AN ECONOMETRIC ANALYSIS OF REMITTANCES AND ITS VOLATILITY ON ECONOMIC GROWTH OF PAKISTAN

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2017

MS
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IME

Economic growth - Pakistan
Real gross domestic product.
Remittances.
Volatility
Co-integration

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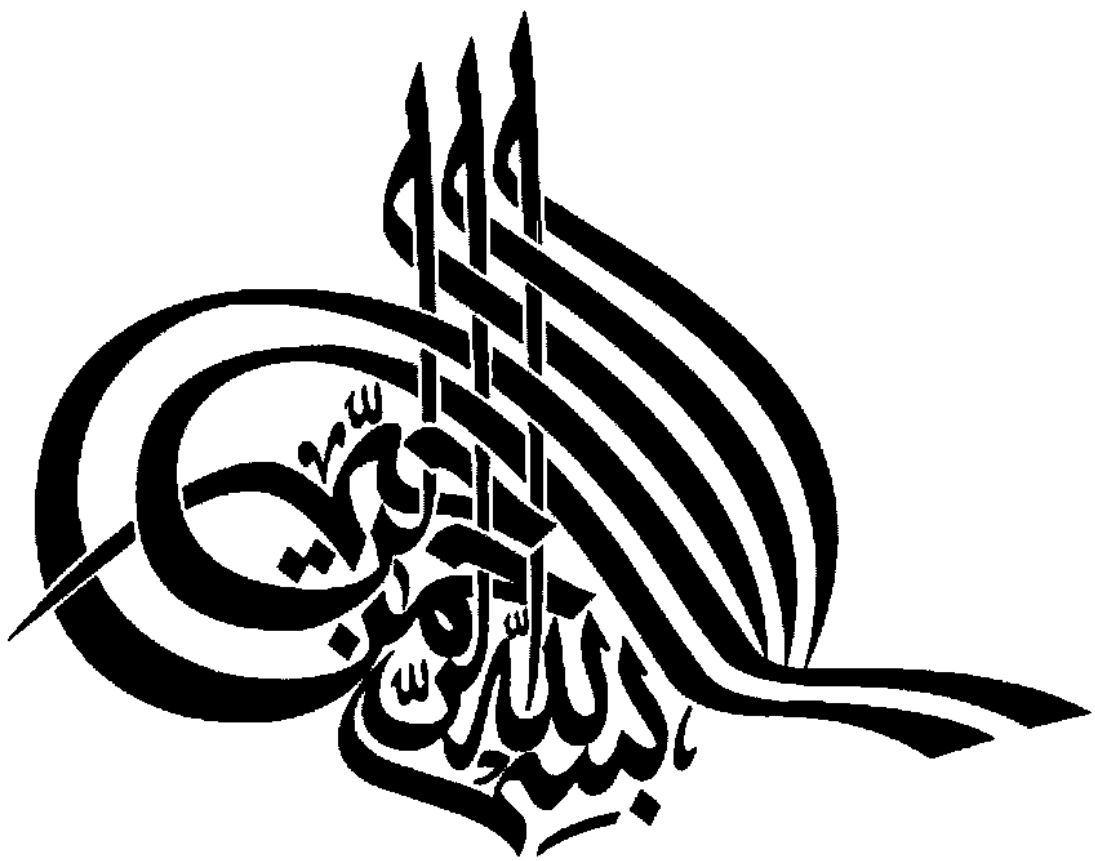
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A Dissertation
Submitted in the Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
IN
STATISTICS

Supervised by

Prof. Dr. ZAHID IQBAL

Department of Mathematics &Statistics
Faculty of Basic and Applied Sciences
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Certificate

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By

Imran Kamal

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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2017

Dedication

To my family,
For the endless support and patience.

To my Teachers,
For the constant source of Knowledge and Inspiration.

To my friends,
The ones that are close and the ones that are far.

Forwarding Sheet by Research Supervisor

The thesis entitled **"AN ECONOMETRIC ANALYSIS OF REMITTANCES AND ITS VOLATILITY ON ECONOMIC GROWTH OF PAKISTAN"** submitted by **IMRAN KAMAL** (Registration # 35-FBAS/MSST/F13) in partial fulfillment of M.S 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 (IIU) Islamabad rules and regulations.

Dated: 20/04/2017

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ACKNOWLEDGEMENT

All the praises to Almighty ALLAH the most gracious, the most merciful and the creator of all the creature in the creature. Thanks to ALLAH and his Prophet (P.B.U.H). There are few people who made this journey easier for me with their encouragement and ideas.

I express my gratitude to my supervisor **Prof. Dr. Zahid Iqbal** for his regardless and inspirational efforts and moral support throughout my research carrier as well as the **Prof. Dr. Ishfaq Ahmad, Prof. Dr. Akbar Awan and Prof. Dr. Irshad Ahmad Arshad** for their sound advices and lots of good ideas were very helpful to me. I would have been lost without them. May ALLAH bless them with all kinds of happiness and success in their life and may all their wishes come true. I am also thankful to Chairman Department of Mathematics and Statistics **Dr. Arshad Zia** for providing such necessary facilities. I express my sincere appreciation to all the helpful staff of the Mathematics Department IIUI.

An expedition is easier when you work together; interdependence is certainly more valuable than independence. University is an enjoyable place to work and eve more, especially when friends are around. My friends are source of laughter, joy and support. I am indebted to my friends and class mates for providing a stimulating and fun filled environment. My thanks go in particular to **Fida Hussain, Muhammad Waqas Ch., Shahid Rauf, Ehtsham Ashraf, Shakeel Ahmad,** especially MS class fellows being around and sharing several good times during my stay in the university. Thank you does not seem sufficient but it is said with appreciation and respect to all of them for their support, encouragement, care, understanding and precious friendship. My gratitude is to the **Dr. Ayaz-ul-Haq** and my colleagues at University of Central Punjab (UCP). I would like to thanks to everybody who was important to successful realization of this thesis as well as expressing my apology to those that I could not mention.

Last, but not least my deepest gratitude does to my beloved parents, brothers, sister and my family for their endless love, prayers and encouragement, for which my expression of thanks does not sufficient. I offer my great regards and blessings to everybody who was indirectly important to the successful realization of thesis; your kindness means a lot to me.

IMRAN KAMAL

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 **Prof. 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.

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Acronyms

AC	Autocorrelation
ADF	Augmented Dickey Fuller
AIC	Akiaike Information Criteria
ARCH	Auto Regressive Conditional Hetrosedasticity
ARDL	Auto Regressive Distributed Lag Model
ART	Auto Regressive Test
BGSC	Breusch-Godfrey Serial Correlation
CIT	Cointegration Test
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares
EG	Economic Growth
ER	Exchange Rate
FDI	Foreign Direct Investment
GARCH	Generalized Auto Regressive Conditional Hetrosedasticity
GC	Gross Capital
GCT	Granger Causality Test
HDI	Human Development Index
HT	Heteroskedasticity Test
INV	Investment
IV	Instrumental Variables

JBT	Jarque-Bera Test
JJ	Johansen and Juselius
LF	Labor Force
LR	Literature Review
OLS	Ordinary Least Square
PAC	Partial Auto Correlation
PR	Personal Remittances
RESID	Residuals
RGDP	Real Gross Domestic Product
RT	Ramsay test
SIC	Scherwaz Information Criteria
ST	Stability Test
TO	Trade Openness
UCP	University of Central Punjab
VECM	Vector Error Correction Model
VO	Volatility
WB	World Bank
WDI	World Development Indicator

Abstract

The present study investigates the impact of remittances and its volatility on economic growth of Pakistan by using the data on seven economic variables for the period from 1980 to 2015. The study develops two different sensitive models to explore the relation between economic growth and the remittances. First, the test of the original basic model checked the effect of remittances on economic growth, and second, it checked the impact of volatility of remittances on economic growth by using different proxies. Co-integration technique developed by Johansen and Juselius in 1990 has been used to estimate the models, and to identify the presence of a long run relationship between worker's remittances and economic growth in Pakistan. Results indicate that long-run relationship between economic growth and six independent variables (Personal Remittances, Investment, Trade Openness, Labor Force, Gross Capital and Human Development Index) measured by real GDP (dependent variable) holds and exist, and remittances have positive impact on economic growth in the long run.

Vector Error Correction Model (VECM) is used to estimate the short term disequilibrium among the variables. Short-term causality or short-run relationship from all the independent variables to dependent variable is measured by using Wald-Test. Granger test was applied to measure the unidirectional and bidirectional causality.

After the confirmation of the hetrosedasticity in the error term, ARCH and GARCH models were used to examine the impact of volatility on growth. The results of the model are significant, explaining the existence of auto regressive conditional hetrosedasticity in the model. The study finds that generalized auto regressive hetrosedasticity and volatility exist among the residual terms. The study also indicates that volatility of the personal remittances influences the volatility of real gross domestic product positively.

Key Words: Economic Growth, Real Gross Domestic Product, Remittances, Pakistan, Volatility, Co-integration.

CHAPTER 1

Introduction

Remittances are considered as the vital source of foreign exchange inflow in Pakistan since the early 1970s. Remittances are defined as the incomes sent to the family by members who are living and working abroad. For the past four decades, Pakistan received a significant amount of remittances which take account for percent of its GDP. However, large fluctuations were also seen in the inflow of remittances. Since the 9/11 invasion of remittances in Pakistan has improved abruptly from US$ 1080 million in the year 2000 to US$ 177407 million in 2010 and further to US$ 271050 million in 2015 (World Bank 2015). This study attempts to gauge the impact of remittances and its volatility on economic growth of Pakistan by using the seven important macro-economic variables (Real Gross Domestic Product, Personal Remittances, Investment, Trade Openness, Labor Force, Gross Capital and Human Development Index) for period 1980 to 2015.

