# A Time Series Analysis of Foreign Direct Investment and Economic Growth of Pakistan

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• Time series analysis

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**2015**

بسم الله الرحمن الرحيم

# Certificate

# A Time Series Analysis of Foreign Direct Investment and Economic Growth of Pakistan

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***Kosar Abbas***

A DISSERTATION SUBMITTED IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF THE ***MASTER OF SCIENCE in STATISTICS***

We accept this dissertation as conforming to the required standard.

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# DEDICATION

*To my family whose debt is great in the form of inspiration, support and cooperation.*

# Forwarding Sheet by Research Supervisor

The thesis entitled **"A Time Series Analysis of Foreign Direct Investment and Economic Growth of Pakistan"** submitted by **Kosar Abbas** (Registration # 12-FBAS/MSST/F12) in partial fulfillment of MS degree in Statistics has been completed under my guidance and supervision. I am satisfied with the quality of his research work and allow him to submit this thesis for further process to graduate with Master of Science degree from Department of Mathematics and Statistics, as per International Islamic University Islamabad rules and regulations.

Date:____________________

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***KOSAR ABBAS***

# DECLARATION

I hereby declare that this thesis, neither as a whole nor a part of it, has been copied out from any source. It is further declared that I have prepared this dissertation entirely on the basis of my personal efforts made under the supervision of my supervisor **Dr. Zahid Iqbal.** No portion of the work, presented in this dissertation, has been submitted in the support of any application for any degree or qualification of this or any other learning institute.

**Signature:** ____________________

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# CONTENTS

# LIST OF ABBREVIATIONS

| | |
|---|---|
| ADF | Augmented Dickey-Fuller |
| AIC | Akaike Information Criterion |
| CI | Condition Index |
| EX | Exports |
| EXCR | Exchange Rate |
| FDI | Foreign Direct Investment |
| GDP | Gross Domestic Product |
| GFCF | Gross Fixed Capital Formation |
| IFS | International Financial Statistics |
| IM | Imports |
| INF | Inflation |
| OLS | Ordinary Least Square |
| PC | Principal Components |
| ARDL | Auto-Regressive Distributed Lag Model |
| SC | Schwaz Criterion |
| UNCTAD | United Nations Conference on Trade and Development |
| VAR | Vector Autoregressive |
| VIF | Variance Inflation Factor |
| WDI | World Develop Indicators |

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# ABSTRACT

The aim of this study is to empirically analyze the economic growth of Pakistan during time period 1960-2012. The gross domestic product (GDP) is taken as dependent variable while foreign direct investment (FDI), Import (IM), Export (EX), Inflation (INF), Exchange rate (EXCR) and gross fixed capital formation (GFCF) are used as independent variables. The methodology to test relationship among these variables is cointigration technique after unit root analysis. The unit root analysis show that all variables except inflation are non-stationary at level but becomes stationary at first difference. The results of cointigration analysis show that all seven variables have a long run relationship. After this, least square regression was applied on Principal Components and found that the inflation and exchange rate has significantly negative impact on economic growth where as FDI, exports, imports and capital formation has a significant positive effect on economic growth of Pakistan during 1960-2012.

# Chapter 1

# INTRODUCTION

The main objective of development is to decrease the number of the poor and get prosperous living. To achieve these purposes, sustainable economic growth and investment on human resource are needed. Limited resources in the poorer countries are the biggest hurdle in achieving this end. So, to seek financial and skill aid from the developed countries has become the dire need of the hour for the poorer countries.

As we very well know foreign direct investment (FDI) as one of the most influential methods of pulling flows from external sources. The technique is also effective in building capital in developing countries around the world. However, it is notable that this drawing of investment has been declining over the past years. For developing countries, the positive impact of FDI has become popular for the measurement of economic growth (Muhammad 2007). The most impressive results of implementation of FDI are the increase in aggregate productivity, increased chances of employment, greater exports and exchange of developed technology between the investor and the host country. FDI in a developing country enables the creation of employment and utilization of all kinds of resources, to undertake most modern methods of business, in terms of management and marketing, and helps in reduction of budget deficit. Another usefulness of FDI is that it reduces the risks and regularizes external debt and adds value to the human capital. The countries with scarce capital and limited technological skills usually have slow economic growth and it is vivid from a number of studies that foreign direct investment can be a source of transfer of technology and knowledge (Dunning & Hamdani 1997).

It is clear that FDI not only affects economic growth, but also influences the host country's growth performance. Moreover both of these growth and FDI are tightly bound with international trade. The relationship between trade and growth is well known and economic growth, whether through exports increase or imports decrease through any strategy, can affect trade flows on large scale. On the other hand the export-led growth (ELG) hypothesis tells that expansion of exports can also promote economic growth by expanding the international market for developing countries. The link between FDI and trade has follows two media.

First of all, countries with least restricted trade policies have more chances to attract FDI, where the degree of openness is measured through the size of the trade (imports plus exports) relative to GDP. Second, FDI can affect trade in many ways, foreign investors, usually bring machinery from outside the host country, and increase the import bill for the host country. Another cause that persuades the multinational companies to invest in the poorer countries is the low cost of production there. This may result in export of price competitive items in the international market and hence this can increase exports of the host country. In a nutshell, it is concluded that FDI, growth and international trade are mutually dependent. Historically, Pakistan economy is having consumption led growth which raises the demand led investment.

Numerous factors affect economic performance and economic growth of a country. Though it is the feature of the economies of the entire world taken together and especially of non progressed countries, Foreign Direct Investment (FDI) has been a vivid determinant for their development.

It has been investigated by many researchers that there has been vital and beneficial impact of FDI flowing into countries on economic growth of those countries.

However, the positive limitation of impact of FDI on economic growth of a country depends upon the amount of available human capital in that particular country.

Zakia & Ziad (2007) additionally tried for examination of the effect of FDI on the monetary development of Jordan, and they likewise tried the impact of imports on financial development, over about a score of years (1976-2003). Also, they discovered bidirectional connections in the middle of FDI and yield and in the middle of imports and yield. The outcomes supported the confirmation of FDI and import-Drove Development Theory for Jordan. Thomas, et al. (2008) has contended that the same venture influences the neighborhood firms and organizations to create innovation as they are in rivalry now.

It additionally connotes that why the creating nations are after remote speculation. The most concerning issue of the creating nations is the hole in the middle of sparing and speculation and FDI minimized the same crevice. This entire procedure prompts innovation exchange, vocation opportunities, benefit expand and expanded rivalry. When all is said in done, economists are collectively of the perspective those FDI increments financial developments (see, for instance, Blonigen, 2005). To put it plainly, FDI ought to have positive effect on financial development in creating nations where the capital collection is at the base level. (it's just plain obvious, for case, Johnson, 2006).

Both cross area and board information examination, it was indicated by Johnson (2006) that FDI quickened financial development in creating nations, however not in created nations. Alfaro (2003), in the wake of doing a cross-country examination, tried for the outcome that impact of FDI on host nation financial development vague; it was watched that infusion of FDI in the essential segment prompted negative impact on monetary development of the host nation. There have been numerous other experimental studies giving out blended proof about the relationship between monetary development and FDI (Wijeweera et. al. 2007; Zhang 2001; Johnson 2006).

Conventional and propelled economists consider passages sure for budgetary advancement. As showed by Marshall (1890), financial progression of a nation must be judged by her level of worldwide trade. As demonstrated by Nurkse (1961) widespread trade is the engine of advancement. Bhagwati (1973) is of the point of view that it is the best thing to have most amazing utilization of existing uncommon resources for extending overall trade volume if the benefits are uncommon.

It has been vivid through many researches that exports support the economic growth of a country. But it is also noteworthy that only countries having bounty of natural resources cannot increase their exports but also the countries with limited natural resources provided that these countries shift their resources from inefficient inland use to dynamic exports channel. Moreover, the exports should not be limited to raw material but there should be finished products that have high prices in the international market.

All the economists emphasize that free trade is minimum tariff and other barriers will lead to real globalization and human welfare and the same will be a factor in poverty alleviation, as free trade gives opportunities jobs, faster economic growth better standards of the masses with better consumption choices. Zaidi (2005) argues that the pattern and nature of foreign trade is a better indicator of the pattern and nature of the economies of trade agreements.

We know that some countries enjoy monopolies in some products where they can earn maximum. And the countries having raw material as exports should increase the quantity of exports using better techniques and they too have certain advantages of their produced goods.

As policy making is an important process in the world and the link between FDI and the economic growth is very important for this purpose so the analysis is always there having deep and deeper eye to split the hair. There has been a bang in FDI inflows in the last score of years and according to UNCTAD (2005), the increase in world FDI inflows has been about U$55 billion in 1980 to around U$1,400 in 2000. This unexpected increase in FDI persuaded both academic economists and policy makers to endeavor more to find exact relationship between FDI and economic growth.

## 1.1: Objectives of Research

1. To use an appropriate methodology to analyze time series regression model.
2. To investigate empirically the impact of FDI on economic growth in Pakistan.
3. To investigate the importance of exports in the process of economic growth in Pakistan.

## 1.2: Hypotheses of the Study

The hypotheses formulated for the study are as follows:

1. Effect of foreign direct investment on economic growth of Pakistan is expected to be positive and statistically significant.
2. Effect of exports on economic growth of Pakistan will be positive and statistically significant.

# Chapter 2

# LITERATURE REVIEW

A lot of research has been done to analyze the relationship between FDI inflow and economic growth and different conclusions has drawn.

Atique et al. (2004) researches the influence of FDI on economic growth under foreign trade regimes for Pakistan. The regression model is used by taking GDP as response variable and FDI labour force (L), capital formation (K) etc as explanatory variables. The information is utilized for period 1971—2001 from Pakistan economy. In this study openness of trade policy regimes (OP) is also used as proxy variable to consider its effect on economic growth. The findings of this research is that trade policy regimes followed by Pakistan has affect significantly both by FDI and economic growth.

The FDI-led growth hypothesis for Sri Lanka is examined by Athukorala (2003). The basis of this study is time series data that ranges 1959 to 2002 together with rejoinder of civil society and overseas firms. The econometric structure of cointegration and error correction mechanism were applied to depict two way linkages between interested variables. From these results, we could not conclude that there is a robust link between FDI and growth in Sri Lanka. The analysis revealed that the effect of FDI on economic growth of Sri Lanka is insignificant but it does not infer that FDI is unimportant as the impact of FDI to create opportunities for domestic business and economic activities is seen positive.

Melina et al. (2004), by applying the co-integration test, inspected that there is relationship among FDI, economic growth and exports in Greece over long haul. The study period for the nation comprises the years 1960-2002. In light of their outcomes, they find that there was a causal relationship among these variables as the Granger causality test utilized called attention to.

The prospective of FDI inflows to influence host country economic growth is examined by Johnson (2006). The researcher argues that the effects of FDI on economic growth are technology spillovers and physical capital inflows. He employed both cross-section and panel data analysis on 90 countries for the period of 1980 to 2002. The results suggest that FDI inflows enhance economic growth in under developed economies but this is not the case for developed economies.

The effect of exports and foreign direct investments on economic growth of China was analyzed by Yao (2006), with a large panel data set including 28 Chinese provinces during 1978–2000. The methodology used in this analysis is Pedroni's panel unit root test and Arellano and Bond's dynamic panel data estimating method. From these results, a strong positive effect of exports and FDI on economic growth of China was found. The conclusions propose that two development policies implemented in China are beneficial for other developing and intermediate economies: export promotion and acceptance of world technology and business performs.

Khan (2007) explores that FDI applied beneficial outcome on monetary development through the process of technological diffusion. In this study, he inspected the relationship among FDI, local monetary area, and financial development for Pakistan amid 1972–2005. He found that the advancement of the local budgetary arrangement of the host nation is a critical precondition for FDI to have a positive effect on financial development. An all around created residential budgetary segment improved productive designation of monetary assets and enhanced the absorptive limit of a nation concerning FDI inflows. The outcomes suggested that FDI inflows had positive effect on financial development in the short-run and the long-run relying on accomplishment of a certain base level of improvement. The discoveries proposed ahead that, to put resources into Pakistan better household monetary conditions pull in outside organizations to contribute, as well as permit boosting the advantages of remote venture

The experimental relationship between non-extractive FDI and monetary development in Nigeria and the determinants of FDI into the Nigerian economy was explored by Ayanwale (2007). The season of study was 1970- 2002. To build the relationship between the FDI, its segments and financial development, an augmented growth model was computed utilizing the conventional least squares and the 2-Stage Least Square technique. The results infer that the determinants of FDI in Nigeria are business sector size, base advance and stable macroeconomic methodology. Then again existing human capital and openness to exchange are not FDI impelling. In Nigeria, FDI contributes completely to monetary development. Despite the fact that the generally impact of FDI on financial development may not be earth shattering. In the correspondence part, FDI has the most extreme potential to raise the economy and is in products in oil segment. In view of denied business environment in the nation, FDI adversely influences the economy in the assembling district. To build it's planned in financial development, there is have to expand the level of accessible human capital and weight on preparing.

Falki (2009) conduct an exploration to break down the impact of FDI on monetary development. The information cover the period 1980—2006 on FDI, Gross domestic product, exchange, work power and capital venture uses. The conclusion is that FDI does not indicate much commitment to financial development in Pakistan for above period as contrasted and local capital and work. This study demonstrates a negative and inconsequential connection in the middle of FDI and Gross domestic product.

Wijeweera et al. (2010) researched the relationship in the middle of FDI and the rate of development of Gross domestic product utilizing a stochastic frontier model and utilizing board information covering 45 nations over the period 1997 to 2004. They found that FDI inflows applied a positive effect on financial development just in the vicinity of a very talented work power; defilement has a negative effect on monetary development; and exchange openness expanded financial development by method for productivity picks up.

Kundan et al. (2010) concentrated on to figure out the linkage between Foreign Direct Investment (FDI) and financial development as far as Total national output Development Rate (GDPGR) for Nepal over the period 1980-2006; utilizing the Granger Causality test, Unit root test and Co-integration test. The outcomes demonstrated that there leave a long haul relationship between the variable and bearing of causality runs from FDI to GDPGR.

Gudaro et al. (2010) studied the impact of FDI on economic growth for Pakistan. The data covering the period of 1981-2010. The researchers take GDP as dependent variable while FDI and CPI as independent variables. The finding is that regression model is significant overall having positive effect of FDI on economic growth and negative relationship between inflation and GDP.

The serial correlation ship between FDI and economic growth of Nepal in terms of gross domestic product was examined by Yan and Pokhrel (2011) during 1983-2007. The basis of this study is to apply Durbin-Watson Test and Cochrance- Orcutt method on log and non-log values. The conclusion of this analysis indicates that FDI do effect the economic growth due to presence of auto-correlation but without auto-correlation, FDI not sufficiently describe the GDP.

Azam (2011) does the examination of the impact of fares and FDI on financial development. The information is taken for period 1980- 2009. In this study GNP is utilized as dependent variable while export and FDI as independent variables. The conclusion of this study is that exports and FDI are measurably noteworthy.

The influence of trade liberalization on economic growth for Malaysia and South Korea is analyzed by Nguyen (2011). To study the associations among economic growth, trade and FDI during 1970 to 2004 for Malaysia and 1976 to 2007 for Korea, a four variable vector autoregression (VAR) is employed. The exports are long-run source of economic growth for both Malaysia and Korea as these are the findings from the Granger causality/Block exogeneity test, impulse response functions and variance decompositions validate. The bi-way causalities between each pair among the four examined variables were found for Malaysia except for the absence of causality from gross domestic product to exports. The one-way causality from exports, imports and gross domestic product to FDI, from exports and imports to gross domestic product and from exports to imports was found. However, the other three variables do not affect the exports. The economic policies are the basis of dissimilarities in results between the two countries. Even though both countries executed policies of export-orientated progress, the Malaysia stimulated FDI as a tool of industrialization, while the Korean government made an "integrated national economy" by means of "chaebol" industrialized structures and reducing the role of foreign direct investment.

Atif (2012) analyses the effect of export, import and FDI on gross domestic product. This study has examined the determinants of economic growth for the period 1980-

2009 in the case of Pakistan. As a representative of economic growth, the GDP growth rate has been used as dependent variable. The coefficients of all the other four statistically significant coefficients are positive as they were expected. The impact of Foreign direct investment on economic growth of Pakistan is less or not statistically significant. Positive and significant impact of exports on economic growth suggested that Pakistan should focus on export-led growth. The Govt. of Pakistan should take some measures to enhance the levels of foreign direct investment directly or to private sector to improve its economic growth rate.

Jayachandran (2012) investigated the relationship among Trade, Foreign Direct Investment and Gross Domestic Product for Singapore during 1970- 2010. This study commonly reveals a positive relationship among Trade, Foreign Direct Investment (FDI) and economic Growth. But according to a few studies, we can apply test of causality to the three variables only in specific conditions. The economic growth can increase trade and Foreign Direct Investment and vice versa. This analysis focused on Singapore, where growth of exports has been noteworthy from Co-integration analysis, he went for the opinion that there is a long-run consistent relationship. The Granger causality test was applied in the analysis and it manifested the causal relationship between the analyzed variables.

