

# **“The Impact of Government Debt on Aggregate Investment and Productivity in Developing Countries”**



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### CERTIFICATE

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## **Declaration**

I Muhammad Ziawar Shah, Student of M.Phil Economics solemnly declare and affirm on oath that I myself have authored this M.Phil Thesis with my own work and means, and I have not used any further means except those I have explicitly mentioned in this document. All items copied from internet or other written sources have been properly mentioned in the quotation marks and with a reference to the source of citation.

**Muhammad Ziawar Shah**

## **Dedication**

This thesis is dedicated to my beloved Parents, Grandfather and my loving brother

Muhammad Khawar Shah.

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***Muhammad Ziawar Shah***

## **Abstract**

The current study highlights the empirical relationship between government debt with aggregate investment and Total Factor Productivity covering the period from 1980-2017 in developing countries of six different developing regions. The regions have been taken on the basis of Human Development Index ranking of United Nation Development Program. From the findings of the study we can see different regions have different responds both in Aggregate investment and Productivity in both 5 year FE and GMM. The impact of government debt on aggregate investment in using 5 year FE gives significant negative impact on aggregate investment in Arab, Europe, Central and South Asian regions while Latin America, Sub Sahara and East Asian economies there have been observed insignificant impact of government debt on aggregate investment. While in case of using GMM it's been observed that there is significant negative impact of government debt on aggregate investment in East Asia, South Asia, Sub Saharan African and Latin American and Caribbean economies while the relationship between government debt and total factor productivity in case of using 5 year FE we can see that in Arab, East Asian, South Asia and Sub Saharan African regions the impact is negative and significant while in Europe and Latin America the impact is insignificant while using GMM the results indicate that increase in government debt will cause to reduce the total factor productivity in the respective regions. Therefore, we need to promote debt reduction policies to promote investment and productivity.

**Keywords:** Government Debt, Aggregate Investment, Productivity, Developing Region

## Table of Content

|   |      |
|---|------|
| <b>Declaration</b> .....  | ii   |
| <b>Acknowledgements</b> .....   | v    |
| <b>Abstract</b> .....   | vi   |
| List of Table: .....  | viii |
| <b>Chapter 1 Introduction</b> .....                                     | 1    |
| 1.1 Introduction .....  | 1    |
| 1.2 Problem Statement .....   | 3    |
| 1.3 Hypothesis of the Study .....                                       | 4    |
| 1.4 Objectives of the Study .....                                       | 4    |
| 1.4 Significance of the Study .....                                     | 5    |
| <b>Chapter 2 Literature Review</b> .....                                | 7    |
| 2.1 Introduction .....  | 7    |
| 2.2 Relationship between Government Debt and Aggregate Investment ..... | 7    |
| 2.3 Relationship between Government Debt and Productivity .....         | 9    |
| 2.4 Conclusion and Research Gap .....                                   | 11   |
| <b>Chapter 3 Research Methodology</b> .....                             | 12   |
| 3.1 Theoretical Framework .....   | 12   |
| 3.1.1 Debt and Investment .....   | 13   |
| 3.1.2 Debt and Productivity .....                                       | 14   |
| 3.2 Estimation Technique .....  | 15   |
| 3.3 Econometric Model .....   | 16   |
| 3.4 Variables and Data Time Period and Sources .....                    | 17   |
| <b>Chapter 4 Estimation and Results</b> .....                           | 19   |
| 4.1 Introduction .....  | 19   |
| 4.2 Summary Statistics of the Data .....                                | 19   |
| 4.3: Unit Root Analysis .....   | 27   |
| 4.4: Results of Regression .....  | 29   |
| 4.5: Comparative Analysis of Developing Regions .....                   | 52   |
| 4.6: Aggregate Analysis of Developing Countries .....                   | 55   |
| 5.1: Conclusion .....   | 58   |
| 5.2: Policy Recommendation .....  | 59   |
| <b>References</b> .....   | 61   |
| <b>Appendix</b> .....   | 65   |

List of Table:

|  |    |
|--|----|
| Table 1 Summary Statistics of Arab States.....   | 20 |
| Table 2 Summary Statistics of East Asia and the Pacific .....  | 21 |
| Table 3 Summary Statistics of Europe and Central Asia.....   | 22 |
| Table 4 Summary Statistics of Latin America and the Caribbean .....  | 23 |
| Table 5 Summary Statistics of South Asia.....  | 25 |
| Table 6 Summary Statistics of Sub-Saharan Africa.....  | 26 |
| Table 7 Unit Root Test.....  | 28 |
| Table 8: Relationship between Government Debt and Aggregate Investment of Arab States .....                  | 30 |
| Table 9: Relation between Government Debt and Aggregate investment of East Asia and the Pacific .....        | 33 |
| Table 10: Relation between Government Debt and Aggregate investment of Europe and Central Asia .....         | 35 |
| Table 11: Relation between Government Debt and Aggregate investment of Latin America and the Caribbean ..... | 37 |
| Table 12: Relation between Government Debt and Aggregate investment of South Asia .....                      | 39 |
| Table 13: Relation between Government Debt and Aggregate investment of Sub-Saharan Africa .....              | 41 |
| Table 14:Relation between government debt and Productivity of Arab states .....                              | 43 |
| Table 15: Relation between government Debt and Productivity of East Asia and the Pacific .....               | 45 |
| Table 16: Relation between Government Debt and Productivity of Europe and Central Asia.....                  | 46 |
| Table 17: Relation between Government Debt and Productivity of Latin America and the Caribbean .....         | 48 |
| Table 18: Relation between Government Debt and Productivity of South Asia .....                              | 50 |
| Table 19:Relation between Government Debt and Productivity of Sub-Saharan Africa .....                       | 51 |



|  |    |
|--|----|
| Table 20: Relationship between Government Debt, Aggregate Investment and Total Factor Productivity in Developing Economies ..... | 53 |
|--|----|

## Chapter 1

## Introduction

### 1.1 Introduction

Prior to the early 1970s, the developing economies were comparatively less external debt the foreign governments, international financial institutions, world bank and regional banks are the most creditors (Todaro & Smith, 2012). Until the 1980s the accumulation of debt was not a problem because before the 1980 developing economies just borrowed at concessional conditions (low interest rates) but commercial banks started to play an important role in lending. After the 1980's the rate of debt accumulation increases in debt servicing emphasizing in most developing countries as important aspect disturbing the growth of output specially after the adoption of Structural Adjustment Program in 1988 (Stanely, 1993). In the global market mostly developing countries lost their competitiveness mainly due to unsatisfactory exchange rate adjustments. Moreover weakening of the terms of trade among countries failure and mismanagement in good governance have also reduced the growth figures in developing countries (Reinhart & Rogoff, 2011). Since in the start of 1980s the developing nations have experienced decline in economic growth. The main reason for this decline in economic growth have decreased the investment rate for a large sample developing countries which have shown positive and significant relation to growth rates IMF (1988).

However, because of important differences between nations, the ratio of gross investment in relation to GDP differed over time from country to country. Lower gross investment growth rates were observed by developing countries in the 1980's due to the high debt service issue, in contrast to the developed economies that have not incurred these debt problems (Greene & Villanueva, 1991). Neoclassical growth framework firstly use by (Modigliani, 1961) argued that if government debt increases, it will cause to be declining the growth of country.

A high ratio of debt to GDP slow investment that cause to low capital forming and productivity level. Mostly investigators focused on the effect of government debt and growth, but neglect its impact on determinants of growth, i.e. investment and productivity. To show this problem Salotti & Trecrocis(2012) investigated the impact of government debt on both main elements of economic growth that is investment and productivity. In the growth theories Investment and productivity have the important elements of long term growth. Bonfiglioli (2008) investigated these two elements investment and productivity with debt suggested that more external debt have negative impact on productivity and investment and that certainly affect growth in long term. Some other investigation argued that high debt ratio could act as limitation of development by reducing productivity. Since if this is felt of government in future (in terms of) more return is made by creditors at that time that is possible the government would not pursue a tough and cost bear policy. At the same time it is assumed that the poor environment of policy affects productivity and investment. In addition lot of uncertainty and instability with regard toward debt burden drive negative impact on effective usage of production sources and better technology. Because in the event of high uncertainty there are opportunities for incorrect allocation of investment expenditure towards fast returned measures rather than focusing on long term. Such incorrect and less allocation towards investment activity and usage of resources can lead to slow down growth of productivity.

Here are some number of links in which government debt can influence growth in the long period. 1st debt service by tax, the private investment crowd out through reducing saving (resulting from lesser disposable income) and finally result in distortive taxation. 2nd an increasing government debt entail to rise in long term nonlinear returns increases the probability of default. Increased long period interest rate push out effective government investment and (importantly) result in decrease in private investment through raising capital

costs and "less R&D investment will take a long term adverse effect on growth" (Elmeskov & Sutherland, 2012).

## **1.2 Problem Statement**

When we deeply analyse the modern economies, we can see that the whole economies are being divided in two major groups, Developed and Developing Economies. From the recent report of United Nation Development Program (UNDP, 2018), there are 147 countries showing developing nations and 46 countries have been considered developed countries. There are bundles of literature on the issues and challenges facing by developing economies but some of the consideration indicate that in the developing economies higher debt level act as barrier to growth by decreasing productivity and discouraging investment. Because it's been felt that government in future pay more return made by creditors at that time that possible that the government would not pursue a tough and cost bear policy. Thus the poor environment of policy affect productivity and investment. In addition lot of uncertainty and instability with regard toward debt burden drive a negative impact on effective usage of production sources and better technology. Because in the event of high uncertainty there are opportunities for incorrect allocation of investment expenditure toward fast returned measures rather than focusing on long term. Therefor these incorrect and less allocation towards investment activity and usage of resources can lead to slow down growth of productivity. There is dearth of knowledge in the literature about these issues and challenges faced by the developing economies. Therefore this study is being motivated to seek the problem associated with Government Debt with investment and productivity in developing nations. This study seek to response the following questions regarding relationship between Government Debt, Investment and Productivity.

- What is the relationship between Government Debt and Investment in Developing Economies?
- How Government Debt affects Factor Productivity in Developing Economies?

### **1.3 Hypothesis of the Study**

The above discussion formalized the following hypothesis to be analysed throughout the study.

H<sub>01</sub>: There is inverse relationship between Debt and Investment.

H<sub>02</sub>: There is inverse relationship between Debt and Productivity.

H<sub>03</sub>: There is linear relationship between Debt and Investment.

H<sub>04</sub>: There is linear relationship between Debt and Productivity.

### **1.4 Objectives of the Study**

The relationship between Government Debt, Aggregate investment and Productivity is one of the most debating issue in modern era. Most of the development economists are of the view that up to a certain level Government debt is good that accelerate the investment and productivity in developing nations but after certain limit it becomes a serious problem in growth in developing countries specially who are suffering more problem of current account deficit. The current study highlight the problem of Debt and Investment and Productivity with the following objectives.

1. To explore the relationship between Government Debt and Investment in developing countries
2. To explore the relationship between Government Debt and Productivity in developing countries

## **1.4 Significance of the Study**

Human Development Index Report published by United Nation Development Program, divides the whole countries into three main groups i.e. Developed, Medium Developed and Least Developed nations further categorizing them into two main groups Developed and Developing countries. From (UNDP, 2018) report there are 46 countries are been considered as developed while 147 countries have been placed in developing countries. There are many indicators and determinants of Economic Growth and Development among which Investment and Productivity play vital and important role. There exists huge literature on the relationship of debt and growth and also on the debt and investments but to my knowledge very few work has been made on debt relation with two main growth elements, that are productivity and investment specially in case of developing economies. While sufficient literature exist for developed and OECD countries, however for Developing countries we have not seen any satisfactory work. Our work is therefore purely focused on the developing economies and since we know that these are the economies that suffer from debt and deficit problem because of current account deficit and deficit budgetary problem. We are going to empirically investigate nature of relationship between Government debt, Investment and Productivity in Developing Countries. The contribution of this study in literature is as follows.