The incursion of remittances increases the economic growth positively by dropping current account deficit, refining the balance of payment positions, and varying dependence on outer borrowing (Iqbal and Star, 2005). In developing countries, remittances play a vital role in the reduction of the poverty and the increment in the Human Development Index (HDI), through financing schooling and medical services (Gupta, 2009).Studies conducted by Chami *et al* (2003), argues that remittances have a negative impact on economic growth as the large amount of remittances discourages the labor force participation. Therefore, it is debatable that whether remittances play a positive role in economic growth of a country or not? Migrants send additional amount to the home to compensate the countrymen in the hard times of the country and throughout monetary crisis, natural disasters, or civil wars the remittances lean towards to rise (Orozco, 2003).

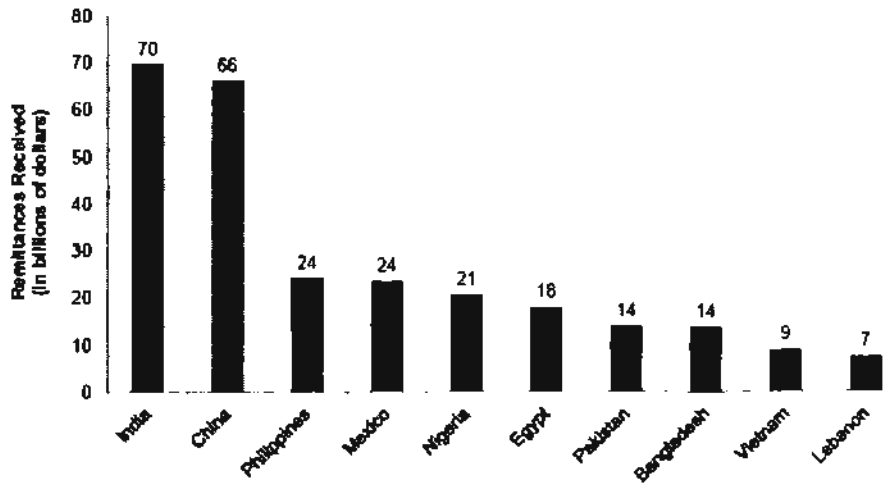
Most of the studies on impact of remittances on economic growth conclude that remittances have strong positive effects on Pakistan's economy in terms of investment, decline in the current account insufficiency, burden of the external loan, and improved education/skills of the families. Migration of the skilled labor from a country composes a valid reason of foreign reserves (Naseem *et al,* 2004). Kemal and Siddiqui (2006) have discovered effect of remittances on welfare and poverty in Pakistan. During 1990s, poverty in Pakistan rose due to decline in remittances which has been shown by many studies. In past most of the studies in Pakistan use appraisal statistics and they had flouted the connection among remittances with its volatility by empirically examining the influence of remittances on economic growth.

In the last two decades major invasions in remittances have been observed in South Asian countries. The principal cause of increase in the remittances from the last two decades is due to the migration of people from developing countries to advanced countries (World Bank, 2007).

To measure the association between economic growth and remittance most of the studies utilized the annual time series data. To investigate the impact of remittance and its volatility, on economic growth this study is a forge contribution to the literature in Pakistan. The method of co-integration technique is used to the long annual time series data from the period of 1980 to 2015 to analyze the relation between economic growth and incoming cash.

In Pakistan this study will be very useful to analyze the instability of incoming cash on economic growth. Skilled labor force is one of the problems of many countries in the world and Pakistan like many other countries is a major and important source of skilled labor force. In Pakistan remittance is a major source of income. The country like Pakistan heavily depends on foreign capital inflows, and economic growth may be affected by volatility in the workers remittances. To check the effect of workers' remittances and its volatility on the economic growth is the essential issue in Pakistan. In this study long term annual time series data is used to measure the desired relationship of economic growth and remittance in Pakistan. Pakistan stands in top ten countries in receiving

remittances in the world (World Bank 2011, 2012). Pakistan stood seventh in the world in receiving remittances, World Bank (2012). It is the need of the time to analyze the impact of remittances and its volatility in Asian countries on economic growth.



Source: World development indicators (2012)

Figure 1.1: Top Remittance recipient countries

To determine the robustness of outcomes of long run coefficients, different analyses are used firstly to analyze the robustness of the primary results new variables are used in the model and then different proxies are used for volatility of workers remittances.

In south Asia to check the connection between remittances and economic growth bivariate model have been used in many previous studies, Paul *et al* (2011), Siddique *et al* (2012). Spurious results is always a major concern in econometric analysis and the chances of spurious results become more high in using bivariate modeling because it has a problem of Omitted variable bias, Tang *et al* (2009). In this study we have used the production function framework to avoid the problem of spurious results and with the presence of capital and labor, remittance and its volatility economic growth will be affected have been proven by evidences.

Remittances is now becoming one of the hot and burning topic of discussion in the world. In the recent years incoming flow of cash has increased sharply. Studies between the remittances and economic growth have not been done frequently. In developing countries remittances were US$165 billion in 2005(World Bank).

Studies proved that the remittances played a vital role in betterment of educational and housing facilities, Adams (2005), as well as Kanaiaupuni (1998) showed that it plays role in reducing the mortality rates. Additionally, it can also be seen in many of the empirical studies that remittance arouses the economic activity and business, Durand *et al* (1996) and Woodruff and Zenteno (2007).

Remittances influence the economic growth directly or indirectly, Buch *et al* (2002). Policies of the government, the ground stability and economic atmosphere also matter in incoming investments. In empirical studies made by Chami *et al* (2005) by using the method of framework of hazard effect have found a negative effect between the economic growth and remittance, least square two stage models was used by introducing (IV) instrumental variables. Countries with low monetary development have a strong positive relationship between cash and growth Giuliano and Ruiz-Arranz (2006). They used the pooled data and (GMM) technique to analyze the data. Another study suggest that due to increasing ability of the savings in the country growth may have positive impact with incoming cash, Ziesemer (2007).

Economic growth and investment have significant and positive relationship. Assets play a facilitator between remittances and economic growth. Indirect relations between incoming cash and growth have been observed in many of the previous empirical studies. Economic growth can be promoted by incoming cash through different facilitating channels which are boosting business market for example insurance, expenditures, capital formation for finance and foreign borrowings. Empirically it has been proven in many of the previous studies that economic growth can be promoted by incoming cash, Ramirez (2013), Lartey (2011), Adenutsi (2011) and Pradhan *et al* (2008).

Contrary to the other ideas, some studies indicate that remittances reduce the economic growth. When a person totally relies on remittances and does not become the active part of the economic growth then economy reduces, Chami *et al* (2005). Faster cash inflow in the system can also be destructive for country economy as it also discourages the exportation which leads to basis in decrease in business competition, Lopez *et al* (2007).

The main objective of the study is to investigate whether the cash inflow is causing the growth or not in Pakistan and also to determine causality relationship between growth and remittances.

In many developing countries to check the association between the cash inflow and economic growth panel data have been used in many previous empirical studies. Cross country data makes it difficult to specifically address the problem of a country. It is said that if the purpose of the remittances is altruistic then with the passage of time amount of remittances. Migrant feel pleasure to send cash to his family as a result of his association with the family members, Stalk (1991).

Another aspect of the remittances is self-interest by a person who is migrant in another country-land and the main reason behind this is that he can earn more because the interest rates which will be much higher in homeland soil as compare it to the worker's place.

Another theory says that migrant sometimes have to set a deal with the family that when he will be settles gradually has to remit to the members of the family because the family has already sponsored him for his emigration expenses, Poirine (1997) and Brown (1997). Financial conditions of the person does matter in this condition.

Co-insurance theory says that the belief on this is theory is very strong that the destination country has better economic conditions. Therefore a family forcefully sends a person abroad to improve their economic conditions. Family members also facilitate and support the migrant in his bad times.

In the developing countries incoming cash flow has getting the magnificent attention in the rural areas. In rural areas incoming cash is contributing overall income inequality, poverty reduction, investment and reducing unemployment, Stark (1986), Taylor (1988) and Adams (1991).

According to the report of World Bank (2011) although in many of the past studies relation between payments and growth sector have been studied but the volatility in remittances on growth is not yet enlighten properly, so this study is the contribution to measure the impact of volatility of cash inflow on growth. In 2011 in Africa above 50%

of the remittances have been received through illegal sources and this is more difficult to exactly measure the accurate amount of size of remittances.

Remittances short term impact on economy has shown contradiction results by, Oberai and Singh (1980), Knowles and Anker (1981). Past theory says that direct impact of remittances cannot be captured directly on short term income inequality. In the long run financing amount always increases assets to the receiving family.

Rural total income only shares a part of the cash studied by Yitzhaki (1985), Stark (1988). Lacking environment of business activities in the country many empirical studies reflect that remittances not playing a positive role in improving economic conditions of rural areas (Stark, 1982).

If the local and labor market is imperfect ten remittances may also influence the overall production decisions on risk-averse household farms.

Source of foreign exchange in many of the developing countries is remittances. The foreign exchange reserves are used to meet different requirements by the Government. In Pakistan which is also a developing country foreign exchange reserve is always a problem like other developing countries. Increasing invasion of remittances overcomes the problem of shortage of foreign exchange reserves may be overcome by the invasion of remittances. Faini (2006), Fayissa and Nsia (2010), Chami *et al* (2003), Mohammed (2009) used to check the influence of remittance on economic growth by using the cross sectional and panel data. Positive effect of the remittances on economic growth have been seen in many of studies which have been conducted by using the time series data by Fayissa and Nsiah (2010), Faini (2006), Azam and Khan (2011). However some empirical studies of time series have been found that remittances have a negative impact on economic growth by Waheed and Aleem (2008), Chami *et al* (2003), Karagoz (2009) Jawaid and Raza (2012).