Naseer (2013) examines the relationship between FDI, exchange rate and economic growth of Pakistan. The study is made on time period 1980-2012. The regression is applied by taking export as dependent variable while GDP, FDI, and real exchange rate as independent variables .The unit root test, lag order selection Schwartz test, Johansen cointigration test and Granger causality test is applied. He concludes that foreign income, FDI, GDP and real effective exchange rate are significantly affect trade.

Qayyum and Mehmood (2013) tried to investigate the inter-linkage between foreign trade and Foreign Direct Investment (FDI) in Pakistan. For the period 1985–2010, annual data have been taken for eight major trading partners like France, Canada Germany, Hong Kong, Japan, Saudi Arabia, UK and USA. They applied Johansen Fisher Panel Cointegration Test and Vector Error Correction Mechanism (VECM) to examine whether the FDI and foreign trade are complements or substitutes. From analysis, they found evidence in favour of complementarities of FDI and foreign trade. It means that FDI promotes foreign trade of Pakistan with its trading partners.

Ali (2014) examined the effects of foreign debt, FDI and worker's remittances on economic growth in Pakistan. The analysis is carried out by using Johansen cointigration method and Granger causality test during 1972-2013. In long run, the negative effect of these flows on economic growth of Pakistan has seen. One way causality running from debt service, FDI, inflation and literacy rate to growth was confirmed in short run analysis. The Causality runs from economic growth to domestic investment but it could not conclude from domestic investment. Two way causality has been established between remittances and growth. The analysis propose some policy recommendation as domestic resource mobilization, construction of physical infrastructure, economic progress, appropriate macroeconomic frame for price solidity and development in human capital for the long run development of the financial system.

# Chapter 3

# MATERIALS AND METHODS

## 3.1: DESCRIPTION OF VARIABLES

### 3.1.1: Gross Domestic Product (GDP)

GDP is the money market value of all final goods and services produced by the factors of production located in the country during a period of one year. GDP is a flow and not a stock.

### 3.1.2: Foreign Direct Investment (FDI)

Foreign direct investment is an investment made by a company or entity based in one country, into a company or entity based in another country. It differs substantially from indirect investment such as portfolio flows, wherein overseas institutions invest in equities listed on a nation's stock exchange.

### 3.1.3: Exports (EX)

The term export refers to selling goods and services produced in one country to the market of other country .Usually Pakistan's export consists only a few goods like cotton, rice, leather, sports etc. These goods export to only a few destinations like USA, UK, Germany, Hong Kong, UAE and Afghanistan.

### 3.1.4: Imports (IM)

The goods and services which are brought in from one country to another country in a legitimate manner are called import. Major imports of Pakistan contains petroleum and petroleum products, edible oils, chemicals, capital goods, raw materials for industries, consumer products and fertilizers etc.

### 3.1.5: Inflation (INF)

Inflation is a state in which general level of prices for goods and services rise and subsequently purchasing power falls. Therefore inflation is depletion in the purchasing capacity of money.

### 3.1.6: Capital Formation (GFCF)

Capital formation refers to the process of adding to the stock of capital over time. The stock of capital can be built up and increased through savings, strong capital market and an act of investment.

### 3.1.7: Exchange Rate (EXCR)

The exchange rate is the price of one unit of the foreign currency in terms of the domestic currency.

The main objective of this study is to empirically analyze the impact of foreign direct investment on economic growth of Pakistan during 1960-2012. For this purpose, annual time series data is collected from different sources like IFS, WDI and Hand Book of Statistics on Pakistan Economy. The dependent variable used in this study is gross domestic product rate as a measure of economic growth, while foreign direct investment, exports, imports, inflation, exchange rate and capital formation are taken as independent variables. The description of each variable and its data source is given in Table 3.1 on next page:

**Table 3.1: Variables Description and their Data Source**

| Variable | Description | Data source |
|---|---|---|
| Exports | Exports of goods and services, current (Pak. Rs. billion) | IFS (International Financial Statistics) |
| Gross domestic product | Current in Pak. Rs. Billion | IFS (International Financial Statistics) |
| Foreign direct investment | Foreign direct investment net inflow (Pak. Rs. billion). | Handbook of Statistics on Pakistan economy-2013. |
| Imports | Imports of goods and services, current (Pak. Rs. billion). | IFS (International Financial Statistics) |
| Inflation | Inflation, consumer prices (annual %) | WDI (World Development Indicators ) |
| Exchange rate | Rs. per US dollar ( period average). | IFS (International Financial Statistics) |
| Gross Fixed Capital Formation | Current, (Pak. Rs. billion). | IFS (International Financial Statistics) |

## 3.2: Econometric Model

The econometric model is formed as below that was already used ( Falki 2009, Saqib et al, 2013)

Gross domestic product = f (exports, foreign direct investment, imports, inflation, exchange rate, gross fixed capital formation)

Mathematically, the Econometric model can be written as:

$$LGDP = \beta_0 + \beta_1 LEX + \beta_2 FDI + \beta_3 LIM + \beta_4 INF + \beta_5 LEXCR + \beta_6 LGFCF$$

+ [illegible] (1)

where,

LGDP is log of Gross domestic product.

LEX is log of Exports.

FDI is foreign direct investment.

LIM is log of Imports.

INF is inflation.

LEXCR is log of exchange rate.

LGFCF is log of gross fixed capital formation.

$\mu$ is stochastic error term.

## 3.3: Methodology

Different methods concerning time series analysis are existing in the literature. To select the right methodology, it requires a much skill, perceptive and expertise to choose the right one. The subsequent part gives in depth the explanation about methodology that is being used.

A set of observations that are arranged according to their occurrence of time is called time series. Therefore our main concern in about time series analysis as our topic being studied here is "A time series analysis of foreign direct investment and economic growth of Pakistan".

White noise process is one of the relatively familiar kinds of stochastic processes. This is a multivariate Stochastic Process. The conditions of White noise process are that it is independently and identically distributed with zero mean and unit variance and having no autocorrelation.

### 3.3.1: Stationarity

Assume a time series at time'$t$' is $X_t$. A strictly stationarity time series is that $of\ X_{t1}$, $X_{t2}, \dots \dots \dots, X_{tk}$ is relatively alike to which of the shift $set\ X_{t1+h}, X_{t2+h}, \dots \dots \dots, X_{tk+h}$ for every type of set of given time $t_1, t_2, \dots \dots, t_k$ for each number $k = 1,2,3 \dots \dots \dots$ and for every move $h = 0,1,2,3, \dots \dots \dots$. The stationarity means that there is uniformity in mean, variance and auto-covariance's by the time period. Therefore, saying in a different way, a time series is covariance stationarity if the subsequent three conditions are fulfilled:

1. Displaying mean reversal is that it oscillates approximately around a fixed long-run mean.
2. Its variance is finite and it does not change with respect to time.
3. As well as the lag length increases, the correlogram of time series declines.

### 3.3.2: Stationarity and Unit Root Tests

To examine whether a time series in stationary or non- stationary, we often use a popular test known as unit root test. The results of least square regression analysis may be misleading if we apply it on a time series which is non- stationary. It is possible that a non-stationary time series regression has no meaning and therefore the results derived from this regression are ambiguous. Hence to avoid ridiculous regression, it is very necessary that first to check that a time series is either stationary or not by using the following expression

$$y_t = \rho y_{t-1} + \mu_t \qquad (2)$$

where $-1 \leq \rho \leq 1$

The autoregressive model AR (1) is fairly analogous to this level. If we put $\rho = 1$, then equation (2) transform into a random Walk model without drift. When $\rho = 1$, then the time series is non-Stationary and on the other hand we can say that there is unit root problem. In this case, the $Y_t$ is not stationary. Hence the unit root name is due to the fact that $\rho$=1. Therefore Random walk, non-stationary and unit root may be treated as homogeny. The unit root testing procedure is not as simple, given below are discussed various problems that may appear;

i. It is essential to check that the process from which data is produced may contain a trend effect.
ii. The data generating procedure may consist of autoregressive or it is rather more composite and definitely may engage moving average terms.
iii. If the size of sample is small, there may be a possibility that it will favour to non-stationarity.
iv. Unexpected structural breaks in the time series may lead us to the opinion of under-rejection of null hypothesis.
v. A time series which is monthly or quarterly basis may include seasonal unit root besides to the usual unit root

### 3.3.3: The Dickey-Fuller and Augmented Dickey-Fuller test

To test whether a time series has a unit root or not, "Dickey-Fuller" (1979) introduced a test with null hypothesis that a series has a unit root against the alternative hypothesis that it is stationary.

The simple form to estimate in "Dickey-Fuller" test is as;

$$y_t = \rho y_{t-1} + \mu_t \quad (3)$$

where $\mu_t$ is a white noise process.

Subtracting $y_{t-1}$ on both side.

$$y_t - y_{t-1} = (\rho - 1)y_{t-1} + \mu_t \quad (4)$$

$$\Delta y_t = (\rho - 1)y_{t-1} + \mu_t \quad (5)$$

where $\mu_t$ is I.I.D $(0, \sigma^2)$

Therefore we can also examine whether equation (2) for $\rho = 1$, against $\rho < 1$, otherwise we can test equation by $H_0; \delta = 0$ in opposition to $H_1; \delta < 0$.

$$where, \quad \rho - 1 = \delta$$

When we consider a more complex AR(p) process, then it is not difficult to consider this second type of test The value $'t'$ of the given coefficient $y_{t-1}$ of resulted "Tau statistic", Dickey-Fuller reckon the critical values of the "Tau statistic" that entirely base upon the foundation "Monte-Carlo Simulations. In applying Dickey-Fuller test, it is assumed that the error terms are uncorrelated. Thereafter, when the error terms $\mu_t$ are correlated, Dickey-Fuller intended a test, recognized as "Augmented Dickey-Fuller test". This test is carried out by augmenting the lag values of the dependent variable $\Delta y_{t-1}$.

$$\Delta y_t = (\rho - 1) y_{t-1} + \Delta y_{t-1} + \mu_t \qquad (6)$$

The given suggestion in center of the 'Augmented Dickey-Fuller' test is being to adequate kinds of terms so that the general error term is serially uncorrelated. The left behind procedure will be in the like pattern as in Dickey-Fuller test.

## 3.4: Cointegration

The previous section given us an important message that a time series that has trend effect may have affinity that the regression obtained from such time series may be spurious. Moreover it is given that most of the macro-economic variables have a trend effect and the regression obtained from such a data may be misleading. To provide the solution of such problems, the only way is first to decide integrated order of the series, so that it can be used for regression analysis. In taking first difference of the series, there are two noteworthy issues to manage. On the off chance that the model is accurately indicated as a relationship between $Y$ variable and $X$ variable and we report the distinction between both given variables then plainly we are additionally differencing the blunder condition in the condition of relapse. The severe estimation problems would appear and then then return to a non-reciprocal moving average error process. Now due to this difficulty, the model can no longer give a single long-run relationship.

### 3.4.1: Engle and Granger Method of Cointigration

Engle and Granger in (1987) introduce an important linkage between the non-stationary and long-run relationship. This is a very simple test to determine whether the series of variables are co integrated.

Engle Granger two steps bi-variate residual method is a common procedure for testing cointigration between economic series. In this methodology, we regress variables in level and then apply unit root test on residuals. These residuals turn out to be stationary, and then variable said to be cointegrated and could be interpreted as stable long run relationship. Although this procedure is an improvement over sample correlation coefficient analysis but still there are some weakness when modeling multivariate cases, which are,

i. Engle-Granger procedure is sensitive to the choice of endogenous variables in the cointegration regression.
ii. Engle-Granger method makes a priori assumption of a single cointegrating vector in the system.
iii. Engle-Granger method tends to yield biased parameter estimates in small samples.

This procedure is based on very restrictive assumptions that all explanatory variables are exogenous.

### 3.4.2: Cointegration and the Error-Correction Mechanism

When there is non-stationary in the variables, then the results obtained from this regression are spurious. Therefore, if both $X_t$ and $Y_t$variables are I(1), then if we regress:

$$Y_t = \beta_0 + \beta_1 X_t + \mu_t \tag{7}$$

We will not generally obtain proper estimates of $\beta_0$and $\beta_1$.

To make certain that whether our variables are stationary or not, one option is to create dissimilarity in our data. Thus, we have the new series will be $\Delta Y_t \sim$ I (0) and $\Delta X_t \sim$ I (0) and the regression model will be as under;

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \mu_t \tag{8}$$

At this moment, the estimates $\alpha_0$ and $\alpha_1$ of the least square regression model gives us the appropriate regression model and the problem of spurious regression is resolves. However, the short-run relationship among variables can be obtained from above equation (8).

To give long-run relationship among variables, ΔY itself is not enough. It requires a concrete knowledge about economic theory and the relation among variables.

### 3.4.3: Auto- Regressive Distributed Lag Model (ARDL)

To test the existence of long-run relationship among the variables in the model, Pesaran et al (2001) introduced Auto Regressive Distributed Lag (ARDL) model. The basis of this model is Unrestricted Error Correction Model (UECM) and after that, ordinary least square method will be used to estimate the model. Because mostly time series data is non-stationary at level, so the regression applied on this data may be spurious. Therefore the first step is to decide the order of integration whether it is I(0), I(1) or higher order. For this explanation, the Augmented Dicky- Fuller (1981) test is used to decide the order of integration.

Once to test the non-stationarity of the data, then we apply ARDL model technique to investigate the long run relationships among the model variables. In the earliest step of ARDL investigation, we examine the existence of long-run relationships. Here, we use General to particular modeling approach. On the basis of different lag selection criterion, we use suitable number of lags of first differenced variables.

$$\begin{aligned}\Delta LGDP_t = \alpha_0 &+ \sum_{i=1}^{n-1} \alpha_{1i}\Delta LGDP_{t-i} + \sum_{i=0}^{n-1} \alpha_{2i}\Delta FDI_{t-i} + \sum_{i=0}^{n-1} \alpha_{3i}\Delta INF_{t-i} \\ &+ \sum_{i=0}^{n-1} \alpha_{4i}\Delta LEX_{t-i} + \sum_{i=0}^{n-1} \alpha_{5i}\Delta LIM_{t-i} \\ &+ \sum_{i=0}^{n-1} \alpha_{6i}\Delta LEXCR_{t-i} + \sum_{i=0}^{n-1} \alpha_{7i}\Delta LGFCF_{t-i} + \beta_1 LGDP_{t-1} \\ &+ \beta_2 FDI_{t-1} + \beta_3 INF_{t-1} + \beta_4 LEX_{t-1} + \beta_5 LIM_{t-1} + \beta_6 LEXCR_{t-1} \\ &+ \beta_7 LGFCF_{t-1} + \mu_t \qquad (9)\end{aligned}$$

where, $\Delta$ represents the first difference and $\mu_t$ is error term.

To test that there is no cointegration among the variables in the model, the null hypothesis and alternative hypothesis can be written as:

$$H_0;\ \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$$

$$H_1;\ \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$$

If the F-statistic value is larger than the upper limit of the upper bound critical values suggested by Pesaran et al (2001), then we would be able to reject the null hypothesis that there is no cointegration among the variables in the model. On the other hand, we do not reject the null hypothesis that there is no cointegration among the variables in the model if the values of F-statistic are lower than the lower bound critical values. The analysis will be indecisive if the F-test value falls within the critical bound limits.

### 3.4.4: Advantages of ARDL Method

The ARDL bound test of cointegration has mainly following advantages in comparison with other methods of cointegration (Harris and Sollis, 2003):

1. In ARDL, it does not require that all the variables in the model has same order of integration and it is applicable when the variables under study has different order of integration.
2. Moreover, as in small samples, ARDL test is comparatively more efficient.
3. The unbiased estimates of the long-run model can be achieved by applying ARDL methodology.
4. In ARDL, at the same time, we estimate the long- run and short- run coefficient of the model.

## 3.5: Principal Component Analysis

Principal component analysis is a method in which orthogonal transformation is applied to a set of variables that are usually correlated and converts it into a set of new variables that are linearly uncorrelated called Principal component. The number of Principal components is usually less or equal to the number of original variables. The first principal component accounts as much variation in the data as possible and has largest variance. The second principal component accounts the second most variation in the data under the assumption that it is uncorrelated with the first principal component and after this each subsequent component in turn attains the largest variance with the restriction that it is uncorrelated with the previous components. As principal components are eigenvectors of the covariance matrix that is symmetric, therefore they are orthogonal.