- This type of study is not done for developing economies in which the effect of government debt is examined on the investment and productivity rather than growth directly.
- This study uses two different methodologies; 1st is 5 year average fixed effect on panel data and 2nd is using system Generalized Method of Moment (GMM) to tackle Endogeneity issue.

So to meet the above objective and hypothesis the current study has been designed in this way that after brief introduction we elaborated the previous studies related to topic both theoretically and empirically in second chapter. Third chapter discusses the theoretical framework with research methodology, variables and data sources. In chapter four we briefly analysed the data related to our variables and in final section conclusion and policy recommendations of the study based on our analysis and suggestion for future research have been made.

### 2.1 Introduction

There exist huge literature on the relationship of debt with the investment and productivity in case of OECD and Developed countries and there is a very little work done in Asian countries. In this study our focus is on developing economies. The current chapter highlights the previous studies have been done on the related topic both at country and panel analysis of different countries. After the introductory paragraph the first section highlight the previous studies on the relationship between government debt and aggregate investment while in third section we have discussed the theoretical and empirical studies on the relationship between government debt and productivity. In final section the literature review conclusion has been drawn with research gap to be fulfilled with the proposed econometric methods.

### 2.2 Relationship between Government Debt and Aggregate Investment

Krugman (1988) in his paper, the trade off is confronted with creditors with huge debt stock furthermore that do not enable them to make focus for new lenders. Debt overhang explain this issue; the resources of some countries do not have more value to resolve the level of "inherited debts." As stated by the study, the choice between repayment of debt and forgiveness of debt should not be based on question of solvency versus liquidity. At the same time, it gives interaction among the choice value of a huge nominal debt and the cause for a debt which hardly need to be stable. Creditors cannot try to cancel debts if country has some rang to repaying. But if a condition in a country which not in favour of repay the debt. The tough issue is, how many to depend on debt financing and how many on it forgiveness.

The effect of government debt examined to be negatively proportional towards investment, this issue of debt is continued by crisis of debt in Latin America in 1980s which indicates the foreign debt had negatively affect the investment and growth. Usually, theory of



debt overhang presented by (Krugman, 1988) and in contrast (Sachs, 1989) was carry with crowding out theory supported by (Cohen, 1993).

Pegkas (2018) stated that increasing public debt and its interaction by other elements of investment and productivity after the global financial crises required renewal of policies discussion on effect of increasing debt on growth level. (Pattilo et al 2004) examined debt influence investment of 61 countries since 1996 to 1998 and concluded that high debt have a negative and non linear relation with growth and investment. This reveals that there is strong evidence the govt have negative and significant effect on Investment and Productivity and higher debt will cause to lose on both investment and productivity side while these two i.e. Investment and Productivity are considered two tyres of Economic Growth (Narayan, 2005).

Akram (2011) investigated the relation among government debt and investments. The author argued, that in the case of Pakistan; both in short run and in long run, the foreign debt of the government appears to negative and significant impact on investment. However, this does not support the presence of crowding out effect because of the insignificant impact of debt servicing on investments while there is negative relationship between internal debts and investments that argues for the existence of "crowding out effects" for private investment and internal debt does not seem to affect economic performance.

Levy&Chowdhury(1993) examined the rise in government foreign debt reduce the GNP level by encouraged capital flight and discouraged capital creation as a result of expectations of tax increases. Other study (Sawada , 1994) examine countries with high debt burden has problem of debt overhang because their existing foreign debt is high than the predicted future return value.

Jecheche (2012) states in his study that in generally in a country the huge part of the economic growth is cause of the high rate of investment and increased total factor productivity because of more efficient use of the production of factors. This factor efficiency

and its development stemmed from the improvements of the early nineties that improve the private investment environment and make room for its elementary role in economic performance. In a time series framework, however, both determinants (private investments and TFP) are insignificant.

Chowdhury K. (1994) examined causality among external debt and GNP growth rate. In this study use data of two regions of developing countries. The study was carried out for the period that began from 1970-1988. For the estimation the study used structural simultaneous equation model and Granger's causality test. Study conclude that the causal link arises in Bangladesh, Indonesia and South Korea from foreign debt to GNP. The result of this study also examined the interrelation of relationships among private and government external debts.

Pattillo et al. (2002) examine the effect of external debt on GDP per capita growth use large panel dataset for 93 developing countries over 1969-1998 and study use various econometric techniques, regression specification and various indicators of debt there result show the negative effect of external debt on growth of GDP per capita.

### **2.3 Relationship between Government Debt and Productivity**

Jecheche (2012) states in his study that in generally in a country the huge part of the economic growth is cause of the high rate of investment and increased total factor productivity because of more efficient use of the production of factors. This factor efficiency and its development stemmed from the improvements of the early nineties that improve the private investment environment and make room for its elementary role in economic performance. In a time series framework, however, both determinants (private investments and TFP) are insignificant.

Ward et al. (2004) found that the non-linear effect of debt on growth is due to the effect on TFP. The result of this study suggests that there is negative effect of debt on

economic growth when debt is 40% of GDP and 160-170% of export earning. To start the inverse effect of debts round these values. A high debt lowers economic growth and mostly reduces the effectiveness of investments. Its means the adverse impact work by reducing the TFP and not by reducing the contributions.

Pegkas (2018) stated that increasing public debt and his interaction by productivity, especially after the global financial crises required renewal of polices discussion on effect of increasing debt on growth level. (Pattilet al 2004) examined the debt influence growth of 61 countries and concluded that high debt have a negative and non linear relation with growth that reveals that there is strong evidence that the govtenment debt have negative and significant effect on Productivity and highier debt cause to lose in productivity side(Narayan, 2005).

The studies of (Siddiqui & Malik, 2001;Chowdhury,2001;Sen, Kasibhatla, & Stewart, 2007;Easterly, 1999) come to the similar decision that external debt have negative impact on growth and productivity. The effect of increasing debt on growth appears negative impact on the investment and to the total factor productivity growth.

Kumar & Woo (2010)examine non-linearity in the relationship of debt and growth and also examine the channel of the impact of debt on growth and used panel data for 38emerging and developed economies from 1970-2007. They use the Cobb Douglas Production function of neoclassical framework. This study use use following estimation technique pooled OLS, fixed effects (FE),Between Estimator (BE), and SGMM. The results of study concluded that largely negative relations described through reduction in growth of productivity in labor mostly because of the decline in investment and low growth of capital stock.

Geiger (1990) examined the impact of Debt on Economic Development in Latin America. He gave insight into the issue that is economic development is negatively affected

by debt. The study use data from 1974-1986 for nine south American countries. For estimation study use a distributed lag model and simple regression model. The result support argument that the economy of country suffers when he accumulate debt burden.

Akram (2011) investigates the relation among government debt and Economic Growth in Pakistan. The author argues, that in the case of Pakistan; both in short run and in long run, the foreign debt of the government appears to negative and significant impact on GDP per capita that justifies presence of debt overhang effect. Other hand, it can be seen that debt servicing have negative and significant linked to economic growth, but this can only be observed in the short term. Cunniiingham(1993)investigated the burden of debt have adverse impact on growth because of the effect of labor and capital on the productivity.

## **2.4 Conclusion and Research Gap**

The overall literature reveals that there are non-linear relations exists among Govt Debt and Economic Growth, some studies in the different region and countries of the world indicate that there is adverse relationship among Government Debt and Investment, and Government Debt and Productivity. There has been found few studies that combine has been done taking Investment and Productivity with Government Debt specially in case of developing economies. Most of the researchers focus on the impact of government debt on growth, but neglect its impact on determinants of growth, i.e. investment and productivity. Therefore through this study it's being focused to analyse the relations between Government Debt, investment and Productivity for developing economies using 5 years fixed effect and System GMM model from 1980-2017. This study has taken a larger set of variables than the previous empirical studies. The current study divides the whole developing Economies into 6 different regions i.e. UNDP, HDI Report

The focus of the current study is to seek the relationship between government debt, aggregate investment and productivity in developing economies. Since we are focusing on panel data analysis by taking a different developing region as study area and taking five different countries as sample representing the respective regions. Therefore, methodology plays a key role to explore the relationship. The current chapter highlights the methodological tools and techniques that are used to find the relationship. The current chapter being designed in this way that in first section our focus is on theoretical framework by focusing two different approaches and theories that are widely used to see the impact among the focused variable. Second section shows the econometrical estimation technique followed by econometric model and in final section we have discussed variables and data time period and data sources.

### 3.1 Theoretical Framework

Theoretical framework highlights the linkage between dependent and independent variables. In the current study we are dealing with two different dependent variables i.e. Aggregate Investment and Productivity that are affecting by Government debt with other control and independent variables. Therefore, we are relying on two different theoretical approaches that discuss the nature of relationship and linkage between dependent and independent variables. To see the theoretical linkage between government debt and aggregate investment we are following the crowding out hypothesis while for productivity and government debt we are using Solow Growth Model. The below section give quick look of the theoretical framework of dependent and independent variables.

### 3.1.1 Debt and Investment

Theoretical framework of the current study is based on widely used debt investment framework that is known as Crowding out Hypothesis. According to Salotti & Trecroci (2012) expansionary fiscal policy make deficit in government current account and to make balance it, Government makes borrowing selling government bonds, securities and treasury bills and will pay an interest rate on this which discouraging private investment and also decline in private consumption cannot rejected. The theoretical link between debt and investment is defines by Crowding out hypothesis and the current study focused on empirical investigation of the relationship among debt and investment in developing economies. Levy & Chowdhury (1993) examined an rise in government foreign debt reduce the GNP level by encouraged capital flight and discouraged capital creation as a result of expectations of tax increases. Akram (2011) investigated the relationship between debts and investments, since investing is considered to be the most striking channel because economic performance can be affected by Government debt. So the given econometric equation showing the relationship between Aggregate investment, debt, deficit, Capital Stock, Population Growth and control variable is given below.

$$Aginv_{i(t,t+4)} = \beta_1 debt_{i,t} + \beta_2 deficit_{i,t} + \beta_3 CS_{i,t} + \beta_4 Popgr_{i,t} + \beta_5 X_{i,t} + \epsilon_{i,t}$$

Where **Aginv** shows Aggregate Investment, **Deficit** describes Government current Account Deficit, **CS** shows Capital Stocks while **X<sub>i</sub>** represents a set of Control Variables i.e. Interest Rate, Trade Openness, Financial Development and Consumer Price Index and **ε<sub>i,t</sub>** denotes the error term while (i) is used for each region and (t) denotes the time period. From the literature its expected that there is adverse relationship among debt, deficit, population growth, Consumer Price Index, Interest Rate and aggregate investment while Capital Stock, financial development and trade openness have positively effect Aggregate investment.

### 3.1.2 Debt and Productivity

Same like Debt and Investment relationship there is another important phenomenon that is associated with debt and investment that because of Crowding out the first sector that get hurts is the productivity level. Because when the deficit in Government current account increases the investors seeks it as higher cost of production and that will affect the productivity of firms. To see the relationship between debt and productivity we will rely on Simple Solow-Sowan Model which is given below;

Let us consider simple production function which is

$$Y_t = A(t) F(k(t), l(t))$$

where  $Y_t$  denote output,  $k$  is denote Capital,  $l$ , denotes labor and  $A$ , shows Solow-Sowan residual while  $(t)$  is time period. The production function which use above will be converted into Cobb-Douglas Production function if parameters of productivity are included in the model

$$Y_t = A(t) K(t)^\alpha L(t)^{1-\alpha}$$

where  $0 < \alpha < 1$ , where  $1-\alpha$  share of labor, and by converting this to intensive model we have

$$Y_t = A(t) K(t)^\alpha$$

Taking first order derivative of above equation

$$f'(Y_t) = A(t) \alpha K(t)^{\alpha-1} > 0$$

$$f'(k(t)) = A(t) \alpha (1-\alpha) k(t)^{-\alpha-1} < 0$$

From the above calculation of modelling theoretically extended Solow Swan model, output depend upon Labor, Capital and Productivity. Since as we know productivity is adverse relation to output and external debt, so bellow our empirical model is given which show link as follows;

$$prodgr_{i(t,t+4)} = \alpha_1 debt_{i,t} + \alpha_2 CS_{i,t} + \alpha_3 Edu_{i,t} + \alpha_5 X_{i,t} + \epsilon_{i,t}$$

where **Prodgr** shows productivity growth which is measured by total factor productivity, **CS** is Capital Stock, **Edu** is Education level, and **X<sub>t</sub>** shows the control variables i.e. Interest Rate, Trade Openness, Financial Development and Consumer Price Index and  $\epsilon_{i,t}$  shows the error term while (i) is use for each region and (t) denotes the time period. The nature of relationship between debt, interest rate, consumer price Index and Productivity Growth is inverse while Capital Stock, Education, Trade openness, Financial Development and Productivity Growth have positive relationship.