Sectoral disaggregated analysis of incoming cash on production imports, consumption and capital formation have been analyzes by some of the empirical studies. Living standards and spending behavior of the individuals with the aggregate and with the local effects have been studied in some studies.

Migrants lead more than $325 billion to their homeland in 2010 which is a much higher official in developing countries and this amount does not include the unofficial amount which is also included in the system. In many developing countries large amount of cash inflow is coming in the system as by each coming day more people are shifting abroad. Many studies have shown mixed impact of remittances and growth.

Researches also plied that large amount of remittances reduces the growth in the long run as the work force reduces. Remittances impose a strong positive impact on the country's credit rating, a permanent source of foreign reserves; restrict the panic, also used for different development purpose, Ratha, Mohapatra, & Scheja (2011).

Increasing cash flow in the country also reduces the poverty. In the long run growth will be decreased negatively as the migration of skilled people is higher than unskilled labor. In Pakistan female migration of skilled labor is higher than unskilled labor in the rural areas, Adams (2003), Docquier, Lohest, & Marfouk (2007).

In Many South Asian countries remittance has strengthen the economy Recent reports enlighten that in the developing countries workers have sent a large amount of remittances which is one of the source of boosting the economy, World Bank (2003). In 2010 more than $400 billion were transferred as a remittance in the world wide and in the developing countries this amount was above $325 billion. Remittances contribute 10% of GDP in the developing countries. Foreign direct investment which is also a major source of growth was almost equal to the remittances in the developing countries in 2011 World Bank (2011).

Studies made by Barajas, Chami, Fullenkamp, Gapen, & Montiel (2009) shows that many official and unofficial channels have been used for shifting the cash inflows for example more than 300 billion dollars in 2009 was moved through legal bases and billions of dollars were transported through illegal stations. Studies of the Nyamongo and Misati (2011), Aggarwal *et al* (2010) shows that when the remittances are transform legally financial growth is always positively boosted skyward, side by side many evidences collected by Aggarwal *et al* (2010) also emphasize that development in financial sector also directly linked with the economic growth and productive investment. Sometimes if

the finance sector of the country is improving rapidly then the growth has less or not affected by the cash inflow.

Report of the world bank which they publishes in 2012 says that in Africa although the amount of remittances is considerably increasing over the years in Guyana but these remittances not have a significant effect on growth (World Bank, 2012).Report of the World Bank also says that in Africa a large and significant amount of remittances are coming through illegal sources.

In the development of a country how much remittances are contributing their part is a debatable topic. Many studies have been done that impact of remittances is positive or negative on human development index in south Asian countries especially in Pakistan. Writers have investigated that the remittances recovers the all loses. Standard of living of the societies and what is their spending is also analyzed in many of the past studies.

Over the past two decades it has been shown in many of the past empirical studies that rapid cash inflow has a strong effect on economic growth in Pakistan. On the other hand employee migration also contributing in reduction of poverty and improving the overall level of the society in Pakistan.

Side by side in many other studies like Kemal has said in his empirical study that due to deterioration in transfers level in 2006 society grooming and welfare level is also decreased, (Kemal, 2006) .

like all others developing countries in Pakistan remittances is now becoming a source of strengthen the economy and remittance is now one of the largest and essential source which is turning the economy in positive mode in Pakistan. By becoming the second largest pillar of the economy remittances have compressed many other foreign sources i.e. foreign aid, direct foreign investment and many other flows of private capital (World Bank, 2013). A large cash inflow in the system is playing a significant effect in the reduction the poverty level of the country but yet the disparity in income not reformed the considerably, Bisogno and Chong (2002), Adams and Page (2005), Duval and Wolff (2010) Adams and Cuecuecha (2013). It is said that due to the international migration remittance will reduce inequality in income.

Impact of remittances on HDI has been studied and supporters suggest that net cash inflow improve the living standard, increase the household stock in health and education learning's also that remittances are essential for the imports and assets. As the remittances sometimes cause inflation so their effect on growth may be negative in the sense that by increasing the inflation workers contribution towards economic will decrease and it will reduce the economic growth in the long run, Chami *et al* (2005), Glytsos (2002) Leon-Ledesma and Piracha (2004).

Globally the net cash inflow will increase up $710 by the end of 2016 mentioned in World Bank report which they published in their annual report.

Increasing prices of fuel and increasing behavior of goods commodities and high food prices have increase the hunger throughout world and especially in poor countries World Bank (2011).Poverty level have been decreased rapidly up to 45 million people due to an increase in the food prices over the world.it is expected that further 10 million people may fall into poverty if further 10% food prices increases in next two years.

In the past any studies have been made on the household distribution variability with the shock prices and its volatility in developing countries. Incoming cash inflow also plays to reduce the effect of shock prices of food.

In the current decade flow of remittances was 335 billion dollars till the year 2010 in developing countries Ratha *et al* (2010). In the many developing countries of the developing world incoming cash is a major source of stable economic activities.

Objectives of the Study

a) To check whether in Pakistan remittances has a relation with economic growth through different macroeconomic variables.

b) To check significance of volatility in the remittances on the economic growth of Pakistan.

c) To check the causality effects of the remittances and other indicators.

Organization of the study

The rest of this thesis is organized as chapter 2 discusses the relation of economic growth and remittances in detail by covering the time period from 1980 to 2015 in Pakistan by reviewing the literature. Data, specification of econometric model and methodology are discussed in chapter 3. Significance of the results is discussed in chapter 4, followed by chapter 5 that concludes the overall study with future aspects.

CHAPTER 2

LITERATURE REVIEW

Rudimentary aim of the literature review is to study the specified topic by keeping main objectives in mind. To study the historical background of the current study, introduction of the topic, research questions, concepts and claims, conclusions and decision made on the basis of the results covered by the researchers. It's also managed to display the references of the studies, as well as helpful in identification of information new ideas relevant to the project, and to recompile the perceptive of the study.

Taylor (1991) worked on remittances and inequality reconsidered direct, indirect and inter temporal effects. He apropos the technique to test direct, indirect and inter-temporal effects of migratory remittances on the scale of distributions of wealth estimated through the Gini Coefficient. He also compared empirical findings and current findings derived by the new given method. They results showed that new influences on income inequality if policymakers are not apatbetic to the distributional impact of growth plans and strategies.

Iqbal *et al* (2005) worked on economic growth of Pakistan due to the workers remittances contribution by taking the data of 1972-2003. Results showed that the remittances are positively associated to the GDP growth of Pakistan, as well as the incoming cash from abroad appeared as the most prominent on number third as foreign investment. Results also illustrated that without the remittances the monetary terms, exchange rates and the fiscal policies were much under compression.

Bugamelli *et al* (2006) worked on the output growth volatility and remittances. The contribution was made by adding the Globalization variable that is one of the most important variables, including international emigrants. The analysis was performed by comprising on the realistic structure taken from the prevailing literature to a sample of about 60 growing and emerging economies from the period 1980-2003. Outcomes

showed robustness proofs that remittances are not positively correlated to productivity of growth instability. IV i.e. Instrumental variable guesstimates support our perceptions about the trend of causality.

Aggarwal (2008) check the impact of the remittances on the financial developments by investigating the data of the 109 developing countries and length of the data ranging from 1975-2007. The relationship of the both factors were measured and the cumulative level of deposits and credit intermediated by the indigenous finance areas. As well as the results illustrated the positive and robust relation among the financial developments in the developing countries and remittances.

Qayyum *et al* (2008) checked the influence of the remittances to uplift the economic development and to reduce the scarceness of wealth, on Pakistan data ranging from 1973-2007 by applying the ARDL technique. Except NWFP all other areas of Pakistan showed poverty reduction due to the remittances. Remittance showed a strong positive relationship with the poverty reduction, so the cash incoming from broad can't be negligible and its positive effects on the economic growth.

Giuliano (2009) studied remittances, financial development and growth by taking the 100 developing countries data of remittances. Observations described that less developed financial mechanisms was mostly up surged by the remittances that is defined as the alternative way of investment. Remittance and financial developments were controlled for the endogeneity and the results corroborated through the robustness tests with threshold estimations. Results were also proved through that a specified channel for remittances can increase the strength of the growth.

ADB (2010) performed a case study in Pakistan on the remittances and household welfare. The illustrations showed by using micro econometric analysis. Findings showed that by reduction will occur in GDP as the remittances will be lessen. As well as investment also decrease, that will resultant to increase poverty on household levels. Analysis also showed the probability of household poorness will decrease up to 12.7% if the remittance will continue. The poverty headcount ratio and Gini coefficient dropped by 7.8% and 4.8%, corresponding to the household-receiving remittances.

Esan *et al* (2011) studied about the remittances and effect on economic growth in Africa ranging from 1980-2009 data. Findings provide that in the study period remittances were the main variable of in the growth of the country. Instability in remittances showed negative relationship with the economic growth as well as remittances seems as the working capital for the financial developments where the financial developments in heightening of economic growth showed weaker effect.

Thanh (2011) investigated on the remittances of economic development by investment perspectives. Research was focused on the migrant's families proving the money to their families as well as investing to their motherlands, with pinning to the both types of transfers, fixed and the contingents. Results showed that most of the times migrants develops services from consumptions and their consumption investment decision was originated from the future investment prospects. Transfers were boosted by the business and income compensatory effects.

Umami (2012) investigate that whether the remittances are playing its role in poverty reduction and enhancing the economic growth of Pakistan. By applying ARDL technique the effect of remittances inflow on economic development was checked while the data for analysis was 1973-2010. District wise analysis was also performed the results shows that the overseas migration is also one of the major factors in poverty reduction in all the provinces of Pakistan, where NWFP was not much affected by remittances. Outcomes also portrayed that economic growth is positively related to remittances. Results also speak about the positive association among the remittances and the poverty lessening.

