.2092978)	(1.194062)
	[0.127]	[0.242]	[0.308]	[0.265]	[0.795]
ECT$_{t-1}$	.1247405***	.2307559**	.0724012*	.1475829**	-.0401671
	(.0331962)	(.1098681)	(.0473017)	(.0716749)	(0655278)
	[0.000]	[0.036]	[0.126]	[0.039]	[0.540]
Short-run Coefficients					
ΔLPUDI	-.0448208	.4441417	-.3321747	-.1544927	-.0582896
	(.1250971)	(.9898881)	(.3430904)	(.2359445)	(.0942622)
	[0.720]	[0.654]	[0.333]	[0.513]	[0.536]
ΔLPRDI	-.1084045	.260265	-.0053053	-.3184908*	.0567548
	(.1498799)	(.3540499)	(.1548701)	(.2109934)	(.0894551)
	[0.470]	[0.462]	[0.973]	[0.131]	[0.526]
ΔLFDI	-.2701***	-.0018711	.020582	-.0339313**	-.0878418*
	(.0768576)	(.0213881)	(.0307171)	(.0154645)	(.0540009)
	[0.000]	[0.930]	[0.503]	[0.028]	[0.104]
ΔLEXP	.1701647	-.8052493**	-.6303397***	-.3987528***	.0056828
	(.1651784)	(.3615604)	(.0860813)	(.1523173)	(.0624856)
	[0.303]	[0.026]	[0.000]	[0.009]	[0.928]
ΔLINTR	-.0169453	.0187491	-.0179924	-.0214297	.0164143
	(.0278527)	(.0395755)	(.0130473)	(.0171432)	(.0300922)
	[0.543]	[0.636]	[0.168]	[0.211]	[0.585]

Observation		160
No. of Cross Unit		5
Hausman Test	132.0116	
	[0.0356]	
Autocorrelation		48.183
		[0.0023]
Log Likelihood	132.0116	

Source: Researcher's computation using econometric software STATA 14

Note: *' **' *** indicates significance at10%, 5% and 1% level.

() standard error was in the parenthesis and [] probability in brackets

The result of the MG model for individual countries was presented in Table 4.6. The results indicate that coefficient of LPUDI has positive significance impact on economic growth in the longrun at 1% level only in South Africa, this implies that a 1% increase in the public domestic investment, will lead to an increase in economic growth by 8.40% in South Africathis result is consistent with findings of (Kandenge, 2007). The provision of these core infrastructures reduces the cost facing private sector firms. This arrangement creates an enabling environment for higher new private sector capital formation and output growth, which will generate more employment as well as improve the level of income.

Moreover, the result shows that the coefficient of LPRDIwas found to havepositive statistically significance impact on economic growth in the longrun at 1% level in Algeria and 5% in South Africa,this implies that a 1% increase in the private domestic investment in three countries, will lead to an increase in economic growth in South Africa by3.41% and by 2.81% in Algeria, which is in conformity with apriori expectation,this result is consistent with findings of (Ndumbiri et al., 2012).That is an increase in private investment will result to more employment generation, which lead to improvement in the level of income as well as increase in demand and supply of goods and services.

While in Egypt LPRDIwas found to havenegative statistically significance impact on economic growth in the longrun at 1% level,this denotes that one unit increase in private domestic investment lead to a decrease in economic growth in Egypt by 3.86%, It implies that an increase in private domestic investment will lower the level of employment, which results to lower productivity; this will reduce the profit of producers and force some firms to leave the market resulting to reduction in economic growth.In

Nigeria and Angola based on the individual country result LPRDI was statistically insignificance at all levels.

The coefficient LEXPwas found to have negative statistically significance impact on GDP in the longrun at ten per cent level in Egypt, which contrary to apriori expectation and this implies that a 1% increase in export will result to decrease in economic growth by 3.68% in the longrun. The implication is that increasing export by the selected African countries will lower GDP in the period under review, because the foreign exchange from export was used to import cheaper consumer goods manufactured by local firms at higher price, which eliminate them out of the market and increase unemployment level this result is contrary with findings ofKalu & Oyinye (2015).

In the shortrun the coefficient of LPRDI has negative significance impact on economic growthin Algeria at ten per cent level of significance, indicating a violation of economic theory meaning that a 1% increase in private domestic investment will result to decrease in growth domestic product by 0.32%.That is an increase in private investment will result to decrease in employment generation, which lead to decrease in the level of income as well as decrease in demand and supply of goods and services, this result is consistent with findings of Kalu & Oyinye (2015).

The result also shows that in the shortrun LFDIhave negative statistical significant impact on economic growth at 1% in Nigeria, 5% in Algeria and 10% in Angola, implies that a 1% increase in the FDI, will lead to a decrease in economic growth by 0.27%, 0.033% and 0.088% in Nigeria, Algeria and Angola respectively, which is contrary to apriori expectation.That is an increase in foreign direct investment will result to decrease in employment generation, which lead to decrease in the level of income as well as

decrease in demand and supply of goods and services.This result is contrary with findings of Epaphira and Massawe (2016).

The coefficient export was found violate apriori expectation, to have negative statistically significance impact on GDP in the shortrun 5% level of significancein South Africa and 1% level of significance in both Egypt and Algeriawhich implies that a 1% increase in export in the short-run will result to decrease in economic growth by 0.81% in South Africa, 0.63% in Egypt and 0.81% in Algeria. The implication is that increasing export by the selected African countries will lower GDP in the period under review, because the foreign exchange from export was used to import cheaper consumer goods manufactured by local firms at higher price, which eliminate them out of the market and increase unemployment level, this result is contrary with findings ofKalu & Oyinye (2015).

While in the remaining four countries namely; Nigeria, Egypt, Algeria and Angola the coefficient of public domestic investment was found to be statistically insignificance at all levels in the longrun. LEXP was alsostatistically insignificant in the remaining Nigeria, South Africa, Algeria and Angola. The coefficient of LFDIand LINTR was found to be statistically insignificant in the longrun for five countries at all levels.

Although the error correction coefficient in this model was statistically significant in four countries only in Angolait has the expected negative sign but statistically insignificant. The coefficient of error correction term in Angola with value of -.0401671 and probability of 0.540 meaning that system correct its disequilibrium at a speed of 4.01% annually which very slow.

4.5.2 Diagnostic Test

Autocorrelation test was conducted to check the consistency and reliability of the estimated coefficients included in the models, the result was presented in table 4.5,which indicates that we have to reject the null hypothesis of no serial correlation .However, to resolve the problem of serial correlation identified in the model, panel generalized least square (panel GLS) model was employed.

4.5.3 Panel Generalized Least Square Models

TABLE 4.7: GLS Estimation Result Model

VARIABLES	COEFFICIENTS	PROBABILITY
CONSTANT	23.7482***	0.000
	(.347697)	
LPUDI	-.3605327***	0.013
	(.1452355)	
LPRDI	.6088896***	0.000
	(.0940524)	
LFDI	-.1099938**	0.021
	(.0477079)	
LEXP	.12793	0.296
	(.1222949)	
LINTR	.215772***	0.000
	(.0619559)	
Observation	165	
No. of Cross Unit	5	
Log Likelihood	-221.0979	

Source: Researcher's computation using econometric software STATA 14
    Note: *' **' *** indicates significance at10%, 5% and 1% level.

The panel Generalized Least Square (GLS)model estimates are presented in Table4.7in the above table, the result showsthat LPUDIhas negative significant relationship with economic growth at one per cent level, meaning that a one per cent increase in public domestic investment would lead to a decrease in GDP by 0.36%while controlling other variables included in the model constant, this is contrary to apriori expectation. It implies that an increase in public domestic investment will lower the level of employment, which results to lower productivity; this will reduce the profit margin of

producers and force some firms to leave the market resulting to reduction in economic growth. This may be attributed to the behaviour of African countries of getting loan supposed to be borrowed by private investors and allocating large percentage of their budget to recurrent expenditure rather than on capital expenditure that reduces the cost facing private sector firms. This result is consistent with the findings of Ndumbiri et al.(2012) and Phetsavong and Ichihashi (2012) and is at variance with the findings of (Olurunfemi, 2008).