### 3.2 Estimation Technique

Since we are working on panel data so our estimation technique is also in accordance with the data form. There are two conventional models in panel data analysis (a) Fixed Effect Models (FEM) and (b) Random Effect models (REM). The selection between the FEM and REM are made on the basis of Hausman test. A prominent econometric technique to avoid the problems of potential endogeneity and reverse causality is Generalized Method of Moment (GMM). GMM is the extension of Instrumental Variable technique. The Basic advantage of GMM approach is that the model to be estimated is not necessarily to be homoscedastic and serially independent (Blundell & Bond, 2000). Thus GMM produce consistent and efficient estimates even in the presence of Heteroscedasticity ( Perera & Pedersen, 2013). For dynamic panel data modeling, GMM has mainly been used by (Arellano & Bond, 1991) then by (Olympia & Arellano, 1996) and later on (Blundell & Bond, 2000) specifically used GMM to cope the problem of endogeneity in production function.



There are certain measures and estimation techniques used to check the relation between debt, investment and productivity growth i.e. Geiger(1990) used simple regression while Siddiqui & Malik (2001) used fixed effect while Kumar & Woo (2010) have used Fixed effect, SGMM while Salotti & Trecroci, 2012; Pattillo et.al 2004; used GMM to analyse the relation among government debt, aggregate investment and productivity growth because GMM is considered well measure to analyse the long panel data and to avoid the problem of endogeneity and reverse causality. The current study employed two methods to meet the desired objectives. First we used Fixed Effects on the average of Five Years panel data on developing economies by dividing the whole developing countries into six different regions because taking data of five year smoothed out the business cycle fluctuation in short term data but it costs us a shorter sample value. In second methodology we used Generalized Method of Moment (GMM) on the annual data on divided regions of developing countries because GMM on annual data we take the advantage of a larger Sample and also GMM deals the problem of endogeneity, reverse causality, autocorrelation and also handle non stationary process in the data.

### 3.3 Econometric Model

From the theoretical framework and proposed econometric estimation the econometric equation showing the relationship between Aggregate investment, debt, deficit, Capital Stock, Population Growth and control variable is given below.

$$Aginv_{i(t,t+4)} = \beta_1 debt_{i,t} + \beta_2 deficit_{i,t} + \beta_3 CS_{i,t} + \beta_4 Popgr_{i,t} + \beta_5 X_{i,t} + \epsilon_{i,t}$$

where **Aginv** shows Aggregate Investment, **Deficit** describes Government current Account Deficit, **CS** shows Capital Stocks while **X<sub>i</sub>** represents set of Control Variables i.e. Interest Rate, Trade Openness, Financial Development and Consumer Price Index and **ε<sub>i,t</sub>** denotes the error term while (i) is use for each region and (t) denotes the time period. From the

literature its expected that there is adverse relationship among debt, deficit, population growth, Consumer Price Index, Interest Rate and aggregate investment while Capital Stock, financial development and trade openness have positively effect Aggregate investment.

Since as we know productivity is adverse relation to output and external debt, so bellow our empirical model is given which show link as follows;

$$prodgr_{i(t,t+4)} = \alpha_1 debt_{i,t} + \alpha_2 CS_{i,t} + \alpha_3 Edu_{i,t} + \alpha_5 X_{i,t} + \epsilon_{i,t}$$

where **Prodgr** shows productivity growth which will measure by total factor productivity, **CS** is Capital Stock, **Edu** is Education level, and **X<sub>t</sub>** shows the control variables i.e. Interest Rate, Trade Openness, Financial Development and Consumer Price Index and  $\epsilon_{i,t}$  shows the error term while (i) is use for each region and (t) denotes the time period. The nature of relationship between debt, interest rate, consumer price Index and Productivity Growth is inverse while Capital Stock, Education, Trade openness, Financial Development and Productivity Growth have positive relationship.

### 3.4 Variables and Data Time Period and Sources

In the ongoing study six regions of developing countries are taken i.e. East Asia& Pacific, Arab States, Europe & Central Asia, , South Asia, Latin America & Carrabin and Sub-Saharan African developing countries. The regions will be taken on the basis of Human Development Index ranking of United Nation Development Program. The sample period of the study is taken from 1980 to 2017. The International Financial Statistics and World Development Indicator will be use as data source because of their reliability and easy access. The below table gives the description, reference and expected sign with notation as well as explanation are given below.

| Notation                     | Explanation                         | Definition   | Reference                   | Data Source |
|------------------------------|-------------------------------------|--|-----------------------------|-------------|
| <b>Dependent Variables</b>   |                                     |  |                             |             |
| AgInv                        | Gross Fixed Capital Formation       | Aggregate Investment in the economy in specific period of time.  | (Salotti & Trencroci, 2012) | WDI         |
| Prodgr                       | Growth in Total Factor Productivity | The Growth in TFP is by dividing growth in output by the weighted average of growth in labor and capital input                                 | (Salotti & Trencroci, 2012) | WDI         |
| <b>Independent Variables</b> |                                     |  |                             |             |
| DTGDP                        | Debt to GDP                         | Ratio of Debt to GDP is the ratio of nation debt to there GDP by comparing what country owed with what it produced.                            | (Salotti & Trencroci, 2012) | WDI         |
| DEFTGDP                      | Deficit to GDP                      | The exceeding expenditure from revenue coz to face deficit and this accrued deficits form national debt.                                       | (Salotti & Trencroci, 2012) | WDI         |
| CS                           | Capital stock                       | The capital stock is the number of general and preferable shares that a company is authorize to issue in accordance with its corporate bylaws. | (Salotti & Trencroci, 2012) | WDI         |
| PG                           | Population Growth                   | The Growth in population of the region over period of time.  | (Salotti & Trencroci, 2012) | WDI         |
| EDU                          | Education                           | Human capital is measured by the log of the average year of secondary education.   | ( Kumar & Woo, 2010)        | WDI         |
| <b>Control Variable</b>      |                                     |  |                             |             |
| TO                           | Trade Openness                      | Measured as Import Plus Export over GDP, denotes that how much a country is open for international trade.                                      | ( Kumar & Woo, 2010)        | WDI         |
| FD                           | Financial Development               | (private credit over GDP) proxy for the level of financial market depth.   | ( Kumar & Woo, 2010)        | IFS         |
| IR                           | Interest rate                       | The amount of a loan that is charge as interest to the borrower, usually express as an annual percentage of the loan.                          | (Salotti & Trencroci, 2012) | IFS         |
| CPI                          | Consumer Price Index                | Consumer Price denotes the Inflation Rate in the economy   | ( Kumar & Woo, 2010)        | WDI         |

## **Chapter 4**

## **Estimation and Results**

### **4.1 Introduction**

The main purpose of the current study is to find out the impact of government debt on aggregate investment and productivity. Since the whole world is divided into two main categories i.e. developed and developing economies. Developed economies are considered as promoted and industrialized with well mature macroeconomic stability and indicators while developing economies are either struggling to transform from agricultural to industrial or they are still far behind what they are expected. Most part of the economies in the real world are developing economies and has been divided into different regions on the basis of geographic location and localities. These regions have different common features and that differs from that of other on the basis of their economic dependence and resource endowments. Therefore to see the effect of government debt on productivity and aggregate investment in developing economies on region wise is the basic theme and objective of the current study. In this section we will elaborate descriptive statistics of the concerned variables where our focus will be on minimum, maximum, mean and standard deviation values of the dependent and independent variable. Section 4.3 will highlight the unit root time series characteristics of the variables while in section 4.4 we will find the relations among Government debt, total factor productivity and aggregate investment through Average fixed Effect Model with Generalize Method of Moment.

### **4.2 Summary Statistics of the Data**

Regions wise summary statistics tables of developing countries is given below in which we can see the mean and standard deviations of all the used variables.

*Table 1 Summary Statistic of Arab States*

| <b>Variable</b> | <b>Obs</b> | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
|-----------------|------------|-------------|-----------|------------|------------|
| <b>LGFCF</b>    | 190        | 24.18191    | 2.447498  | 19.76814   | 29.67109   |
| <b>LTFP</b>     | 190        | 18.38598    | 2.40187   | 13.47448   | 22.89861   |
| <b>DTGDP</b>    | 190        | 0.522125    | 0.687251  | 0.00028    | 3.27933    |
| <b>DEFTGDP</b>  | 190        | -0.09096    | 0.127549  | -0.54897   | 0.268914   |
| <b>LCS</b>      | 190        | 8.798353    | 1.764947  | 5.892397   | 13.01705   |
| <b>PG</b>       | 190        | 2.247929    | 1.0774    | 0.760981   | 5.56412    |
| <b>LEDU</b>     | 190        | 4.133944    | 0.370376  | 3.03933    | 4.986178   |
| <b>TO</b>       | 190        | 0.812197    | 0.34805   | 0.302466   | 2.075087   |
| <b>LFD</b>      | 190        | 3.653627    | 0.705782  | 1.362877   | 4.519274   |
| <b>IR</b>       | 190        | 4.095184    | 7.021437  | -29.7737   | 24.32732   |
| <b>LCPI</b>     | 190        | 3.959846    | 0.80706   | 1.390898   | 5.442873   |

The mean value for the variable Aggregate investment (in log form) in developing Arab countries is 24.18191 and its standard deviation is 2.447498, Variable growth in total factor productivity (in log form) is having a mean 18.38598 and standard deviation 2.40187. The mean value for the variable ratio of debt to GDP in developing Arab nations (used in study) is 0.522125 and its standard deviation is 0.687251, for deficit to GDP ratio mean and standard deviation are -0.09096 and 0.127549 respectively. In case of the variable Capital stock (in log form) has a mean value 8.798353 and standard deviation 1.764947 of the above used developing Arab countries. For population growth mean 2.247929 and standard deviation are 1.0774. Mean value of human capital(in log form) is 4.133944 and human capital has standard deviation 0.370376. The mean value of trade openness is 0.812197 and standard deviation is 0.34805. 3.653627 and 0.705782 are the mean and standard deviation of financial

development(in log form) 4.095184 is the mean value for interest rate of developing Arab countries whereas its standard deviation is 7.021437. The mean value of CPI is 3.959846 and standard deviation 0.80706.