Katsushi *et al* (2012) worked on remittances growth and poverty in Asian countries. The effect on GDP and poverty by foreign incomes were checked in 24 Asia Pacific countries. Although the results showed that the economic growth and remittances are strongly and positively associated but at the same time outturns also showed that FDI and economic growth have the negative association due to the volatility in incoming cash. Overall the remittance described the positive association between the poverty reduction and the remittance.

Ronald (2013), studied about remittances and economic growth in Guyana, he utilized an augmented Solow framework as well as an ARDL model with bounds test for co-

In the contemporaneous study two main tasks are performed. Primarily the relationship between remittances and GDP per capita, secondary theoretical and empirical literature related to the remittances.

Jawaid *et al* (2014) studied the significant effect of remittances and their volatility on economic growth in south Asia. He worked on the five South Asian countries taking the data from 1975-2009. The results showed that remittances are significantly related to economic growth with positive for the relationship of long period of time in Bangladesh, Sri Lanka and Nepal. Contrariwise, the remittances were negatively correlated with the economic growth in India Sri Lanka, Bangladesh and Pakistan. The concluding remarks also be speak about the Pakistan which was less affected by the volatile in remittances by relating to economic growth. Results were proved to be robust by applying various types of sensitivity tests. A low intensity volatile inflow of workers remittances was observed due to the economic growth.

Joseph *et al* (2014) studied the impact of remittances on economic growth of Ghana. The out turn of the study described that remittances have an insignificant impact on economic growth as equated to the other parts of the Sub-Saharan Africa. He used the technique of Granger-causality and Co-Integration tests to check the effect. Outcomes showed that cash inflow sign to economic growth somewhat but economic growth not showed any evident to remittances. But remittances are much beneficial in support to the household prosperity and health.

Katsushi *et al* (2014) worked on remittances, growth and poverty on 24 Asian and Pacific countries panel data. Findings provided that remittances brooks are generally beneficial for economic growth. They also found that variation in FDI and remittances are significantly harmful for economic growth of the country. That endorsed that remittances are healthier for economic growth which is also supportive in cause of output shocks. Results also emphasis that remittances are key factor in lessening of poverty and uplifting of the economic growth especially through there direct effect.

Lim (2014) explored on the promotion of economic growth by the remittances in Caribbean public and common market. By mirroring through the co-integration tests on the panel data the results poured out that no long lasting relationship exist in the data of

remittances and real GDP per capita but contrary to first a few showed relevancy between the remittances and the consumptions. This proposes that remittance inflows to the CARICOM area are used for consumption drives rather than output sanitizing expenditure.

Martinez (2014) studied the economic casualness and the venture funding impact of remittances to developing 48 countries, where data varying from 2001-2009, results portrayed that remittances boosted the venture funding availability. Remittances are vigorous to backing the new productions and entrepreneurship and overall economic growth provided by the migrants and abroad living personals.

Goschin (2014) investigated through the CEE countries to check the remittances as economic indicator of development by treating the remittances as the capital flows having the macroeconomic potential for growth. Two models of growth were developed comprising on the remittance as the main interest variable with the production factor. Central and eastern Europe's 10 countries data was utilized having data 1995-2011. Sectional heterogeneity was tested the results showed significantly positive influence of the remittances both GDP growth.

Hussian *et al* (2014) worked on the worker's Remittances and gross domestic product Growth of Pakistan, by taking the data varying from the 1972-2011. Generalized Methods of Moments (GMM) technique was implied to control endogeneity and to deal with hidden effects. Worker's remittances delivered the positive relationship with GDP growths. Financial sector's influence on GDP progression was also non-negative and significant like as the trade openings and growth in GDP.

Kiio *et al* (2014) worked on the Kenyan Data and checked the Impact of Workers remittances on economic growth. The time length of data is ranging from 1970-2010 and tested by using different statistical techniques. Time series Regression was also utilized, the results illustrated that the direct and strongly significant association between incoming cash flow and real GDP per capita, signifying that developed economic growth is linked with higher remittances. By extending the project it was also find that the positive impact of gross capital development and change of exchange rate system from static to floating on economic growth.

Duval *et al* (2015) researches made on ethnicity and remittance in Kosovo. By investigating the data from 8000 households in Kosovo residential areas and 650 of their family members living out of the country. Two major ethnic groups Serbs and Albanians were under observations. The results showed that the Albanians were more involve in migration and remittances as comparing to the Serbs. Remittances clue to a significant upsurge in the mediocre level of per capita consumption for all ethnic groups even after screening for endogeneity of the transferal variable.

Faruk (2015) researched on the elements of risk distribution through remittances. Remittances are the decentralized decision of the abroad living persons, by using the 86 developing countries data varying from 1990-2010. He observed that remittance support and play an active and significant role in the developing countries by which risk sharing occurs. The magnitude of income by remittances positions at about 5% on average. Successively, the diversification of immigrants turns out to be the primary interpretation for the degree of risk sharing via remittances as the more varied the immigrant's destinations of a country, the higher the amount of risk shared.

Bayar (2015) checked the effect on economic growth by the remittances in the transitional economic of the European Union. Remittances portrayed as the main financing source of the developing countries. Per capita real GDP and personal remittances showed causal relationship with net foreign direct inflows in European Union including Czech Republic, Bulgaria, Croatia, Estonia, Hungary, Poland, Romania, Slovak Republic and Slovenia from 1996-2013. Results proved that unidirectional interconnection from remittances and foreign direct investment arrivals to the economic growth.

CHAPTER 3

MATERIAL AND METHODS

3.1 Data and Material

The contemporaneous study constitutes on the measurements and studies of the relation between remittances and economic growth by using the seven economic variables and the length of the time is from 1980 to 2015. Remittances are the second main source of income in Pakistan which is rapidly growing day by day, according to the report of World Bank which they published in their annual report of 2014.

The abbreviation of variables their names their explanations and their complete sources are given in the following table. The comprehensive detail of the variables with their abbreviations is given below.

Table 3.1: Variables

Variable Notation	Variable Name And Construction	Source
RGDP	Real Gross Domestic Product	World Development Indicators
PR	Personal Remittances received (% of GDP)	World Development Indicators
INV	Domestic Investment (% of GDP) calculated as (Gross Fixed Capital Formation)	World Development Indicators
TO	Trade Openness calculated as (Imports+Exports)/GDP	World Development Indicators
LF	Labor Force Participation Rate, total (% of total population ages 15+)	World Development Indicators
GC	Gross Capital (% of GDP)	World Development Indicators
HDI	Human Development Index	UNDP World Bank World Development Indicators

All the data is collected from the World Bank and world development indicator (WDI) for 36 years ranging from 1980 to 2015.

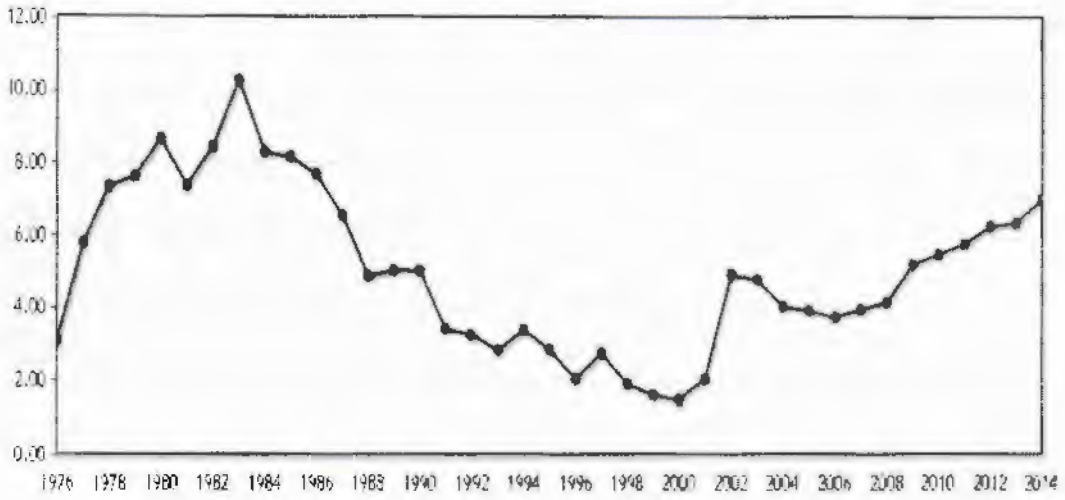
The comprehensive detail of the variables with their complete meanings is given below.

3.1.1 Real Gross Domestic Product (RGDP)

As real gross domestic product is calculated at constant or fixed prices so it is therefore considered the true representative of the economic growth of the country. Normally RGDP mentions to the total output or economic worth of the goods and the services produced in a specific financial year after adjusting the prices. In this study we have calculated the real GDP by adjusting the factor of Consumer Price Index (CPI). So RGDP is calculated at the prices which were constant in the past at some specific time period, knowing as the fix period or base period. Because of these characteristics that real GDP does not affected by the change in the prices and fluctuations in the currency it is more precisely enlightened the economic growth of the Pakistan.

3.1.2 Personal Remittances, Received (% of GDP) (PR)

Amount sent by the employees working abroad are called remittances or personal remittances. All the cash transfer by the workers which is received by the households in the country is called personal transfers. Amount sent by the employees by seasonal, short term bases is referring to as the compensations. Thus all the cash transferred to the homeland by the employees is known as the personal transfers or the personal remittances. Remittances are considered the second pillar in the growth of the economy.