The estimate coefficient of private domestic investment was found to be positive and statistically significant at 1%, which indicates a positive relationship exist between private domestic investment and GDP that is the result conforms with apriori expectation, meaning that a 1% increase private domestic investment would lead to an increase in economic growth by 0.61%. This indicates that private investment stimulates economic growth in the selected countries. That is an increase in private investment will result to more employment generation, which lead to improvement in the level of income as well as increase in demand and supply of goods and services. This result is consistent with findings ofEpaphira and Massawe (2016); Kanu and Ozurumba(2014) Ugochukwu and Chinyere (2013) and inconsistent with the findings of Kalu and Oyinye(2015).

The coefficient of foreign direct investment is statistically significance at 1% level with a negative relationship to GDP. By controlling all other independent variables included in the model, that a 1% increase in the FDI causes a decrease in economic growth by 0.1010% in the selected countries. That is an increase in foreign direct investment will result to decrease in employment generation, which lead to decrease in the level of income as well as decrease in demand and supply of goods and services.This result is contrary with findings of Tang and Tan(2015).

Interest ratecoefficientis statistically significance at 1% level with a positively relationship to economic growthwhich implies that a positive relationship exist between interest and GDP, the result contrary to apriori expectation, meaning that a 1% increase interest will result to an increase in economic growth by 0.22%.The implication of this result is despite high interest rate private investors will borrow and invest in government bond as well as execute government lucrative contract. This result is consistent with findingsTan and Tang (2016)

The coefficient of LEXP was found to be statistically insignificant al all level. Thisinsignificant impact of export may be associated with low level of export in selected countries in relation to import or due to low commodity price in African countries.

TABLE 4.8: GLS Estimation Result for Individual Countries

VARIABLES	NIGERIA	S/AFRICA	EGYPT	ALGERIA	ANGOLA
CONSTANT	26.06661***	-1.894873	38.0694***	13.00908***	23.91162***
	(.9174296)	(3.017011)	(1.580489)	(1.644482)	(.3442047)
	[0.000]	[0.530]	[0.000]	[0.000]	[0.000]
LPUDI	-.236247	6.614205***	-1.083801*	.8858749**	-.5716667***
	(.4416557)	(.8768585)	(.5704606)	(.4183352)	(.1509875)
	[0.593]	[0.000]	[0.057]	[0.034]	[0.000]
LPRDI	.1840302	1.5822***	-2.560865***	1.922428***	4410864***
	(.4291024)	(.5088986)	(.3042732)	(.2389055)	(.105494)
	[0.668]	[0.002]	[0.000]	[0.000]	[0.000]
LFDI	-.6731315*	-.027012	.3132183***	-.0136418	-.5264848***
	(.3526497)	(.0403689)	(.084857)	(.0271996)	(.1048256)
	[0.056]	[0.503]	[0.000]	[0.616]	[0.000]
LEXP	-.1987962	1.071125**	-.8549783***	.8744179***	.3755806***
	(.3645931)	(.4743477)	(.2263687)	(.2306992)	(.1299593)
	[0.586]	[0.024]	[0.000]	[0.000]	[0.004]
LINTR	.2613328*	.105341*	-.135503**	-.042855	.1352918*
	(.1386301)	(.067472)	(.0533986)	(.0454727)	(.0854736)
	[0.059]	[0.118]	[0.011]	[0.346]	[0.113]
Observation	33	33	33	33	33
Log Likelihood	-44.25713	-1.56442	-10.75883	-.7921304	-30.68623

Source: Researcher's computation using econometric software STATA 14
Note: *' **' *** indicates significance at10%, 5% and 1% level.
() standard error was in the parenthesis and [] probability in brackets

The results indicate that coefficient of LPUDI has positive significance impact on economic growthat 5% in South Africa and Algeria,this implies that a 1% increase in the public domestic investment, will lead to an increase in economic growth by 6.61% in South Africa 0.89% in AlgeriaThis result is consistent with findings of Lea and Suruga (2005). Whilein Egypt and Angola 1% increase in the public domestic investment,while in Egypt and Angola it negatively affect LGDP at 10% and 1% level of significance respectively,this will lead to andecrease in economic growth by 1.08% and 0.57%.This result is contrary to economic theory, It implies that an increase in public domestic investment will lower the level of employment, which results to lower productivity; this will reduce the profit margin of producers and force some firms to leave the market resulting to reduction in economic growth.This result is contrary with findings of Aurengzeb and Ul-haq (2012).

However, the result shows that the coefficient of LPRDIwas found to havepositive statistically significance impact on economic growthat 1% level in Algeria in South Africa, Algeria and Angola.In Egypt LPRDIwas found to havenegative statistically significance impact on economic growthat 1% level of significance. This implies that a 1% increase in the private domestic investment will lead to an increase in economic growth in South Africa by1.58%, Algeria by 1.92% and by 4410% in AngolaThis result is consistent with findings of Ugochukwu and Chinyere(2013) and in contrast with the work of Kalu and Oyinye(2015). Whereas 1% increase in the private domestic investment will lead to lead to a decrease in economic growth by 2.56% in Egypt.

The coefficient LFDIwas found to have negative statistically significance impact on GDPat ten per cent level in Nigeria and 1% level of significance in Angola this implies that a 1% increase in FDI will result to decrease in economic growth by 0.67% in

Nigeria and 0.53 in Angola.While in Egypt FDI have positive statistically significance impact on GDP, indicating that a 1% increase in FDI will result to increase in economic growth by 0.31%.This result is contrary with findings of Epaphira and Massawe (2016).

The coefficient of LEXP havepositive significance impact on economic growthin South Africa, Algeria and Angola at 5% level of significance, meaning that a 1% increase in export will result to increase in growth domestic product in three countries by1.07%, 0.87%, and 0.38%, respectively.While in Egypt coefficient of LEXP has negative significance impact on economic growth at 1% level of significance, implying that 1% increase in export will result to decrease in economic growth by 0.85%. This result is consistent with findings of Tang and Tan (2015).

The coefficient of LINTR havepositive significance impact on economic growthin Nigeria, Algeria and Angola at 10% level of significance, meaning that a 1% increase in interest rate will result to an increase in growth domestic product in the three countries by 0.26%, 0.11% and 0.14%, respectively.The positive sign of the coefficient is contrary to apriori expectation.This result is consistent with findingsTan and Tang (2016).

While in Egypt coefficient of LINTR has negative significance impact on economic growth at 5% level of significance, implying that 1% increase in interest rate will result to decrease in economic growth by 0.14% .The negative sign of the coefficient conform to apriori expectation that high interest rate may discourage investment more especially when government deficit is financed with banking sector loan.This result is contrary with findingsKalu and Oyinye (2015).

The above GLS result provides more consistent and reliable estimate that is dependable with apriori expectation; hence recommendation will be based on GLS model result.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

This study examined the impact of domestic investment on economic growth in five African countries with highest GDP for the period of thirty three years from 1985 to 2017. Dynamic panel data technique such as panel unitroot tests, panel cointegration tests and mean group/pooled mean group were applied. Annual data on variables of GDP, public domestic investment, private domestic investment, foreign direct investment, exports and interest rate were utilized in the analysis.

The results show that three variables are stationary at level that is LPUDI, LFDI and LINTR at 5% level of significance, while some variables such as LGDP, LPRDI, LEXP were stationary at first difference at 5% level of significance in both LLC and IPS panel unitroot tests. The result Pedroni (2004) and Kao (1999) co-integration tests show the presence of cointegration relationship, meaning that long run relationship exists among variables. This supports the findings of Epaphira and Massawe(2016).

The findings of the study using autoregressive distributed lag (ARDL), Mean Group model reveals that only LFDI hasnegative statistical significant impact on economic growth at 10% level and LPUDI, LPRDI, LEXP and LINTR are not significant in the longrun, while in the shortrun LPUDI, LEXP and LINTR have negative statistical significant impact on economic growth at 10% but LFDI and LPRDI are statistically insignificant.

The MG result of individual countries shows that public domestic investment has positive significant impact in South Africa and Egypt in the longrun. LPRDIhas positive

impact on GDP in South Africa and Algeria as well as negative impact in Egypt in the longrun.Similarly, FDI has negative influence on economic growth in Nigeria, Algeria and Angola in the shortrun only.

The speed of adjustment coefficients is with value of 0.458%, means that the systemis correcting the previous disequilibrium very slowly. In other word it will take much time for the system converge to the steady state.

Moreover, the result from the GLS model reveals that public domestic investment and foreign direct investment have negative significant impact on economic growth; private domestic investment and interest rate have positive significant impact on GDP, while export has positive insignificant impact on economic growth in the selected countries.