*Table 2 Summary Statistics of East Asia and the Pacific*

| <b>Variable</b> | <b>Obs</b> | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Man</b> |
|-----------------|------------|-------------|-----------|------------|------------|
| <b>LGFCF</b>    | 190        | 28.3056     | 3.008357  | 23.5117    | 36.01367   |
| <b>LTFP</b>     | 190        | 21.99972    | 2.974907  | 17.15469   | 29.41319   |
| <b>DTGDP</b>    | 190        | 0.013221    | 0.013     | 0          | 0.076969   |
| <b>DEFTGDP</b>  | 190        | 0.020431    | 0.072535  | -0.10567   | 0.250524   |
| <b>LCS</b>      | 190        | 11.00572    | 2.600766  | 6.147466   | 17.7566    |
| <b>PG</b>       | 190        | 1.598558    | 0.699608  | 0.252354   | 2.995393   |
| <b>LEDU</b>     | 190        | 4.12546     | 0.35423   | 3.324241   | 4.792741   |
| <b>TO</b>       | 190        | 0.838224    | 0.490865  | 0.124249   | 2.204073   |
| <b>LFD</b>      | 190        | 4.110016    | 0.686445  | 2.270118   | 5.11502    |
| <b>IR</b>       | 190        | 4.991288    | 5.448644  | -24.6002   | 22.95688   |
| <b>LCPI</b>     | 190        | 3.971087    | 0.771417  | 1.714599   | 4.957111   |

The mean value for the variable Aggregate investment (in log form) in developing East Asia and the Pacific countries is 28.3056 and its standard deviation is 3.008357, Variable growth in total factor productivity (in log form) is having a mean 21.99972 and standard deviation 2.974907. The mean value for the variable debt to GDP ratio in developing East Asia and the Pacific countries (used in study) is 0.013221 and its standard deviation is 0.013, for deficit to GDP ratio mean and standard deviation are 0.020431 and 0.072535 respectively. In case of the variable Capital stock(in log form) has a mean value 11.00572 and standard deviation 2.600766 of the above used developing East Asia and the Pacific countries. For population

growth mean 1.598558 and standard deviation are 0.699608. Mean value of human capital(in log form) is 4.12546 and human capital has standard deviation 0.35423. The mean value of trade openness is 0.838224 and standard deviation is 0.490865. 4.110016 and 0.686445 are the mean and standard deviation of financial development (in log form) 4.991288 is the mean value for interest rate of developing East Asia and the Pacific countries whereas its standard deviation is 5.448644. The mean value of CPI is 3.971087 and standard deviation 0.771417.

*Table 3 Summary Statistic of Europe and Central Asia*

| <b>Variable</b> | <b>Obs</b> | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
|-----------------|------------|-------------|-----------|------------|------------|
| <b>LGFCF</b>    | 190        | 21.74273    | 5.552247  | 9.367344   | 27.98082   |
| <b>LTFP</b>     | 190        | 16.00427    | 5.355012  | 4.210278   | 22.20635   |
| <b>LDTGDP</b>   | 190        | -1.5867     | 3.995924  | -7.25064   | 8.204544   |
| <b>DEFTGDP</b>  | 190        | -0.03946    | 0.242342  | -0.92569   | 0.799356   |
| <b>LCS</b>      | 190        | 8.034939    | 5.074833  | -5.26981   | 14.45755   |
| <b>PG</b>       | 190        | 0.608869    | 1.092724  | -2.39039   | 2.687862   |
| <b>LEDU</b>     | 190        | 4.368366    | 0.239413  | 3.626036   | 4.651237   |
| <b>TO</b>       | 190        | 0.974432    | 2.99557   | 0.136371   | 40.09762   |
| <b>LFD</b>      | 190        | 2.577355    | 1.025466  | 0.003216   | 4.261947   |
| <b>IR</b>       | 190        | 10.38391    | 20.79836  | -63.7922   | 67         |
| <b>LCPI</b>     | 190        | 1.515146    | 3.696549  | -6.36119   | 5.164607   |

The mean value for the variable Aggregate investment (in log form) in developing Europe and Central Asia countries is 21.74273 and its standard deviation is 5.552247, Variable growth in total factor productivity (in log form) is having a mean 16.00427 and standard deviation 5.355012. The mean value for the variable debt to GDP ratio (in log form) in

developing Europe and Central Asia countries (used in study) is -1.5867 and its standard deviation is 3.995924, for deficit to GDP ratio mean and standard deviation are -0.03946 and 0.242342 respectively. In case of the variable Capital stock (in log form) has a mean value 8.034939 and standard deviation 5.074833 of the above used developing Europe and Central Asia countries, for population growth mean 0.608869 and standard deviation are 1.092724. Mean value of human capital (in log form) is 4.368366 and human capital has standard deviation 0.239413. The mean value of trade openness is 0.974432 and standard deviation is 2.99557. 2.577355 and 1.025466 are the mean and standard deviation of financial development (in log form). 10.38391 is the mean value for interest rate of developing Europe and Central Asia countries whereas its standard deviation is 20.79836. The mean value of CPI is 1.515146 and standard deviation 3.696549.

***Table 4 Summary Statistics of Latin America and the Caribbean***

| <b>Variable</b> | <b>Obs</b> | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
|-----------------|------------|-------------|-----------|------------|------------|
| <b>LGFCF</b>    | 190        | 25.45861    | 4.78789   | 7.215923   | 32.91188   |
| <b>LTFP</b>     | 190        | 19.80305    | 4.830912  | 1.135541   | 27.04617   |
| <b>LDTGDP</b>   | 190        | -3.06929    | 4.585189  | -9.22573   | 14.41427   |
| <b>DEFTGDP</b>  | 190        | -0.00939    | 0.039444  | -0.10341   | 0.138062   |
| <b>LCS</b>      | 190        | 10.20278    | 4.708566  | -8.10576   | 16.75546   |
| <b>PG</b>       | 190        | 1.782809    | 0.491416  | 0.84364    | 2.695037   |
| <b>LEDU</b>     | 190        | 4.22451     | 0.286636  | 3.686826   | 4.859982   |
| <b>TO</b>       | 190        | 0.489315    | 0.180127  | 0.221173   | 0.924899   |
| <b>LFD</b>      | 190        | 3.143385    | 0.432267  | 2.215014   | 4.126807   |
| <b>IR</b>       | 190        | 12.3584     | 16.81645  | -60.034    | 76.42825   |
| <b>LCPI</b>     | 190        | 16.81645    | 3.557065  | -13.4895   | 4.881875   |



The mean value for the variable Aggregate investment (in log form) in developing Latin America and the Caribbean countries is 25.45861 and its standard deviation is 4.78789, Variable growth in total factor productivity (in log form) is having a mean 19.80305 and standard deviation 4.830912. The mean value for the variable debt to GDP ratio (in log form) in developing Latin America and the Caribbean countries (used in study) is -3.06929 and its standard deviation is 4.585189, for deficit to GDP ratio mean and standard deviation are 0.00939 and 0.039444 respectively. In case of the variable Capital stock (in log form) has a mean value 10.20278 and standard deviation 4.708566 of the above used developing Latin America and the Caribbean countries, for population growth mean 1.782809 and standard deviation are 0.491416. Mean value of human capital(in log form) is 4.22451 and human capital has standard deviation 0.286636. The mean value of trade openness is 0.489315 and standard deviation is 0.180127. 3.143385 and 0.432267 are the mean and standard deviation of financial development(in log form) 12.3584 is the mean value for interest rate of developing Latin America and the Caribbean countries whereas its standard deviation is 16.81645. The mean value of CPI is 16.81645 and standard deviation 3.557065.

*Table 5 Summary Statistics of South Asia*

| <b>Variable</b> | <b>Obs</b> | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
|-----------------|------------|-------------|-----------|------------|------------|
| <b>LGFCF</b>    | 190        | 26.80488    | 2.051444  | 22.02645   | 31.49782   |
| <b>LTFP</b>     | 190        | 20.9771     | 1.988947  | 16.52214   | 25.30434   |
| <b>DTGDP</b>    | 190        | 0.010121    | 0.007796  | 0.001878   | 0.042346   |
| <b>DEFTGDP</b>  | 190        | -0.07725    | 0.057837  | -0.3379    | 0.010337   |
| <b>LCS</b>      | 190        | 10.00343    | 1.335532  | 7.356889   | 13.33913   |
| <b>PG</b>       | 190        | 1.808811    | 0.699955  | 0.50852    | 3.360418   |
| <b>LEDU</b>     | 190        | 3.759403    | 0.509113  | 2.662288   | 4.602103   |
| <b>TO</b>       | 190        | 0.408166    | 0.179357  | 0.123521   | 0.886364   |
| <b>LFD</b>      | 190        | 3.208217    | 0.497198  | 1.752905   | 4.392538   |
| <b>IR</b>       | 190        | 6.299629    | 4.017225  | -6.82292   | 20         |
| <b>LCPI</b>     | 190        | 3.708664    | 0.881904  | 1.519699   | 5.142467   |

The mean value for the variable Aggregate investment (in log form) in developing South Asia countries is 26.80488 and its standard deviation is 2.051444, Variable growth in total factor productivity (in log form) is having a mean 20.9771 and standard deviation 1.988947. The mean value for the variable ratio of debt to GDP in developing South Asia nations (used in study) is 0.010121 and its standard deviation is 0.007796, for deficit to GDP ratio mean and standard deviation are -0.07725 and 0.057837 respectively. In case of the variable Capital stock (in log form) has a mean value 10.00343 and standard deviation 1.335532 of the above used developing South Asia countries. for population growth mean 1.808811 and standard deviation are 0.699955. Mean value of human capital(in log form) is 3.759403 and human capital has standard deviation 0.509113. The mean value of trade openness is 0.408166 and standard deviation is 0.179357. 3.208217 and 0.497198 are the mean and standard deviation

of financial development(in log form) 6.299629 is the mean value for interest rate of developing South Asia countries whereas its standard deviation is 4.017225. The mean value of CPI is 3.708664 and standard deviation 0.881904.

**Table 6 Summary Statistics of Sub-Saharan Africa**

| <b>Variable</b> | <b>Obs</b> | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
|-----------------|------------|-------------|-----------|------------|------------|
| <b>LGFCF</b>    | 190        | 25.05881    | 2.428975  | 19.46659   | 30.45882   |
| <b>LTFP</b>     | 190        | 19.14483    | 2.683469  | 12.72474   | 25.62586   |
| <b>DTGDP</b>    | 190        | 0.032229    | 0.040058  | 0          | 0.195979   |
| <b>DEFTGDP</b>  | 190        | -0.00981    | 0.15562   | -1.79872   | 0.266874   |
| <b>LCS</b>      | 190        | 10.16176    | 1.573904  | 6.528413   | 13.30789   |
| <b>PG</b>       | 190        | 2.084396    | 0.922931  | 0.068723   | 3.817828   |
| <b>LEDU</b>     | 190        | 3.96186     | 3.96186   | 2.615548   | 4.632337   |
| <b>TO</b>       | 190        | 0.719958    | 0.340083  | 0.091359   | 1.371121   |
| <b>LFD</b>      | 190        | 3.346187    | 0.960484  | 1.600906   | 5.075953   |
| <b>IR</b>       | 190        | 4.683387    | 8.839136  | -65.8572   | 21.09633   |
| <b>LCPI</b>     | 190        | 3.431275    | 1.337951  | -0.8947    | 5.36706    |

The mean value for the variable Aggregate investment (in log form) in developing Sub-Saharan Africa countries is 25.05881 and its standard deviation is 2.428975, Variable growth in total factor productivity (in log form) is having a mean 19.14483 and standard deviation 2.683469. The mean value for the variable debt to GDP ratio in developing Sub-Saharan Africa countries (used in study) is 0.032229 and its standard deviation is 0.040058, for deficit to GDP ratio mean and standard deviation are -0.00981 and 0.15562 respectively. In case of the variable Capital stock(in log form) has a mean value 10.16176 and standard deviation

1.573904 of the above used developing Sub-Saharan Africa countries. for population growth mean 2.084396 and standard deviation are 0.922931. Mean value of human capital(in log form) is 3.96186 and human capital has standard deviation 3.96186. The mean value of trade openness is 0.719958 and standard deviation is 0.340083. 3.346187 and 0.960484 are the mean and standard deviation of financial development(in log form) 4.683387 is the mean value for interest rate of developing Sub-Saharan Africa countries whereas its standard deviation is 8.839136. The mean value of CPI is 3.431275 and standard deviation 1.337951.

#### **4.3: Unit Root Analysis**

Before start to apply any econometric tools and techniques on the available data it's important to check the stationary level of the variables, because in the presence of unit root most of the econometric techniques are useless and they give significance relationship or give higher coefficient values with any significant relationship in real. So for our ongoing study we will rely on Levin-Lin-Chu test of unit root that is mostly use to analyse the panel data.

