GROSS FIXED CAPITAL FORMATION & ECONOMIC GROWTH OF PAKISTAN

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ABSTRACT

This study analyzed the impact of gross fixed capital formation on economic growth of Pakistan using annual time series data from 1981-2014. Before the regression analysis the data was pre-tested by applying Augmented Dicky-Fuller (ADF) unit root test to check stationary of data. The Johansen Co-integration and Vector Error Correction Model (VECM) are applied to find the co-integrating factor and regression analysis with the help of econometric software E-Views. The variables included in the study is the Economic Growth of Pakistan (GDP) as the dependent variable and the independent variables are Gross Fixed Capital Formation or Gross Fixed Capital Investment (GFCF), private physical capital investment (PRIVT), Public Capital Investment ratio to GDP (Pub), Dummy for Trade Openness Policies or Trade Liberalization Policies (TOP), price index of capital goods (Ipk), both Literacy rate and technical education (Edu) and Financial development is taken as the ratio of M3 to GDP (FD). All the variables are significant having true expected signs showing the long run relation with the economic growth. The study suggests that the provision of skilled labor can improve the productivity and the export of final products can give rise to economic growth of the country.

KEYWORDS: GDP, GFCF, ADF and VECM Model

INTRODUCTION

Investment is capital formation, the acquisition or creation of resources to be used in production. In the national income accounts, investment consists of the addition to the nation's capital stock (i.e. fixed investment) of buildings including residential and non-residential, machines and equipments used in production (i.e. business fixed investment) and changes in business inventories (i.e. inventory investment) during a year. Investment involves the sacrifice of current consumption to increase future consumption. Classical and neo-classical economists have stressed on the role of investment in providing for the future. Investment is the flow of spending that adds to the physical stock of the capital (it is a flow concept, because it is concerned with the creation of new capital, whereas capital is stock concept, because it is concerned with the accumulated volume of capital). To calculate the capital stock, it is necessary to know the capital addition is the rate of investment and capital losses. In common terms, investment often refers to buying financial or physical assets. In macro-economics, investment has a narrower, technical meaning: investment is the flow of spending that adds to the physical stock of capital (Balassa, 2006).

Fixed investment takes place both in public and private sectors. The simplest definition of fixed investment is Gross Domestic Fixed capital formation, which is the sum of all spending on new capital goods in a given period. This definition, however, will include investment to replace the capital that is lost during that period owing to depreciation (also known as capital consumption), which is the loss of capital due to wear and tear or obsolescence. Net investment or Net Domestic fixed capital Formation (NDFC) is gross investment minus capital consumption. In practice, net investment is

difficult to measure, because rates of depreciation are hard to calculate and are subject to wide margins of error (Calcagnini, 2002).

Gross Fixed Capital Formation (GFCF) builds an important part of GDP. There are three main components of GFCF namely GFCF private sector, GFCF Public Sector and GFCF General Government Sector. Two of them namely the GFCF Private Sector and GFCF Public Sector are used in this study. Public capital is thought to have negative effects on the growth and private capital is shown to have encouraging and positive effects on the growth of economy. There is a common agreement on the role of private investment that it enhances the economic performance, possibly because change in technology or technological advancement is exemplified in the recent years of capital. The question that public investment is having positive or negative impact on the economic growth is of great importance to the economists. Some of the literature shows a positive impact of public investment and argues that public investment boosts the productivity of the private sector which in turn increases the economic growth (Arrow & Kurtz (1970); Barro (1990). According to this view, public investment is important to determine the long run economic growth in the sense that it not only creates positive spillovers by providing education, basic scientific research, health and physical infrastructure, but it may also enhance economic growth by crowding in the private investment. There arises some questions about the efficiency of public investment on one hand and on the other hand its relationship with private investment is questioned. It is argued that public investment may not have favorable impact on economic growth (Khan (1996); Devarajan (1996). Since the theoretical relation of investment in public sector to growth of the economy is not clear, it is an issue of empirical consideration.