However, result from individual countries shows that LPUDI positively influence economic growth in South Africa and Algeria, but in Egypt and Angola public investment reduces economic growth. LPRDI affect GDP positively in South Africa, Algeria and Angola,whereas,it decrease economic growth in Egypt. FDI have positive significant impact on economic growth only in Egypt and has a negative significant impact on GDP in Nigeria and Angola. Export positively influence economic growth in South Africa Algeria, and Angola, while in Egypt it affect GDP negatively. Interest rate has positive significant impact on economic growth in Nigeria, South Africa and Angola, and has negative significant impact on GDP in Egypt.

5.2 Conclusion

The impact of domestic investment on economic growth is a long standing issue in macroeconomics however, this study employ MG, PMG and GLS panel data models to

assess the impact of public domestic investment and privatedomestic investment on economic growth.

The results have revealed that there is long run relationship among public domestic investment,private domestic investment and economic growth.Private domestic investment was discoveredto be an important determinant of economic growth in the selected African countries. This implies that government should provide enabling environment to private investors if they need to achieve sustainable economic growth.

The study also discovered that public domestic investment in the selected African countries is dominated by recurrent expenditure.The results of the study also imply that foreign direct investment displaced Private domestic investment in the selected countries.

5.3Recommendations

Based on the findings of this study and conclusions drawn; the following recommendations are offered:

Private domestic investment remained a key to achieving long term economic growth in selected African countries; this requires creating policies that will provide conducive enabling environment to private investors by the Government of selected countries. This should be through granting tax holiday/provision of grant to any domestic investor with minimum of five (5) employees andat least one year record ofexistence in business. Although the tax holiday may resulted to decrease in government revenue, government may increase the tax of imported goods and services to compensate the loss.

Policy direction should be geared towards reducing public domestic investment and for the fact that it retards economic growth and by extension crowds out private domestic investment. This should be through the reduction of recurrent expenditure and conducting

feasibility studies before embarking on any capital project to determine the project contribution to the economy or otherwise. The reduction of recurrent expenditure may reduce the income of public servant but provision of adequate infrastructure would lower the cost of production as well as the price of goods and service.

The selected countries should put sound policies in place that would control the activities of foreign investors to avoid warranting them excessive power that could generate negative impact to the economy through compelling them to source at least 60% of their raw material from within the country. While this may force the foreign investors to withdraw their investment but provision of enabling environment and availability of market will attract them.

African countries should harmonize their economies by creating single investment policy that will encourage the utilization good and services produced within the African economies. This should be through creating bodythat will comprise Ministers of Finance and Central Bank governors who will be responsible for developing and supervising domestic investment development plan using locally derived raw materials. They could be authorized to collect raw materials from surplus areas and channel it to deficit areas.

5.4 Suggestion for Further Researches

For the future research public domestic investment should be divided into capital and recurrent expenditure components. This will assist in determining contribution of each component of public domestic investment to economic growth. It is also suggested to employ more African countries in future researches.

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APPENDIX I

countries	id	year	gdp	Public di	Private di	fdi	export	Interest rate
Nigeria	1	1985	2.89E+10	12.73176	11.35743	1.681726	17.3852	3.686666
Nigeria	1	1986	2.07E+10	12.58138	15.7025	0.932437	13.31603	-1.49676
Nigeria	1	1987	2.41E+10	7.20595	12.66393	2.534126	26.94186	-31.9218
Nigeria	1	1988	2.33E+10	7.645588	9.848316	1.627125	22.85462	-5.12928
Nigeria	1	1989	2.42E+10	5.446973	11.7467	7.776141	43.98132	-16.96
Nigeria	1	1990	3.08E+10	4.964438	14.42773	1.911375	35.34425	14.64821
Nigeria	1	1991	2.74E+10	4.833249	13.79346	2.600578	41.70108	2.072104
Nigeria	1	1992	2.93E+10	5.961901	12.80218	3.060115	37.50938	-25.767
Nigeria	1	1993	1.58E+10	6.542752	13.61295	8.520921	33.82986	4.374451
Nigeria	1	1994	1.81E+10	17.94384	11.19636	10.83256	24.31023	-8.03441
Nigeria	1	1995	2.85E+10	12.08512	7.083232	3.780688	35.76149	-43.5727
Nigeria	1	1996	3.5E+10	10.01718	7.303718	4.554308	32.23857	-9.71197
Nigeria	1	1997	3.58E+10	12.99717	8.372144	4.297446	41.7746	16.61355
Nigeria	1	1998	3.2E+10	13.97338	8.619863	3.284921	29.69152	25.28227
Nigeria	1	1999	3.59E+10	6.982946	7.011568	2.80149	33.86953	2.767927
Nigeria	1	2000	4.64E+10	8.34258	7.03106	2.457999	51.73036	-10.3198
Nigeria	1	2001	4.41E+10	8.210655	7.593798	2.697492	45.44807	23.83785
Nigeria	1	2002	5.91E+10	6.709872	7.020332	3.170113	35.96569	-10.8121
Nigeria	1	2003	6.77E+10	5.152789	9.913518	2.964052	39.7879	8.613594
Nigeria	1	2004	8.78E+10	6.731593	7.401317	2.133362	30.16075	19.36914
Nigeria	1	2005	1.12E+11	6.807476	5.467015	4.438848	31.65697	-3.34037
Nigeria	1	2006	1.45E+11	6.859525	8.273721	3.337937	43.11133	-0.3731
Nigeria	1	2007	1.66E+11	10.18013	9.256423	3.626301	33.72852	11.61433
Nigeria	1	2008	2.08E+11	11.64139	8.329817	3.938918	39.88313	4.190484
Nigeria	1	2009	1.69E+11	12.95737	12.09461	5.047601	30.76862	23.7065
Nigeria	1	2010	3.69E+11	8.711384	17.29074	1.632849	25.26412	-42.3102
Nigeria	1	2011	4.12E+11	8.494303	16.21198	2.147237	31.32981	5.941526
Nigeria	1	2012	4.61E+11	8.20005	14.90769	1.533762	31.43875	6.883106
Nigeria	1	2013	5.15E+11	7.155219	14.90391	1.08024	18.04991	10.24735
Nigeria	1	2014	5.68E+11	6.464486	15.8027	0.818201	18.43513	11.35621
Nigeria	1	2015	4.81E+11	5.935159	15.4901	0.65216	10.66631	13.59583
Nigeria	1	2016	4.05E+11	5.384282	15.34003	1.098498	9.21811	6.685325
Nigeria	1	2017	3.76E+11	0	0	0.930683	0	5.816991
South Africa	2	1985	6.92E+10	17.0874	22.04958	-0.65403	30.44215	4.010452
South Africa	2	1986	8.21E+10	17.52426	21.02094	-0.06149	29.60159	-2.40626
South Africa	2	1987	1.07E+11	18.29942	17.78428	-0.17844	29.30869	-1.7287
South Africa	2	1988	1.18E+11	17.78391	21.2283	0.133893	28.18824	0.159846
South Africa	2	1989	1.29E+11	17.73677	22.74589	-0.15609	25.86726	2.225483
South Africa	2	1990	1.16E+11	18.56133	19.41325	-0.06553	23.49492	4.782658
South Africa	2	1991	1.24E+11	18.65856	19.02497	0.20504	21.09804	4.029848