**Table 7 Unit Root Test**

| Variables      | Arab States |            | East Asia and Pacific |            | Europe and Central Asia |            | Latin America and Caribbean |            | South Asia |            | Sub Saharan Africa |            |
|----------------|-------------|------------|-----------------------|------------|-------------------------|------------|-----------------------------|------------|------------|------------|--------------------|------------|
|                | p-value     | Difference | p-value               | Difference | p-value                 | Difference | p-value                     | Difference | p-value    | Difference | p-value            | Difference |
| <b>LGFCF</b>   | 0.0000      | I(1)       | 0.0253                | I(0)       | 0.0004                  | I(0)       | 0.0000                      | I(0)       | 0.0000     | I(1)       | 0.0208             | I(0)       |
| <b>LTFP</b>    | 0.0001      | I(0)       | 0.0452                | I(0)       | 0.0062                  | I(0)       | 0.0000                      | I(0)       | 0.0121     | I(1)       | 0.0000             | I(0)       |
| <b>DTGDP</b>   | 0.0000      | I(0)       | 0.0197                | I(0)       | 0.0157                  | I(0)       | 0.0000                      | I(0)       | 0.0244     | I(0)       | 0.0046             | I(0)       |
| <b>DEFTGDP</b> | 0.0000      | I(1)       | 0.0042                | I(0)       | 0.0544                  | I(0)       | 0.0003                      | I(0)       | 0.0000     | I(1)       | 0.0007             | I(1)       |
| <b>LCS</b>     | 0.0000      | I(0)       | 0.0011                | I(0)       | 0.0183                  | I(0)       | 0.0000                      | I(0)       | 0.0011     | I(1)       | 0.0000             | I(0)       |
| <b>PG</b>      | 0.0000      | I(0)       | 0.0006                | I(0)       | 0.0000                  | I(0)       | 0.0003                      | I(0)       | 0.0001     | I(0)       | 0.0000             | I(0)       |
| <b>LEDU</b>    | 0.0120      | I(0)       | 0.0477                | I(1)       | 0.0228                  | I(0)       | 0.0001                      | I(1)       | 0.0294     | I(0)       | 0.0000             | I(0)       |
| <b>TO</b>      | 0.0026      | I(0)       | 0.0000                | I(1)       | 0.0000                  | I(1)       | 0.0000                      | I(1)       | 0.0000     | I(1)       | 0.0000             | I(1)       |
| <b>LFD</b>     | 0.0001      | I(1)       | 0.0166                | I(0)       | 0.0000                  | I(1)       | 0.0000                      | I(1)       | 0.0000     | I(1)       | 0.0000             | I(1)       |
| <b>IR</b>      | 0.0000      | I(1)       | 0.0001                | I(0)       | 0.0000                  | I(1)       | 0.0001                      | I(0)       | 0.0000     | I(1)       | 0.0001             | I(0)       |
| <b>LCPI</b>    | 0.0004      | I(0)       | 0.0011                | I(0)       | 0.0001                  | I(0)       | 0.0000                      | I(0)       | 0.0146     | I(0)       | 0.0001             | I(0)       |

The above table tells us about the unit root nature of the variables. Simply Levin-Lin-Chu unit root technique is used to test the unit root tests. There has been placed both level and first difference explanations of the probability value, so we can decide the existence of unit root through the probability values of the determined variables. We can see that in case of Arab Region, the LGFCF, DEFTGDP, LFD, IR are stationary at 1<sup>st</sup> difference while the remaining variables are stationary at level which used in our empirical investigation. In the East Asia and the Pacific case LGFCF, LTFP, DTGDP, DEFTGDP, LCS, PG, LFD, IR, LCPI are stationary at level and all remaining variables are at 1<sup>st</sup> difference and in case of Europe and Central Asian developing regions, LGFCF, LTFP, DTGDP, DEFTGDP, LCS, PG, LEDU, LCPI are stationary at level and other variables are stationary at 1<sup>st</sup> difference. In Latin America and the Caribbean LGFCF, LTFP, DTGDP, DEFTGDP, LCS, PG, IR, LCPI are level stationary and all other variables are stationary at 1<sup>st</sup> difference. In developing countries of South Asia LGFCF, LTFP, DEFTGDP, LCS, TO, LFD, IR are 1<sup>st</sup> difference stationary and all other variable are stationary at level and in Sub-Saharan Africa LGFCF, LTFP, DTGDP, LCS, PG, LEDU, IR, LCPI are stationary at level and all other variable are stationary at 1<sup>st</sup> difference. So the results indicate that most of our dependent and independent variables have both features of stationary and non stationary at 1<sup>st</sup> difference and at level. Therefore instead of simple Econometric tools and techniques we will rely on fixed effect models and Generalized Method of Moment because through fixed effect model we will see the average effects of independent and control variables relationship with a small sample size while through GMM we will make a comparative static analysis of the short run and long run relation.

#### **4.4: Results of Regression**

The region wise regression result of the government debt and aggregate investment and government debt and productivity are given below.

#### **4.4.1: Relation between Government Debt and Aggregate investment of Arab states**

The objective and aim of the current study are to see the impact on Government debt of aggregate investment and productivity in different the developing region of the world. We have taken six different regions explained by Human Development Index report of UNDP based on their economic and geographical features and we are using two different approaches to check the impact i.e. Five Year Fixed Effect and because of two reasons. First Five Year fixed effect will give us the results of short period impact while GMM will tell us the result of long observations and panel data. The findings of 5 Years Fixed Effect and GMM given below with probability in parenthesis and satiric shows the significance level of the variables.

**Table 8: Relationship between Government Debt and Aggregate Investment of Arab States**

| <b>Variables</b> | <b>5 Year FE</b>     | <b>GMM</b>             |
|------------------|----------------------|------------------------|
| <b>DEBT</b>      | -0.30813<br>(0.046)* | 0.000419<br>(0.984)    |
| <b>DEFICIT</b>   | -0.21677<br>(0.736)  | -0.1104<br>(0.249)     |
| <b>LCS</b>       | 1.239781<br>(0.000)* | -0.03347<br>(0.069)*** |
| <b>PG</b>        | 0.059575<br>(0.428)  | -0.00765<br>(0.467)    |
| <b>TO</b>        | 0.397485<br>(0.126)  | 0.130198<br>(0.001)*   |
| <b>LFD</b>       | 0.065695<br>(0.425)  | -0.04195<br>(0.002)*   |
| <b>IR</b>        | 0.011596<br>(0.287)  | -0.00485<br>(0.000)*   |
| <b>LCPI</b>      | -0.19469<br>(0.477)  | -0.02043<br>(0.12)     |

Note: Dependent variable used Aggregate investment. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

The above tables tell us about the relationship among Aggregate investment and independent variables. We can see in case of Arab regions the short run relationship between aggregate investment and government debt gives negative and significant relationship showing that increase in government by one percent will cause to decrease the aggregate investment by 0.381% while in long term there is insignificant relation among aggregate investment and government debt with a high insignificant probability of 98%. Results are in line with (Akram, 2011),(Qayyum & Haider, 2012),(Salotti & Trecroci, 2012) and (Greene & Villanueva, 1991).There are certain reasons that may cause insignificant relationship one may



be most of the Arab countries are oil rich countries and have nearly monopoly oil exporting to world economy that in short period may be due to deficit bow down them to get foreign debt while in long term there deficit gets down and they not much rely on foreign debt. Other independent and control variables also shows significant and insignificant results at different significant level i.e. deficit, Consumer Price Index and population growth show insignificant relationship both in 5 Years fixed effects and GMM while Trade Openness, Financial Development and interest Rate shows insignificant relationship in short run while in GMM they shows significant relationship while Capital Stock shows significant relationship both in short period and long period.

#### **4.4.2: Relation between Government Debt and Aggregate investment of East Asia and the Pacific**

The estimation begin with the effect of Government debt on aggregate investment and productivity in East Asia and Pacific that is the region of developing countries of the world explain by Human Development Index report of UNDP. We are using two different approaches to check the impact i.e. Generalized Method of Moment and Five Year Fixed Effect because of two reasons. First Five Year fixed effect will give us the results of short period impact while GMM will tell us the result of long observations and panel data. The findings of 5 Years Fixed Effect and GMM is given below with probability in parenthesis and steric shows the significance level of the variables.

**Table 9: Relation between Government Debt and Aggregate investment of East Asia and the Pacific**

| <b>Variables</b> | <b>5 Year FE</b>     | <b>GMM</b>            |
|------------------|----------------------|-----------------------|
| <b>DEBT</b>      | -4.28065<br>(0.027)  | -1.6482<br>(0.018)**  |
| <b>DEFICIT</b>   | -1.99307<br>(0.000)* | -0.59332<br>(0.000)*  |
| <b>LCS</b>       | -0.00872<br>(0.363)  | -1.302307<br>(0.000)* |
| <b>PG</b>        | 0.163663<br>(0.214)  | 0.007489<br>(0.672)   |
| <b>TO</b>        | 0.00495<br>(0.963)   | 0.023247<br>(0.488)   |
| <b>LFD</b>       | 0.226708<br>(0.006)* | -0.00583<br>(0.758)   |
| <b>IR</b>        | 0.00548<br>(0.003)*  | 0.00941<br>(0.000)*   |
| <b>LCPI</b>      | -0.23984<br>(0.039)* | -0.0465<br>(0.000)*   |

Note: Dependent variable used Aggregate investment. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

In the basic model in which aggregated investment is dependent variable, debts are significant and negative impact on aggregate investment using GMM, government debt is significant at 5% significance level, one of our most important focus relationships is this significant relationship of government debt and investment. With an reduction in the government debt level, a increase in total investments is observed. These result are support through the study of (Salotti & Trecroci, 2012). In another identification where the ratio of deficit is used behalf of the debt, a coefficient of the deficit is negative and our results

confirm that if both the debt and deficit increases the aggregate investment level is decreases the reason for it, known crowding out effect . some reason which explain through the crowding out effect is that when the government debt growing the government has two option to cover that increasing debt. Firstly, increasing interest rates and secondly, raising tax rates and both methods discussed above have a adverse effect on investment(Greene & Villanueva, 1991).The sample of current study consists of developing countries and these countries are confronted each year with a large budget deficit. This condition indicates that government revenue are low and if government expenditures get higher, the government will have to raise taxes or increase interest rates. In both cases the investment will therefore decrease negatively and significantly. Capital stock result are insignificant using 5 year fixed effect and the result of capital stock is significant at 1% level in using GMM and coefficient has a negative sign this indicate that in the case of developing nations of East Asia and Pacific there is a conditional convergence. Population growth and Trade openness has a insignificant relation with aggregate investment. Financial development is significant at 1% significant level and positively related to the aggregate investment using fixed effect of 5 year while using GMM its result are insignificant. The rate of interest is positively associate with total investment and under both estimation technique, interest rate is significant at 1% level of significance. In both techniques five year fixed effect and GMM there is a adverse and significant relation among inflation and aggregate investment.

#### **4.4.3: Relation between Government Debt and Aggregate investment of Europe and Central Asia**

In the current Europe and Central Asian region we have taken five different countries that have nearly similar economic features and characteristics. The results of relation among Government debt and aggregate investment in Central Asia and Europe region are given below.

**Table 10: Relation between Government Debt and Aggregate investment of Europe and Central Asia**

| <b>Variables</b> | <b>5 Year FE</b>       | <b>GMM</b>           |
|------------------|------------------------|----------------------|
| <b>DEBT</b>      | -0.53635<br>(0.013)**  | 0.025516<br>(0.237)  |
| <b>DEFICIT</b>   | -2.6381<br>(0.146)     | -1.24497<br>(0.000)* |
| <b>LCS</b>       | 0.769387<br>(0.000)*   | 0.002969<br>(0.887)  |
| <b>PG</b>        | 0.465395<br>(0.331)    | -0.08021<br>(0.162)  |
| <b>TO</b>        | -0.26601<br>(0.091)*** | -0.03306<br>(0.007)* |
| <b>LFD</b>       | 0.280828<br>(0.410)    | 0.066496<br>(0.148)  |
| <b>IR</b>        | 0.007227<br>(0.668)    | -0.00046<br>(0.814)  |
| <b>LCPI</b>      | 0.021881<br>(0.951)    | 0.083898<br>(0.001)* |

Note: Dependent variable used Aggregate investment. . in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

Finding of above tables tell us about the nature of significance of relation amongst dependent and independent and control variables in short run and long run. We can see there is significant and negative relation exists among government debt and aggregate investment at 5% significance level showing that if there is increase 1% in government debt the aggregate investment fall by 0.53% while in GMM model relation among government debt and aggregate investment is insignificant. Deficit shows insignificant relationship in the short run

while in the long run it shows negative relationship with aggregate investment means when the deficit rises the aggregate investment falls by 1.2% while capital stock show positive relationship with aggregate investment in short run while in long run it doesn't have significant relation. Population Growth, Financial development and interest rate in Europe and Central Asia show insignificant relationship both in the long run and short run, this may be because of lower population growth in Europe and matured financial development with almost lowest levels of interest rate in the region as compare to other region make them insignificant. Trade openness shows significant and inverse relationship in both long run and short run indicating that more liberalized and open any economy discourage to aggregate investment because it becomes cost efficiency problem and investors perceptions towards less profit earning lead to discourage aggregate investment. The Consumer Price Index shows highly significant results at 1% showing that when there is increase One Percent in Consumer Prices the aggregate investment increases by 0.083 units.