Let $X_1, X_2, \dots\dots\dots\dots, X_P$ are $p$ random variables. The principal components are the linear combinations of these $p$ random variables. These linear combinations geometrically correspond to a new coordinate system that is obtained by rotation of original system through $X_1, X_2, \dots \dots \dots \dots, X_P$ as coordinate axes. The simple and thrifty explanation of the covariance structure is obtained by new axes. As principal components exclusively depend on variance-covariance matrix $\Sigma$ of $X_1, X_2, \dots \dots \dots \dots, X_P$, therefore it does not require multivariate normal assumption for the development of principal components.

Suppose the random vector $X' = [X_{1,} X_{1,}, \dots \dots \dots, X_P]$ have the variance-covariance matrix $\Sigma$ having Eigen values $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_p \geq 0$, with eigen vectors as $a_1, a_2, \dots \dots \dots, a_p$.

Then the linear combinations are

$$Y_1 = PC1 = a'_1 X = a_{11}X_1 + a_{12}X_2 + \dots + a_{1p}X_p \quad (10)$$

$$Y_2 = PC2 = a'_2 X = a_{21}X_1 + a_{22}X_2 + \dots + a_{2p}X_p \quad (11)$$

$$\vdots \qquad \qquad \vdots$$

$$Y_p = PCp = a'_p X = a_{p1}X_1 + a_{p2}X_2 + \dots + a_{pp}X_p \quad (12)$$

Then, variance is obtained as;

$$var(Y_i) = a'_i \Sigma a_i = \lambda_i \quad ; \quad i = 1,2, \dots, p \quad (13)$$

$$cov(Y_i, Y_k) = a'_i \Sigma a_k = 0 \quad ; \quad i \neq k \quad (14)$$

The principal components are the linear combinations $Y_1, Y_2, \dots \dots \dots \dots, Y_P$ that are uncorrelated whose variances as in equation (13) are as large as possible.

The first principal component is the linear combination $a'_1 X$ that maximizes $var(a'_1 X)$ depending on $a'_1 a_1 = 1$.

The second principal component is the linear combination $a'_2 X$ that maximizes $var(a'_2 X)$ depending on $a'_2 a_2 = 1$ and $a'_1 \Sigma a_2 = 0$

at the i$^{th}$ stage,

The $i^{th}$ principal component is the linear combination $a'_iX$ that maximizes $var(a'_iX)$ depending on $a'_ia_i = 1$ and $cov(y_i, y_k) = 0$ for $k \neq i$.

### 3.5.1: Kaiser-Meyer-Olkin (KMO)

Kaiser-Meyer-Olkin (KMO) measure of sample adequacy (MSA) for the variable $x_j$ is presented by the following formula

$$KMO_j = \sum_{i \neq j} r^2_{ij} / \left( \sum_{i \neq j} r^2_{ij} + \sum_{i \neq j} u^2_{ij} \right) \qquad (15)$$

where $R = [r_{ij}]$ is the correlation matrix and $U = [u_{ij}]$ is the partial covariance matrix. The KMO measure of sample adequacy for all variables as a whole is obtained by the above equation (15) by taking all combinations and $i \neq j$.

The value of KMO lies between 0 and 1. A value close to zero signifies that the partial correlation sums are as large as compared to the pair wise correlations sum. This indicates that the correlations are prevalent and therefore cannot take together as a few variables. This is an indication that principal component analysis is not suitable here. On the other hand, a value of KMO close to 1 signifies that principal component analysis is a good fit.

### 3.5.2: Requirements of Principal Component Analysis

The requirement of Principal components analysis is as follows:

1. Some of the pair correlations between the variables in the analysis are greater than 0.3.
2. The Kaiser-Meyer-Olkin, the Measure of Sampling Adequacy (MSA) for each variable and overall set of variables should be at least 0.50 to perform the PCA.
3. The Bartlett's Test of Sphericity is statistically significant.

## Chapter 4

# RESULTS AND DISCUSSIONS

### 4.1: Descriptive Statistics

To investigate the relationship among studied variables, the first step is to describe the data. The table 4.1 presents descriptive statistics of the variables in terms of their mean, median, maximum, minimum, standard deviation, skewness, kurtosis and normality.

**Table 4.1: Descriptive Statistics at Level**

| | FDI | INF | EXCR | EX | GDP | GFCF | IM |
|---|---|---|---|---|---|---|---|
| Mean | 0.456580 | 8.3134 | 28.83250 | 419.0500 | 2812.69 | 456.5802 | 467.6637 |
| Median | 0.093795 | 7.3361 | 17.02500 | 71.16500 | 543.505 | 93.79500 | 108.0000 |
| Maximum | 2.525020 | 26.663 | 93.39000 | 2983.120 | 20653.8 | 2525.020 | 2575.360 |
| Minimum | 0.003550 | −0.516 | 4.76000 | 2.05000 | 23.700 | 3.55000 | 2.91000 |
| Std. Dev. | 0.732073 | 5.4765 | 26.14975 | 709.8690 | 4747.28 | 732.0732 | 722.7724 |
| Skewness | 1.829868 | 1.3048 | 0.945546 | 2.299146 | 2.25180 | 1.829868 | 1.809808 |
| Kurtosis | 5.023240 | 5.0945 | 2.634120 | 7.860912 | 7.54879 | 5.023240 | 5.090933 |
| Jarque-Bera | 37.88885 | 24.261 | 8.038544 | 97.00763 | 88.7771 | 37.88885 | 37.85953 |
| Probability | 0.000000 | 0.0000 | 0.017966 | 0.000000 | 0.00000 | 0.000000 | 0.000000 |
| Sum | 23.74217 | 432.30 | 1499.290 | 21790.60 | 146259. | 23742.17 | 24318.51 |
| Observations | 52 | 52 | 52 | 52 | 52 | 52 | 52 |

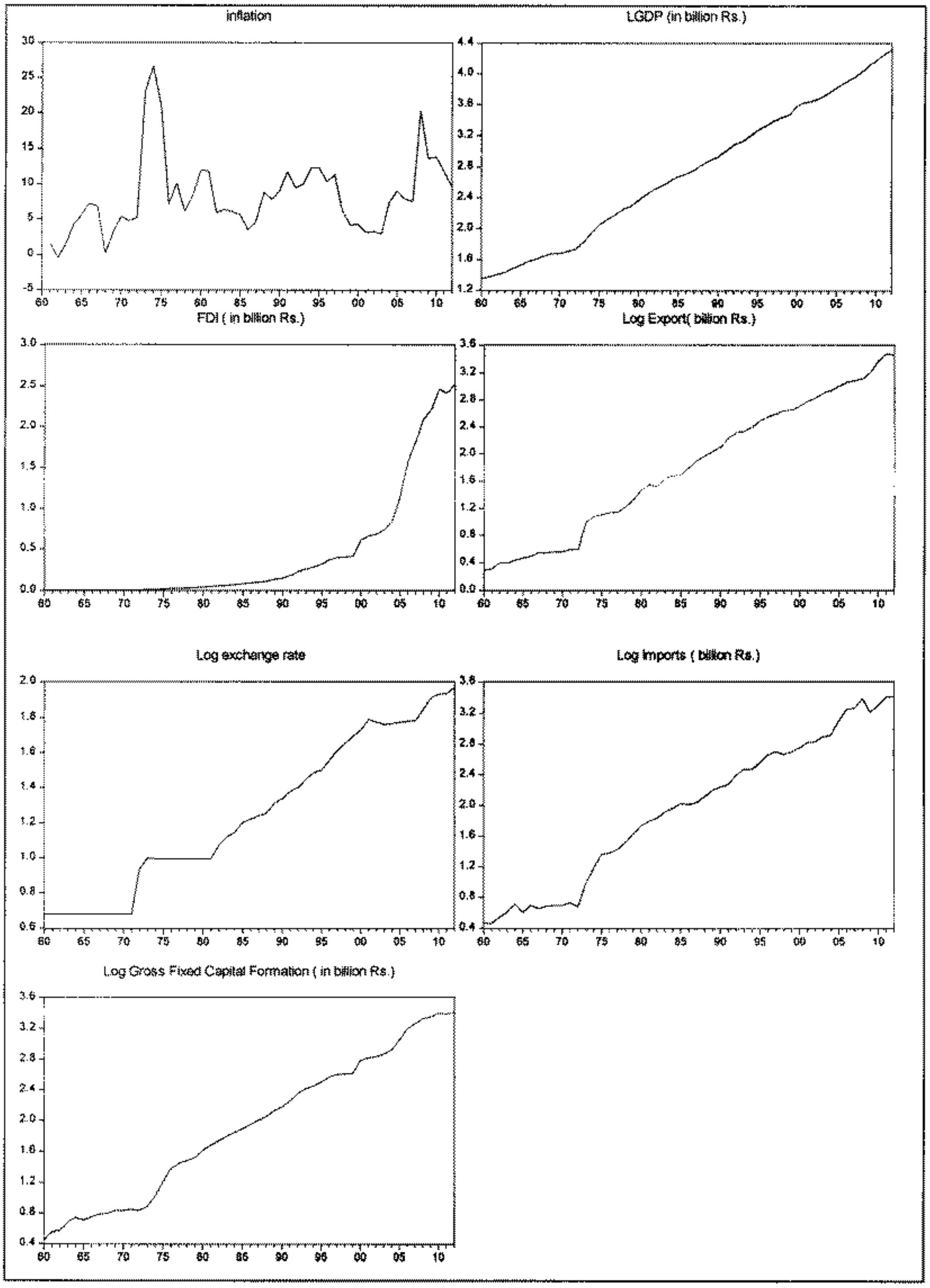
From these statistics, both the mean and median of each variable foreign direct investment (FDI), inflation (INF), exchange rate(EXCR),exports (EX), gross domestic product (GDP), gross fixed capital formation (GFCF) and imports (IM) are not same, their skewness are not close to zero and kurtosis are not close to 3. Moreover, the Jarque-Bera p-values of all these variables are significant. Therefore, we can conclude that foreign direct investment (FDI), inflation (INF), exchange rate(EXCR), exports (EX), gross domestic product (GDP), gross fixed capital formation (GFCF) and imports (IM) are not normally distributed at level.

**Table 4.2: Descriptive Statistics at log Level**

| | FDI | INF | LEXCR | LEX | LGDP | LGFCF | LIM |
|---|---|---|---|---|---|---|---|
| Mean | 0.456580 | 8.313482 | 1.264504 | 1.837404 | 2.746809 | 1.954592 | 1.972411 |
| Median | 0.093795 | 7.336123 | 1.230982 | 1.849577 | 2.734586 | 1.971215 | 2.033394 |
| Maximum | 2.525020 | 26.66303 | 1.970300 | 3.474671 | 4.315001 | 3.402265 | 3.410838 |
| Minimum | 0.003550 | −0.516462 | 0.677607 | 0.311754 | 1.374748 | 0.550228 | 0.463893 |
| Std. Dev. | 0.732073 | 5.476553 | 0.432601 | 0.992843 | 0.898261 | 0.915091 | 0.943305 |
| Skewness | 1.829868 | 1.304847 | 0.062489 | −0.039044 | 0.048442 | −0.0003 | −0.151228 |
| Kurtosis | 5.023240 | 5.094519 | 1.666408 | 1.686582 | 1.752215 | 1.720647 | 1.744875 |
| Jarque-Bera | 37.88885 | 24.26127 | 3.887191 | 3.750855 | 3.393769 | 3.546278 | 3.611440 |
| Probability | 0.000000 | 0.000005 | 0.143188 | 0.153289 | 0.183254 | 0.169799 | 0.164356 |
| Sum | 23.74217 | 432.3011 | 65.75418 | 95.54502 | 142.8341 | 101.6388 | 102.5654 |
| Observations | 52 | 52 | 52 | 52 | 52 | 52 | 52 |

From these statistics, both the mean and median of Foreign direct investment (FDI) and inflation (INF) are not same, their skewness is not close to zero and kurtosis is not close to 3. Moreover, the Jarque-Bera p-values are significant. Hence we can say that foreign direct investment (FDI) and inflation (INF) are not normally distributed at level. Now both the mean and median of each variable log exchange rate (LEXCR), log exports (LEX), log gross domestic product (LGDP), log gross fixed capital formation (LGFCF) and log imports (LIM) are almost same, their skewness are close to zero and kurtosis are not much far from 3. Moreover, the Jarque-Bera p-values of all these variables are insignificant. Therefore, we can conclude that log exchange rate (LEXCR), log exports (LEX), log gross domestic product (LGDP), log gross fixed capital formation (LGFCF) and log imports (LIM) are normally distributed.

**Figure 4.1: Trends of variables at level**




From these graphs of the examined variables, we observe that out of seven variables, the six variables have a trend effect as they are increasing with time. So there may be non-stationarity at level in these variables. However the graph of inflation depicts that there may be stationarity at level.

## 4.2: Unit Root Tests

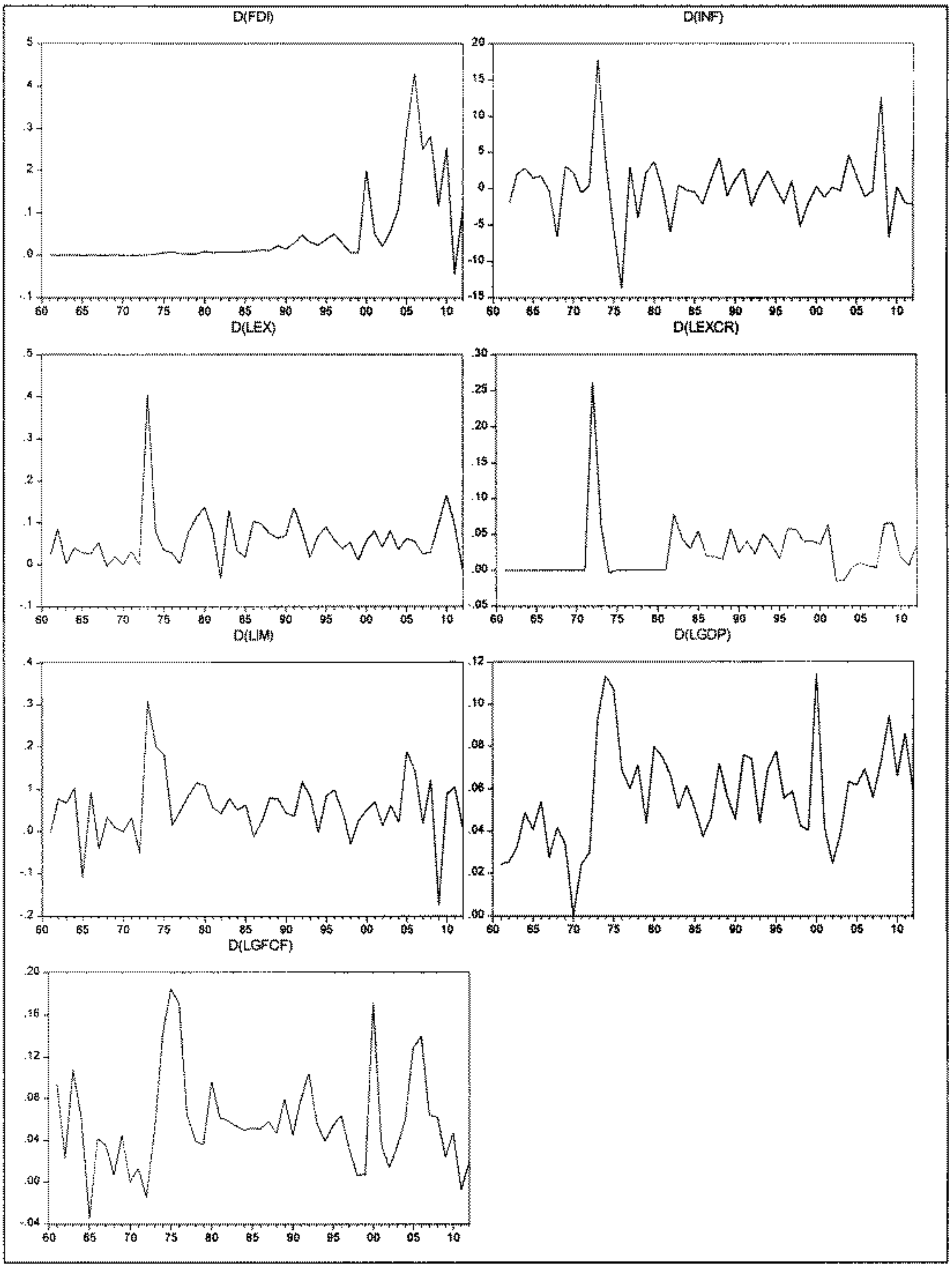
It is necessary to test for stationarity of economic time series before proceeding for examining cointegration and long-run relationship. The Augmented Dickey- Fuller (ADF) is employed on the variables in level and at first differences. These results shown in Table 4.3 pointed towards the non-stationarity at level of all variables excluding inflation but become stationary at first difference. The tests suggest that all variables in this study are I (1) except inflation, which I (0).