Economic growth of the country is considered to be the derived by Gross Capital Formation. Economic growth of the country is measured as the rise in the amount of Capital Formation of services and goods of an economy over a period of time. Generally the rise in the real gross domestic Capital Formation in percentage form is used to measure the Economic growth (IMF, October 2012)". The relationship between Gross Capital Formation and economic growth has been discussed greatly. There is shown an effect that Gross Capital Formation has on the growth of the economy by the literature. Most of the studies concluded that Gross Capital Formation has positive effects on the economic growth of an economy (Edwards, (1996); Ahmad, Yusuf & Anoruo (2000)).Greenaway et al. (1998) identified that the human capital has a positive relationship with growth rate looking into the situation and circumstances of the country. Bolaky & Freund (2004) also reported the same findings. Yanikkaya (2002) studied the relationship between gross fixed investment and growth for poor and developing economies using two measures. The results were found sound as predicted, in the light of relevant literature of growth; they revealed that in the case of poor and small economies Capital Formation is positively related with economic growth.

The relationship between economic growth and education is traced back to the endogenous growth theory. These theories and economists were of the view that greater investment in human capital and improved technology can bring about increase in productivity. These theories appreciate the innovation of the institutions and markets of both the public and private sectors in order to get more fruits of it by providing facilities to individuals to invent. The knowledge can be stated as the main determinant of the growth of the economy. Endogenous theories show a positive effect of high knowledge of a developed economy which in turn develops the competition in growth industries in the economy globally. Its contribution towards economic growth is carried out in the shape of improvement in the health situation, political stability and decreasing the fertility. Education can be fruitful to an economy in the shape of improving its labor market by providing disciplined, literate and flexible labor force by providing them with good education.

Gross investment or "gross fixed capital formation" includes spending on machinery, equipments and structures, and changes in inventories. Whereas net investment means spending on capital goods that constitute an addition to the production capacity that existed before. For fixed investment (Investment excluding inventory changes), net investment is calculated as "gross investment" (all new plant and equipment) less depreciation (an estimate of the amount of capital stock that is used up or worn-out during the period). It is net investment that varies with the change in real Gross Domestic Product, according to the accelerator model. The part of gross investment that replaces or maintains the existing capital stock is likely to be proportional to real Gross Domestic Product and varies with the change in Gross Domestic Product.

Arby (2004) and Bengalwali (1995) using quarterly time series data for the period of 1971-2006 to assessed the impact of gross fixed capital formation on macro-economic variables of Pakistan. Kamal (2004) expressed the bilateral relation between gross fixed capital formation, national accounts and real growth of Pakistan from supply side of the some economic sectors. Farooq &Batool (2007) used commodity flow approach to determine the relationship between gross fixed capital formation and national income accounts using time series data. Ayaz (2006) attempted to find out the relation of annual number of gross fixed capital formation with a series of generated economic sectors like furniture and fixture, metal and non-metal, production and manufacturing industries. Khan (1988) studied the change in gross fixed capital formation and its impact on the output. Sajid et al (2012) examined the impact of human gross capital formation and economic growth of Pakistan for the period of 1972-2010. Abbas (2001) determined the role of gross fixed capital formation in the economic development of Pakistan.

Beside the truth that there are some limited literatures existed on current issue, but these past studies didn't clearly work on the relation of gross fixed capital formation with the economic growth. This research study has an attempt to examine the true picture of the gross fixed capital formation and the economic growth as well as the possible relation between them too. The main focus of this study is on the impact and relation between the gross fixed capital formation and the economic growth. It is expected that this study will clearly determined the impact of gross fixed capital formation on the economic growth of Pakistan and also that either there is short or long run relation between gross fixed capital formation and economic growth of Pakistan. In this study some other supporting variables are too included to make a deep look and analysis.

The main objective of this research study is to find out the effect of gross fixed capital formation or gross fixed capital investment on the economic growth of Pakistan. Second, this study are also examining that either there is short or long term relation between gross fixed capital formation or investment and economic growth of Pakistan.