South Africa	2	1992	1.35E+11	18.96576	16.76861	0.002496	20.70374	3.786464
South Africa	2	1993	1.34E+11	19.64118	15.16232	0.008406	21.82513	2.81176
South Africa	2	1994	1.4E+11	19.79856	17.7201	0.26791	21.47419	5.531638
South Africa	2	1995	1.55E+11	18.11765	19.16665	0.803051	22.1356	6.986659
South Africa	2	1996	1.48E+11	19.14527	18.04003	0.553079	24.08026	10.77132
South Africa	2	1997	1.53E+11	19.29195	17.71512	2.497306	23.98733	11.17491
South Africa	2	1998	1.38E+11	18.91177	17.99154	0.399449	25.00505	13.01244
South Africa	2	1999	1.37E+11	18.58083	17.0351	1.100279	24.69521	10.20626
South Africa	2	2000	1.36E+11	18.38694	16.36533	0.710486	27.15888	5.196634
South Africa	2	2001	1.22E+11	18.53406	15.74458	5.978862	29.37483	5.730392
South Africa	2	2002	1.16E+11	18.80519	16.27797	1.27847	31.78084	3.126719
South Africa	2	2003	1.75E+11	19.05789	17.10588	0.44685	26.88506	8.662872
South Africa	2	2004	2.29E+11	19.15756	18.4666	0.306382	25.4671	4.472723
South Africa	2	2005	2.58E+11	19.47819	18.31498	2.531169	26.44666	4.908487
South Africa	2	2006	2.72E+11	18.15353	20.18299	0.229311	29.27389	4.622151
South Africa	2	2007	2.99E+11	17.81401	20.98552	2.202694	31.17385	3.966265
South Africa	2	2008	2.87E+11	18.65793	23.15017	3.443052	35.62244	5.782789
South Africa	2	2009	2.97E+11	19.86448	20.7049	2.565296	27.91189	3.910347
South Africa	2	2010	3.75E+11	20.22964	19.51297	0.98409	28.61524	3.2744
South Africa	2	2011	4.17E+11	19.86223	19.72094	0.992925	30.46094	2.31644
South Africa	2	2012	3.96E+11	20.25993	19.96597	1.167209	29.72388	3.293249
South Africa	2	2013	3.67E+11	20.57498	21.16356	2.244236	30.97134	2.208772
South Africa	2	2014	3.51E+11	20.79568	20.49948	1.650494	31.46865	3.389971
South Africa	2	2015	3.18E+11	20.46034	20.97968	0.478736	30.15605	4.086022
South Africa	2	2016	2.96E+11	20.80686	19.35308	0.749015	30.7026	3.450746
South Africa	2	2017	3.49E+11	20.93433	18.60187	0.392632	29.77289	4.584463
Egypt	3	1985	3.47E+10	17.24013	26.67512	3.394599	19.91428	5.468195
Egypt	3	1986	3.59E+10	16.52936	23.70685	3.393031	15.73157	1.966303
Egypt	3	1987	4.05E+10	14.25341	26.08278	2.339577	12.55871	-11.2895
Egypt	3	1988	3.5E+10	13.93534	34.91937	3.39567	17.31839	2.944909
Egypt	3	1989	3.96E+10	12.63167	31.77451	3.153168	17.89348	-0.17206
Egypt	3	1990	4.31E+10	11.2859	28.81284	1.701815	20.0476	0.472294
Egypt	3	1991	3.7E+10	11.19157	21.1696	0.684328	27.8156	0
Egypt	3	1992	4.19E+10	10.42416	19.48239	1.096617	28.39684	0.496864
Egypt	3	1993	4.66E+10	10.30928	19.84536	1.058425	25.83763	9.101237
Egypt	3	1994	5.19E+10	10.28571	20.62857	2.420133	22.57143	7.43542
Egypt	3	1995	6.02E+10	10.53922	20.14706	0.994028	22.54902	4.552166
Egypt	3	1996	6.76E+10	10.37489	18.13426	0.940415	20.74978	7.91322
Egypt	3	1997	7.84E+10	11.32005	17.56299	1.135376	18.84167	3.562244
Egypt	3	1998	8.48E+10	11.30828	21.50313	1.268437	16.21434	8.782559
Egypt	3	1999	9.07E+10	11.60598	21.61899	1.174393	15.05202	11.99073
Egypt	3	2000	9.98E+10	11.20259	19.55307	1.236997	16.20112	7.893578

Egypt	3	2001	9.76E+10	11.31865	18.26038	0.522267	17.47979	11.21451
Egypt	3	2002	8.79E+10	12.58907	17.99947	0.736363	18.31618	10.27876
Egypt	3	2003	8.29E+10	12.67066	16.88623	0.286284	21.79641	6.32582
Egypt	3	2004	7.88E+10	12.755	16.93798	1.589571	28.22996	1.524825
Egypt	3	2005	8.97E+10	12.73909	17.97586	5.993819	30.34355	6.530998
Egypt	3	2006	1.07E+11	12.28752	18.73078	9.343527	29.94981	4.890681
Egypt	3	2007	1.3E+11	11.3319	20.85124	8.873538	30.24973	-0.07535
Egypt	3	2008	1.63E+11	10.88777	22.38973	5.831413	33.04299	0.109099
Egypt	3	2009	1.89E+11	11.35099	19.19017	3.551442	24.95682	0.710272
Egypt	3	2010	2.19E+11	11.1636	19.50108	2.917287	21.34925	0.816681
Egypt	3	2011	2.36E+11	11.45066	17.10306	-0.20453	20.56743	-0.5492
Egypt	3	2012	2.79E+11	11.17812	16.02675	1.001422	16.39697	-6.27243
Egypt	3	2013	2.89E+11	11.3524	14.212	1.452668	17.01785	3.292157
Egypt	3	2014	3.06E+11	11.84977	13.64319	1.509575	14.24413	0.414129
Egypt	3	2015	3.33E+11	11.75989	14.28864	2.081527	13.18385	1.541068
Egypt	3	2016	3.33E+11	11.42688	15.04023	2.435002	10.34546	6.922011
Egypt	3	2017	2.35E+11	10.09222	15.27378	3.140471	16.29971	-3.87005
Algeria	4	1985	5.79E+10	16.71816	34.56917	0.000687	23.58393	-1.87909
Algeria	4	1986	6.37E+10	18.99833	33.55592	0.008347	12.85476	0.824817
Algeria	4	1987	6.67E+10	19.43157	27.55638	0.005561	14.27247	-4.44867
Algeria	4	1988	5.91E+10	20.11445	27.63948	0.022032	15.50787	-4.64049
Algeria	4	1989	5.56E+10	18.00142	30.07323	0.021735	18.63926	-8.05499
Algeria	4	1990	6.2E+10	16.06693	28.58942	0.00054	23.44369	-17.0886
Algeria	4	1991	4.57E+10	14.71877	31.84133	0.025459	29.11782	-29.7737
Algeria	4	1992	4.8E+10	16.01794	30.75749	0.062496	25.31959	-11.4218
Algeria	4	1993	4.99E+10	17.32419	29.09091	0	21.78388	-4.95001
Algeria	4	1994	4.25E+10	17.87462	30.08014	0	22.53073	-13.747
Algeria	4	1995	4.18E+10	16.76379	30.90856	0	26.19478	-7.90217
Algeria	4	1996	4.69E+10	15.77432	25.67841	0.575184	29.76045	-4.04921
Algeria	4	1997	4.82E+10	16.53838	22.44697	0.539667	30.90631	8.136645
Algeria	4	1998	4.82E+10	17.79191	27.14848	1.258826	22.57835	15.10401
Algeria	4	1999	4.86E+10	16.78724	26.24767	0.599499	28.15012	-0.09591
Algeria	4	2000	5.48E+10	13.58395	23.56391	0.511222	42.06972	-10.3174
Algeria	4	2001	5.47E+10	14.77507	26.84106	2.033266	36.6893	10.0298
Algeria	4	2002	5.68E+10	15.48712	30.65337	1.876312	35.50453	7.17771
Algeria	4	2003	6.79E+10	14.80339	30.34066	0.939943	38.24883	-0.18816
Algeria	4	2004	8.53E+10	13.77265	33.26354	1.033521	40.05323	-3.78266
Algeria	4	2005	1.03E+11	11.45042	31.65641	1.120174	47.20519	-6.99022
Algeria	4	2006	1.17E+11	11.23158	30.17046	1.573137	48.81069	-2.31863
Algeria	4	2007	1.35E+11	11.6435	34.46948	1.249647	47.06816	1.481573
Algeria	4	2008	1.71E+11	13.20671	37.34844	1.543039	47.97335	-6.37636
Algeria	4	2009	1.37E+11	16.14529	46.87646	2.001975	35.37165	21.60764