**Table 4.3: Unit Root Tests**

| Variable | Augmented Dickey-Fuller Test Statistics | | | |
|---|---|---|---|---|
| | Level | | First Difference | |
| | Intercept | Trend & Intercept | Intercept | Trend & Intercept |
| LGDP | 1.0311 | −3.0726 | −4.513** | −4.680** |
| FDI | 4.2202 | 3.1968 | −2.0584* | −4.3424* |
| INF | −3.3177* | −3.303* | −7.043** | −6.990** |
| LEX | 0.248 | −3.023 | −6.951** | −6.885** |
| LIM | −0.309 | −0.309 | −0.309** | −6.990** |
| LGFCF | −0.126 | −3.312 | −4.771** | −4.726** |
| LEXCR | 0.383 | −3.494 | −5.829** | −5.814** |

* and ** show significant at 5 % and 1% respectively.

**Figure 4.2: Trends of variables at first difference after Stationarity.**




The graphs of all variables at first difference presented in above figure shows that all variables are stationary at first difference as they are more stable.

## 4.3: Choosing the Appropriate Lag Length

In the next step, the appropriate number of lags is chosen for the given model. For this purpose, an unrestricted VAR model is used. We take all the variables in the system as endogenous for unrestricted VAR model and then suitable lag length can be chosen by applying various criteria for lag length.

**Table 4.4: Lags under different criteria**

| Lag | Selection Order Criteria | | | | |
|---|---|---|---|---|---|
| | **LR** | **FPE** | **AIC** | **SC** | **HQ** |
| 0 | NA | 1.42e-10 | −2.806916 | −2.53403 | −2.70379 |
| 1 | 627.5924 | 1.72e-16 | −16.45506 | −14.272* | −15.6300 |
| 2 | 71.80068 | 1.71e-16 | −16.58917 | −12.4959 | −15.042 |
| 3 | 95.27048 | 4.87e-17 | −18.21175 | −12.2083 | −15.9430 |
| 4 | 83.92265* | 1.03e-17* | −20.58707* | −12.6734 | −17.596* |

* Lag order selected by criteria

The results of selection of optimal lag length for the model are shown in above Table 4.4. Sequential Modified LR test, FPF, AIC and Hannan Quinn (HQ) suggested four lag but Schwarz Criterion suggests one lag. However, we use four lags as majority of test criterion recommend it and reducing lag till one.

## 4.4: ARDL Bound Test approach for Cointegration

Now, we apply ARDL bound test approach developed by Pesaran et al. (2001) to investigate the long-run relationship among variables in the model. Here we use four lags as majority of test criterion recommend it. The results are presented in Table 4.5 on next page;

**Table 4.5: Results of ARDL Bounds Test for Co-integration Relationship**

| Calculated F-value: 6.007 | | |
|---|---|---|
| Level of Significance | Critical Bounds | |
| | Lower bounds | Upper bounds |
| 1% | 3.15 | 4.43 |
| 5% | 2.45 | 3.61 |
| 10% | 2.12 | 3.23 |

Note: The Bounds test values are based on Pesaran et al. (2001), Table CI (iii) Case III:

As the calculated value of F-statistic is greater than upper bound critical values on the basis of Pesaran et al. (2001) at the 1%, 5% and 10% level of significance, therefore we conclude that there exists a long run relationship among variables in the model.

Now we check the estimated ARDL model for diagnostic test which is serial correlation test and the results are presented in Table 4.6 below:

**Table 4.6: Breusch-Godfrey Serial Correlation LM Test**

| (Obs. $R^2$) | P-vaue |
|---|---|
| 3.5500 | 0.0730 |

The serial correlation is tested by Breusch-Godfrey LM Test and its p-value = 0.0730 > 0.05. Therefore, we conclude that there is no autocorrelation.

Next, to assess the parameter stability of ARDL model given by equation (9), the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests (Pesaran and Pesaran (1997)) are applied to evaluate the stability of model parameters. The results are shown in figure 4.3 and figure 4.4 on next page:

**Figure 4.3: Plot of CUSUM Test for LGDP**

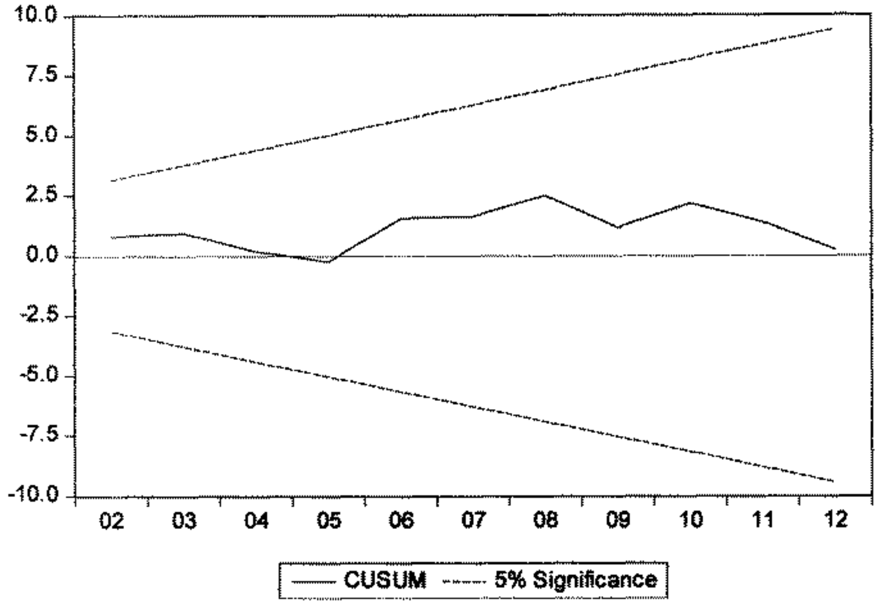
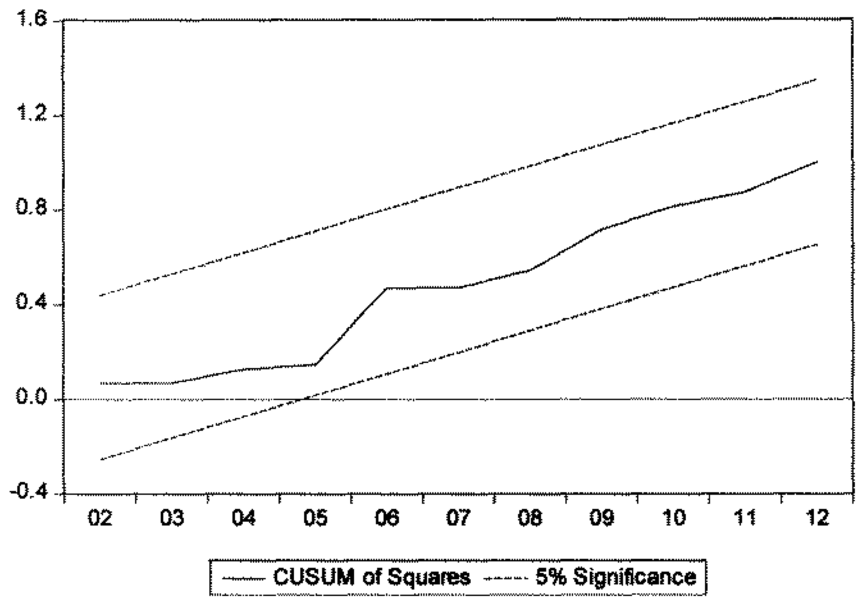



**Figure 4.4: Plot of CUSUMSQ Test for LGDP**




These results presented in above figures indicates that the estimated model parameters are stable as CUSUM and CUSUMSQ statistic values fall within 5% critical bound values.

# 4.5: Least Square Regressions

## 4.5.1: Least Square Regression at Level

Now, the Least Square Regression is applied at level by taking logs of all variables except FDI and inflation. In all Regression Models, we use Durbin-Watson statistic to see only that whether Regression Model is spurious or not. The results are shown in Table 4.7 on next page:

**Table 4.7: Least Square Regression at log Level**

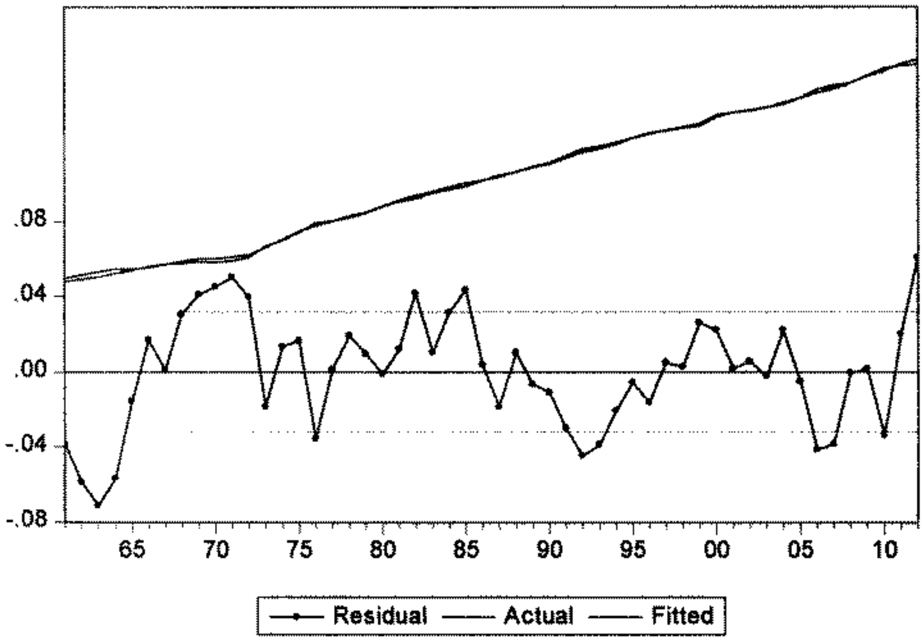
| Dependent variable: LGDP | | | |
|---|---|---|---|
| variable | coefficient | t-statistic | p-values |
| C | 0.931402** | 18.50002 | 0.0000 |
| FDI | 0.047227** | 3.561043 | 0.0009 |
| INF | −0.001955 | −1.786350 | 0.0808 |
| LEX | 0.420920** | 5.493917 | 0.0000 |
| LEXCR | 0.172932* | 2.157556 | 0.0363 |
| LGFCF | 0.483828** | 4.744095 | 0.0000 |
| LIM | −0.064726 | −0.797713 | 0.4292 |
| adj. $R^2$ | 0.998742 | -------- | -------- |
| Durbin-Watson stat | ------ | 0.70781 | ------- |
| F-statistic | ------ | 6751.398** | 0.0000 |

* and ** show significance at 5 % and 1% respectively

The results shown in Table 4.7 indicate that this estimated least square regression is spurious because adj. $R^2$ (0.9987) > Durbin- Watson Statistic (0.7078). However, this regression is overall significant at 1% level with adj. $R^2$=0.9987, means that all explanatory variables have a joint effect on GDP growth. The coefficients of FDI, exports (LEX), exchange rate (LEXCR) and gross fixed capital formation (LGFCF) are positively significant at 5% level. Moreover, most of the variables are significant and with expected signs.

Now, we plot the actual and fitted values of the response variable to examine that how good our OLS Regression model fit.

**Figure 4.5: Residual plot of OLS Regression at level**




The residual plot of actual and fitted values of the response variable is presented in above Figure 4.5. This plot indicates that our estimated OLS Regression is however looks good fit but actually does not fulfill the condition of stationarity.

After this, residual diagnostic tests were applied on this estimated least square regression and results are presented in Table 4.8 below:

**Table 4.8: Residual Diagnostic Tests of OLS Regression at Level**

| Test | Statistic | p-values |
|---|---|---|
| Normality Test ( Jarque- Bera) | 0.8998 | 0.6376 |
| Serial Correlation LM Test Breusch-Godfrey: (Obs. $R^2$ ) | 25.6141** | 0.0000 |
| Heteroskedasticy Test Breusch-Pagan - Godfrey ( Obs. $R^2$ ) | 19.2735** | 0.0037 |

* and ** shows significant at 5% and 1% % respectively.

These results in above Table show that though residuals are normally distributed, but are serially correlated and their variances are heteroscedastic in nature. Moreover, the multicollinearity is examined by calculating pair wise correlations of all explanatory variables and the results are presented in Table 4.9 on next page:

**Table 4.9: Pair wise Correlations at Level**

| | LEXCR | LEX | FDI | LGFCF | LIM | INF |
|---|---|---|---|---|---|---|
| LEXCR | 1.00000 | | | | | |
| LEX | 0.99004** | 1.000000 | | | | |
| FDI | 0.77300** | 0.76575** | 1.000000 | | | |
| LGFCF | 0.98397** | 0.99586** | 0.78237** | 1.000000 | | |
| LIM | 0.979755** | 0.995105** | 0.750818** | 0.9961** | 1.00000 | |
| INF | 0.231266 | 0.235453 | 0.245170 | 0.20130 | 0.2357 | 1.00000 |

* and ** shows significant at 5% and 1% % respectively.

The examination of correlation matrix in above Table 4.9 indicates that explanatory variables are highly correlated as most of the correlation coefficients are greater than 0.7 and significant.

After this, multicollinearity diagnostics are applied at level on regressors. To detect collinearity among explanatory variables, we calculate Tolerance, Variance Inflation Factor (VIF) and Condition Index (CI). The results are shown in Table 4.10 below:

**Table 4.10: Multicollinearity Diagnostics at Level**

| Regressor | Tolerance | VIF | Condition Index |
|---|---|---|---|
| FDI | .211 | 4.738 | 4.966 |
| INF | .554 | 1.805 | 3.336 |
| LEX | .003 | 290.815 | 9.151 |
| LEXCR | .017 | 60.426 | 47.714 |
| LGFCF | .002 | 437.749 | 150.535 |
| LIM | .003 | 294.437 | 111.382 |

These results indicate that among six regressors, the Tolerance of four variables is very close to zero which is an indication of strong multicollinearity. The variance inflation factor (VIF) of four variables out of six variables is greater than 10, which also indicates severe multicollinearity. Now, the Condition Index of three independent variables are more than 10 which is too a symptom of strong multicollinearity.

Hence, we conclude that the above estimated OLS is totally meaningless and the results obtained from this regression are misleading. So we do not relay on this regression because:

1. It is spurious as adj. $R^2$ (0.9987) > Durbin- Watson Statistic (0.7078).
2. Residuals are serially correlated.
3. Residuals are hetroscedastic.
4. There is problem of multicollinearity.

Therefore, we reject these results and we do not decide or make any policy on the basis of these results.

### 4.5.2: Least Square Regression at First Difference with Lags

As earlier, the results of unrestricted VAR model, the majority of test criterion has suggested four lags. Therefore Least Square Regression at first difference with four, three, two and one lag as explanatory variables is applied respectively to examine the effect on the estimated model.

### 4.5.2-1: Least Square Regression at First Difference Four Lags

First we apply Least Square Regression by taking four lags of dependent variable LGDP as majority of test criterion has suggested four lags. The results obtained from estimated least square regression model are shown in Table 4.11 on next page:

**Table 4.11: Least Square Regression at First Difference with Four lags**

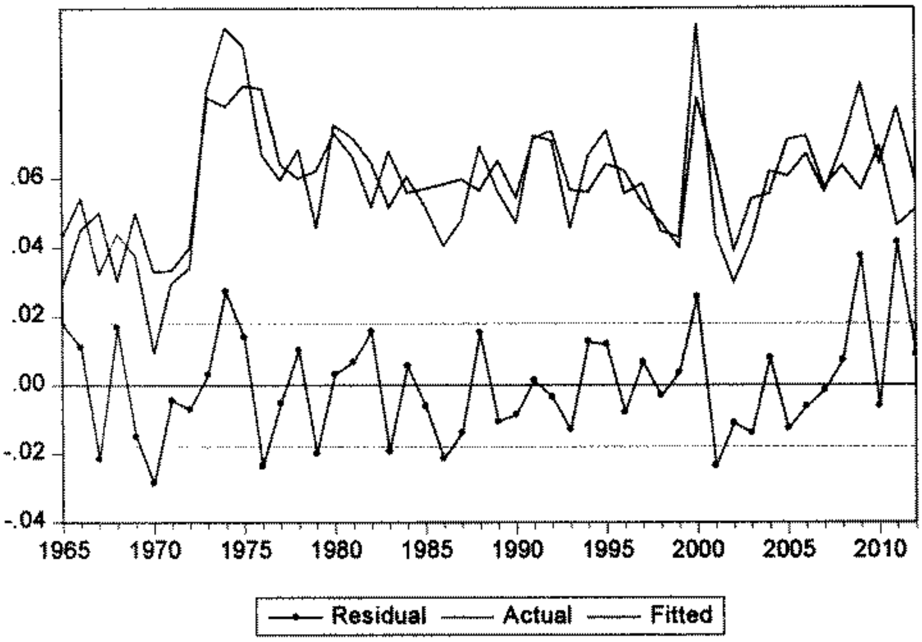
| Dependent variable: D(LGDP) | | | |
|---|---|---|---|
| variable | coefficient | t-statistic | p-values |
| C | 0.016329 | 1.379469 | 0.1760 |
| D(FDI) | −0.005237 | −0.173094 | 0.8635 |
| D(INF) | 0.000551 | 0.643622 | 0.5238 |
| D(LEX) | 0.101424* | 2.038425 | 0.0487 |
| D(LEXCR) | 0.052648 | 0.792356 | 0.4332 |
| D(LGFCF) | 0.291379** | 3.595252 | 0.0009 |
| D(LIM) | −0.006215 | −0.117594 | 0.9070 |
| D(LGDP(-1)) | 0.188173 | 1.296283 | 0.2029 |
| D(LGDP(-2)) | −0.023974 | −0.169059 | 0.8667 |
| D(LGDP(-3)) | 0.138141 | 0.962027 | 0.3423 |
| D(LGDP(-4)) | 0.032039 | 0.247212 | 0.8061 |
| adj. $R^2$ | 0.416612 | ------- | -------- |
| F-statistic | 4.356387** | ------- | 0.000462 |

* , ** shows significant at 5% and 1% respectively.