#### **4.4.4: Relation between Government Debt and Aggregate investment of Latin America and the Caribbean**

The United Nation Development Program report argues that there are 33 nations, out of which there are 13 dependence nations while 20 countries in the region of Latin America and Caribbean. The below table give a quick look of the relation among government debt and aggregate investment in Latin American and Caribbean countries.

**Table 11: Relation between Government Debt and Aggregate investment of Latin America and the Caribbean**

| <b>Variables</b> | <b>5 Year FE</b>       | <b>GMM</b>           |
|------------------|------------------------|----------------------|
| <b>DEBT</b>      | 0.060633<br>(0.452 )   | -0.0901<br>(0.009)*  |
| <b>DEFICIT</b>   | -1.17744<br>(0.149)    | 0.203298<br>(0.551)  |
| <b>LCS</b>       | 1.018607<br>(0.000)*   | 0.100986<br>(0.009)* |
| <b>PG</b>        | -0.29782<br>(0.005)*   | -0.39001<br>(0.000)* |
| <b>TO</b>        | 0.812039<br>(0.001)*   | -0.79<br>(0.000)*    |
| <b>LFD</b>       | 0.115078<br>(0.204)    | -0.30925<br>(0.000)* |
| <b>IR</b>        | -0.00134<br>(0.440)    | -0.0107<br>(0.000)*  |
| <b>LCPI</b>      | 0.033046<br>(0.103)*** | -0.01019<br>(0.205)  |

Note: Dependent variable used Aggregate investment. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

From the result of above table we can see that there is insignificant relation exists between Government debt and aggregate investment in short run while in long term there is inverse and significant relationship exist. The result indicates that increase in government debt by one percent will cause to decrease the aggregate investment by 0.09% in long run. Here a point is to remember that Latin American country Mexico default huge government debt and collapsed in 1980's and refused to repay any kind of debt government received from international economies and agencies. We can see that in Case of Latin America and

Caribbean capital stocks, population growth and Trade openness give significant relation in both in long run and short run. while impact is different Capital stocks gives positive relationship while population growth have negative significant effect on aggregate investment and trade openness in short run shows positive in the short run while in long term it has inverse significant effect on aggregate investment. The interest rate shows negative insignificant impact in short run while show significant negative relationship in long run and consumer price index have positive short run impact while negative insignificant impact in long run.

#### **4.4.5: Relation between Government Debt and Aggregate investment of South Asia**

The estimation begin with the impact of government debt on aggregate investment and productivity in South Asia, which is the region of developing countries in the world, by UNDP Human Development Index report. we use two different approaches to check the impact, i.e the 5 year fixed effect and the generalized method of moment, for two reasons. 1st 5 year fixed effect gives us the results of a short period impact while GMM will tell us the result of long observations and panel data. The findings of the 5-year fixed effect and generalized method of moment (GMM) are given below with the probability in parentheses and sterically shows the significance level of the variables.

**Table 12: Relation between Government Debt and Aggregate investment of South Asia**

| <b>Variables</b> | <b>5 Year FE</b>        | <b>GMM</b>             |
|------------------|-------------------------|------------------------|
| <b>DEBT</b>      | -6.529351<br>(0.065)*** | -3.87982<br>(0.064)*** |
| <b>DEFICIT</b>   | -0.41977<br>(0.510)     | -0.50784<br>(0.000)*   |
| <b>LCS</b>       | 1.558957<br>(0.000)*    | 0.015471<br>(0.22)     |
| <b>PG</b>        | -0.23253<br>(0.028)     | 0.027688<br>(0.15)     |
| <b>TO</b>        | 0.761254<br>(0.006)*    | 0.018925<br>(0.729)    |
| <b>LFD</b>       | 0.045633<br>(0.617)     | -0.03274<br>(0.126)    |
| <b>IR</b>        | 0.013364<br>(0.225)     | 0.00349<br>(0.027)**   |
| <b>LCPI</b>      | -0.60157<br>(0.100)***  | -0.06564<br>(0.013)**  |

Note: Dependent variable used Aggregate investment. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

We start the empirical analysis by giving some estimates in above Table of the effect of public debt and deficit on aggregate investment, debt are significant and negative impact on aggregate investment, government debt is significant at 10% significance level, in both the 5 year fixed effect and GMM one of our most important focus relationships is this significant relationship of government debt and investment. With an reduction in the government debt level, a increase in total investments is observed. Result are in line with (Akram, 2011), (Salotti & Trecroci, 2012) and (Qayyum & Haider, 2012). In another identification where the ratio of deficit is used behalf of the debt, coefficient of the deficit is negative the deficit is



significant at 1% using GMM and our results confirm that if both the debt and deficit increases the aggregate investment level is decreases the reason for it, known crowding out effect . some reason which explain through the crowding out effect is that when the government debt growing the government has two option to cover increasing debt. Firstly, increasing interest rates and secondly, raising tax rates and both methods discussed above have a negative impact on investment. Result of 5 year fixed effect shows that the capital stock appears to be positive effect on aggregate investment and significant at 1% level of significance. However, this estimates does not apply to Generalize Method of Movement based on annual data. Population growth has insignificant relation with aggregate investment in both estimation method and Trade openness have significant and positive relation with aggregate investment and the result of trade openness is significant at 1% level using 5 year fixed effect while using Generalize method of movement the coefficient of trade openness is insignificant. Financial development has insignificant relation with aggregate investment in both estimation method. The rate of interest is significantly and positively associate with total investment and under GMM interest rate is significant at 5% level of significance. In both method 5 year fixed effect and GMM there is a negative and significant relation amongst inflation and aggregate investment.

#### **4.4.6: Relation between Government Debt and Aggregate investment of Sub-Saharan Africa**

The estimation begin with the effect of government debt on aggregate investment in sub Saharan Africa, which is the region of developing countries in the world, by UNDP Human Development Index report. we use two different approaches to check the impact, i.e the 5 year fixed effect and the Generalized Method of Moment, for two reasons. The first 5 year fixed effect gives us the results of a short period impact while GMM will tell us the result of

long observations and panel data. The findings of the 5-year fixed effect and Generalized Method of Moment(GMM) are given below the probability in parentheses and sterically show the significance level of the variables.

**Table 13: Relation between Government Debt and Aggregate investment of Sub-Saharan Africa**

| <b>Variables</b> | <b>5 Year FE</b>     | <b>GMM</b>             |
|------------------|----------------------|------------------------|
| <b>DEBT</b>      | -2.11267<br>(0.172)  | -0.71593<br>(0.004)*   |
| <b>DEFICIT</b>   | -1.78214<br>(0.006)* | 0.141089<br>(0.134)    |
| <b>LCS</b>       | 0.978766<br>(0.000)* | -0.05491<br>(0.004)*   |
| <b>PG</b>        | -0.35637<br>(0.003)  | 0.014515<br>(0.299)    |
| <b>TO</b>        | 0.537663<br>(0.191)  | 0.230335<br>(0.000)*   |
| <b>LFD</b>       | -0.10985<br>(0.723)  | -0.02327<br>(0.066)*** |
| <b>IR</b>        | -0.0132<br>(0.21)    | -0.00213<br>(0.014)**  |
| <b>LCPI</b>      | 0.004284<br>(0.983)  | 0.020424<br>(0.109)    |

Note: Dependent variable used Aggregate investment. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

In the basic model in which aggregated investment is dependent variable, debts are significant and negative impact on aggregate investment using Generalize Method of Movement, government debt is significant at 1% significance level, while using 5 year fixed

effect the debt has insignificant. One of our most important focus relationships is this significant relationship of government debt and investment. With an reduction in the government debt level, a increase in total investments is observed. Result are in line with (Qayyum & Haider, 2012) and (Salotti & Trecroci, 2012). In another identification where ratio of the deficit is used in place of the debt, coefficient of the deficit is negative obtained in using 5 year fixed effect but in case of using Generalize Method of Movement coefficient of deficit is insignificant and our results confirm that if both the debt and deficit increases the aggregate investment level is decreases the reason for it, known crowding out effect . some reason which explain through crowding out effect is that when the government debt growing the government have two option to cover that increasing debt. Firstly, increasing interest rates and secondly, raising tax rates and both methods discussed above have a inverse effect on investment. The sample of current study consists of developing countries and these countries are confronted each year with a large budget deficit. This condition indicates that government revenue are low and if government expenditures get higher, the government will have to raise taxes or increase interest rates. In both cases the investment will therefore decrease negatively and significantly. Capital stock result are significant at 1% level in both the estimation technique and coefficient has a negative sign in the case of using Generalize Method of Movement but in case of 5 year fixed effect coefficient of capital stock is positive sign. Population growth has insignificant relation with aggregate investment and trade openness has insignificant relation with aggregate investment while using Generalize Method of Movement trade openness have positive and highly significant relation with investment. Financial development is significant at 10% significant level and negatively related to the aggregate investment using Generalize Method of Movement while using 5 year fixed effect its result are insignificant. The rate of interest is negatively associate with total investment in using Generalize Method of Movement while it has insignificant in case of 5-year fixed

effect. Under both method fixed effect of 5 year and Generalize Method of Movement there is insignificant relation between inflation and aggregate investment.

#### 4.4.7: Relation between Government Debt and Productivity of Arab States

The below table shows the relationship between productivity and government debt both in long run and short run.

*Table 14:Relation between government debt and Productivity of Arab states*

| Variables   | 5 Year FE            | GMM                   |
|-------------|----------------------|-----------------------|
| <b>DEBT</b> | -0.82092<br>(0.000)* | -0.0912<br>(0.000)*   |
| <b>LCS</b>  | 0.666359<br>(0.000)* | -0.00325<br>(0.824)   |
| <b>LEDU</b> | 0.826414<br>(0.003)* | 0.124318<br>(0.000)*  |
| <b>TO</b>   | -2.19151<br>(0.000)* | -0.1701<br>(0.000)*   |
| <b>LFD</b>  | -0.20901<br>(0.211)  | -0.04866<br>(0.001)*  |
| <b>IR</b>   | -0.01545<br>(0.400)  | -0.01122<br>(0.000)*  |
| <b>LCPI</b> | 0.220225<br>(0.132)  | 0.027819<br>(0.048)** |

Note: Dependent variable used Productivity. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

From the given table result show that relationship of Government debt and productivity in Arabs regions with other control and independent variables. The relationship shows that debt is inversely associated to productivity in both short run and long run. Results are supported

by literature (Salotti & Trecroci, 2012) and (Bonfiglioli, 2008). The finding shows in short run impact is so highly affecting productivity. When there is 1% increase in Government debt the productivity falls by 0.82% in short run while 0.019% in long run with significant values at 1% significance level. So we can easily conclude that Government debt and productivity in case of Arab region is negatively correlated. By carefully analysing the other independent variables we can see that Capital Stock in short run is significant while in long run is insignificant. While Education, Trade openness and Consumer Price Index are giving significant relation with Government debt in both short run and long run while the interest rate in short have no significant impact while in long term it has negative significant effect on productivity.