Source: World Bank (2014)

Figure 3.1: Personal Remittances (% of GDP)

3.1.3 Investment Gross Fix Capital Formation (% of GDP) (INV)

Investment is defined as the fixed Gross capital formation of the country (formerly gross domestic fixed investment). Investment covers all the developments in land-living area (ditches, drains, fences and so on); machinery, plants and all the purchasing of apparatus's; road safety and their structure, condition of railways, all the residential apartments and commercial buildings, and also include the industrial constructions, as well as learning institutions, sickbays, workplaces. Capital formation also covers all the purchases.

3.1.4 Trade Openness (% of GDP) (TO)

Total of the exports and the imports of a given country measured in terms of GDP (gross domestic product) are known as the trade open ness. So it is said that the Trade is the sum of imports and exports as the percent of gross domestic product.

3.1.5 Labor force participation rate, total (% of total population ages 15+) (LF)

People older than 15 years of age are included in the criteria of the labor force which is the standard for labor organizations internationally. For a certain time period if a person

is contributing in the production of goods and services then he will be included in the labor force. If a person is contributing in the economic growth of the country then he will be a member of labor force irrespective of the matter that he is employed or unemployed. Usually national armed forces, part time job holder's workers who works on season based and unemployed people are the part of the labor force. But the volunteers and the other unpaid people and the many informal areas are not included in the category of the labor force. A proportion of people which are economically contributing in the economic growth and are the age of above 15 comprises the labor force.

3.1.6 Human Development Index (HDI)

One of the well-known economists of Pakistan Mahbub ul Haq working the Indian economist Amartya Scn developed the concept of HDI (human development index. HDI is consisting of three basic economic variables, education, life span and per capita income. These variables are used to categorize the human development of a country. Lower inflation rate, with high GDP per capita, smaller fertility rate, higher lifespan, and higher education standard indicate that HDI of the country will be high. According to the definition of the United Nations Development Programmed HDI explains weather the people are able to "be" and "do" wanted things in their life. In this study we have used the growth of the human development index.

3.1.7 Gross Capital Formation (% of GDP) (GC)

Gross capital formerly known as the total domestic investment explain about the inventories and the fix assets of the economy.

Normally in fix assets we explain all the terrestrial developments like purchased equipment's, fences, drains, plant, machinery, railways, road constructions, schools, private offices, medical complex and private and industrial buildings.

Inventories look an eye on all he store stock secure by the organizations which they used in unexpected or temporary fluctuations in the supply or demand of the raw material, and in work under construction.

3.2 Methodology

3.2.1 Preliminary Stationary Test

Firstly to check whether all the variables are stationary unit root test was applied on all the original variables and it was obvious that being time series data all the variables were not found stationary at their levels. Therefore all the variables were transformed to lag form to overcome the problem of unit root before the estimation. After taking the lag all the variables were found stationary at the first difference.

3.2.2 Augmented Dickey Fuller (ADF)

To check the unit root problem firstly we have used ADF (Augmented Dickey Fuller) test which he developed in 1979 to check the stationary. Augmented Dickey Fuller (ADF) is based on the following equation as

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{k} d_j \Delta Y_{t-j} + \varepsilon_t$$

Where in the above equation ε_t denotes the error noise term, d is the difference operator, Y_t denotes the series of time, k represent the maximum lags of the endogenous variable and α_0 is the constant term. Δ is used as the lag operator. If the value of the factor α_1 is less than the critical value then the variable is in its stationary form. Augmented Dickey Fuller (ADF) was used to test the stationary of the data under the null hypothesis that there is no stationary in the data or there is unit root problem in the data set against the alternative hypothesis that there is no unit problem in the data/ data is stationary.

3.3 Model Specification

We have developed **two** different sensitive models explore the impact of economic growth and the remittances, first by checking the original basic model and second the volatility in remittances by using different proxies.

3.4 Economic Growth and Remittances

The Econometric Model to estimate the relation is

$$RGDP_t = \alpha_0 + \alpha_1 PR_t + \alpha_2 INV_t + \alpha_3 TO_t + \alpha_4 LF_t + \alpha_5 GC_t + \alpha_6 HDI + \varepsilon_t \qquad (1)$$

Where RGDP is the real gross domestic product, PR is the personal remittances used as the percentage of GDP; INV is the domestic investment as the percentage of GDP and formed as the gross/fixed capital formation, HDI is the human development index and TO is the trade openness calculated as the ratio of the GDP and sum of imports and exports. After transforming the model into natural log form the above model had been estimated at first the difference. In this study we have used E-Views 8 soft-ware to investigate the model.

We have used the similar model which as previously suggested by Ravallion (1997), Ravallion and Chen (1997), Page and Adam (2005) and Abdul Qayyyum and Muhammad Jawaid (2008) to explore the effect of personal remittances on economic growth. In the light of previous studies made by (Sattar and Iqbal 2005) remittances and economic growth has a positive effect. The effect of investment, human development index and trade openness on economic growth is assumed to be positive. Previously in all of the above studies RGDP is taken as the dependent variable and all the other variables are consider as the determinants of the RGDP. So in the light of previous studies we have considered the five main determinants of the RGDP along with the personal remittance which is our main determinant are included in our model.

3.5 Cointegration Test

Cointegration basically is the advance form of regression. Regression measures the overall relation of the variables from the starting point of the time series to the end of the time period. So we can say that regression measures the relationship between the corner points of the time series data. Co-integration measures the relationship with in the time series data. For example co-integration explains that in one year if the independent

variable was changed by ten times then in the response of that change how many times the dependent variable was change and whether this change was in the positive direction or the change was in the negative direction.

Cointegration was primarily presented by Granger (1981). Ganger expended further by Engle and Granger (1987), Phillips and Ouliaris (1990) and Johansen (1988, 1991, 1995a).

Time series Y_t and X_t are said to be co integrated of order d, where $d \geq 0$, written as Y_t, $X_t \sim CI(d)$. If

(a) Both X_t and Y_t series are co integrated of order d,

(b) A linear combination between these two variables also exists.

If a boy and a girl are walking in a park then its tells us noting about them or their location except that both the boy and the girl are in some sort of random walk and both of them are unrelated, but on the other hand a dog and an old person are walking the park and old person is holding the chain of dog in his hand. Although they both are on the random walk but still they both are co integrated because of the chain.

Types of Co-integration

a) When only one co integrating vector is under attention Engle-Granger (1987) is used.

b) When there is more than one co-integrating vectors are being studied then Johansen and Juselius (1990) are used.

To estimate the model in equation (1) co-integration technique developed by Johansen and Juselius (j.j) in 1990 was used to identify the existence of a long run relationship between worker's remittances and economic growth in Pakistan. Cointegration technique developed by Johansen and Juselius is based on k trace and k max statistics. First "trace test" Cointegration rank "r" is as follow:

$$\lambda_{trace} = -T \sum_{j=r+1}^{n} \ln(1-\lambda_j)$$

Second, K max maximum number of integrating vectors against r+1 is presented in this manner

$$\lambda_{max}(r, r+1) = -T\ln(1-\lambda_j)$$

Null hypothesis of the Johansen and Juselius is stated as

H_0: There is no Cointegration between equations.

H_1: There is Cointegration between equations.

Null hypothesis of the Johansen and Juselius test states that there was no long run relationship among the variables and the rejection of the hypothesis showed a strong and significant relationship between cash inflow and economic growth.

3.6 Vector Error Correction Model (VECM)

Because the variables were co integrated or variables were moving in the same direction and their long run relationship have been proved in the Cointegration test so we have run restricted VAR i.e. vector error correction model. Vector error correction estimates briefly explain the short term disequilibrium of the variables with respect to their corrections. Vector error correction model was further used to estimate the short term disequilibrium or short term shocks among the variables. Vector error correction model was used to adjust the changes in the specific variables. Furthermore vector error correction model also adjust the deviations from the equilibrium by converting the variables into its first difference. Vector error correction model is stated as

$$DLnRGDP = \ell_1[DLnRGDP(-1) + DLnPR(-1) + DLnINV(-1) + DLnTO(-1) + DLnLF(-1) + DLnGC(-1) + LnDGHDI(-1) + CONS] + \ell_2 DLnRGDP(-1)) + \ell_3 DLnPR(-1) + \ell_4 DLnINV(-1) + \ell_5 DLnTO(-1) + \ell_6 DLnLF(-1) + \ell_7 DLnGC(-1) + \ell_8 DLnGHDI(-1) + \ell_9$$

In the above model dependent variable is real gross product and all the other variables are independent here we had at most seven co-integrated models and we had observed that

vector error correction model convert the variables into first difference. Actually we have one error correction term and furthermore every variable has one lag term. As real gross domestic product is our dependent variable so this was our target variable. ℓ_1 Was the coefficient of the co-integration model? Short term causality or short run relationship from all the independent variables to dependent variable was measured by using Wald test by equating the coefficients of the independent variables equal to zero. The null hypothesis stated that there was short run disequilibrium between the variables from one specific time period to another time period, and it is stated as.

$$H_0 : \ell_3 = \ell_4 = \ell_5 = \ell_6 = \ell_7 = \ell_8 = 0$$
$$H_1 : \ell_3 \neq \ell_4 \neq \ell_5 \neq \ell_6 \neq \ell_7 \neq \ell_8 \neq 0$$

Wald test checked the coefficient of each independent variable by equating it to zero independently and the significant coefficients showed that there was short run disequilibrium from that independent variable to the dependent variable. Insignificant coefficients showed that there was no short run disequilibrium from independent towards the dependent variable.