The results shown in above Table 4.11 indicates that estimated least square regression is overall significant at 1% level reveals that all the explanatory variables have a joint effect on LGDP growth. But none of the four lags are significant. The only coefficient of gross fixed capital formation is positively significant at 1% whereas coefficient of log exports D(LEX) is significant at 5% and the remaining five regressors are insignificant and have not expected signs except D(LIM) while D(FDI) has opposite sign. One cause for insignificant of most of the variables is multicollinearity. It may possible that these variables are actually significant.

Now, we plot the actual and fitted values of the response variable to examine that how good our OLS Regression model fit.

**Figure 4.6: Residual plot of OLS Regression at first difference with four lags.**




The residual plot of actual and fitted values of the response variable is presented in above Figure 4.6 indicates that our estimated OLS Regression is good fit as the differences between actual and fitted values is small. After this, residual diagnostic tests were applied on this estimated least square regression and results are presented in Table 4.12 below:

**Table 4.12: Residual Diagnostic Tests of OLS Regression with four Lags**

| Test | Statistic | p-values |
|---|---|---|
| Normality Test ( Jarque- Bera) | 1.7412 | 0.4186 |
| Serial Correlation LM Test Breusch-Godfrey: (Obs. $R^2$ ) | 0.3884 | 0.8235 |
| Heteroskedasticy Test Breusch- Pagan - Godfrey ( Obs. $R^2$ ) | 9.7713 | 0.4608 |
| Sum squared resid | 0.011799 | ------- |
| AIC | −5.014725 | ------- |
| SC | −4.585908 | ------ |

These results show that residuals are normally distributed as Jarque-Bera p-value=0.4186 > 0.05. The serial correlation is tested by Breusch-Godfrey LM Test and its p-value = 0.8235 > 0.05. Therefore, there is no autocorrelation. The Heteroskedasticy is tested by Breusch- Pagan – Godfrey Test and its p-value = 0.4608 > 0.05. This indicates that residual variances are not heteroscedastic in nature. Moreover, the multicollinearity is examined by calculating pair wise correlations of all explanatory variables and the results are presented in Table 4.13:

**Table 4.13: Pair wise Correlations at First Difference with four Lags**

| | D(LEXCR) | D(LEX) | D(FDI) | D(LGFC) | D(LIM) | D(INF) | D(LGDP(-1)) | D(LGDP(-2)) | D(LGDP)-3)) | D(LGDP(-4)) |
|---|---|---|---|---|---|---|---|---|---|---|
| D(LEXCR) | 1.0000 | | | | | | | | | |
| D(LEX) | 0.0348 | 1.0000 | | | | | | | | |
| D(FDI) | -0.0267 | -0.0092 | 1.0000 | | | | | | | |
| D(LGFCF) | -0.2115 | 0.0920 | 0.368** | 1.0000 | | | | | | |
| D(LIM) | -0.1043 | 0.4850** | 0.1679 | 0.5015** | 1.0000 | | | | | |
| D(INF) | 0.0715 | 0.5071** | 0.1231 | -0.1106 | 0.4364** | 1.000 | | | | |
| D(LGDP(-1)) | -0.0682 | -0.0401 | 0.1369 | 0.4454** | 0.1926 | -0.375** | 1.0000 | | | |
| D(LGDP(-2)) | -0.2919 | -0.1528 | -0.0157 | 0.1933 | 0.0282 | -0.365 | 0.4057** | 1.0000 | | |
| D(LGDP(-3)) | -0.1583 | -0.1704 | -0.0705 | -0.0495 | -0.2666 | -0.317** | 0.1277 | 0.4219** | 1.0000 | |
| D(LGDP(-4)) | 0.0292 | -0.0593 | -0.0531 | -0.2034 | -0.0867 | -0.031 | 0.0609 | 0.1209 | 0.444** | 1.0000 |

* and ** show significant at 5 % and 1% respectively.

The results of the above Table 4.13 indicate that there may be strong multicolleneraity as most of the pair wise correlations are more than 0.5 and significant. However, to detect collinearity among explanatory variables, we also calculate Tolerance, Variance Inflation Factor (VIF) and Condition Index (CI). The results are shown in Table 4.14 on next page:

**Table 4.14: Multicollinearity Diagnostics at First Difference with four lags**

| Regressor | Tolerance | VIF | Condition Index |
|---|---|---|---|
| D(FDI) | .797 | 1.255 | 2.147 |
| D(INF) | .428 | 2.336 | 2.718 |
| D(LEX) | .633 | 1.580 | 3.038 |
| D(LEXCR) | .849 | 1.178 | 3.848 |
| D(LGFCF) | .460 | 2.174 | 5.076 |
| D(LIM) | .400 | 2.502 | 6.717 |
| DLGDP(-1) | .587 | 1.704 | 8.022 |
| DLGDP(-2) | .616 | 1.622 | 9.222 |
| DLGDP(-3) | .580 | 1.724 | 11.538 |
| DLGDP(-4) | .723 | 1.382 | 13.316 |

These results in above Table indicate that the Tolerance values of all ten regressors are not close to zero which is a sign of weak multicollinearity. The variance inflation factor (VIF) of all explanatory variables is less than 10, which also indicates weak multicollinearity. Now, the Condition Index of two independent variables out of ten is more than 10 which is a symptom of strong multicollinearity.

We have used four criteria to detect multicollinearity and among these, pair wise correlations and Condition Index indicate that there is strong multicollinearity. Furthermore, the all four lags of DLGDP are insignificant which may be due to multicollinearity. So we do not rely on this regression and now apply least square regression by dropping the 4$^{th}$ lag.

### 4.5.2-2: Least Square Regression at First Difference Three Lags

As none of the four lags were significant, therefore we apply Least Square Regression by taking three lags of the dependent variables as regressors and compare these results with the previous estimated Regression with four lags. Table 4.15 on next page presented the results of OLS Regression.

**Table 4.15: Least Square Regression at First Difference with three lags**

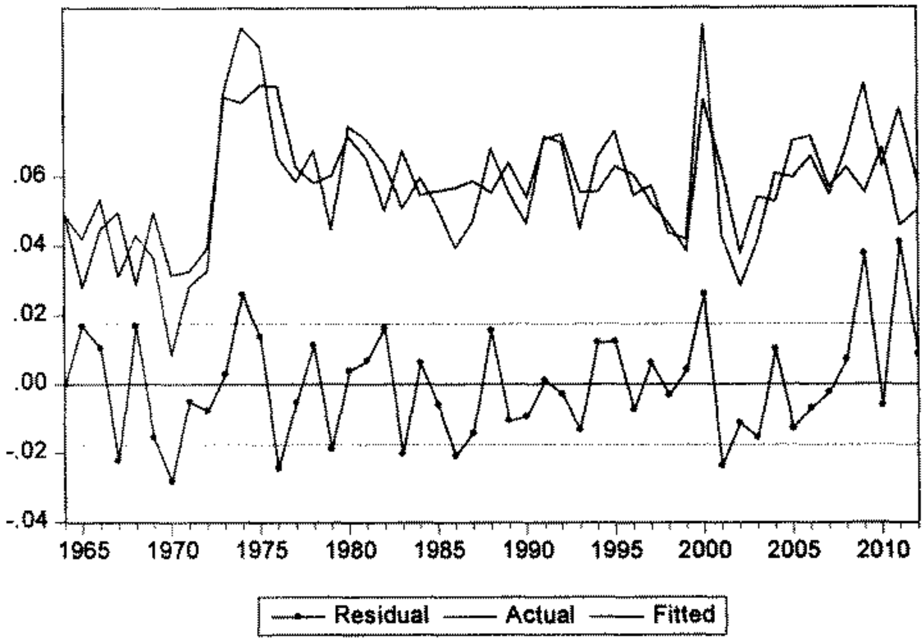
| Dependent variable: D(LGDP) | | | |
|---|---|---|---|
| variable | coefficient | t-statistic | p-values |
| C | 0.017138 | 1.633547 | 0.1104 |
| D(FDI) | −0.004898 | −0.167092 | 0.8682 |
| D(INF) | 0.000564 | 0.677110 | 0.5023 |
| D(LEX) | 0.100699* | 2.100054 | 0.0422 |
| D(LEXCR) | 0.053835 | 0.839639 | 0.4062 |
| D(LGFCF) | 0.286371** | 3.743974 | 0.0006 |
| D(LIM) | −0.004531 | −0.089069 | 0.9295 |
| DLGDP(-1) | 0.193318 | 1.385784 | 0.1737 |
| DLGDP(-2) | −0.025735 | −0.188266 | 0.8516 |
| DLGDP(-3) | 0.154597 | 1.248211 | 0.2194 |
| adj. $R^2$ | 0.436056 | ------- | ------- |
| F-statistic | 5.123871** | ------- | 0.000137 |

* and ** shows significant at 5% and 1% respectively.

The results given in the above Table 4.15 indicates that estimated least square regression is overall significant at 1% level reveals that all the explanatory variables have a joint effect on LGDP growth. Moreover, the adj. $R^2$ has been increased from 0.416612to 0.436056as compared with already estimated Regression with four lags. In OLS Regression with three lags, the coefficients of D(LEX) and D(LGFCF) are significant at 5% and 1% respectively and have not expected signs except D(LIM) and D(FDI) has a negative sign. Still the three lags are insignificant. One cause for insignificant of most of the variables is multicollinearity. It may possible that these variables are actually significant.

Now, we plot the actual and fitted values of the response variable to examine that how good our OLS Regression model fit.

**Figure 4.7: Residual plot of OLS Regression at first difference with three lags.**




The residual plot of actual and fitted values of the response variable is presented in above Figure 4.7 indicates that our estimated OLS Regression at first difference with three lags is good fit as the differences between actual and fitted values is small. After this, residual diagnostic tests were applied on this estimated least square regression and results are presented in Table 4.16 below:

**Table 4.16: Residual Diagnostic Tests of OLS Regression with three Lags**

| Test | Statistic | p-values |
|---|---|---|
| Normality Test ( Jarque- Bera) | 1.6613 | 0.4357 |
| Serial Correlation LM Test Breusch-Godfrey: (Obs. $R^2$ ) | 0.5515 | 0.7590 |
| Heteroskedasticy Test Breusch- Pagan – Godfrey ( Obs. $R^2$ ) | 9.7208 | 0.3736 |
| Sum squared resid | 0.011819 | ------- |
| AIC | –5.083854 | -------- |
| SC | –4.697769 | ------ |

These results in above Table show that residuals are normally distributed as Jarque-Bera p-value = 0.4357 > 0.05. The serial correlation is tested by Breusch-Godfrey LM Test and its p-value = 0.7590 > 0.05. Therefore, there is no autocorrelation. The Heteroskedasticy is tested by Breusch- Pagan – Godfrey Test and its p-value = 0.3736 > 0.05. This indicates that residual variances are not heteroscedastic in nature. Moreover, the sum of squared residuals is almost same as it is 0.011799 and was 0.011819 in regression with four lags and the values of AIC and SC has decreased as compared with regression in four lags.

The multicollinearity is examined by calculating pair wise correlations of all explanatory variables and the results presented in Table 4.13 indicate that there may be multicollineraity as some pair wise correlations are more than 0.5 and significant. However, to detect collinearity among explanatory variables, we also calculate Tolerance, Variance Inflation Factor (VIF) and Condition Index (CI). The results are shown in Table 4.17 below:

**Table 4.17: Multicollinearity Diagnostics at First Difference with three lags**

| Regressor | Tolerance | VIF | Condition Index |
|---|---|---|---|
| D(FDI) | .801 | 1.248 | 2.029 |
| D(INF) | .427 | 2.342 | 2.588 |
| D(LEX) | .646 | 1.549 | 2.853 |
| D(LEXCR) | .859 | 1.164 | 3.797 |
| D(LGFCF) | .491 | 2.038 | 4.819 |
| D(LIM) | .407 | 2.457 | 6.494 |
| LGDP(-1) | .588 | 1.701 | 8.345 |
| LGDP(-2) | .606 | 1.649 | 9.838 |
| LGDP(-3) | .713 | 1.403 | 11.810 |

These results in above Table 4.17 indicate that the Tolerance values of all nine regressors are not close to zero which is a sign of weak multicollinearity. The variance inflation factor (VIF) of all explanatory variables is less than 10, which also indicates weak multicollinearity. Now, the Condition Index of four independent variables are more than 5 which is too a symptom of strong multicollinearity.

We have used four criteria to detect multicollinearity and among these, pair wise correlations and Condition Index indicate that there is strong multicollinearity. Furthermore, all the three lags of D(LGDP) are insignificant which may be due to multicollinearity. So we do not rely on this regression and now apply least square regression by dropping the 3rd lag.

### 4.5.2-3: Least Square Regression at First Difference with Two Lags

As in estimated Least Square Regression with three lags, we have seen that none of the three lags are significant; therefore we apply the Least Square Regression with two lags to compare it with three lags Regression. The results are shown in Table 4.18 below:

**Table 4.18: Least Square Regression at First Difference with two lags**

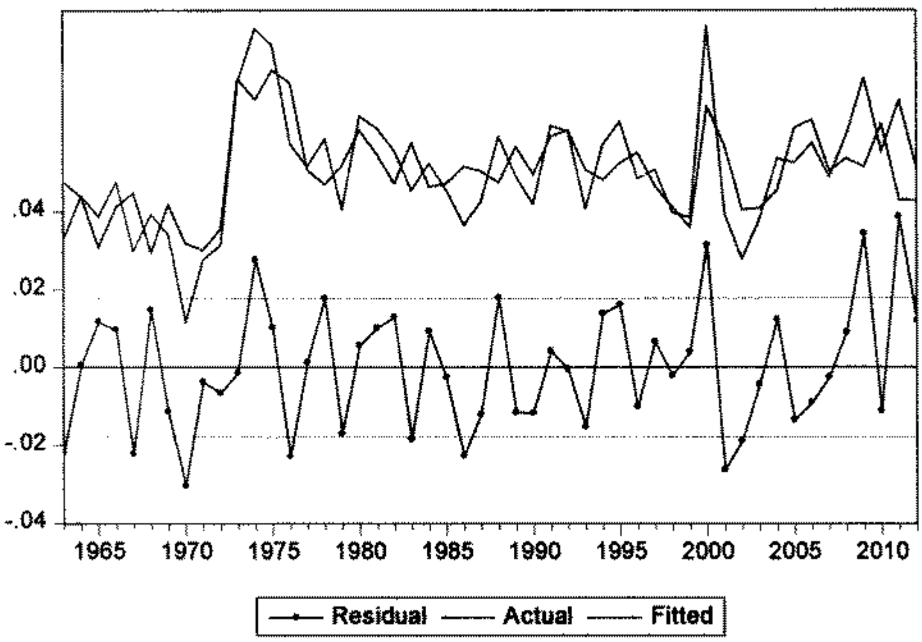
| Dependent variable: D(LGDP) | | | |
|---|---|---|---|
| variable | coefficient | t-statistic | p-values |
| C | 0.019296* | 2.084220 | 0.0434 |
| D(FDI) | 0.002113 | 0.071726 | 0.9432 |
| D(INF) | 0.000411 | 0.486790 | 0.6290 |
| D(LEX) | 0.116778* | 2.434831 | 0.0193 |
| D(LEXCR) | 0.054870 | 0.845741 | 0.4026 |
| D(LGFCF) | 0.256243** | 3.411752 | 0.0015 |
| D(LIM) | −0.015232 | −0.301443 | 0.7646 |
| LGDP(-1) | 0.224599 | 1.600111 | 0.1173 |
| LGDP(-2) | 0.065034 | 0.510068 | 0.6127 |
| adj. $R^2$ | 0.418681 | ------- | -------- |
| F-statistic | 5.411376** | ------- | 0.000113 |

* and ** shows significant at 5% and 1% respectively..