Investment takes many forms such as investment in human capital, in intangible assets, in financial assets and fixed assets, etc. In capitalist economies much attention is focused on business investment in physical capital like buildings, equipments and inventories. Recently, broader definitions of capital have included the acquisition of intangible capital. Investment is also undertaken by governments, nonprofit institution and households and it includes the acquisition of human and intangible capital.

DATA AND METHODOLOGY

In this section a brief explanation of data, sources, stationary test, models and its justification are to be given.

Data Analysis & Description

The data used in this study are based on annual figures because quarterly data for most of the variables are not available from any source in case of Pakistan. The time period of the study data is from 1981-2014, because data prior to 1981 at constant price are unavailable. There is no direct source to complete data; therefore data are collected from different sources includes, Economic Surveys of Pakistan, Federal Bureau of Statistics, State Bank of Pakistan, Agriculture Development Bank of Pakistan (ZTBL), Cooperatives and Commercial Banks, International Financial Statistics (IFS), Pakistan Institute of Development Economics (PIDE), World Development Report (WDR), The Global Economy, National Accounts of Pakistan and from different surveys and reports.

All the variables used in the estimation for all investment function are taken as real and at constant prices. The price index of capital (IPK) good has been calculated by dividing the value of gross fixed capital formation at current price by corresponding value at constant prices.

Developing of the Econometric Model

The present study examines the impact and relation between the gross fixed capital investment and economic growth of Pakistan. The basic idea for developing the econometric framework to truly capture the impact and relation of the fixed investment and GDP growth of Pakistan are taken from the earlier models develop and used by (Khadaroo, 2007),(Seetanah, 2008) and (Mauritius, 2007). For selecting the variables for this study the idea are taken from the new growth theory (Romer, 1990), (Renalt, 1992) and (Easterly, 2001). The theoretical model of the study in their functional form is;

$$GDP = f\,(GFCF,\ PRIVT,\ Pub,\ Ipk,\ TOP,\ Edu,\ FD) \tag{2.1}$$

The econometric model of the above function (2.1) can be written as;

$GDP_t = \beta_0 + \beta_1(GFCF)_t + \beta_2(\mathrm{P}RIVT)_t + \beta_3(Pub)_t + \beta_4(TOP)_t + \beta_5(I_{pk})_t + \beta_6(Edu)_t + \beta_6(FD)_t + \varepsilon_t$ The expected sign of the co-efficient are;

$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 < 0, \beta_6 > 0, \beta_7 > 0$

The variables included in the study are;

GDP = Economic Growth of Pakistan.

GFCF = Gross Fixed Capital Formation or Gross Fixed Capital Investment.

PRIVT = private physical capital investment

Pub = Public Capital Investment ratio to GDP

TOP= Dummy for Trade Openness Policy or Trade Liberalization Policy.

Ipk = price index of capital (IPK) goods

Edu = both Literacy rate and technical education

FD = Financial development is taken as the ratio of M3 to GDP

ESTIMATION TECHNIQUE AND REGRESSION RESULTS

The analytical technique and the regression analysis adopted in this research study are tried to be most appropriate regarding to data, analysis of the model and variables used in this research study. Firstly, to search for the most suitable regression techniques to analyze truly the picture of the data and model depend upon the stationary of the data that are checked through unit root tests. As this research study consist on the time series data, mostly suffers from non-stationarity. Therefore, the unit root test ADF is applied to check the stationarity of the data. The variables show their stationary at first difference as shown in the table 1. To find out the relationship between the variables the Johanson co-integration test was applied, detecting the long run relation between the variables as shown in table 2. The Vector Error Correction (VECM) model is suggested in most of the studies where the variables are stationary at first difference. As, the variables in this research study also shown their stationarity on I(1) So, the VECM model was used for the regression analysis of the variables to find out the impact of gross fixed capital formation on the economic growth of Pakistan as well as the relation between these variables.