3.7 Granger Causality Test

Granger causality test was applied to analyze the whether the relations between the variables was either unidirectional or bidirectional. In this study we have explained the pair wise relationship or bivariate relationship or two way relationship between two variables by taking the one lag. Results of the Granger causality test explained that whether the dual directional relationship between the two variables exists or relationship was unidirectional or there was no direction of the relationship between the variables.

First all the variables were checked their direction of dual relationships with real gross domestic product. Firstly relation between personal remittances and real gross domestic product was analyzed whether the direction of relation was unidirectional, bidirectional or there was no relation between the personal remittances and real gross domestic product. Granger causality test also indicates that if there exist a relation between personal remittance and real gross domestic product then which variable was leading variable. The granger causality test was analyzed by using the F- Statistic under the null

hypothesis that the first variable does not cause the second variable and second variable does cause the first variable. The rejection of the null hypothesis showed that there was a significant relation between two variables. For the first two variables personal remittance and real gross domestic product the null hypothesis is stated as

H_0: PR does not Granger Cause RGDP.

H_1: PR does Granger Cause RGDP.

And similarly

H_0: RGDP does not Granger Cause PR.

H_1: RGDP does Granger Cause PR.

The rejection of the null hypothesis showed that relationship between two variables was significant and otherwise there was no relationship between two variables.

3.8 Economic Growth and Volatility in Remittances

After the first model was critically reviewed now to observe the association between the economic growth and volatility of worker's remittances by using the production function framework. The general function of production function is derived as

$$Y_t = \beta_0 + \beta_1 L_t + \beta_2 K_t + \beta_3 T_t + \beta_4 H_t + \beta_5 R_t + \varepsilon_t \qquad (2)$$

Where Y_t is real gross domestic product, L_t is the labor force, K_t is the capital, T_t represent the trade openness, H_t is human development index, R_t is the personal remittances and ε_t is the error term. Here two vectors were used to examine the relationship. First vector have all the variables i.e. real GDP, labor force, personal remittances and capital. Second vector includes all the variables included in the first vector except the worker's remittances is replaced by the volatility of worker's remittances and the equation of the second vector is written below.

$$Y_t = \beta_0 + \beta_1 L_t + \beta_2 K_t + \beta_3 T_t + \beta_4 H_t + \beta_5 VR_t + \varepsilon_t \qquad (3)$$

Where VR_t represent the volatility of the worker's remittances and all the remaining variables are same. Equation 2 and 3 measures the effect of volatility of worker's

remittances on economic growth. Positive relation was expected of real GDP, capital and labor with the volatility of remittances and the sign of R was to be measured. Variables were used in their first difference after taking the natural log.

3.9 Stability Test

To check that whether the coefficients of the growth model on the long and short run were stable for the whole time series data we have used cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) methodology, assuming in the null hypothesis that all the coefficients were stable. This methodology was first proposed by Brown *et al* (1975) and Pearson *et al* (2001). This test used the cumulative sum of recursive residuals based on the first n observations and then updated recursively and plotted against break points. The values of CUSUM and CUSUMSQ were fallen within the critical bound at five percent level of significance which showed that coefficients were stable.

3.10 Heteroskedasticity Test

Heterosedasticity White Test explains about the error term that whether the variance of error term was constant or not commonly known as the hetrosedasticity test, by using the white test under the null hypothesis that variance of error term is constant against the alternative hypothesis that variance of error term is not constant.

Rejection of the null hypothesis showed that result were significant, which also implied that there was problem of hetrosedasticity in the error term i.e. variance of residuals was not constant. White test used value of the F-statistic test to measure the problem of hetrosedasticity in the error term.

3.11 Normality test

The normality of the residuals term was checked by Jarque-Bera test under the null hypothesis that residual term was normally distributed. The null hypothesis stated that error term was normally distributed against the alternative hypothesis that error term was not normally distributed.

The rejection of the null hypothesis indicates that error term was not normally distributed.

3.12 Breusch-Godfrey Serial Correlation LM Test (RESID)

Auto correlation or the serial correlation was measured by Breusch-Godfrey LM test which is shortly known as the LM test for residuals. LM test assume in the null hypothesis that there was no auto correlation in the model; the null hypothesis stated that there was no auto correlation in the model against the alternative hypothesis that there was auto correlation in the model.

LM test used F-Statistic to measure the auto correlation. If the null hypothesis was rejected then it indicates that there was auto correlation or serial correlation exists in the model.

3.13 Multicollinearity Test (Correlation Analysis)

To check that independent variables were not correlated correlation matrix was used under the null hypothesis that variables were independent against the alternative hypothesis that variables were correlated. Rejection of the null hypothesis showed that there exists the problem of multicollinearity in the model.

3.14 Ramsay Test for Goodness of Fit

To check the overall goodness of the model and to check whether our data was good fitted or not F-statistic was used .The null hypothesis was stated as model was not well fitted against the alternative hypothesis that model was well fitted. If the null hypothesis was rejected then it indicates that F-statistic was significant which showed that data was good fitted or model was fitted well.

3.15 Clustering Volatility and Auto Regressive Test

Clustering volatility means that period of low volatility are followed by periods of low volatility for a long period and periods of high volatility will be followed by periods of high volatility for a long period and this will confirm that there was cluster volatility.

Auto Regressive Test explains that whether the lag effect or difference effect of one year is significant to the previous year or not by using the t test distribution under the null hypothesis that lag effect was independent to the previous lag period against the alternative hypothesis that lag effect was dependent to the previous lag period.

Rejection of the null hypothesis showed that lag of time period does affect the lag of the previous time period. Auto regressive term explains that one term was dependent on its previous lag term.

3.16 ARCH AND GARCH MODEL

To measure the effect of the volatility of the worker's remittances Auto Regressive Conditional Hetroscedasticity (ARCH) and Generalized Auto Regressive Conditional Hetroscedasticity (GARCH) test was used. The volatility represents the varying variance of the time series, and such type of time series can be modeled by ARCH and GARCH models. To use the ARCH model first condition is that all variables should be in stationary form and if the variables are not stationary then first make them stationary as in our study all the variables were stationary after taking the first difference. Second condition is that there should be clustering volatility and also ARCH test should be rejected implies that there should be ARCH affect then we can run ARCH model. To check the cluster volatility and ARCH test we run the regression under the null hypothesis that there was no ARCH effect in the data series against the alternative hypothesis that there was ARCH effect in the data series.

The rejection of the null hypothesis showed that there was ARCH effect in the model and which give the permission to run the ARCH model.

3.16.1 ARCH MODEL

ARCH model is the nonlinear model which has the large spread application in finance; it is the extension of the auto regressive model. One of the assumptions of the error term is that it is a white noise stochastic process i.e. μ_t is normally distributed with zero mean and constant variance. We also assume that data was in its stationary form. However it was unlikely in time series especially financial time series that the variance of the error

will be constant over time, it means that the error term will be hetroscedastic. Another important feature was that volatility clustering exists of financial time series and volatility is auto correlated. It leads us to construct such a model that would capture phenomena of volatility clustering of the time series by allowing varying the variance of the residual in the model. The equation of the ARCH (1) is written as

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \mu_t$$

Where μ_t is normally distributed with $(0, \sigma_t^2)$ i.e. zero mean and constant variance, and also conditional variance is $\sigma_t^2 = \beta_0 + \beta_1 \mu^2_{t-1}$

3.16.2 TESTING OF ARCH

i) Estimate the model and calculate residual i.e. $\hat{\mu}_t$

ii) Run the following regression

$$\hat{\mu}^2_t = \alpha_0 + r_1 \hat{\mu}^2_{t-1} + r_2 \hat{\mu}^2_{t-2} + \ldots\ldots\ldots + r_q \hat{\mu}^2_{t-q}$$

iii) Obtain R^2 and the test statistic

$$TR^2 approaches \chi^2_{(q)}$$

iv) Test the hypothesis

$$H_0 : r_1 = r_2 = r_3 \ldots\ldots\ldots = r_q = 0$$

And

$$H_1 : r_1 = r_2 = r_3 \ldots\ldots\ldots = r_q \neq 0$$

v) If H_0 is rejected it implies that ARCH effect exist, then we use ARCH model.

In ARCH model it is sometimes difficult to decide the value of "q" i.e. bow many terms in residual variance should be included. As q capture all the conditional variance and it might be large so due to these reasons ARCH model was extended to GARCH model.

3.17 GARCH (p, q) MODEL

GARCH model was developed by Bollersleve (1986) and Tayler (1986) which represent generalized ARCH model. This model allows the conditional variance to dependent upon previous on lags along with the Lag residual term and is represented as

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \alpha_3 Y_{t-3} + \mu_t$$

Where μ_t is normally distributed with $(0, \sigma_t^2)$ i.e. zero mean and constant variance, and also variance is

$$\sigma^2_t = \beta_0 + \beta_1 \mu^2_{t-1} + \beta_2 \sigma^2_{t-1} + \varepsilon_t$$

It is GARCH (1,1) model if

$$\sigma^2_t = \beta_0 + \beta_1 \mu^2_{t-1} + \beta_2 \sigma^2_{t-1} + \beta_3 \sigma^2_{t-3} + \varepsilon_t$$

It is GARCH (1, 2) model

σ^2_t May be interpreted as a weighted function of a long term average value that gives us

i) Information about the volatility during the previous period ($\beta_1 \mu^2_{t-1}$) and

ii) The fitted variance from the model during the previous period ($\beta_2 \sigma^2_{t-1}$)

So we have used ARCH and GARCH model to measures the volatility of worker's remittances which was also adopted by the jawaid and Haq (2012), and Bleaney and Green away (2001) capture the effect of volatility.