The findings of the above Table 4.18 indicates that estimated least square regression is overall significant at 1% level reveals that all the explanatory variables have a joint effect on LGDP growth. Moreover, the adj. $R^2$ has been decreased from 0.436056 to 0.418681 as compared with already estimated Regression with three lags. In OLS

Regression with two lags, the coefficients of D(LEX) and D(LGFCF) are significant at 5% and 1% respectively, whereas these same coefficients D(LEX) and D(LGFCF) was also significant in Regression with three lags. However the two lags of the dependent variable are insignificant and not expected signs. Most of the variables are insignificant which may be due to multicollinearity. But in reality they are significant. Now, we plot the actual and fitted values of the response variable to examine that how good our OLS Regression model fit.

**Figure 4.8: Residual plot of OLS Regression at first difference with two lags.**




The residual plot of actual and fitted values of the response variable is presented in above Figure 4.8 indicates that our estimated OLS Regression at first difference with two lags is good fit as the differences between actual and fitted values is small. After this, residual diagnostic tests were applied on this estimated least square regression and results are presented in Table 4.19 on next page:

**Table 4.19: Residual Diagnostic Tests of Regression with two lags**

| Test | Statistic | p-values |
|---|---|---|
| Normality Test ( Jarque- Bera) | 0.9916 | 0.6090 |
| Serial Correlation LM Test Breusch-Godfrey: (Obs. $R^2$ ) | 5.970540 | 0.0505 |
| Heteroskedasticy Test Breusch- Pagan - Godfrey ( Obs. $R^2$ ) | 6.449660 | 0.5970 |
| Sum squared resid | 0.012886 | ------- |
| AIC | −5.065769 | ------- |
| SC | −4.721605 | ------ |

These results show that residuals are normally distributed as Jarque-Bera p-value = 0.6090 > 0.05. The serial correlation is tested by Breusch-Godfrey LM Test and its p-value = 0.0505 > 0.05. Therefore, there is no autocorrelation. The Heteroskedasticy is tested by Breusch- Pagan – Godfrey Test and its p-value = 0.5970 > 0.05. This indicates that residual variances are not heteroscedastic in nature. Moreover, the sum of squared residuals has been increased from 0.011819 to 0.012886 and the values of AIC and SC has decreased as compared with regression in three lags. The multicollinearity is examined by calculating pair wise correlations of all explanatory variables and the results are presented in above Table 4.13 indicate that there may be weak multicollineraity as various pair wise correlations are less than 0.5. However, to detect collinearity among explanatory variables, we also calculate Tolerance, Variance Inflation Factor (VIF) and Condition Index (CI). The results are shown in Table 4.20 on next page:

**Table 4.20: Multicollinearity Diagnostics at First Difference with two lags**

| Regressor | Tolerance | VIF | Condition Index |
|---|---|---|---|
| D(FDI) | .819 | 1.221 | 1.941 |
| D(INF) | .430 | 2.327 | 2.422 |
| D(LEX) | .658 | 1.520 | 2.678 |
| D(LEXCR) | .863 | 1.158 | 3.840 |
| D(LGFCF) | .515 | 1.942 | 4.512 |
| D(LIM) | .428 | 2.338 | 5.899 |
| LGDP(-1) | .579 | 1.727 | 8.861 |
| LGDP(-2) | .695 | 1.438 | 10.193 |

These results in above Table 4.20 indicate that the Tolerance values of all eight regressors are not close to zero which is a sign of weak multicollinearity. The variance inflation factor (VIF) of all explanatory variables is less than 10, which also indicates weak multicollinearity. Now, the Condition Index of three independent variables are more than 5 which is too a symptom of strong multicollinearity.

We have used four criteria to detect multicollinearity and among these, pair wise correlations and Condition Index indicate that there is strong multicollinearity. Furthermore, two lags of DLGDP are insignificant which may be due to multicollinearity. So we do not rely on this regression and now apply least square regression by dropping the 2$^{nd}$ lag.

### 4.5.2-4: Least Square Regression at First Difference with one Lags

As none of the two lags are significant in above estimated Least Square Regression, therefore we now estimate OLS Regression with one lag only and compare it with earlier estimated Regression. Table 4.21 on next page presents the results of this Regression.

**Table 4.21: Least Square Regression at First Difference with one lag**

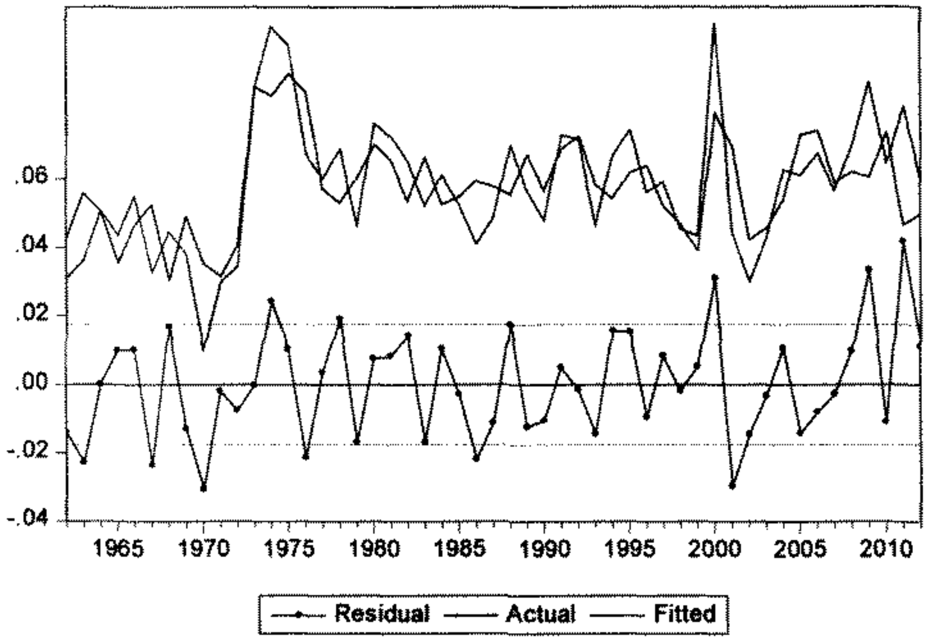
| Dependent variable: D(LGDP) | | | |
|---|---|---|---|
| variable | coefficient | t-statistic | p-values |
| C | 0.020124 | 0.589473 | 0.5586 |
| D(FDI) | 0.001281 | −1.573891 | 0.1228 |
| D(INF) | 0.000508 | 0.355680 | 0.7238 |
| D(LEX) | 0.112544* | 2.191656 | 0.0339 |
| D(LEXCR) | 0.049442 | 0.919269 | 0.3631 |
| D(LGFCF) | 0.260940** | 4.763082 | 0.0000 |
| D(LIM) | −0.021491 | −0.070259 | 0.9443 |
| LGDP(-1) | 0.277934** | 2.789859 | 0.0078 |
| adj. $R^2$ | 0.443022 | ------- | ------ |
| F-statistic | 6.681455** | | 0.000023 |

* and ** show significant at 5 % and 1% respectively.

This OLS Regression presented in Table 4.21 indicate that estimated least square regression is overall significant at 1% level reveals that all the explanatory variables have a joint effect on GDP growth. The coefficients of exports and gross fixed capital formation are positively significant at 5% and 1% respectively. The 1st lag of dependent variable LGDP is also significant. However the adj. $R^2$ has been increased from 0.418681 to 0.443022 as compared with already estimated Regression with two lags and have not expected signs except D(LIM) and D(FDI). Most of the variables are insignificant which may be due to multicollinearity. But in reality they are significant.

Now, we plot the actual and fitted values of the response variable to examine that how good our OLS Regression model fit.

**Figure 4.9: Residual plot of OLS Regression at first difference with one lag.**




The residual plot of actual and fitted values of the response variable is presented in above Figure 4.9 indicates that our estimated OLS Regression is good fit as the differences between actual and fitted values is small.

Now the residual statistics of above estimated OLS regression is shown in the Table 4.22 given below;

**Table 4.22: Residual Statistics of OLS Regression at first difference with one lag**

| Variable: Residual | Statistic |
|---|---|
| Mean | $-4.12e^{-18}$ |
| Median | –0.001408 |
| Maximum | 0.041705 |
| Minimum | –0.030656 |
| Standard Deviation | 0.016246 |
| Skewness | 0.282109 |
| Kurtosis | 2.714571 |

These results presented in above Table indicates that residuals mean and median is approximately zero and its skewness is very small and kurtosis is close to 3 which shows that residuals are nearly normally distributed.

After this, residual diagnostic tests were applied on this estimated least square regression and results are presented in Table 4.23 below:

**Table 4.23: Residual Diagnostic Tests of Regression at First difference with one Lag**

| Test | Statistic | p-values |
|---|---|---|
| Normality Test ( Jarque- Bera) | 0.8496 | 0.6539 |
| Serial Correlation LM Test Breusch-Godfrey: (Obs. $R^2$ ) | 3.9942 | 0.1357 |
| Heteroskedasticy Test Breusch-Pagan - Godfrey ( Obs. $R^2$ ) | 5.3273 | 0.6201 |
| Sum squared resid | 0.013196 | ------- |
| AIC | −5.108032 | ------- |
| SC | −4.805001 | ------ |

These results show that residuals are normally distributed as Jarque-Bera p-value=0.6539 > 0.05. The serial correlation is tested by Breusch-Godfrey LM Test and its p-value = 0.1357 > 0.05. Therefore, there is no autocorrelation. The Heteroskedasticy is tested by Breusch- Pagan – Godfrey Test and its p-value = 0.6201 > 0.05. This indicates that residual variances are not heteroscedastic in nature. Moreover, the sum of squared residuals has been increased from 0.012886 to 0.013196 and the values of AIC and SC has decreased as compared with regression in two lags.

The multicollinearity is examined by calculating pair wise correlations of all explanatory variables and the results of the above Table 4.12 indicate that there may be strong multicollineraity as most of correlations are significant and two of them are more than 0.5 and significant. However, to detect collinearity among explanatory variables, we calculate Tolerance, Variance Inflation Factor (VIF) and Condition Index (CI). The results are shown in Table 4.24 on next page:

**Table 4.24: Multicollinearity Diagnostics at First Difference with one lag**

| Regressor | Tolerance | VIF | Condition Index |
|---|---|---|---|
| D(FDI) | .816 | 1.226 | 1.849 |
| D(INF) | .480 | 2.083 | 2.235 |
| D(LEX) | .662 | 1.510 | 2.491 |
| D(LEXCR) | .920 | 1.086 | 3.694 |
| D(LGFCF) | .524 | 1.907 | 4.496 |
| D(LIM) | .444 | 2.250 | 5.627 |
| LGDP(−1) | .673 | 1.487 | 8.561 |

These results indicate that the Tolerance value of all seven regressors is not close to zero which is a sign of weak multicollinearity. The variance inflation factor (VIF) of all explanatory variables is less than 10, which also indicates weak multicollinearity. Now, the Condition Index of two independent variables are more than 5 which is too a symptom of strong multicollinearity.

We have used four criteria to detect multicollinearity and among these, pair wise correlations and Condition Index indicate that there is strong multicollinearity. In all the previous regressions, we have seen that most of the independent variables are insignificant. It is further seen that the diagnostic tests indicate the problem of multicollinearity. Therefore we solve this problem by using principal component technique.

## 4.6: Principal Component Analysis

As in the estimated least square regression, the problem of multicollinearity was arising because most of the pairs in correlation matrix are close to 0.5 and significant and Conditional Index of some regressors is more than 5. To overcome the multicollinearity problem, the methods available are principal component analysis, ridge regression and partial least square regression. But we used here the principal component analysis because the estimated coefficients derived from PCs are more stable than any other method.

The requirement of Principal components analysis is that some of the pair correlations between the variables in the analysis are greater than 0.3. For our set of variables six correlations in pair wise correlation Table 4.12 are more than 0.3.

Further the Kaiser-Meyer-Olkin, Measure of Sampling Adequacy (MSA) should be greater than 0.50 to perform the PCA. The Table 4.25 below represents the value of MSA for each variable at the diagonal:

**Table 4.25: Anti-image Correlation Matrix**

| | DINF | DLEX | DLEXCR | DLGFCF | DLIM | DFDI | DLGDP(-1) |
|---|---|---|---|---|---|---|---|
| DINF | .418[a] | −.331 | −.104 | .416 | −.411 | −.322 | .253 |
| DLEX | −.331 | .631[a] | .003 | .012 | −.306 | .179 | −.183 |
| DLEXCR | −.104 | .003 | .702[a] | .087 | .117 | .005 | −.068 |
| DLGFCF | .416 | .012 | .087 | .367[a] | −.547 | −.433 | .248 |
| DLIM | −.411 | −.306 | .117 | −.547 | .550[a] | .076 | −.005 |
| DFDI | −.322 | .179 | .005 | −.433 | .076 | .404[a] | −.657 |
| DLGDP(−1)) | .253 | −.183 | −.068 | .248 | −.005 | −.657 | .381[a] |

a. Measures of Sampling Adequacy (MSA)

The above Table represents that MSA value of all the regressors are nearly 0.5. Next we calculate the overall MSA for the set of variables that are included in the analysis. The results are presented in Table 4.26 below:

**Table 4.26: KMO and Bartlett's Test**

| Test | coefficient | p-value |
|---|---|---|
| Kaiser-Meyer-Olkin MSA | 0.456 | -------- |
| Bartlett's Test of Sphericity | 88.083** | 0.000 |

* and ** show significant at 5 % and 1% respectively.

The above Table shows that overall MSA value of all variables is 0.456 which is near to 0.5. Moreover, the Bartlett's Test of Sphericity is significant at 1% level. These two results fulfill the requirements that we can perform Principal component analysis on these variables.

After that, we will determine the number of factors that should retain in the factor solution. The Table 4.27 on next page represents the total variance explained by each Principal Component.

**Table 4.27: Total Variance Explained by Components**

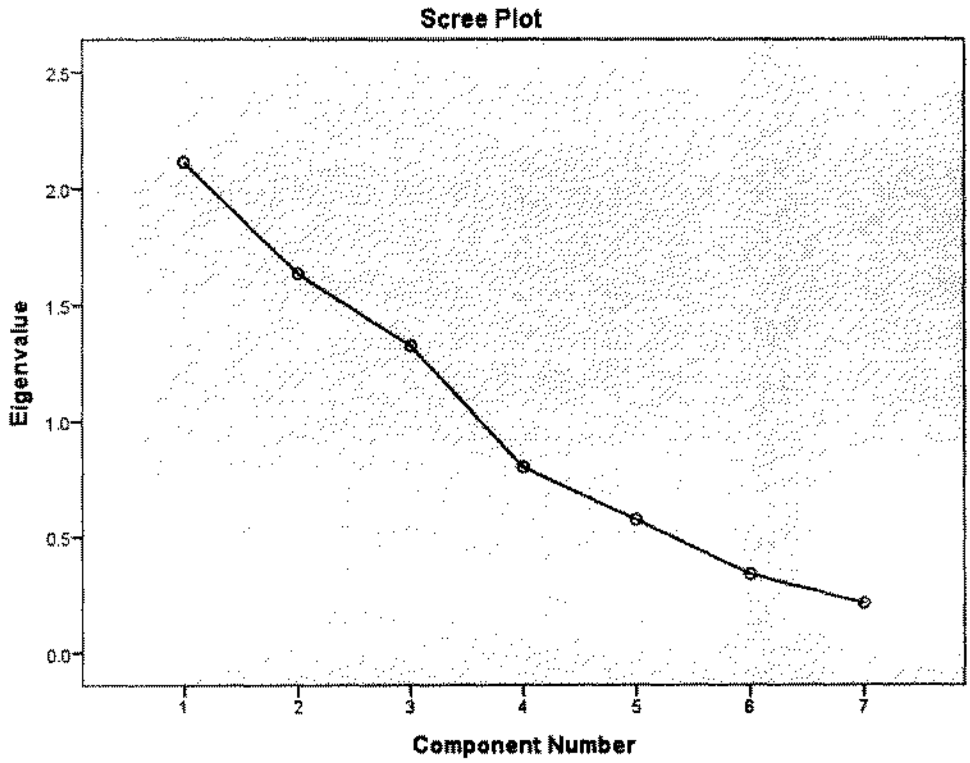
| component | Initial Eigen values | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative% | Total | % of Variance | Cumulative % |
| 1 | 2.112 | 30.175 | 30.175 | 1.588 | 22.684 | 22.684 |
| 2 | 1.633 | 23.322 | 53.497 | 1.483 | 21.188 | 43.872 |
| 3 | 1.324 | 18.912 | 72.408 | 1.202 | 17.177 | 61.049 |
| 4 | .805 | 11.500 | 83.908 | 1.165 | 16.649 | 77.697 |
| 5 | .574 | 8.196 | 92.104 | 1.008 | 14.407 | 92.104 |
| 6 | .340 | 4.857 | 96.961 | ----- | ----- | ----- |
| 7 | .213 | 3.039 | 100.000 | ---- | ---- | ---- |

The results of above Table indicates that there are five eigen values greater than 0.5. On the basis of latent root criteria, the number of factors derived showed that there were 5 components that are to be extracted for these set of variables.