Algeria	4	2010	1.61E+11	17.22676	41.43029	1.426964	38.44455	-6.96209
Algeria	4	2011	2E+11	20.66746	38.05506	1.285496	38.78695	-8.66105
Algeria	4	2012	2.09E+11	20.31803	39.15828	0.717693	36.89055	0.48256
Algeria	4	2013	2.1E+11	19.14275	43.3906	0.806601	33.2099	8.066833
Algeria	4	2014	2.14E+11	19.79075	45.55443	0.703172	30.21912	8.314254
Algeria	4	2015	1.66E+11	21.63427	50.68896	-0.24319	23.18644	15.59701
Algeria	4	2016	1.59E+11	20.7831	50.70906	1.029475	21.00176	7.047381
Algeria	4	2017	1.7E+11	17.29335	47.78354	0	24.03083	1.123428
Angola	5	1985	7.55E+09	44.24729	0	3.680384	44.24729	0
Angola	5	1986	7.07E+09	47.25984	0	3.308794	47.25984	0
Angola	5	1987	8.08E+09	41.34462	0	1.472067	41.34462	0
Angola	5	1988	8.77E+09	38.11325	0	1.493856	38.11325	0
Angola	5	1989	1.02E+10	32.76359	0	1.960573	32.76359	0
Angola	5	1990	1.12E+10	29.76504	0	-2.98163	29.76504	0
Angola	5	1991	1.06E+10	57.14286	14.28571	6.266631	28.57143	0
Angola	5	1992	8.31E+09	28.94737	2.631579	3.466088	47.36842	0
Angola	5	1993	5.77E+09	38.09524	10.20408	5.236863	49.31973	0
Angola	5	1994	4.44E+09	36.67601	15.17475	3.837037	0	0
Angola	5	1995	5.54E+09	0	0	8.529489	0	-84.095
Angola	5	1996	7.53E+09	0	0	2.398994	0	-93.5135
Angola	5	1997	7.65E+09	0	0	5.382318	0	-29.5227
Angola	5	1998	6.51E+09	0	0	17.12159	0	4.047559
Angola	5	1999	6.15E+09	0	0	40.16725	0	-72.5785
Angola	5	2000	9.13E+09	31.5272	30.49322	9.623866	89.68583	-60.7813
Angola	5	2001	8.94E+09	25.15463	30.49322	24.00912	75.38894	-5.03293
Angola	5	2002	1.25E+10	26.85253	11.82069	13.95099	68.29095	-18.7287
Angola	5	2003	1.42E+10	27.65956	12.84299	25.20956	68.42474	5.374232
Angola	5	2004	1.96E+10	19.90524	9.166794	11.18703	70.2503	29.67744
Angola	5	2005	2.82E+10	19.98444	8.779251	-4.61801	86.01863	35.21128
Angola	5	2006	4.18E+10	18.45152	15.3614	-0.09025	79.79625	4.19436
Angola	5	2007	6.04E+10	15.27777	13.50498	-1.47785	73.95818	5.021541
Angola	5	2008	8.42E+10	17.13223	16.21889	1.994548	76.31842	-5.97252
Angola	5	2009	7.55E+10	17.50471	15.22906	2.921219	54.90769	24.95206
Angola	5	2010	8.25E+10	17.64672	14.42293	-3.91053	62.34599	0.099026
Angola	5	2011	1.04E+11	19.57332	12.90574	-2.90424	65.35271	-4.33458
Angola	5	2012	1.14E+11	21.48239	15.11745	-6.05492	63.08923	10.33293
Angola	5	2013	1.25E+11	19.79038	14.69819	-5.7	55.68875	11.61952
Angola	5	2014	1.27E+11	20.60281	15.34608	1.516371	48.01637	17.92919

APPENDIX II

UNITROOT TESTS

```
. xtunitroot llc lgdp, lags(1)


Levin-Lin-Chu unit-root test for lgdp
-----------------------------------
Ho: Panels contain unit roots          Number of panels  =      5
Ha: Panels are stationary              Number of periods =     33

AR parameter: Common                   Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included


ADF regressions: 1 lag
LR variance:    Bartlett kernel, 10.00 lags average (chosen by LLC)
-------------------------------------------------------------------------------
                  Statistic      p-value
-------------------------------------------------------------------------------
 Unadjusted t        -1.4968
 Adjusted t*          0.0646        0.5257
-------------------------------------------------------------------------------
. xtunitroot llc lpudi, lags(1)


Levin-Lin-Chu unit-root test for lpudi
-------------------------------------
Ho: Panels contain unit roots          Number of panels  =      5
Ha: Panels are stationary              Number of periods =     33

AR parameter: Common                   Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included


ADF regressions: 1 lag
LR variance:    Bartlett kernel, 10.00 lags average (chosen by LLC)
-------------------------------------------------------------------------------
                  Statistic      p-value
-------------------------------------------------------------------------------
 Unadjusted t        -5.6164
 Adjusted t*         -1.8273        0.0338
-------------------------------------------------------------------------------
. xtunitroot llc lprdi, lags(1)


Levin-Lin-Chu unit-root test for lprdi
-------------------------------------
Ho: Panels contain unit roots          Number of panels  =      5
Ha: Panels are stationary              Number of periods =     33

AR parameter: Common                   Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included


ADF regressions: 1 lag
LR variance:    Bartlett kernel, 10.00 lags average (chosen by LLC)
-------------------------------------------------------------------------------
                  Statistic      p-value
-------------------------------------------------------------------------------
```

```
 Unadjusted t        -3.8129
 Adjusted t*         -0.7502          0.2266
--------------------------------------------------------------------------------
. xtunitroot llc lfdi, lags(1)


Levin-Lin-Chu unit-root test for lfdi
-----------------------------------
Ho: Panels contain unit roots              Number of panels  =       5
Ha: Panels are stationary                  Number of periods =      33

AR parameter: Common                       Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included


ADF regressions: 1 lag
LR variance:     Bartlett kernel, 10.00 lags average (chosen by LLC)
--------------------------------------------------------------------------------
                    Statistic      p-value
--------------------------------------------------------------------------------
 Unadjusted t        -5.1291
 Adjusted t*         -2.1713          0.0150
--------------------------------------------------------------------------------
xtunitroot llc lexp, lags(1)


Levin-Lin-Chu unit-root test for lexp
-----------------------------------
Ho: Panels contain unit roots              Number of panels  =       5
Ha: Panels are stationary                  Number of periods =      33

AR parameter: Common                       Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included


ADF regressions: 1 lag
LR variance:     Bartlett kernel, 10.00 lags average (chosen by LLC)
--------------------------------------------------------------------------------
                    Statistic      p-value
--------------------------------------------------------------------------------
 Unadjusted t        -3.8931
 Adjusted t*         -0.1275          0.4493
--------------------------------------------------------------------------------
. xtunitroot llc lintr, lags(1)


Levin-Lin-Chu unit-root test for lintr
-----------------------------------
Ho: Panels contain unit roots              Number of panels  =       5
Ha: Panels are stationary                  Number of periods =      33

AR parameter: Common                       Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included


ADF regressions: 1 lag
LR variance:     Bartlett kernel, 10.00 lags average (chosen by LLC)
--------------------------------------------------------------------------------
                    Statistic      p-value
```

```
--------------------------------------------------------------------------------
 Unadjusted t        -6.6754
 Adjusted t*         -3.6169          0.0001
--------------------------------------------------------------------------------
. xtunitroot ips lgdp, lags(1)


Im-Pesaran-Shin unit-root test for lgdp
-------------------------------------
Ho: All panels contain unit roots          Number of panels  =      5
Ha: Some panels are stationary             Number of periods =     33

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included


ADF regressions: 1 lag
--------------------------------------------------------------------------------
                  Statistic      p-value
--------------------------------------------------------------------------------
 W-t-bar           2.1627         0.9847
--------------------------------------------------------------------------------
. xtunitroot ips lpudi, lags(1)


Im-Pesaran-Shin unit-root test for lpudi
--------------------------------------
Ho: All panels contain unit roots          Number of panels  =      5
Ha: Some panels are stationary             Number of periods =     33

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included


ADF regressions: 1 lag
--------------------------------------------------------------------------------
                  Statistic      p-value
--------------------------------------------------------------------------------
 W-t-bar          -1.7849         0.0371
--------------------------------------------------------------------------------
. xtunitroot ips lprdi, lags(1)


Im-Pesaran-Shin unit-root test for lprdi
--------------------------------------
Ho: All panels contain unit roots          Number of panels  =      5
Ha: Some panels are stationary             Number of periods =     33

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included


ADF regressions: 1 lag
--------------------------------------------------------------------------------
                  Statistic      p-value
--------------------------------------------------------------------------------
 W-t-bar          -0.8468         0.1985
--------------------------------------------------------------------------------
. xtunitroot ips lfdi, lags(1)
```

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```
Im-Pesaran-Shin unit-root test for lfdi
---------------------------------------
Ho: All panels contain unit roots           Number of panels  =       5
Ha: Some panels are stationary              Number of periods =      33