#### **4.4.8:Relation between Government Debt and Productivity of East Asia and the Pacific**

The relation between debt and productivity is measured on the basis total factor productivity and both models discussed above are measured by two estimation techniques, the first 5 year fixed effect and the second is Generalized Method of movement on annual panel data. In this model the dependent variable is productivity and measured the impact of the independent variable that is debt and some other variable.

**Table 15: Relation between government Debt and Productivity of East Asia and the Pacific**

| <b>Variables</b> | <b>5 Year FE</b>       | <b>GMM</b>             |
|------------------|------------------------|------------------------|
| <b>DEBT</b>      | -14.4217<br>(0.021)**  | -0.928735<br>(0.034)** |
| <b>LCS</b>       | 1.070486<br>(0.000)*   | 0.021382<br>(0.085)*** |
| <b>LEDU</b>      | 0.273163<br>(0.203)    | -0.01302<br>(0.733)    |
| <b>TO</b>        | 0.150169<br>(0.373)    | -0.03488<br>(0.354)    |
| <b>LFD</b>       | -0.17461<br>(0.153)    | 0.018438<br>(0.285)    |
| <b>IR</b>        | -0.01928<br>(0.104)*** | -0.00913<br>(0.000)*   |
| <b>LCPI</b>      | -0.11897<br>(0.489)    | -0.04402<br>(0.016)*   |

Note: Dependent variable used Productivity. . in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

The effect of debt on total factor productivity has a negative and on the basis of 5 year fixed effect and generalized method of movement the government debt is significant at 5% level. Our results are support through the literature of (Bonfiglioli, 2008)and(Salotti & Trecroci, 2012). In the other specification coefficient of capital stock(in log form) is positive and significant at 1% level used 5 year fixed effect while used GMM the coefficient of capital stock(in log form) is significant and positive at 10% significance level. In specification human capital, trade openness and financial development are insignificant in both estimation technique i.e 5 year fixed effect and Generalizes Method of Movement (GMM). Interest rate

is significant both estimation technique i.e 5 year fixed effect and Generalize Method of Movement. The CPI result has insignificant in 5 year fixed effect while significant at 1% level using GMM.

#### 4.4.9: Relation between Government Debt and Productivity of Europe and Central Asia

The below table shows the relationship between productivity and government debt both in long run and short run.

*Table 16: Relation between Government Debt and Productivity of Europe and Central Asia*

| Variables   | 5 Year FE            | GMM                    |
|-------------|----------------------|------------------------|
| <b>DEBT</b> | -0.02549<br>(0.872)  | -0.00423<br>(0.881)    |
| <b>LCS</b>  | 0.604933<br>(0.000)* | 0.008301<br>(0.742)    |
| <b>LEDU</b> | 0.913493<br>(0.639)  | -0.25237<br>(0.421)    |
| <b>TO</b>   | -0.53576<br>(0.000)* | -0.04128<br>(0.013)*   |
| <b>LFD</b>  | 0.334019<br>(0.285)  | 0.120964<br>(0.035)**  |
| <b>IR</b>   | 0.040642<br>(0.008)* | -0.0059<br>(0.032)**   |
| <b>LCPI</b> | 0.496319<br>(0.001)* | 0.059573<br>(0.062)*** |

Note: Dependent variable used Productivity. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

The findings of study of a relationship between Total factor productivity and government debt indicate that there is insignificant negative relation exists both in long run and short run.

Capital stocks show positive relationships with total factor productivity at very high significant level of 0% in short run while in long it has no significant relationship with total factor productivity. Trade Openness shows negative significant relationship both in short period and long period indicating making more open the economy to international trade will cause to lower down the productivity. As we observed that trade openness and aggregate investment have significant negative relationship both in short term and long term same like it the relation among total factor productivity and trade openness has significant negative relationship promoting the free trade the total factor productivity falls. Surprisingly the interest rate has shown positive significant relationship in short run while its impact in long run has been observed negative and significant this may be in short term the interest rate may cause to support the business to bow down towards borrowing to promote the business while in long run it causes negative relationship because of opening economy for international trade demands tough competition that demolish the business expectations. So the business either shut down or either not moves to borrowing that's why the factor productivity falls in long run. Financial development has been observed have positive relationship in long run, while have no significant relationship in short run. Thus, we can say that more liberalized economies in Europe and Central Asia are facing negative impact of government debt on productivity while the free trade discourages the productivity making it tough to compete the global economies.

#### **4.4.10: Relation between Government Debt and Productivity of Latin America and the Caribbean**

The below table shows relationship between productivity and government debt both in long run and short run.



**Table 17: Relation between Government Debt and Productivity of Latin America and the Caribbean**

| <b>Variables</b> | <b>5 Year FE</b>      | <b>GMM</b>           |
|------------------|-----------------------|----------------------|
| <b>DEBT</b>      | 0.041828<br>(0.923)   | -0.04944<br>(0.226)  |
| <b>LCS</b>       | 1.015842<br>(0.023)** | 0.131446<br>(0.004)* |
| <b>LEDU</b>      | 0.733105<br>(0.395)   | 0.333065<br>(0.000)* |
| <b>TO</b>        | -4.36457<br>(0.000)*  | -1.0595<br>(0.000)*  |
| <b>LFD</b>       | -0.39866<br>(0.472)   | -0.25191<br>(0.000)* |
| <b>IR</b>        | -0.02457<br>(0.029)** | -0.01091<br>(0.000)* |
| <b>LCPI</b>      | 0.095271<br>(0.266)   | -0.00704<br>(0.401)  |

Note: Dependent variable used Productivity. . in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

The above table of a relationship between short and long term relation of productivity and government debt in Latin American and Caribbean countries show positive insignificant effect in short period while in long period it has negative insignificant impact. Capital Stocks gives positive significant effect both in short term and long term describing that one percent rise in Capital Stock will rise productivity by 1.12% and 0.31% in short and long term respectively. Trade Openness shows inverse and high significant effect on total factor productivity showing that internationally making economy more open to trade the total factor productivity falls more sharply both in short term and long term while education has no

significant effect in short period while in long period it have positive significant impact on total factor productivity showing that increase one year in education will cause to increase the total factor productivity by 33% in long run. Interest rate in case of Latin America and Caribbean regions show negative significant effect in both short term and long term denoting that increasing interest rate will cause to reduction in productivity by 0.02% and 0.019 in short and long run respectively. Consumer Price Index has no significant impact on total factor productivity.

#### **4.4.11: Relation between Government Debt and Productivity of South Asia**

The relationship between debt and productivity is measured on the basis total factor productivity and both models discussed above are measured by two estimation techniques, the first 5 year fixed effect and the second is Generalized Method of Movement on annual panel data. In this model the dependent variable is productivity and measured the impact of the independent variable that is debt and some other variable.

**Table 18: Relation between Government Debt and Productivity of South Asia**

| <b>Variables</b> | <b>5 Year FE</b>       | <b>GMM</b>             |
|------------------|------------------------|------------------------|
| <b>DEBT</b>      | -14.5321<br>(0.079)*** | -0.27057<br>(0.091)*** |
| <b>LCS</b>       | 0.680741<br>(0.11)***  | 0.013891<br>(0.038)*** |
| <b>LEDU</b>      | 1.087937<br>(0.203)    | -0.03499<br>(0.022)**  |
| <b>TO</b>        | -7.58149<br>(0.000)*   | 0.122407<br>(0.086)*** |
| <b>LFD</b>       | 0.852998<br>(0.148)    | 0.005499<br>(0.802)    |
| <b>IR</b>        | 0.199485<br>(0.001)*   | -0.00267<br>(0.199)    |
| <b>LCPI</b>      | 0.17932<br>(0.828)     | -0.0478<br>(0.107)     |

Note: Dependent variable used Productivity, in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

The impact of debt on total factor productivity has a negative and significant on the basis of 5 year fixed effect and generalized method of movement the government debt is significant at 10% significance level. Results are in line with (Bonfiglioli, 2008) and (Salotti & Trecroci, 2012). In the other specification coefficient of capital stock(log form) is positive and significant at 10% level used fixed effect5 year while used of Generalize Method of Movement (GMM) the coefficient of capital stock(log form) also positive and significant at 10% significance level. In specification of total factor productivity, human capital is significant at 10% level using GMM, while human capital is insignificant in 5 year fixed effect. Using 5year fixed effect trade openness is negatively related with productivity while in case of Generalize Method of Movement it has positively related with productivity and

financial development are insignificant in both estimation technique i.e 5 year fixed effect and Generalize Method of Movement. Interest rate is significant at 1% level and while in significant in GMM. The CPI result has insignificant in both estimation technique. i.e 5 year fixed effect and Generalize Method of Movement.

#### 4.4.12: Relation between Government Debt and Productivity of Sub Saharan Africa

The relation between government debt and productivity is measured on the basis total factor productivity and both models discussed above are measured by two estimation techniques, the first 5 year fixed effect and the second is Generalized Method of Movement on annual panel data. In this model the dependent variable is productivity and measured the impact of the independent variable that is debt and some other variable.

*Table 19:Relation between Government Debt and Productivity of Sub-Saharan Africa*

| Variables   | 5 Year FE              | GMM                    |
|-------------|------------------------|------------------------|
| <b>DEBT</b> | -0.37381<br>(0.092)*** | -0.17347<br>(0.067)*** |
| <b>LCS</b>  | 1.032036<br>(0.000)*   | 0.03253<br>(0.215)     |
| <b>LEDU</b> | -2.28834<br>(0.000)*   | -0.18156<br>(0.012)**  |
| <b>TO</b>   | -5.52411<br>(0.000)*   | -0.11939<br>(0.31)     |
| <b>LFD</b>  | 0.787588<br>(0.000)*   | 0.031586<br>(0.214)    |
| <b>IR</b>   | 0.010609<br>(0.56)     | -0.0091<br>(0.000)*    |
| <b>LCPI</b> | 0.576325<br>(0.000)*   | 0.019344<br>(0.411)    |

Note: Dependent variable used Productivity. in parentheses show Probability, \*, \*\* and \*\*\* respectively represent 1%, 5% and 10% level of significance.

The effect of debt on total factor productivity has a significant and negative on the basis of 5 year fixed effect and generalized method of movement the government debt is significant at 10% significance level. Results are supported the literature (Bonfiglioli, 2008) and (Salotti & Trecroci, 2012). In the other specification coefficient of capital stock(log form) is positive and significant at 1% level used 5year fixed effect while used GMM the coefficient of capital stock(log form) is insignificant. In specification of total factor productivity, human capital is negative and significant relation with total factor productivity in both estimation technique i.e 5 year fixed effect and Generalize Method of Movement. Using 5year fixed effect trade openness is significantly and negatively related with productivity while in case of Generalize Method of Movement it has insignificant relation with productivity and financial development is positive and significant in using 5year fixed effect and it has insignificant in case of Generalize Method of Movement. Interest rate is significant at 1% level using Generalize Method of Movement and while insignificant in 5 year fixed effect. The CPI result has positive and significant in using 5year fixed effect and it is insignificant in case of Generalize Method of Movement.

#### **4.5: Comparative Analysis of Developing Regions**

Throughout the study we focused on the relation among government debt and aggregate investment and government debt and total factor productivity in different regions of developing a world with different set of independents and control variables with a sample of 30 countries of 6 developing region by taking 5 countries as sample representing different region. Now we will compare the findings of the relation among government debt and aggregate investment and government debt and total factor productivity by assuming 5 Years Fixed Effect representing short run relationship and Generalized Method of Moment for long run relationship. The statistical summary of the findings of long run and short run relations of the variable is given below.