On the other hand, the cumulative proportions of variance criteria require that 3 components would retain to explain 60% or more of the total variance. Here the 3 components explain 72.408% of the total variance. However, we retain 5 components to explain 92.104% of the total variance.

Next we make scree plot that will help us to decide number of principal components.

**Figure 4.10: Scree plot of the principal components.**




The above figure indicates that 4 components should keep, but we shall retain 5 components to include more variance.

Now, we obtain the rotated principal components. Table 4.28 represents the results of rotated principal components.

**Table 4.28: Rotated component Matrix**

| Rotated Component Matrix[a] | | | | | |
|---|---|---|---|---|---|
| | Component | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| DINF | .013 | −.015 | .942 | .264 | .043 |
| DLEX | .015 | .088 | .255 | .929 | −.004 |
| DLEXCR | .032 | −.118 | .028 | −.013 | .992 |
| DLGFCF | .118 | .941 | −.127 | −.017 | −.097 |
| DLIM | −.033 | .680 | .410 | .425 | −.107 |
| DFDI | .850 | .317 | .207 | −.171 | −.004 |
| D(LGDP(-1)) | .922 | −.115 | −.150 | .147 | .044 |

a. Rotation converged in five iterations.

Now we estimate the Least Square Regression on Principal components and the results are shown in Table 4.29 below:

**Table 4.29: Least Square Regression on Principal Components**

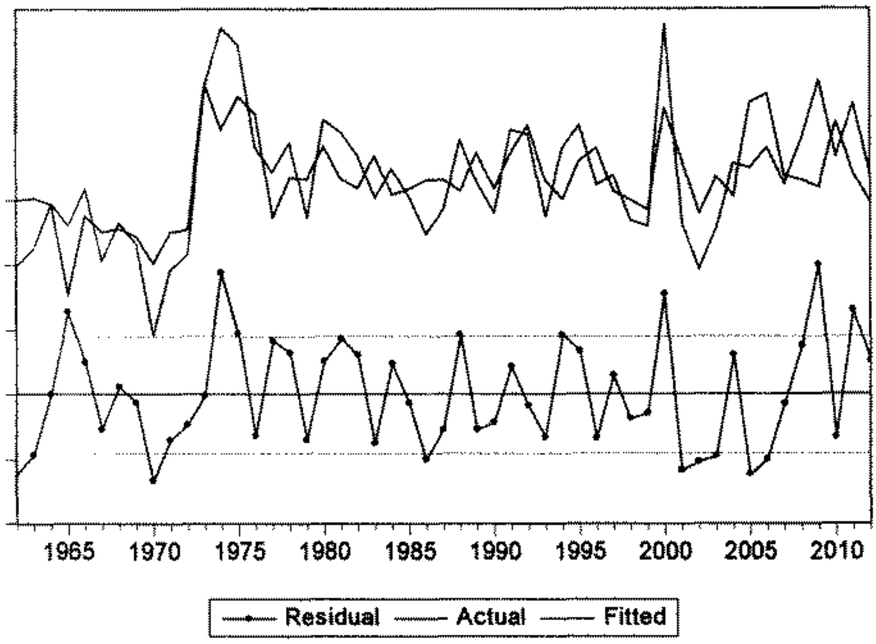
| Dependent variable: D(LGDP) | | | |
|---|---|---|---|
| variable | coefficient | t-statistic | p-values |
| C | .058** | 22.852 | 0.000 |
| pc1 | 0.006* | 2.235 | 0.030 |
| pc2 | .012** | 4.869 | 0.000 |
| pc3 | −0.002 | −.712 | 0.480 |
| pc4 | .008** | 3.233 | 0.002 |
| pc5 | 0.001 | 0.463 | 0.646 |
| adj. $R^2$ | 0.411 | ------- | ------ |
| F-statistic | 7.974** | ------- | 0.000 |

* and ** show significant at 5 % and 1% respectively.

This OLS Regression presented in above Table indicates that it is overall significant at 1% level reveals that all the explanatory variables have a joint effect on GDP growth. The value of adj. $R^2$ has been slightly decreased from 0.443 to 0.411 as compared with earlier estimated Regression in Table 4.24. However the value of F-statistic has been increased from 6.681 to 7.974. In least square regression on PC's, there are three components out of five that are significant where as in OLS Regression with one lag only three regressors out of seven are significant. The residual sum of squares has a little bit increased from 0.013 to 0.015. This indicates that Regression estimated from PC's is more reliable and best fit.

Now, we plot the actual and fitted values of the response variable on next page to examine that how good our OLS Regression model fit.

**Figure 4.11: Residual plot of OLS Regression on Principal Components.**




The residual plot of actual and fitted values of the response variable is presented in above Figure 4.11 indicates that our estimated OLS Regression is good fit as the differences between actual and fitted values is small. Now the residual statistics of above estimated OLS regression is shown in the Table 4.30 given below;

**Table 4.30: Residual Statistics of OLS Regression on Principal Components**

| **Variable: Residual** | **Statistic** |
|---|---|
| **Mean** | $-9.56e^{-18}$ |
| Median | –0.002862 |
| Maximum | 0.039734 |
| Minimum | –0.026607 |
| Standard Deviation | 0.017093 |
| **Skewness** | 0.406675 |
| Kurtosis | 2.290970 |

These results presented in above Table indicates that residuals mean and median is approximately zero and its skewness is very small and kurtosis is close to 3 which shows that residuals are nearly normally distributed.

After this, residual diagnostic tests were applied on this estimated least square regression on principal components and results are presented in Table 4.31 below:

**Table 4.31: Residual Diagnostic Tests of Regression on Principal Components**

| Test | Statistic | p-values |
|---|---|---|
| Normality Test ( Jarque- Bera) | 2.4740 | 0.2902 |
| Serial Correlation LM Test Breusch-Godfrey: (Obs. $R^2$ ) | 2.1710 | 0.3377 |
| Heteroskedasticy Test Breusch- Pagan - Godfrey ( Obs. $R^2$ ) | 2.6875 | 0.7480 |
| Sum squared resid | 0.014608 | ------- |
| AIC | –5.084826 | ------- |
| SC | –4.857552 | ------ |

These results show that residuals are normally distributed as Jarque-Bera p-value=0.2902 > 0.05. The serial correlation is tested by Breusch-Godfrey LM Test and its p-value = 0.3377 > 0.05. Therefore, there is no autocorrelation. The Heteroskedasticy is tested by Breusch- Pagan – Godfrey Test and its p-value = 0.7480 > 0.05. This indicates that residual variances are not heteroscedastic in nature. Moreover, the sum of squared residuals has been increased from 0.013196 to 0.014608 and the values of AIC has increased where as SC has decreased as compared with regression in one lag.

The multicollinearity is examined by calculating pair wise correlations among Principal Components and the results are presented in Table 4.32 on next page:

**Table 4.32: Pairwise Correlations among Principal Components**

| | Y1 =PC1 | Y2 =PC2 | Y3 =PC3 | Y4 =PC4 | Y5 =PC5 |
|---|---|---|---|---|---|
| Y1 =PC1 | 1.000 | .000 | .000 | .000 | .000 |
| Y2 =PC2 | .000 | 1.000 | .000 | .000 | .000 |
| Y3 =PC3 | .000 | .000 | 1.000 | .000 | .000 |
| Y4 =PC4 | .000 | .000 | .000 | 1.000 | .000 |
| Y5 =PC5 | .000 | .000 | .000 | .000 | 1.000 |

The results in above Table indicate that there are all zero correlations among Principal Components. However, to detect collinearity among explanatory variables, we calculate Tolerance, Variance Inflation Factor (VIF) and Condition Index (CI). The results are shown in Table 4.33 below:

**Table 4.33: Multicollinearity Diagnostics of Principal Components**

| Regressor | Tolerance | VIF | Condition Index |
|---|---|---|---|
| PC1 | 1.000 | 1.000 | 1.000 |
| PC2 | 1.000 | 1.000 | 1.000 |
| PC3 | 1.000 | 1.000 | 1.000 |
| PC4 | 1.000 | 1.000 | 1.000 |
| PC5 | 1.000 | 1.000 | 1.000 |

These results in above Table indicate that the Tolerance, variance inflation factor (VIF) and Condition Index of all Principal Components are one, which indicates no multicollinearity.

Using the above Table 4.27, we can write the Principal Components as below:

$$Y1 = PC1 = 0.013 DINF + 0.015\, DLEX + 0.032\, DLEXCR + 0.118\, DLGFCF - 0.033\, DLIM + 0.850\, DFDI + 0.922\, DLGDP(-1) \qquad (16)$$

$$Y2 = PC2 = -0.015\, DINF + 0.088 DLEX - 0.118 DLEXCR + 0.941 DLGFCF + 0.680 DLIM + 0.317 DFDI - 0.115\, DLGDP(-1) \qquad (17)$$

$$Y3 = PC3 = 0.942\, DINF + 0.255\, DLEX + 0.028\, DLEXCR - 0.127\, DLGFCF + 0.410\, DLIM + 0.207\, DFDI - 0.150\, DLGDP(-1) \qquad (18)$$

$$Y4 = PC4 = 0.264\, DINF + 0.929\, DLEX - 0.013 DLEXCR - 0.017 DLGFCF + 0.425 DLIM - 0.171\, DFDI + 0.147\, DLGDP(-1) \qquad (19)$$

$$Y5 = PC5 = 0.043DINF - 0.004DLEX + 0.992DLEXCR - 0.097DLGFCF + -0.107DLIM - 0.004DFDI + 0.044\,DLGDP(-1) \quad (20)$$

$$D(LGDP) = 0.058 + 0.006PC1 + 0.012\,PC2 - 0.002PC3 + 0.008PC4 + 0.001PC5 \quad (21)$$

Therefore, the estimated least square regression model is

Putting all values of Principal Components in above equation, we get:

$$D(LGDP) = 0.058 - 0.002171\,D(INF) + 0.009084 - 0.003216\,D(LEXCR) + 0.012021\,D(LGFCF) + 0.010435\,D(LIM) + 0.007118\,D(FDI) + 0.005672\,D(LGDP(-1) \quad (22)$$

The standard errors of coefficients are obtained by using the following formula (Fekedulegn D. B., etal 2002) given below:

$$se\,(b_j^*) = se(b_j) * se(reg)/\sqrt{\lambda_j} \quad (23)$$

where,

$j = 1,2,3 \ldots\ldots\ldots.$

$se\,(b_j^*)$ = standard error of least square regression estimates on principal components.

$se(b_j)$ = standard error of jth least square regression estimate at first difference with 1st lag.

$se(reg)$ = standard error of least square regression on principal components.

$\lambda_j$ = eigen value of the jth principal components.

**Table 4.34: Least Square Regression at First Difference derived from PC**

| Dependent variable: D(LGDP) | | | |
|---|---|---|---|
| variable | coefficient | Standard error | t-statistic |
| C | 0.05800** | 0.002538 | 22.852 |
| D(FDI) | 0.007118** | 0.00036883 | 19.2988 |
| D(INF) | -0.002171** | 1.13514E-05 | -191.254 |
| D(LEX) | 0.009084** | 0.000755766 | 12.0195 |
| D(LEXCR) | -0.003216* | 0.001270744 | -2.5308 |
| D(LGFCF) | 0.012021** | 0.001780235 | 6.75247 |
| D(LIM) | 0.010435** | 0.001547232 | 6.74430 |
| LGDP(-1) | 0.005672 | 0.005040463 | 1.12529 |

* and ** show significant at 5 % and 1% respectively.

The above results indicate that among seven regressors, the six are significant but there were only three regressors significant in least square regression without PC's at first difference with 1st lag. Moreover, the signs of partial regression coefficients are according to economic theory which was not proper in least square regression with first lag as presented above in Table 4.21. This shows that the least square regression obtained from principal components is more reliable. All the variables are significant except lag and with expected signs.

## 4.7: Forecasting

It is known fact, that forecasting is an important part of econometric analysis. It is very helpful to the countries to make their future policies. To forecast the econometric variables there are two techniques:

1. **Autoregressive Integrated Moving Average (ARIMA)**
2. **Vector Auto Regression (VAR)**

Here in our model we use the (ARIMA) model to forecast the economic variables, as foreign direct investment (FDI), Import (IM), Export (EX), Inflation (INF), Exchange rate (EXCR) and gross fixed capital formation (GFCF), to forecast the Gross Domestic Product rate as economic growth. We forecast the Gross Domestic Product rate outside the samples for next eight years (2013 to 2020). For this purpose we chose the best models to forecast each variable, using (ARIMA) model dynamically. We forecast each variable one step ahead, dynamically.

### 4.7.1: Forecasting of Gross Domestic Product

To forecast the Gross Domestic Product for next seven years we use our Least Square Regression Line that was obtained from Principal components. The econometric model can be formed as

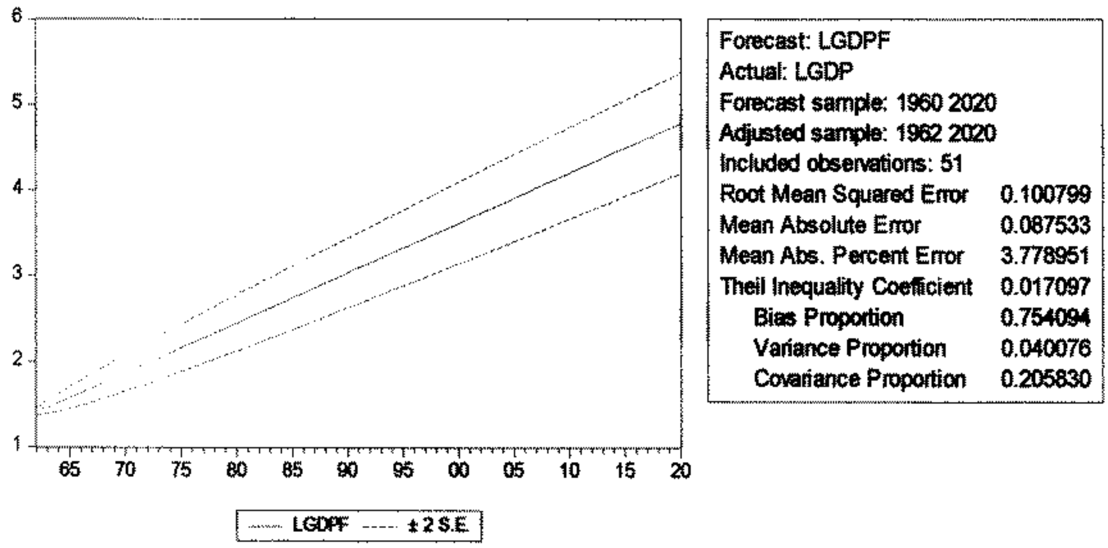
$$\begin{aligned} D(LGDP) = {} & 0.058 - 0.002171\,D(INF) + 0.009084 - 0.003216\,D(LEXCR) \\ & + 0.012021\,D(LGFCF) + 0.010435\,D(LIM) + 0.007118\,D(FDI) \\ & + 0.005672\,D(LGDP(-1) \qquad (24) \end{aligned}$$

For next eight years, the estimated values of Gross domestic product in Pakistan are as following given on next page:

**Table 4.35: Forecasting of Gross Domestic Product**

| Year | Forecast Value of LGDP | Forecast Value of GDP(billion Rs.) |
|---|---|---|
| 2013 | 4.436468 | 27319.2014 |
| 2014 | 4.502773 | 31825.3361 |
| 2015 | 4.569564 | 37116.2422 |
| 2016 | 4.63688 | 43339.1111 |
| 2017 | 4.704762 | 50671.2945 |
| 2018 | 4.773254 | 59327.2202 |
| 2019 | 4.842404 | 69567.1160 |
| 2020 | 4.912262 | 81707.5145 |

**Figure 4.12: Forecasting Graph of LGDP**




In above figure 4.12, we present the forecasting graph of log gross domestic product (LGDP). Theil inequality coefficient, variance proportions and Mean Absolute Error are very small. The forecasting of LGDP is between plus and minus 2 standard deviations.

# Chapter 5

# CONCLUSION AND RECOMMENDATIONS

The findings of this research are very interesting and the signs of least square regression coefficients are according to economic theory. Here, we explain the each of our regression coefficient individually.