AR parameter: Panel-specific                Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included

ADF regressions: 1 lag
--------------------------------------------------------------------------------
                    Statistic       p-value
--------------------------------------------------------------------------------
 W-t-bar            -1.9300         0.0268
--------------------------------------------------------------------------------
. xtunitroot ips lexp, lags(1)


Im-Pesaran-Shin unit-root test for lexp
---------------------------------------
Ho: All panels contain unit roots           Number of panels  =       5
Ha: Some panels are stationary              Number of periods =      33

AR parameter: Panel-specific                Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included

ADF regressions: 1 lag
--------------------------------------------------------------------------------
                    Statistic       p-value
--------------------------------------------------------------------------------
 W-t-bar             0.5479         0.7081
--------------------------------------------------------------------------------
. xtunitroot ips lintr, lags(1)


Im-Pesaran-Shin unit-root test for lintr
----------------------------------------
Ho: All panels contain unit roots           Number of panels  =       5
Ha: Some panels are stationary              Number of periods =      33

AR parameter: Panel-specific                Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included

ADF regressions: 1 lag
--------------------------------------------------------------------------------
                    Statistic       p-value
--------------------------------------------------------------------------------
 W-t-bar            -3.7572         0.0001
--------------------------------------------------------------------------------
```

APPENDIX III

COINTEGRATION TESTS

Pedroni Residual Cointegration Test
Series: LGDP LPRDI LPUDI LFDI LINTR LEXP01
Date: 09/12/18   Time: 10:35
Sample: 1985 2017
Included observations: 165
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 6
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.046286	0.8523	-1.221530	0.8891
Panel rho-Statistic	0.078169	0.5312	0.283197	0.6115
Panel PP-Statistic	-3.042600	0.0012	-2.909849	0.0018
Panel ADF-Statistic	-3.152825	0.0008	-3.155946	0.0008

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.088095	0.8617
Group PP-Statistic	-2.646528	0.0041
Group ADF-Statistic	-2.205842	0.0137

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Nigeria	0.228	0.175295	0.163134	4.00	32
South Africa	0.058	1.221987	0.364578	11.00	32
Egypt	0.495	0.247869	0.274352	2.00	32
Algeria	0.371	1.407190	1.687817	3.00	32
Angola	0.454	0.478642	0.357783	6.00	32

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Nigeria	0.228	0.175295	0	6	32
South Africa	0.058	1.221987	0	6	32
Egypt	0.495	0.247869	0	6	32
Algeria	0.371	1.407190	0	6	32
Angola	0.454	0.478642	0	6	32

Pedroni Residual Cointegration Test
Series: LGDP LPRDI LPUDI LFDI LINTR LEXP01

Date: 09/12/18   Time: 10:36
Sample: 1985 2017
Included observations: 165
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 6
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.353231	0.9120	-2.043485	0.9795
Panel rho-Statistic	1.045409	0.8521	1.165412	0.8781
Panel PP-Statistic	-3.273212	0.0005	-3.071060	0.0011
Panel ADF-Statistic	-3.351149	0.0004	-3.203412	0.0007

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.920424	0.9726
Group PP-Statistic	-3.065300	0.0011
Group ADF-Statistic	-2.199833	0.0139

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Nigeria	0.219	0.151889	0.148163	1.00	32
South Africa	0.053	1.218269	0.368222	11.00	32
Egypt	0.492	0.241679	0.249176	3.00	32
Algeria	0.272	0.917290	0.822256	4.00	32
Angola	0.190	0.431566	0.088146	17.00	32

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Nigeria	0.219	0.151889	0	6	32
South Africa	0.053	1.218269	0	6	32
Egypt	0.492	0.241679	0	6	32
Algeria	0.272	0.917290	0	6	32
Angola	0.190	0.431566	0	6	32

Pedroni Residual Cointegration Test
Series: LGDP LPRDI LPUDI LFDI LINTR LEXP01

Date: 09/12/18   Time: 10:36
Sample: 1985 2017
Included observations: 165
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: No deterministic intercept or trend
Automatic lag length selection based on SIC with a max lag of 6
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.747039	0.7725	-1.035257	0.8497
Panel rho-Statistic	-0.016358	0.4935	0.470690	0.6811
Panel PP-Statistic	-2.601436	0.0046	-2.288434	0.0111
Panel ADF-Statistic	-2.753640	0.0029	-2.624362	0.0043

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.076215	0.8591
Group PP-Statistic	-3.006919	0.0013
Group ADF-Statistic	-2.215207	0.0134

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Nigeria	0.228	0.196544	0.191163	4.00	32
South Africa	0.048	1.220679	0.247803	13.00	32
Egypt	0.584	0.338860	0.199228	7.00	32
Algeria	0.384	1.420893	1.791198	2.00	32
Angola	0.688	0.669232	0.704029	1.00	32

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Nigeria	0.228	0.196544	0	6	32
South Africa	0.048	1.220679	0	6	32
Egypt	0.584	0.338860	0	6	32
Algeria	0.384	1.420893	0	6	32
Angola	0.688	0.669232	0	6	32

Kao Residual Cointegration Test
Series: LGDP LPRDI LPUDI LFDI LINTR LEXP01

Date: 09/12/18   Time: 10:38
Sample: 1985 2017
Included observations: 165
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 8
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.743801	0.0001

Residual variance	1.032353
HAC variance	0.611386

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 09/12/18   Time: 10:38
Sample (adjusted): 1986 2017
Included observations: 160 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.379779	0.056504	-6.721300	0.0000

R-squared	0.220514	Mean dependent var	0.033811
Adjusted R-squared	0.220514	S.D. dependent var	1.096090
S.E. of regression	0.967721	Akaike info criterion	2.778485
Sum squared resid	148.9010	Schwarz criterion	2.797705
Log likelihood	-221.2788	Hannan-Quinn criter.	2.786290
Durbin-Watson stat	2.054389		

APPENDIX IV

MG and PMG ESTIMATION RESULT

```
. xtpmg d.lgdp d.lpudi d.lprdi d.lfdi d.lexp d.lintr , lr(l.lgdp lprdi lpudi
lfdi  lexp lintr)
>  ec( ECT) replace mg


--------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
      D.lgdp |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+------------------------------------------------------------------
ECT          |
       lprdi | -.1205763   1.969674    -0.06   0.951    -3.981066    3.739913
       lpudi |   1.63003   1.536419     1.06   0.289    -1.381296    4.641357
        lfdi | -.4224776   .2303015    -1.83   0.067    -.8738603    .0289052
        lexp | -1.954565   2.647453    -0.74   0.460    -7.143478    3.234347
       lintr |  .3675819   .3030909     1.21   0.225    -.2264655    .9616292
-------------+------------------------------------------------------------------
SR           |
         ECT | -.0045798   .0395854    -0.12   0.908    -.0821658    .0730062
             |
       lpudi |
         D1. | -.2138243   .1141394    -1.87   0.061    -.4375334    .0098849
             |
       lprdi |
         D1. | -.0777173   .1047184    -0.74   0.458    -.2829616     .127527
             |
        lfdi |
         D1. | -.0743002   .0568928    -1.31   0.192     -.185808    .0372077
             |
        lexp |
         D1. | -.3364759   .1875492    -1.79   0.073    -.7040657    .0311138
             |
       lintr |
         D1. | -.0104189   .0056163    -1.86   0.064    -.0214266    .0005888
             |
       _cons | -.1171808   .9805329    -0.12   0.905     -2.03899    1.804628
--------------------------------------------------------------------------------




. xtpmg d.lgdp d.lpudi d.lprdi d.lfdi d.lexp d.lintr , lr(l.lgdp lprdi lpudi
lfdi  lexp lintr)
>  ec( ECT) replace pmg
```

```
Iteration 0:   log likelihood = 106.54851  (not concave)
Iteration 1:   log likelihood = 125.63032  (not concave)
Iteration 2:   log likelihood = 126.94446  (not concave)
Iteration 3:   log likelihood =  130.6784  (not concave)
Iteration 4:   log likelihood = 131.52048  (not concave)
Iteration 5:   log likelihood = 131.57002  (not concave)
Iteration 6:   log likelihood = 131.65985  (not concave)
Iteration 7:   log likelihood = 131.73631  (not concave)
Iteration 8:   log likelihood = 131.79255
Iteration 9:   log likelihood = 131.98899
Iteration 10:  log likelihood = 132.00979
Iteration 11:  log likelihood = 132.01161
Iteration 12:  log likelihood = 132.01161


Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): id                    Number of obs      =        160
Time Variable (t): year                   Number of groups   =          5
                                          Obs per group: min =         32
                                                         avg =       32.0
                                                         max =         32

                                          Log Likelihood     = 132.0116
------------------------------------------------------------------------------
     D.lgdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
ECT         |
      lprdi | -.0335319   1.017562    -0.03   0.974    -2.027917    1.960853
      lpudi |  -7.34106   3.643274    -2.01   0.044    -14.48175   -.2003747
       lfdi | -.1463067   .2574647    -0.57   0.570    -.6509282    .3583148
       lexp |  6.245512   2.953017     2.11   0.034     .4577046    12.03332
      lintr | -.5663376   .3932069    -1.44   0.150    -1.337009    .2043338
------------+-----------------------------------------------------------------
SR          |
        ECT | -.0233234   .0039956    -5.84   0.000    -.0311547    -.015492
            |
      lpudi |
        D1. | -.1601257   .0977855    -1.64   0.102    -.3517817    .0315303
            |
      lprdi |
        D1. | -.0868426   .1341477    -0.65   0.517    -.3497673     .176082
            |
       lfdi |
        D1. | -.0774556   .0452295    -1.71   0.087    -.1661039    .0111926
            |
       lexp |
        D1. | -.2805682   .1727341    -1.62   0.104    -.6191208    .0579844
            |
      lintr |
        D1. | -.0101125   .0099227    -1.02   0.308    -.0295607    .0093357
            |
      _cons |   .653715    .108161     6.04   0.000     .4417233    .8657066
------------------------------------------------------------------------------

. hausman mg pmg, sigmamore

                    ---- Coefficients ----
```

```
            |       (b)           (B)            (b-B)     sqrt(diag(V_b-V_B))
            |       mg            pmg         Difference        S.E.
-------------+-----------------------------------------------------------------
      lprdi |   -.1205763      -.0335319       -.0870445        2.25095
      lpudi |    1.63003       -7.34106         8.971091           .
       lfdi |   -.4224776      -.1463067       -.2761708        .1309052
       lexp |   -1.954565       6.245512       -8.200077        1.517923
      lintr |    .3675819      -.5663376        .9339195           .
-------------------------------------------------------------------------------
                        b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

              chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =          11.94
            Prob>chi2 =      0.0356
            (V_b-V_B is not positive definite)


xtserial lgdp lpudi lprdi lfdi lfdi lexp lintr

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      4) =      48.183
          Prob > F =       0.0023


. xtpmg  d.lgdp d.lpudi d.lprdi d.lfdi  d.lexp d.lintr , lr(l. lgdp lpudi lprdi lfdi lexp
lintr

> ) ec ( ECT) replace full mg

-------------------------------------------------------------------------------

Mean Group Estimation: Error Correction Form

(Estimate results saved as MG)

-------------------------------------------------------------------------------

-------------------------------------------------------------------------------

     D.lgdp |    Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+-----------------------------------------------------------------

id_1ECT     |

      lpudi |   .3025771    .914738      0.33   0.741    -1.490276    2.095431

      lprdi |   .6330031   .9503472      0.67   0.505    -1.229643    2.495649

       lfdi |  -1.003476   .7406478     -1.35   0.175    -2.455119    .4481672

       lexp |  -1.144294   1.093048     -1.05   0.295     -3.28663    .9980414

      lintr |   .5117859   .3353975      1.53   0.127    -.1455811    1.169153

-------------+-----------------------------------------------------------------

id_1SR      |

        ECT |   .1247405   .0331962      3.76   0.000     .0596771    .1898039
```

```
             |

      lpudi  |

         D1. |   -.0448208    .1250971    -0.36   0.720    -.2900066     .200365

             |

      lprdi  |

         D1. |   -.1084045    .1498799    -0.72   0.470    -.4021636    .1853546

             |

       lfdi  |

         D1. |      -.2701    .0768576    -3.51   0.000    -.4207381   -.1194618

             |

       lexp  |

         D1. |    .1701647    .1651784     1.03   0.303    -.1535789    .4939083

             |

      lintr  |

         D1. |   -.0169453    .0278527    -0.61   0.543    -.0715356    .0376451

             |

       _cons |     -3.2986    1.112606    -2.96   0.003    -5.479268   -1.117932

-------------+----------------------------------------------------------------

id_2ECT      |

      lpudi  |    8.399829    2.494351     3.37   0.001     3.510992    13.28867

      lprdi  |    3.405212    1.453114     2.34   0.019     .5571614    6.253262

       lfdi  |    .0215809    .1308181     0.16   0.869    -.2348179    .2779797

       lexp  |    .0958583     1.53264     0.06   0.950     -2.90806    3.099777

      lintr  |    .2174263    .1856639     1.17   0.242    -.1464682    .5813208

-------------+----------------------------------------------------------------

id_2SR       |
         ECT |    .2307559    .1098681     2.10   0.036     .0154183    .4460935
             |
      lpudi  |
         D1. |    .4441417    .9898881     0.45   0.654    -1.496003    2.384287
             |
      lprdi  |
         D1. |     .260265    .3540499     0.74   0.462      -.43366      .95419
             |
       lfdi  |
         D1. |   -.0018711    .0213881    -0.09   0.930     -.043791    .0400487
             |
       lexp  |
         D1. |   -.8052493    .3615604    -2.23   0.026    -1.513895   -.0966039
             |
      lintr  |
         D1. |    .0187491    .0395755     0.47   0.636    -.0588175    .0963157
```

```
             |
       _cons |   2.220691   1.602658     1.39   0.166    -.9204605    5.361843
-------------+----------------------------------------------------------------
id_3ECT      |
       lpudi |    1.39738   2.565127     0.54   0.586    -3.630177    6.424937
       lprdi |  -3.855508    1.32136    -2.92   0.004    -6.445326    -1.26569
        lfdi |   .3579389   .3441509     1.04   0.298    -.3165845    1.032462
        lexp |  -3.683651   1.962641    -1.88   0.061    -7.530358    .1630553
       lintr |  -.2043528   .2006419    -1.02   0.308    -.5976036     .188898
-------------+----------------------------------------------------------------
id_3SR       |
         ECT |   .0724012   .0473017     1.53   0.126    -.0203085    .1651109
             |
       lpudi |
         D1. |  -.3321747   .3430904    -0.97   0.333    -1.004619    .3402701
             |
       lprdi |
         D1. |  -.0053053   .1548701    -0.03   0.973     -.308845    .2982344
             |
        lfdi |
         D1. |    .020582   .0307171     0.67   0.503    -.0396224    .0807863
             |
        lexp |
         D1. |  -.6303397   .0860813    -7.32   0.000    -.7990561   -.4616234
             |
       lintr |
         D1. |  -.0179924   .0130473    -1.38   0.168    -.0435646    .0075798
             |
       _cons |  -3.158082    1.86635    -1.69   0.091    -6.816062    .4998971
-------------+----------------------------------------------------------------
id_4ECT      |
       lpudi |   1.332242   1.162371     1.15   0.252    -.9459642    3.610448
       lprdi |   2.810545   .7466714     3.76   0.000     1.347096    4.273994
        lfdi |  -.0461836   .0875549    -0.53   0.598     -.217788    .1254209
        lexp |  -.3778225   .9493353    -0.40   0.691    -2.238485     1.48284
       lintr |   .2334833   .2092978     1.12   0.265    -.1767328    .6436994
-------------+----------------------------------------------------------------
id_4SR       |
         ECT |   .1475829   .0716749     2.06   0.039     .0071026    .2880631
             |
       lpudi |
         D1. |  -.1544927   .2359445    -0.65   0.513    -.6169355    .3079501
             |
       lprdi |
         D1. |  -.3184908   .2109934    -1.51   0.131    -.7320302    .0950486
             |
        lfdi |
         D1. |  -.0339313   .0154645    -2.19   0.028    -.0642412   -.0036215
             |
        lexp |
         D1. |  -.3987528   .1523173    -2.62   0.009    -.6972891   -.1002164
             |
       lintr |
         D1. |  -.0214297   .0171432    -1.25   0.211    -.0550298    .0121704
             |
       _cons |   -1.82549   1.126754    -1.62   0.105    -4.033887    .3829064
-------------+----------------------------------------------------------------
id_5ECT      |
       lpudi |  -4.081674   6.087596    -0.67   0.503    -16.01314    7.849796
       lprdi |   .7105816   1.107529     0.64   0.521    -1.460135    2.881299
        lfdi |  -1.075817   1.237212    -0.87   0.385    -3.500708    1.349074
        lexp |   2.983149   4.627146     0.64   0.519    -6.085889    12.05219
       lintr |  -.3097713   1.194062    -0.26   0.795     -2.65009    2.030548
-------------+----------------------------------------------------------------
id_5SR       |
         ECT |  -.0401671   .0655278    -0.61   0.540    -.1685993     .088265
```