CHAPTER 4

RESULTS AND DISCUSSIONS

In this study all the data that we have used is based on time series and being time series data it is therefore becomes our first priority to check the stationary of the data at very first. The variables that are not stationary first we have make them stationary and then became more appropriate for us to choose the best econometric technique for our further analysis. We apply the Augmented Dickey Fuller (ADF) test to check the unit root problem in the data set. First of all the detail of the descriptive analysis of the original data set is detailed in the following table.

Table 4.1: Descriptive Statistics Original Series

	RGDP	PR	INV	TO	LF	GC	GHDI
Mean	2.09E+09	5.003155	16.20952	33.98475	50.81389	17.83925	0.012205
Median	1.99E+09	4.890420	16.66793	34.12509	50.70000	18.40099	0.010677
Maximum	2.85E+09	10.24763	19.23542	38.90949	54.60000	20.81826	0.022517
Minimum	1.53E+09	1.453638	12.52063	27.60429	32.20000	14.12063	0.003711
Std. Dev.	3.64E+08	2.276920	1.664302	2.731179	3.669889	1.667778	0.004600
Skewness	0.267367	0.335547	-0.583974	-0.300534	-3.604222	-0.629608	0.799000
Kurtosis	1.965286	2.255878	2.479746	2.821276	19.63481	2.484643	3.366678
Jarque-Bera	2.034862	1.506129	2.452151	0.589838	493.0179	2.776828	4.032082
P values	0.013652	0.040921	0.009344	0.014459	0.000000	0.008471	0.003182

In the table 4.1 all the basic statistics of all the variables is given in detail. Starting from the first average RGDP of the Pakistan from 1980 to 2015 was around 3 billion us dollars and the average remittances received in Pakistan from 1980 to 2015 was more than 5 million dollars in percent of GDP. In Pakistan in 2015 the amount of remittances according to World Bank was 18.4 billion dollars. Average investment was 16% of the gross domestic product. Average value of the trade openness and the labor force was 34

and 51 percent of GDP. Average growth in the human development index was 0.012 units which stand below the standards. Probability values of all the variables are less than five percent which are indicating that variables are not normal.

Table 4.2: Descriptive Statistics Transformed Series

	LNRGDP	LNPR	LNINV	LNTO	LNLF	LNGC	GHDI
Mean	21.44465	1.494862	2.780200	3.522693	3.925021	2.876939	0.012205
Median	21.41103	1.587265	2.813435	3.530027	3.925926	2.912395	0.010677
Maximum	21.76899	2.327047	2.956753	3.661238	4.000034	3.035831	0.022517
Minimum	21.14631	0.374070	2.527377	3.317971	3.471966	2.647637	0.003711
Std. Dev.	0.173885	0.510774	0.106831	0.081945	0.085187	0.097041	0.004600
Skewness	0.045750	-0.501449	-0.757692	-0.514515	-4.241459	-0.780931	0.799000
Kurtosis	1.854970	2.436135	2.654107	3.060494	23.61192	2.646989	3.366678
Jarque-Bera	1.979199	1.985625	3.624045	1.593845	745.2165	3.846049	4.032082
P Values	0.371726	0.370533	0.163323	0.450714	0.253911	0.146164	0.133182

Table 4.2 shows that probability values of all the variables are more than five percent which shows that after taking the natural log all the series becomes normal, which also give us the permission to use the natural log in our series.

After the brief discussion of the descriptive statistics of the data now first we apply ADF test to the natural log series under the null hypothesis that there is no stationary in the data or there is unit root problem in the data set. Detail Results are given in the following table.

Table 4.3: Stationary Test at Level of Transformed Series

Variables	Intercept	P Values	Intercept, Trend	P Values
LNRGDP	-1.556117	0.4939	-1.594085	0.7749
LNPR	-1.524972	0.5094	-1.173314	0.9006
LNINV	-1.550105	0.4969	-2.272549	0.4371
LNTO	-2.269181	0.1871	-2.773246	0.2160
LNLF	-3.682371	0.1070	-3.078674	0.1288
LNGC	-1.508983	0.5174	-2.495949	0.3281
GHDI	-1.629546	0.4573	-1.740615	0.7114

Table 4.3 shows the stationary results of all the variables after taking the natural log. Unit root test is applied by using the Augmented Dickey Fuller test. First stationary of all the transformed variables is checked at level. Unit root is applied with both with and without trend and the results are shown in the table 4.3. Findings of the stationary test indicate that all the variables are not stationary at their level. It means unit root problem exist in all the variables. Not a single variable was found significant at level. So the results of the unit root shows that data is not stationary at level which support us and permit us to use the Johansen and Juselius Cointegration technique in our study.

Table 4.4: Stationary Test at First Difference of Transformed Series

Variables	Intercept	P Values	Intercept, Trend	P Values
DLN RGDP	-4.874251	0.0004***	-4.878408	0.0021***
DLN PR	-5.128148	0.0002***	-5.291142	0.0007***
DLN INV	-5.157834	0.0002***	-5.093000	0.0012***
DLN TO	-7.561459	0.0000***	-7.519786	0.0000***
DLN LF	-3.808113	0.0071***	-3.847233	0.0276***
DLN GC	-5.896335	0.0000***	-5.826158	0.0002***
DGHDI	-5.603663	0.0000***	-5.560232	0.0003***

***, ** &*are used to show the significance at 1%, 5% and 10%

Table 4.4 shows the stationary results of all the variables at their first difference i.e. after taking the first lag. Unit root test was applied by using the Augmented Dickey Fuller test. Now the stationary of all the variables was checked at their first difference. Unit root was applied with both with and without trend and the results are shown in the table 4.4. Findings of the stationary test explained that all the variables were becomes stationary at their first difference. It means that now at the first difference all the variables were free from unit root problem. So the results of the table 4.4 demonstrate that data was stationary at first difference which support our justification and permit us to use the Cointegration technique in our study to analyze the relationship between economic growth and remittances. The most important and basic condition of the Johanson and

Juselius Cointegration technique is that all the data should be stationary at their first difference. This was justified and proved in the table 4.4.

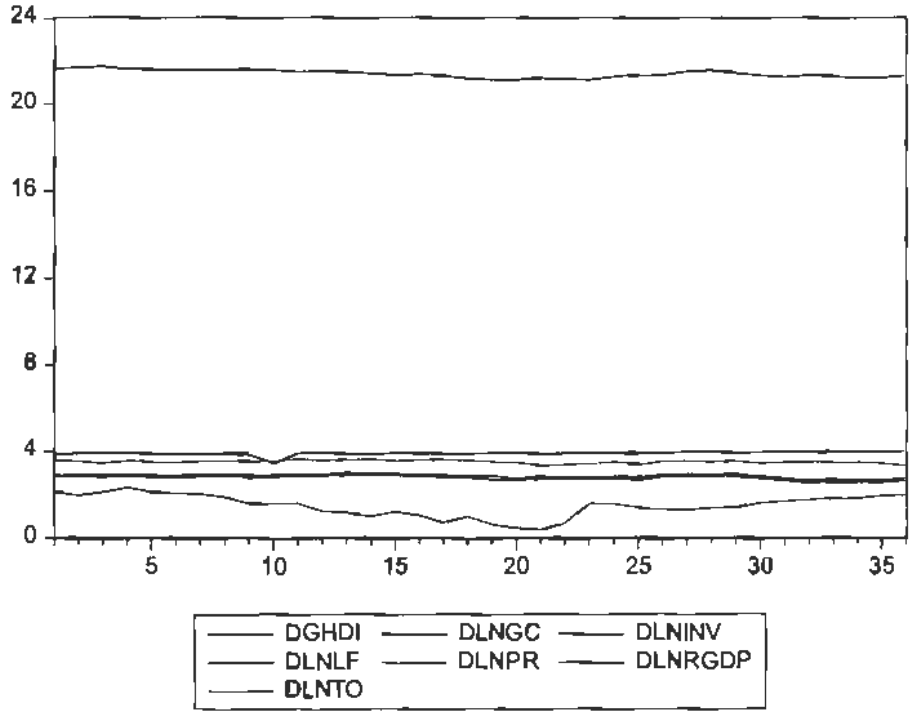


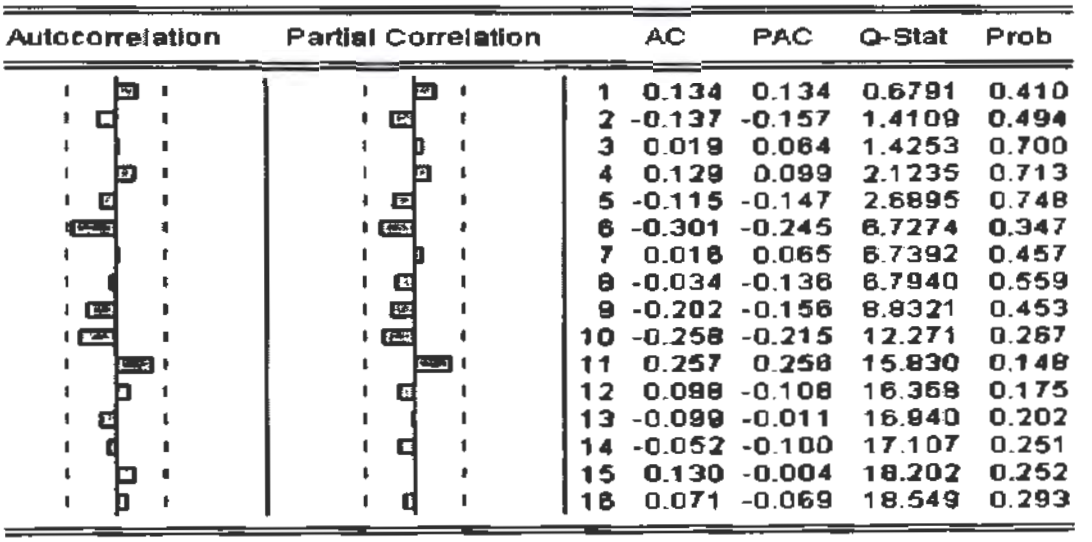
Figure 4.1: Plot showing the stationary of variables at first difference.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.882	0.882	30.415	0.000
		2	0.717	-0.277	51.089	0.000
		3	0.565	0.007	64.309	0.000
		4	0.439	-0.001	72.554	0.000
		5	0.287	-0.255	76.195	0.000
		6	0.157	0.070	77.323	0.000
		7	0.086	0.124	77.670	0.000
		8	0.023	-0.176	77.697	0.000
		9	-0.040	0.005	77.779	0.000
		10	-0.086	0.141	78.011	0.000
		11	-0.044	0.019	78.116	0.000
		12	-0.074	-0.330	78.425	0.000
		13	-0.127	0.077	79.382	0.000
		14	-0.169	-0.024	81.153	0.000
		15	-0.177	-0.067	83.203	0.000
		16	-0.215	-0.072	86.359	0.000

Figure 4.2: Correlogram of Transformed Series at Level

Cross correlogram explains that stationary of whole series under the null hypothesis that variables are stationary against the alternative hpothesis that variables are not stationary.