The effect of foreign direct investment (FDI) on monetary development of a nation is either positive or negative. Today all the developing economies liberalizing their investment polices to attract the foreign direct investment. The FDI have a multiplier effect on the economy. The greatest consequences of execution of FDI are the increment in total profit, expanded shots of work, more prominent fares and trade of created innovation between the financial specialist and the host nation. FDI in a creating nation empowers the formation of work and usage of a wide range of assets, to embrace most present day routines for business, regarding administration and promoting, and aides in diminishment of spending plan shortfall. Another helpfulness of FDI is that it lessens the dangers and regularizes outer obligation and increases the value of the human capital. The nations with rare capital and constrained mechanical aptitudes as a rule have moderate financial development and it is striking from various studies that outside direct venture can be a wellspring of exchange of innovation and information (Dunning & Hamdani 1997). Presently, the partial regression coefficient of foreign direct investment is 0.007118 and is significant at 1%. This positive coefficient of FDI demonstrate that the Gross domestic product development rate is relied upon to increment with the increment in remote direct speculation holding the impact of every free variable consistent.

According to economic theory, inflation rate of 3% to 5% has a positive impact on economic growth but if this rate attains a double figure, it reduces the purchasing power of the consumer in an economy and as a result the aggregate demand decreases and it creates a negative impact on economic growth of a country. As we well know that in case of Pakistan, the inflation rate is nearly in double digits. The partial regression coefficient of inflation is - 0.002171 and is significant at 1%. This negative sign indicates that the inflation has a negative effect on GDP growth rate and we can say that as inflation increases, the GDP growth rate will be decreases keeping the effect of all independent variables constant. Hence for Pakistan economy, inflation has a negative impact on economic growth.

According to economic theory, when exports of a country increase, it improves the balance of payments and increases the foreign exchange reserves which ultimately bring a positive change in economic growth of a country. In this research, the partial regression coefficient of log exports (LEX) is 0.009084 and is significant at 1%. This positive coefficient of exports is according to economic theory. Therefore we can say that an increase in exports may cause to increase in GDP growth rate keeping the effect of all independent variables constant.

According to economic theory, when currency of a country depreciates, it causes to increase in export and decrease in import because when currency depreciates, exports become cheaper for the foreigner and imports become more expensive for domestic consumer. As a result this increase in exports and decrease in imports will improve the balance of payments and made a positive impact on economic growth of a country. In case of Pakistan normally our currency deprecates always against dollar and according to economic theory exchange rate should have a positive impact on economic growth but it has a negative impact because our exports are mainly agricultural products which are very cheaper in international market. On the other hand our main imports are capital goods which are very expensive, so it negatively affects the balance of payments and economic growth. The partial regression coefficient of log exchange rate is - 0.003216 which is significant at 5%. This negative sign explains that as well as the increase in exchange rate, the GDP growth rate is expected to decrease keeping the effect of all independent variables constant.

According to economic theory, when the capital formation increases, it increase the output of a country this increase in output will ultimately increase the economic growth. Hence we can say that capital formation always has a positive impact on economic growth. The partial regression coefficient of log capital formation (LGFCF) is 0.012021 and is significant at 1%. Once again this positive coefficient is according to economic theory. Thus we can conclude that an increase in capital formation of Pakistan, the GDP growth rate is expected to increase keeping the effect of all independent variables constant.

According to theory of economics, the impact of import on economic growth will be positive or negative. If a country imports are capital goods, then it creates a positive impact on economic growth. As in case of Pakistan, our main imports are capital goods which take a positive impact on Pakistan economy. Now, the partial regression coefficient of log imports (LIM) is 0.010435 and is significant at 1%. This positive coefficient of imports is again according to the theory of economics. The coefficient of imports indicates that by increasing in imports, the GDP growth rate is expected to increase keeping the effect of all independent variables constant.

## 5.1: GUIDELINES FOR POLICY RECOMMENDATIONS

Our results are likely to provide an opportunity to frame some policy implications. The regression results confirmed that an increase in FDI has positive impact on growth rate of Pakistan. Hence the authorities should positively concentrate on maximum utilization of resources to increase FDI in order to increase GDP growth rate. It needs effective and encouraging FDI attractive policies from the public sector to restore the confidence of the investors. Government should offer Business friendly environment as it provides pace to attract huge FDI.As Pakistan is a populous country and have deprived educational system therefore, fundamental attempts could be taken to attract FDI in this sector. In Pakistan the major setback against FDI growth is political instability, so to boost the economic growth of Pakistan; govt. should take solid steps to attract the foreign direct investment in the country.

### 1. Ensuring Trade Enjoyable Atmosphere

To be a focus on great FDI, business affable atmosphere must be formed on priority basis. To take the advantage of FDI, Govt. should need to increase human capital and trained labour force. According to the report of International Finance Corporation (2010), Pakistan ranked was 85$^{th}$ out of 113 countries where business environment is friendly to do business. The causes are insubstantial labor market rigidity, have no outstanding airports, ports, roads and normally 6-7 hours of load shedding. Further troubles are that of procedure to register property, investor's safety, much administration, be deficient in tax arrangement, competition regulations and too much time in enforcing contracts.

## 2. Better Education Region

Perhaps the most neglecting sector of Pakistan is education sector and its education standard is very poor. The causes of poor quality of education is less economic funding in education sector which leads to scarcity of trained and technical man power and ultimately it creates negative impact on domestic economic growth. Pakistan is extremely colonized state although its working peoples are unqualified and inexperienced. This region requires a striking amount of FDI to encourage opportunities to attract the local and foreign investors.

### 3. Improved Agriculture Sector

The financial system of Pakistan is mostly depends on the agriculture sector which is not a well-dynamic. This region is extremely trifling and the value of its production is not very fine. The insufficient economic resources, out-of-date technology and meager fertilizers require improve which could be achievable by suitable FDI. A large amount of foreign direct investment may be put in food processing; farming services, machinery and latest agriculture talent will be the desire.

### 4. Ensuring Political Firmness

A dynamic business economy needs political steadiness for its best potential results. The financial vulnerability is made because of political flimsiness and at last decrease in venture. An extraordinary sparing viability is produced by durable budgetary division and it prompts recognized financial development. However, this solid budgetary area must be prospered in political made environment. The financial specialist's certainty may lessen because of Political instability in nation. The choices are for the most part rely on upon stable political setting in business however not on the way of the legislature. In the late years a chose government is there in the nation, however remote direct speculation is rapidly diminishing. It infers that sound and stable political states of the nation must be to draw enormous measure of remote direct venture.

### 5. Better Infrastructure

Framework is vital for the financial development of a nation. The nations got to be most magnificent and striking hosts for the outside direct venture which have splendid physical base. So the economies having denied framework maybe considered as a vital premise for pulling in remote direct speculation as their boss prerequisite is to create foundation from the colossal venture

## 6. Improvement in Economy

The moving of assets from fewer elements to more productive areas of the economy shows financial amendment. Genuine development in assembling is specifically connected with the proficient advancement in the economy by reorganization in less element to the more dynamic segments of the economy. To move the assets from less element to more productive parts of the economy, remote direct venture is without a doubt concerned.

# REFERENCES


Ahmed, M.Q., Butt, S.M. and Alam, S. (2000). "Economic Growth, Export, and External Debt Causality: The Case of Asian Countries". *The Pakistan Development Review, 39(4), 591-608.*

Alfaro, L. (2003), "Foreign Direct Investment and Growth: Does the Sector Matter". Paper NO.14, Harvard Business School.

Ali, S. (2014). "Foreign Capital Flows and Economic Growth in Pakistan: An Empirical Analysis". *World Applied Sciences Journal, 29 (2):* 193-201.

Athukorala, W.P.P.A. (2003). "The Impact of Foreign Direct Investment for Economic Growth; A Case Study in Sri Lanka". 9th International Conference on Sri Lanka Studies, Paper NO.15 Matara, Sri lanka.

Atif, A.M. (2012). "Impacts of Imports, Exports and Foreign Direct Investment on the Gross Domestic Product (GDP) Growth". Proceedings of 3rd International Conference on Business Management, Lahore, Pakistan.

Atique, Z., Ahmad, H. M. and Azhar, U. (2004). "The impact of FDI on economic growth under foreign trade regimes: A case study of Pakistan". *The Pakistan Development Review, 43(4), 707-718.*

Ayanwale, B.A. (2007). "FDI and Economic Growth: Evidence from Nigeria". *African Economic Research Consortium, Nairobi Paper NO.165.*

Azam, M. (2011). "Exports and Economic Growth in Pakistan: An Empirical Analysis". *Journal of Managerial Sciences 5(2), 159-166.*

Bhagwati, J. N. (1973). "The Theory of Immiserizing Growth: Further Application. In Michael B Connolly and Alexander K. Swoboda". *International Trade and Money.* Toronto: University of Toronto Press.

Blonigen, B. (2005). "A Review of the Empirical Literature of FDI Determinants". *NBER* Working Paper No. 11299.

Cerny, C.A., and Kaiser, H.F. (1977). "A study of a measure of sampling adequacy for factor-analytic correlation matrices". *Multivariate Behavioral Research, 12(1)*, 43-47.

Dickey, D.A. and Fuller W. A. (1979). "Distribution of the Estimators for Autoregressive Time Series with a Unit Root". *Journal of the American Association, 427-431.*

Dickey, D.A. and Fuller, W.A. (1981). "Distribution of the estimators for the autoregressive time series with a unit root". *Econometrica*, 49, 1057-1072.

Dritsaki, M., Dritsaki, C. and Adamopoulos, A. (2004). "A Causal Relationship between Trade, Foreign Direct Investment and Economic Growth for Greece". *American Journal of Applied Sciences, 1(3), 230-235.*

Dunning, J. and Hamdani, A. (1997). "The new globalism and developing countries". Tokyo; New York: United Nations University Press.

Engle and Granger, C.(1987). "Cointegration and Error correction: Representation, Estimation and Testing". *Econometrica. 55, 251-261.*

Esther, O. Adegbite, Folorunso, S. and Ayadi (2011). "The role of foreign direct investment in economic development: A study of Nigeria". *World Journal of Entrepreneurship, Management and Sustainable Development, 6(1/2), 133-147.*

Falki, N. (2009)."Impact of Foreign Direct Investment on Economic Growth in Pakistan". *International Review of Business. 5(5), 110-120.*

Fekedulegn, D. B., Colbert, J.J., Jr. Hiks, R.R. and Schuckers, E.M. (2002). " Coping with Multicollinearity: An Example on Application of Principal Components Regression in Dendroecology". USDA Forest Service, Research Paper NE-721.

Gudaro, A. M., Chhapra, I. U. and Sheik, S. A. (2010). "Impact of Foreign Direct Investment on Economic Growth: A Case Study of Pakistan". *Journal of Management and Social Sciences 6(2), 84-92.*

Gujarati, D. (2003). "Basic Econometrics" (4th ed.). McGraw-Hill, New York.

Harris, R. and Sollis, R. (2003). "Applied Time Series Modelling and Forecasting". Wiley, West Sussex.

International monetray fund, (2013). "International Financial Statistics" (IFS), Washington DC.

Jayachandran, G. (2012). "FDI, Trade and Economic Growth in Singapore-Evidence from Time-Series Causality Analyses". *Journal of Research in Commerce, IT & Management, 2(9).*

Jayachandran, G. and Seiland, A. (2010). "A Causal Relationship between Trade, Foreign Direct Investment and Economic Growth for India". *International Research Journal of Finance and Economics, Issue 42.*

Jeffrey, M. and Wooldridge. (2007). "Introductory Econometrics: A Modern Approach" (3rd ed.) 894.

Johansen, S. and Juselius, K. (1990). "Maximum Likelihood Estimation and Cointegration with Applications the Demand for money". *Oxford Bulletin of Economics and Statistics, 52(2), 169-210.*

Johansen, S.(1988). "Statistical Analysis of Cointegrating Vectors". *Journal of Economics Dynamics and Control, 12(2), 231-254.*

Johnson, A. (2006). "The Effects of FDI Inflows on Host Country Economic Growth". *Royal Institute of Technology, Sweden. CESIS Working, Paper No. 58.*

Kemal, A.R., Musleh ud din, Usman, Q., Lloyd, F. and Colombage, S.S. (2002). "Exports and Economic Growth in South Asia: A Study prepared for the South Asia". Network of Economic Research Institutions.

Khan, A.M. (2007). "Foreign Direct Investment and Economic Growth: The role of Domestic Financial Sector". *Pakistan Institute of Development Economics Islamabad, Pakistan. Working Paper NO.18.*

Khan, K. and Leng K (1997). "Foreign Direct Investment, exports and Economic growth". Singapore. *Economic Review. 42(2),40-60.*

Kundan, M.P. and Gu,Q. (2010). "A Time Series Analysis of Foreign Direct Investment and Economic Growth: A Case Study of Nepal". *International Journal of Business and Management Sciences*, 5(2).

Liew, S.K.V. (2004). "Which Lag Length Selection Criteria Should We Employ?" *Economics Bulletin*, 3(33), 1–9.

Marshall, A. (1890). "Principles of Economics", London: Macmillan.

Melina, D., Chaido, D. and Antonious, A. (2004). "A Causal Relationship between Trade, Foreign Direct Investment and Economic Growth for Greece". *American Journal of Applied Sciences*, 1(3), 230-235.

Muhammad, A. (2007). "Economic Growth and Foreign Direct Investment: The Role of Domestic Financial Sector", PIDE Working Papers No.18.

Naseer, A.M. (2013). "A Causal Relationship between Trade, FDI, Exchange Rates and Economic Growth of Pakistan". *African Journal of Business Management.* 7(21). 2020-2025.

Nguyen, T.H. (2011). "Exports, Imports, FDI and Economic Growth". Discussion papers in economics: working paper no. 11-03. University of Colorado at Boulder, Boulder Colorado.

Nurkse, R. (1961). "Further Comments on Professor Rosenstein-Rodan's Paper. In Howard S. Ellis, assisted by Henry C. Wallich (eds.)". *Economic Development for Latin America,* Proceedings of a Conference held by the International Economic Association. London: Macmillan.

Pesaran, H.M., Shin, y. and Smith, R.J. (2001). "Bounds Testing Approaches to the Analysis of long-run Relationships". *Journal of Applied Econometrics*, 16, 289-326.

Pesaran, M.H. and Pesaran, B. (1997). Working with Microfit 4.0: Interactive Econometric Analysis, Oxford University Press: Oxford.

Pesaran, M.H. and Shin, N.Y. (1999). An autoregressive distribution lag modeling approach to cointegration analysis, in S. Strom (ed.), Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. Cambridge: Cambridge University Press.

Phillips, P.C.B. and Perron, P. (1988). "Testing For a Unit Root in Time Series Regression". *Biometrika, 75(2).*

Qayyum, U. and Mahmood, Z.(2013). "Inter-linkage between Foreign Direct Investment and Foreign Trade in Pakistan: Are they Complements or Substitute"? *Pakistan Institute of Development Economics Islamabad, Pakistan. Working Papers NO. 91.*

Saqib, N., Masnoon, M. and Rafique, N. (2013). "Impact of Foreign Direct Investment on Economic Growth of Pakistan". *Advances in Management & Applied Economics*, 3(1), 35-45.

Thomas, H., Li, X. and Liu, X. (2008). "Ownership Structure and Now Product Development in Transnational Corporation in China". *Transnational Corporations*,17(2),17-44.

Tiwari, K. A. and Mutascu, M. (2011). "Economic Growth and FDI in Asia: A Panel-Data Approach". *Economic Analysis & Policy*, *41*(2).

UNCTAD .(2005). "United Nations Conference on Trade and Development", *World Investment Report 2005*, New York and Geneva: United Nations.

Wijeweera, A., Villano, R. and Dollery, B. (2007). "An Econometric Analysis of Economic Growth and FDI Inflows: A Stochastic Frontier Analysis". *The Journal of Developing Areas, 43*(2), *143-158.*

World Bank, (2013). World Development Indicators (WDI),Washington, DC.

Yan, X. and Pokhrel, K. M. (2011). "Relationship between Foreign Direct Investment and Economic Growth: Case Study of Nepal". *International Journal of Business and Management, 6*(6).

Yao, S. (2006). "On Economic Growth, FDI and Exports in China". *Applied Economics, 38(3), 339-351.*

Zaidi, S. A. ( 2005). "Issues in Pakistan's Economy". (2nd ed.) Revised and Expanded, Oxford University Press.

Zakia, M. and Ziad, A.(2007). "The Impact of Foreign Direct Investment and Imports on Economic Growth: The Case of Jordan". *Journal of Economic and Administrative Sciences,* 23(1), 1-31.

Zhang, K.H. (2001). "Does Foreign Direct Investment Promote Economic Growth? Evidence from East Asia and Latin America". *Contemporary Economic Policy*, 19(2), 175-185.