Table 1: The ADF unit Root Test Results(The Variables are Taken in their Logarithmic form)

Variables	1		2		3		4	
	At Level with Intercept		At Level with Trends & Intercept		At 1st Difference Intercept		At 1st Difference with Trends & Intercept	
	T-state	Prob.	T-state	Prob.	T-state	Prob.	T-state	Prob.
GDP	-1.825290	-0.1809	-0.467922	0.6523	-1.83068	0.1045	-1.996698	0.0860
GFCF	-1.727565	0.2332	-1.344561	0.2156	-3.12449	0.0141	-4.498140	0.0028
PRIVT	-1.198211	0.9010	-0.459768	0.6579	-1.11635	0.2967	-1.941453	0.0933
Pub	-1.345566	0.1148	-1.732301	0.2358	-3.34487	0.0102	-3.457371	0.0106
TOP	-1.009134	0.8990	-1.318099	0.8221	-1.89015	0.0954	-2.382211	0.0487
Ipk	-0.603831	0.5609	-0.038750	0.9861	-3.33741	0.0103	-3.272911	0.0136
Edu	-1.063039	0.3155	-0.010853	0.7902	-3.19312	0.0127	-3.130303	0.0166
FD	-0.197815	0.7930	-1.498670	0.2723	-3.91077	0.0045	-5.402729	0.0010

The ADF unit root test is chosen for the stationarity of data as it is good in case of large samples. The best estimator chosen to test the hypothesis of unit root is t-test and Prob. F statistics. The ADF tests applied on all the variables to check stationarity. The variables didn't show the stationarity at level form (with and with-out trends). Further, ADF test was applied on the variables for the first difference where the variables show the stationary. The results are incorporated in Table 1.

Table 2: Results of the Johnson Co-integration Test

	Null Hypothesis	Alternative Hypothesis	Test Statistics	Critical value 5%	Probability P- value
Maximal Eigen value	None*	r =1	46.17	37.40	0.0000
	At most 1*	r =2	33.21	31.78	0.0281
	At most 2*	r =3	28.47	24.85	0.0786
	At most 3	r =4	13.19	19.31	0.0962
	At most 4	r =5	6.24	15.62	0.3401
	At most 5	r =6	1.32	3.84	0.3884
Trace of the Stochastic matrix	None*	r =1	153.66	93.57	0.0000
	At most 1*	r =2	103.28	67.18	0.0000
	At most 2*	r =3	47.48	45.58	0.0901
	At most 3	r =4	25.43	27.97	0.1095
	At most 4	r =5	13.07	13.94	0.1934
	At most 5	r =6	1.98	3.84	0.1398

denotes rejection of null hypothesis at 0.05 level

Johanson co-integration test is very well-liked tools in econometric work to find out that either the variables are co-integrated with each other used in the model. If the variables are co-integrated, means that the variables have long-run relation. The importance of this test is that, it gave help in selecting the technique and tools for the regression analysis of the study. The relation between variables is tested by applying the Johanson test of co-integration to find out if there is any co-integrating in the long-run vector exits or not. This is done by selecting first the Vector Error Correction (VECM) model order for variables. A Vector Error Correction (VECM) model of order 1 is used according to the Schwarz Bayesian Criterion (SBC). The criteria tests are based upon the presence of deterministic trend either constant or linear in the long-run. Both the trace statistics and the result of maximal Eigen value states that there is present three co-integrating vector at most in the model. These results show that both the trace statistics and maximal Eigen value at 5% level of significance there are co-integrating vectors present in the model and the variables are co-integrated. The results of Johanson test are shown in table 2.

Regression Analysis of the Data and Interpretation of the Results

The results in table 1, ADF unit root test showing that all the variables included in the study are stationary at first difference I(1). In such a situation, where all the variables are showing their stationarity at first difference, the economist and researchers suggest Vector Error Correction (VECM) model. The Vector Error Correction (VECM) model is assumed to be good for regression analysis of this research study as analytical technique. The Vector Error Correction (VECM) model has a sound theoretical and econometric background in analyzing, forecasting and explaining of the data. It is believed that the Vector Error Correction (VECM) model may give good forecast values rather than other models used in time series for this research study.