```
          |
    lpudi |
       D1. |   -.0582896    .0942622    -0.62   0.536    -.2430401    .1264609
          |
    lprdi |
       D1. |    .0567548    .0894551     0.63   0.526    -.1185739    .2320834
          |
     lfdi |
       D1. |   -.0878418    .0540009    -1.63   0.104    -.1936816    .0179981
          |
     lexp |
       D1. |    .0056828    .0624856     0.09   0.928    -.1167867    .1281523
          |
    lintr |
       D1. |    .0164143    .0300922     0.55   0.585    -.0425653    .0753939
          |
    _cons |    1.104172     1.57718     0.70   0.484    -1.987044    4.195388
--------------------------------------------------------------------------------
```

APPENDIX V
<u>PANEL GLS MODEL</u>

```
xtgls lgdp lpudi lprdi lfdi lexp lintr
```

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        homoskedastic
Correlation:   no autocorrelation

Estimated covariances      =         1        Number of obs     =       165
Estimated autocorrelations =         0        Number of groups  =         5
Estimated coefficients     =         6        Time periods      =        33
                                              Wald chi2(5)      =     83.79
Log likelihood             = -221.0979        Prob > chi2       =    0.0000

------------------------------------------------------------------------------
        lgdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lpudi |  -.3605327   .1452355    -2.48   0.013    -.6451892   -.0758763
       lprdi |   .6088896   .0940524     6.47   0.000     .4245502    .7932289
        lfdi |  -.1099938   .0477079    -2.31   0.021    -.2034995   -.0164881
        lexp |     .12793   .1222949     1.05   0.296    -.1117636    .3676235
       lintr |    .215772   .0619559     3.48   0.000     .0943407    .3372032
       _cons |    23.7482    .347697    68.30   0.000     23.06672    24.42967
------------------------------------------------------------------------------


. xtgls lgdp lpudi lprdi lfdi lexp lintr if id==1


Cross-sectional time-series FGLS regression


Coefficients:  generalized least squares

Panels:        homoskedastic

Correlation:   no autocorrelation


Estimated covariances      =         1        Number of obs     =        33

Estimated autocorrelations =         0        Number of groups  =         1

Estimated coefficients     =         6        Time periods      =        33

                                              Wald chi2(5)      =     20.65

Log likelihood             = -44.25713        Prob > chi2       =    0.0009




------------------------------------------------------------------------------
        lgdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
    lpudi |   -.236247    .4416557    -0.53   0.593    -1.101876    .6293823

    lprdi |    .1840302    .4291024     0.43   0.668     -.656995    1.025055

     lfdi |   -.6731315    .3526497    -1.91   0.056    -1.364312    .0180492

     lexp |   -.1987962    .3645931    -0.55   0.586     -.9133856    .5157932

    lintr |    .2613328    .1386301     1.89   0.059    -.0103772    .5330428

    _cons |    26.06661    .9174296    28.41   0.000     24.26848    27.86474

-------------------------------------------------------------------------------


. xtgls lgdp lpudi lprdi lfdi lexp lintr if id==2

Cross-sectional time-series FGLS regression


Coefficients:  generalized least squares

Panels:        homoskedastic

Correlation:   no autocorrelation


Estimated covariances      =          1     Number of obs      =         33

Estimated autocorrelations =          0     Number of groups   =          1

Estimated coefficients     =          6     Time periods       =         33

                                            Wald chi2(5)       =      94.27

Log likelihood             =  -1.56442      Prob > chi2        =     0.0000

-------------------------------------------------------------------------------

     lgdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+-----------------------------------------------------------------

    lpudi |    6.614205    .8768585     7.54   0.000     4.895594    8.332816

    lprdi |      1.5822    .5088986     3.11   0.002     .5847773    2.579623

     lfdi |    -.027012    .0403689    -0.67   0.503    -.1061335    .0521095

     lexp |    1.071125    .4743477     2.26   0.024     .1414207    2.000829

    lintr |     .105341     .067472     1.56   0.118    -.0269017    .2375837

    _cons |   -1.894873    3.017011    -0.63   0.530    -7.808106     4.01836

-------------------------------------------------------------------------------


. xtgls lgdp lpudi lprdi lfdi lexp lintr if id==3
```

```
Cross-sectional time-series FGLS regression


Coefficients:  generalized least squares

Panels:        homoskedastic

Correlation:   no autocorrelation


Estimated covariances      =          1      Number of obs     =         33

Estimated autocorrelations =          0      Number of groups  =          1

Estimated coefficients     =          6      Time periods      =         33

                                             Wald chi2(5)      =     127.90

Log likelihood             = -10.75883       Prob > chi2       =     0.0000



------------------------------------------------------------------------------
      lgdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

     lpudi |  -1.083801   .5704606    -1.90   0.057    -2.201883    .0342817

     lprdi |  -2.560865   .3042732    -8.42   0.000     -3.15723   -1.964501

      lfdi |   .3132183    .084857     3.69   0.000     .1469016    .4795349

      lexp |  -.8549783   .2263687    -3.78   0.000    -1.298653   -.4113038

     lintr |   -.135503   .0533986    -2.54   0.011    -.2401623   -.0308437

     _cons |    38.0694   1.580489    24.09   0.000      34.9717     41.1671

------------------------------------------------------------------------------
```

. xtgls lgdp lpudi lprdi lfdi lexp lintr if id==4

Cross-sectional time-series FGLS regression

```
Coefficients:  generalized least squares

Panels:        homoskedastic

Correlation:   no autocorrelation


Estimated covariances       =           1     Number of obs      =          33

Estimated autocorrelations =           0     Number of groups   =           1

Estimated coefficients      =           6     Time periods       =          33

                                              Wald chi2(5)       =      139.39

Log likelihood              = -.7921304       Prob > chi2        =      0.0000




------------------------------------------------------------------------------
      lgdp |     Coef.   Std. Err.      z     P>|z|    [95% Conf. Interval]

-------------+----------------------------------------------------------------
     lpudi |  .8858749   .4183352     2.12   0.034    .0659531   1.705797

     lprdi |  1.922428   .2389055     8.05   0.000    1.454182   2.390674

      lfdi | -.0136418   .0271996    -0.50   0.616    -.066952   .0396683

      lexp |  .8744179   .2306992     3.79   0.000    .4222558    1.32658

     lintr |  -.042855   .0454727    -0.94   0.346   -.1319799   .0462698

     _cons |  13.00908   1.644482     7.91   0.000    9.785951    16.2322

------------------------------------------------------------------------------
```

. xtgls lgdp lpudi lprdi lfdi lexp lintr if id==5

Cross-sectional time-series FGLS regression

85

```
Coefficients:  generalized least squares

Panels:        homoskedastic

Correlation:   no autocorrelation


Estimated covariances      =          1        Number of obs      =          33

Estimated autocorrelations =          0        Number of groups   =           1

Estimated coefficients     =          6        Time periods       =          33

                                               Wald chi2(5)       =       88.59

Log likelihood             = -30.68623         Prob > chi2        =       0.000

------------------------------------------------------------------------------
       lgdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+----------------------------------------------------------------
      lpudi |  -.5716667   .1509875    -3.79   0.000    -.8675968   -.2757365

      lprdi |   .4410864    .105494     4.18   0.000      .234322    .6478507

       lfdi |  -.5264848   .1048256    -5.02   0.000    -.7319392   -.3210303

       lexp |   .3755806   .1299593     2.89   0.004      .120865    .6302962

      lintr |   .1352918   .0854736     1.58   0.113    -.0322334    .3028171

      _cons |   23.91162   .3442047    69.47   0.000     23.23699    24.58625

------------------------------------------------------------------------------
```