*Table 20: Relationship between Government Debt, Aggregate Investment and Total Factor Productivity in Developing Economies*

| Variables                          | Aggregate Investment    |                       | Total Factor Productivity |                        |
|------------------------------------|-------------------------|-----------------------|---------------------------|------------------------|
| Region                             | 5 Years Fixed Effects   | GMM                   | 5 Years Fixed Effects     | GMM                    |
| <b>Arab States</b>                 | -0.30813<br>(0.046)*    | 0.0004<br>(0.984)     | -0.82092<br>(0.000)*      | -0.0912<br>(0.000)*    |
| <b>Europe and Central Asia</b>     | -0.53635<br>(0.013)**   | 0.0255<br>(0.237)     | -0.02549<br>(0.872)       | -0.00423<br>(0.881)    |
| <b>East Asia and Pacific</b>       | -4.28065<br>(0.227)     | -1.6482<br>(0.018)**  | -14.4217<br>(0.021)**     | -0.92873<br>(0.034)**  |
| <b>Latin America and Caribbean</b> | 0.060633<br>(0.452 )    | -0.090<br>(0.09)*     | 0.04182<br>(0.923)        | -0.04944<br>(0.226)    |
| <b>South Asia</b>                  | -6.529351<br>(0.065)*** | -3.8798<br>(0.064)*** | -14.5321<br>(0.079)***    | -0.27057<br>(0.091)*** |
| <b>Sub Saharan Africa</b>          | -2.11267<br>(0.172)     | -0.7159<br>(0.004)*   | -0.37381<br>(0.092)***    | -0.17347<br>(0.067)*** |

The report of United Nation Development Program on Human Development Report distributed 146 developing economies into six different regions according to their geographical and economic indicators. Most of the developing nations in the regions are highly dependent on foreign borrowing. Most of the nations in Europe and Arab states are well matured according to their economic stabilization while the economies of East Asian region are newly industrialized economies while South Asian economies are growing faster, the economies of Sub Saharan Africa have featured off too small per capita income and low

process of growth and Latin American economies are considered as struggling economies. The theme of the study is to check the impact of government debt on aggregate investment and productivity in developing regions because the impact of government debt in OECD and developed economies has shown significant impact. From the findings of the study we can see different regions have different responses both in Aggregate investment and Productivity in both long run and short run. The effect of government debt on aggregate investment in short run gives significant negative effect on aggregate investment in Arab, Europe and Central and South Asian region showing that 1% rise in government debt causes to reduce the aggregate investment by 0%, 0.5% and 6.52% in the respective regions. In Latin America, Sub Sahara and East Asian economies there has been observed no significant effect of government debt on aggregate investment. While in form of long term relation among Government Debt and aggregate investment in developing regions it's been observed that there is significant inverse effect of government debt on aggregate investment in East Asia, Sub Saharan African, South Asia, and Latin American Caribbean economies showing 1% rise in Government debt will cause to decline the aggregate investment by 1.64%, 0.09%, 3.8% and 0.71% in the respective regions in long run and in case of Arabs and European region it has no significant impact on aggregate investment in long run.

There are many theories related to Government debt and total factor productivity some are supporting Government debt to improve productivity while others argue that it will lead to demolish productivity while others argue that up to a specific level government debt is beneficial to productivity and after that level high borrowing will cause to reduce the productivity. From the findings of relation amongst government debt and total factor productivity we can see that in Arab, East Asian, South Asia and Sub Saharan African regions the impact is negative and significant while in Europe and Latin America the impact is insignificant. In Arab, East Asia, Sub Saharan and South Asia Regions the results indicate

that 1% increase in government debt will cause to reduce the total factor productivity by 0.82%, 14.42%, 14.53% and 0.37% in short run and 0.091%, 0.928%, 0.270% and 0.173% in long run in the respective regions.

#### **4.6: Aggregate Analysis of Developing Countries**

The above discussion was individual region wise analysis of debt, aggregate investment and productivity in developing countries. We notice that in most of the region the relations among government debt and aggregate investment is significant and have negative impact while in Arab region case the relationship is insignificant in long run. The relationship between government debt and total factor productivity also confirmed theoretical prospective of having negative relationship in almost all regions with significant impact. That was region wise analysis of the relationship between dependent and independent variables. Now we will analyze the aggregate data analysis of whole Thirty countries Five from each six region and will analyze that how differently government debt affects aggregate investment and productivity as overall. The below table gives finding of the aggregate analysis of long run and short run relations between government debt, aggregate investment and productivity.



**Table 21: Relation between Government Debt and Aggregate investment and Government Debt and Total Factor Productivity**

| Variables      | Aggregate Investment |                      | Total Factor Productivity |                       |
|----------------|----------------------|----------------------|---------------------------|-----------------------|
|                | 5 Year FE            | GMM                  | 5 Year FE                 | GMM                   |
| <b>DEBT</b>    | -0.23713<br>(0.000)* | -0.02093<br>(0.000)* | -0.13802<br>(0.002)*      | -0.007752<br>(0.402)  |
| <b>DEFICIT</b> | -1.56878<br>(0.001)* | -0.48933<br>(0.000)* | –                         | –                     |
| <b>LCS</b>     | 0.871391<br>(0.000)* | -0.0015<br>(0.86)    | 0.740448<br>(0.000)*      | 0.03788<br>(0.002)*   |
| <b>PG</b>      | -0.26799<br>(0.002)* | -0.10916<br>(0.000)* | –                         | –                     |
| <b>LEDU</b>    | –                    | –                    | 0.603737<br>(0.000)*      | 0.137618<br>(0.000)*  |
| <b>TO</b>      | -0.21236<br>(0.000)* | -0.045<br>(0.000)*   | -0.43501<br>(0.000)*      | -0.07054<br>(0.000)*  |
| <b>LFD</b>     | 0.241488<br>(0.007)* | -0.03948<br>(0.000)* | 0.070093<br>(0.454)       | -0.0141<br>(0.31)     |
| <b>IR</b>      | -0.00025<br>(0.961)  | -0.00558<br>(0.000)* | 0.004089<br>(0.442)       | -0.00751<br>(0.000)*  |
| <b>LCPI</b>    | 0.040462<br>(0.531)  | 0.019291<br>(0.007)* | 0.264841<br>(0.000)*      | 0.022398<br>(0.053)** |

We begin the analysis empirically by giving some estimates in above Table of the impact of government debt on aggregate investment and total factor productivity, debt are negatively and significantly effect on aggregate investment, government debt is significant at 1 percent significance level, in both the 5 year fixed effect and GMM one of our most important focus relationships is this significant relationship of government debt and investment. With a reduction in the government debt level, a increase in total investments is observed. Results are in line with (Qayyum & Haider, 2012),(Greene & Villanueva, 1991),(Salotti & Trecroci, 2012). In another identification where the ratio of deficit is use behalf of the debt, the coefficient of deficit is negative and deficit is significant at 1% in both estimation method and our results confirm that if both the debt and deficit increases the aggregate investment level is decreases. Result of 5 year fixed effect shows that the capital stock appears to be

positive impact on aggregate investment and significant at 1% level of significance and in case of using GMM the coefficient of capital stock is insignificant. trade openness and Population growth has negatively and significantly relate with aggregate investment in both estimation method. Result of 5 year fixed effect shows that the financial development appears to be positive impact on aggregate investment at 1%, level of significance. In case of using GMM it has the negative relation with aggregate investment. The rate of interest is negatively and significantly associate with total investment under GMM interest rate is significant at 5% of significance and its coefficient is insignificant in 5 year fixed effect and CPI is positively and significantly associate with total investment under GMM CPI is significant at 5 % level of significance and its coefficient is insignificant in 5 year fixed effect.

The impact of debt on total factor productivity has negative and significant on the basis of 5 years fixed effect and in the case of generalized method of movement the government debt is insignificant. In the other specification coefficient of capital stock(log form) is positive and significant at 1% level using fixed effect while use GMM the coefficient of Capital Stock(log form) is also significant and positive at 1% significance level. Human capital has positive and significant relation with total factor productivity in both estimation method at 1% level of significance. Trade openness has negatively and significantly associated with total factor productivity in both estimation method at 1% level of significance. Financial development are insignificant in both estimation technique i.e 5 years fixed effect and Generalize Method of Movement. Interest rate is insignificant in fixed effect of 5 years and while in GMM coefficient of rate of interest is significant and negative relation with total factor productivity. CPI has significant and positive relation with productivity in both estimation technique i.e 5 year fixed effect and Generalize Method of Movement.

**5.1: Conclusion**

The current study examines the association of government debt with aggregate investment and productivity for developing countries. The study covered the period from 1980-2017 for six regions of developing countries i.e. Arab States, Europe and Central Asia, East Asia and Pacific, Latin America and Caribbean, Sub-Saharan Africa and South Asia. The regions have been taken on the basis of Human Development Index ranking of United Nation Development Program. The Hausman test shows to use the panel-fixed effect. The current study use two model for estimation through the suggestion of rich growth literature i.e. 5 Year Fixed effects and Generalize Methods of Movement.

The focus variables of the study are government debt, Aggregate Investment and Total Factor Productivity. The explanatory variables lag is used as an instrument. To analyze the panel data Generalized Method of Moment and Five Year Fixed Effect has been used. From the findings of the study, we can see different regions have different responds both in Aggregate investment and Productivity in both long run and short run. The impact of government debt in short run gives significant negative impact on aggregate investment in Arab, Europe, Central and South Asian region showing that increase in government debt cause to decrease the aggregate investment in the respective regions. In Latin America, Sub Sahara and East Asian economies there has been observed insignificant impact of government debt on aggregate investment in 5 years Fixed Effect. While in case of long run relations between Government Debt and aggregate investment in the developing regions it's been observed that there is significantly and negatively association of government debt on aggregate investment in East Asia, Sub Saharan African, South Asia and Latin American and Caribbean economies showing increase in Government debt will cause to diminish the

aggregate investment in the respective regions in long run and in case of Arabs and European region it has insignificant impact on aggregate investment in long run using Generalize Method of Movement (GMM).

There are many theories related to Government debt and total factor productivity some are supporting Government debt to improve productivity while other argues that it will leads to demolish productivity while other argues that up to a specific level government debt is beneficial to productivity and after that level high borrowing will cause to reduce the productivity. From the findings of the dependence between government debt and total factor productivity in short run we can see that in Arab, East Asian, South Asia and Sub Saharan African regions the impact is negative and significant while in Europe and Latin America the impact is insignificant. In Arab, South Asia, East Asia and Sub Saharan Regions the finding show that increase in government debt will cause to reduce the total factor productivity using 5 year fixed effect and in long run using Generalize Method of Movement (GMM) the finding direct that increase in government debt will cause to reduce the total factor productivity in the respective regions.

## **5.2: Policy Recommendation**

The findings and results of the study make it clear to us that how Government debt is related to aggregate investment and Total Factor Productivity. On the basis of findings and results the following policy recommendation is forwarding to the policy makers.

1. Being a developing economy we saw that the impact of government debt on aggregate investment is negative and to achieve sustainable growth we need to boost aggregate investment. Therefore we should make least dependence on foreign borrowing.
2. Government debt is affecting total factor productivity inversely means higher the debt burden lower will be the productivity and in globalized economy to be competitive,

economy have to be productive as much to compete the competing economies.

Therefore to make our human capital more productive the government make focus on human capital stimulation and human capital formation.

3. Since government debt is adversely relation with aggregate investment and productivity, government should use a good and proper debt decreasing policy.

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## Appendix

### *Appendix A: Regions wise countries include in sample*

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|          | <i>Arab States</i> | <i>East Asia and<br/>the Pacific</i> | <i>Europe and<br/>Central Asia</i> | <i>Latin America and<br/>the Caribbean</i> | <i>South Asia</i> | <i>Sub-<br/>Saharan<br/>Africa</i> |
|----------|--------------------|--------------------------------------|------------------------------------|--|-------------------|------------------------------------|
| <i>1</i> | Egypt              | China                                | Turkey                             | Mexico                                     | Bangladesh        | Botswana                           |
| <i>2</i> | Algeria            | Indonesia                            | Serbia                             | Peru                                       | India             | Kenya                              |
| <i>3</i> | Tunisia            | Philippines                          | Albania                            | Colombia                                   | Pakistan          | Nigeria                            |
| <i>4</i> | Jordan             | Thailand                             | Armenia                            | Costa Rica                                 | Sri Lanka         | South<br>Africa                    |
| <i>5</i> | Morocco            | Malaysia                             | Azerbaijan                         | Ecuador                                    | Nepal             | Mauritius                          |

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