Lag Length Criteria

The lag length criteria are used in the time series data analysis in order to decide about the number of lags that will be used in the data variables. The data used in economic analysis mostly have the nature of time series and the time series model mostly used is the autoregressive (AR). AR model is used in order to determine the autoregressive lag length. There are so many lag selection criteria used in order to find out the lag length in the time series data variables. The lag length autoregressive process p states that a time series in which the present value of the variables is derived by its first lagged value AR (p). This AR(p) is always unknown and is carried out by the lag length criteria namely the Schwarz Information Criterion (SIC), Bayesian Information Criterion (BIC), Aikaike's Information criterion (AIC), Final Prediction Error (FPE), and Hannan Quinn Criterion (HQC) (Liew (2000)). The criteria mostly preferred in economic studies are the Aikaike's Information Criterion (AIC). In the given time series data all the lag selection criteria are applied and their results are given below. Here LR test statistics, SIC, AIC, FPE, and HQ (at 5% level) all shows that there should be 2 lags selected of each variable and used in the analysis of the data.

Table 3: Lag-Length Criteria Results

Lag	Log L	LR	FPE	AIC	SC
0	-445.8734	NA	456890.0	29.030611	28.63911
1	-311.8924	179.7391	1298.871	25.71152	27.51356
2	-239.3491	72.01941*	209.9235*	21.93913*	25.86868*

Vector Error Correction Model Estimates

The researcher suggest using the Vector Error Correction Model for the regression analysis in case of presence of co-integrating vectors. The VECM model is used as a system which has the characteristics where the deviation of the present state is served from long-run relation into the short-run dynamics. These models are a part of multiple time series models which estimates directly the speed of equilibrium of the dependent variable as in this study (GDP) after a change in the independent variable as (GFCF, PRIVT, Pub, TOP, Ipk, Edu and FD). Error correction models are very helpful to find out the short-run and long-run estimates of different time series on one another. ECMs are very useful in dealing with the integrated data, and it can also be used for stationary data. After knowing that there is co-integration vectors present in the variables and hence there exists a relation among variables in the long-run, we specify and estimate VECM along with the co-integrating vector by examining the model's dynamic nature. The regression model as formulated earlier will be taken /written in their logarithmic form for the regression in the following form:

$$Log(GDP)_t = \beta_0 + \beta_1 Log(GFCF)_t + \beta_2 Log(PRIVT)_t + \beta_3 Log(Pub)_t +$$
$$\beta_4 Log(TOP)_t + \beta_5 Log(I_{pk})_t + \beta_6 Log(Edu)_t + \beta_6 Log(FD)_t + \varepsilon_t$$

The results obtained after the regression analysis are shown in Table 4.

Table 4: Regression Results of the Variables as Taken in their Logarithmic form

Dept. Variable	Independent Variables							
GDP	C	GFCF	PRIVT	Pub	TOP	Ipk	Edu	FD
(1)	-8.419683 (6.8792)	.609165 (5.18125)	0.435602 (3.87254)	0.148742 (4.53814)	0.720821 (8.54712)	-0.045921 (2.61532)	0.653471 (6.72608)	0.349820 (4.68213)

Note: *Parenthesis ( ) shows the t-statistics values*

The variables included in the model have significant expected true signs showing their positive impact on the economic growth. The results in the Table 4 shows that all these independent variables have long run relation with the economic growth positively affected by all these variables included in the study.

Gross Fixed Capital Formation (GFCF) builds an important part of GDP. There are three main components of GFCF namely GFCF private sector, GFCF Public Sector and GFCF General Government Sector. Two of them namely the GFCF Private Sector and GFCF Public Sector are used in the study. Public capital is thought to have negative effects on the growth and private capital is shown to have encouraging and positive effects on the growth of economy. There is a common agreement on the role of private investment that it enhances the economic performance, possibly because change in technology or technological advancement is exemplified in the recent years of capital. The question that public investment is having positive or negative impact on the economic growth is of great importance to the economists. Some of the literature shows a positive impact of public investment and argues that public investment boosts the productivity of the private sector which in turn increases the economic growth (Arrow and Kurtz (1970); Barro (1990). According to this view, public investment is important to determine the long run economic growth in the sense that it not only creates positive spillovers by providing education, basic scientific research, health and physical infrastructure, but it may also enhance economic growth by crowding in the private investment. There arises some questions about the efficiency of

public investment on one hand and on the other hand its relationship with private investment is questioned. It is argued that public investment may not have favorable impact on economic growth (see, Khan (1996); Devarajan (1996). Since the theoretical relation of investment in public sector to growth of the economy is not clear, it is an issue of empirical consideration.

The results revealed in this study that GFCF has positive long run effect on the economic growth of Pakistan. An increase of 1% in GFCF will bring a 60% increase in the economic growth of Pakistan. This shows that from investment side GFCF is an important element of the GDP growth. Since private physical capital investment and Public Capital Investment ratio to GDP has also having positive, significant impact on the economic growth. 1% change in these two variables will brought approximately 43% and 14 % change in the economic growth respectively. The results are consistent with the study of (Rienhart, 1989; Delong & Summers, 1990; Delong &Summers, 1994; Pareira, 2000; Seetanah, 2008; Arin, 2004).

The variable Trade openness (TOP) is used as a proxy for the country's openness level.). The idea that economic growth and liberalization of trade are positively related to each other is supported by many researchers. The increase in economic growth due to trade openness is carried out via various channels: efficient allocation of resources, communication and by adopting the global knowledge swiftly, improved specialty, increase in competition domestically, easy approach to large markets, an improvement in the R&D situation by the access gains from innovation, and also giving a secure and good opportunity of investment in transitional goods. The results of this study also found trade liberalization policies having strong impact on the economic growth. It is highly significant and shows that 1% change towards the trade openness policies will push the economic growth by 72 %. A lot of literature existed having same results obtained by some researchers in their earlier studies done their study on trade openness in relation with economic growth (Dollar, 1992; Warner &Sachs, 1995;Edwards, 1996; Ahmad et. al., 2000;Edwards, 1998)

The other variable included in the study is the Education that measures the quality of labor in the model. Looking into the level of education and skills of workers, it can be thought that economic growth is affected by human capital, ceteris paribus, the workers with high skills and education is more productive and innovative. Capital accumulation or even the rise in the technological advancement can be the fruits of higher level of human capital for the adherent countries (Temple, 2001). The impact of quality of labor (Education) is also positive on the economic growth and is stated as if there is an increase of 1% in the quality of labor the economic growth of the country will go up by 65% which is a good sign for the economic growth of the country as well as for the productivity. The results are similar to the studies of (Romer, Weil, &Mankiw, 1992; Barro, 1998).

Moreover, the economic growth may also affected greatly by financial development. Economic growth can be attained through capital accumulation and technological innovations by taking into account the functions that are performed by financial markets and intermediaries like resource allocation, management of risk, saving mobilization, and ease in trading. The result of this study shows that 1% increase in the financial development system will bring an increase of 34 % in overall growth of the economy. The results are consistent with the studies of (Levine & King; 1993, Levine; 1997, Ghali; 1999, Khan; 1996; Devarajan; 1998).

CONCLUSIONS

In economics "Economic growth" or "economic growth theory" typically refers to "potential output" growth, i.e. producing at "full employment level". Economic growth is distinguished from business cycle in terms of short-run and long-run changes in production. Business cycle is considered as the short-run variations in the growth of economy while growth of the economy is attributed to the change in the amount of production in the long-run which are caused by the infrastructure changes named as factor accumulation and growth of the technology. Traditionally, the increase in human and physical capital and changes in the technology which cause the increase in the productivity is documented as economic growth. It can also be described as the result of developing new goods and services, creating demand.

Economic growth can be promoted by gross fixed capital formation through several ways, like by creating massive benefits, increasing investments by creating enlarged markets and economies of scale, by the transfer of information, technology and knowledge spillovers. It generates resourceful exploitation of resources, improvement in technology and facilities relating trade which in turn gives higher foreign exchange which is used to expand those sectors of economy which are not developed. This concept is supported by many theorists and some studies concluded that the role of human and physical capital is very effective in the less developed countries. South Asia is considered to be one of the less developed regions because it is economically weak and it concentrates on more labor capital to enhance the rapid increase in economic growth.

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