In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics, as all the probability values are less than 5 % so we reject the null hypothesis and conclude that series is not stationary at level.



	AC	PAC	Q-Stat	Prob
1	0.134	0.134	0.6791	0.410
2	-0.137	-0.157	1.4109	0.494
3	0.019	0.064	1.4253	0.700
4	0.129	0.099	2.1235	0.713
5	-0.115	-0.147	2.6895	0.748
6	-0.301	-0.245	6.7274	0.347
7	0.016	0.065	6.7392	0.457
8	-0.034	-0.136	6.7940	0.559
9	-0.202	-0.156	8.8321	0.453
10	-0.258	-0.215	12.271	0.267
11	0.257	0.258	15.830	0.148
12	0.098	-0.108	16.368	0.175
13	-0.099	-0.011	16.940	0.202
14	-0.052	-0.100	17.107	0.251
15	0.130	-0.004	18.202	0.252
16	0.071	-0.069	18.549	0.293

Figure 4.3: Correlogram of Transformed Series at First Difference

Cross correlogram explains that stationary of whole series at first difference under the null hypothesis that variables are stationary under the altenative hypothesis variables are not stationary. In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics as all the probability values are more than 5 % so we cannot reject the null hypothesis and conclude that whole series is stationary at first difference.

Table 4.5: Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	40.09942	NA	1.98e-05	-2.318714	-2.181301	-2.273165
1	102.3900	109.0086*	7.09e-07*	-5.649378*	-5.099727*	-5.467184*
2	111.0791	13.57661	7.36e-07	-5.629943	-4.668053	-5.311103
3	119.3074	11.31389	8.07e-07	-5.581710	-4.207583	-5.126226
4	128.5670	10.99579	8.63e-07	-5.597936	-3.811570	-5.005806

* indicates lag order selected by the each criterion at 5% level

Above table briefly explains the maximum lags that should be included in the estimation of our model. As we can see that sequential modified LR test statistic and final prediction error have a star at lag 1, so both the criteria are giving an indication that there should be only one lag in the model. Similarly other three criterion i.e. Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion are also giving the strong indication of one lag in the model because they all three have their least value at lag one. So with the strong evidence of the above table we will include one lag in our final model.

Table 4.6: Johansen's Cointegration Test (Trace Statistic)

No. of CE(s)	Eigen values	Statistic	Critical Values	P Values
None *	0.892998	234.2408	125.6154	0.0000
At most 1 *	0.853065	160.4887	95.75366	0.0000
At most 2 *	0.633446	97.20258	69.81889	0.0001
At most 3 *	0.582837	64.08351	47.85613	0.0008
At most 4 *	0.403717	35.23231	29.79707	0.0107
At most 5 *	0.319901	18.17001	15.49471	0.0193
At most 6 *	0.152181	5.447926	3.841466	0.0196

* denotes rejection of the hypothesis at the 0.05 level

As discuss earlier in the chapter 3 that if a set of all variables are stationary at I (1) that is stationary at their first difference so we can run the Johansen's test of Cointegration and can see how many systems of equations have long run relationships or how many co-integrating vectors exist.Table 4.6 indicate the results of Cointegration Rank test that will tell us about the number of co-integrating equations or we can say it that it will tells us about the number of co-integrating models. The first null hypothesis is that there is no Cointegration among all the variables. Results of the table reject the first null hypothesis at 5 percent level of significance which indicates that there exists a long run relationship between the variables. The second null hypothesis is that there is one Cointegration equation or model. Results of the table reject the second null hypothesis which indicates that there exists a Cointegration equation or on the long run variables are co-integrated. The third null hypothesis is that there are at most two Cointegration equations or models exist. Results of the table also reject the third null hypothesis which indicates that there at most two Cointegration equations. The fourth null hypothesis is that there are at most three Cointegration equations or models exist. Results of the table also reject the fourth

null hypothesis which indicates that there exist at most three Cointegration equations. Similarly rest of the entire null hypothesis is rejected at 5 percent level of significance. Trace test indicate that there exist seven of the equations that are co-integrated in the long run they have association. Results of the table 4.6 also verify that all the variables move together. Because it can be seen from the above table that we have more variables which have co-integrating vectors now then vector error correction model will be used to adjust the changes in the specific variables. Furthermore vector error correction model will also adjust the deviations from the equilibrium.

Vector Error Correction Estimates

Table 4.7: Long Run Causality Test

Dependent Variable DLNRGDP				
Variables	Coefficient	Std. Error	t-statistic	P Values
Constant	-0.337251	0.184386	-1.829047	0.0793
DLNRGDP(-1)	0.799517	0.340302	2.349437	0.0270
DLNPR(-1)	0.112267	0.058573	1.916717	0.0668
DLNINV(-1)	1.699045	0.829504	2.048268	0.0512
DLNTO(-1)	0.192814	0.191527	1.006719	0.3237
DLNLF(-1)	0.192068	0.118257	1.624157	0.1169
DLNGC(-1)	-2.027905	0.901793	-2.248749	0.0336
DGHDI(-1)	5.078625	5.712748	0.888999	0.3825

In the above table our dependent variable is real gross product and all the other variables are independent here we have one co-integrated model and we can see in the above table that vector error correction model convert the variables into first difference. Actually we have one error correction term and furthermore every variable has one natural lag term, and the relation is measured by the following vector error correction equation.

$$DLnRGDP = \ell_1[DLnRGDP(-1) + DLnPR(-1) + DLnINV(-1) + DLnTO(-1) + DLnLF(-1) + DLnGC(-1) + LnDGHDI(-1) + CONS] + \ell_2 DLnRGDP(-1)) + \ell_3 DLnPR(-1) + \ell_4 DLnINV(-1) + \ell_5 DLnTO(-1) + \ell_6 DLnLF(-1) + \ell_7 DLnGC(-1) + \ell_8 DLnGHDI(-1) + \ell_9$$

As real gross domestic product is our dependent variable so this is our target variable. As mention in the chapter 3 that coefficient of the real gross domestic product is denoted by ℓ_1 so it is the coefficient of the co-integration model. ℓ_1 Is actually the co-efficient of co-integrating model? ℓ_1 Is the error correction term or ℓ_1 is the speed of adjustment towards the equilibrium. First we will discuss long run causality between the independent and dependent variable. If the ℓ_1 is negative and significant then we can say that there is a long term causality running from all the independent variables towards the dependent i.e. real gross domestic product. From the above table we can see that ℓ_1 is negative but not significant so there is no long run causality running from all the independent variables to real gross domestic product.

Table 4.8: Short Run Causality Test (Wald Test)

Dependent Variable DLNRGDP								
S/No	Coefficient	Std. Error	t-Statistic	P Values	F-statistic	P Values	Chi-square	P Values
DLNPR(-1)	0.112267	0.058573	1.916717	0.0668	3.673803	0.0668	3.673803	0.0553
DLNINV(-1)	1.699045	0.829504	2.048268	0.0512	4.195401	0.0512	4.195401	0.0405
DLNTO(-1)	0.192814	0.191527	1.006719	0.3237	1.013482	0.3237	1.013482	0.3141
DLNLF(-1)	0.192068	0.118257	1.624157	0.1169	2.637887	0.1169	2.637887	0.1043
DLNGC(-1)	-2.027905	0.901793	-2.248749	0.0336	5.056871	0.0336	5.056871	0.0245
DGHDI(-1)	5.078625	5.712748	0.888999	0.3825	0.790318	0.3825	0.790318	0.3740

To measure the short term causality between the independent and dependent variables we use the Wald test criteria by individual effect of the independent variable on dependent variable by testing the coefficient of independent variable. In the present study we have used the following vector error correction equation to measure the short term causality.

$$DLnRGDP = \ell_2 DLnRGDP(-1)) + \ell_3 DLnPR(-1) + \ell_4 DLnINV(-1) + \ell_5 DLnTO(-1) + \ell_6 DLnLF(-1) + \ell_7 DLnGC(-1) + \ell_8 DLnGHDI(-1) + \ell_9$$

First we check the short run causality between personal remittance and real gross domestic product by equating the co-efficient of $\ell_3 = 0$ in the null hypothesis. For this we use Wald test to measure the short run relationship. Because the probability value is more than 5% so we cannot reject the null hypothesis so there is no short run causality running from personal remittance towards real gross domestic product. To measure the short term causality between the investment and real gross domestic product we equate the co-efficient of $\ell_4 = 0$ in the null hypothesis. Results of Wald Test explains that the probability value is less than 5% so we reject the null hypothesis which indicates that there is a short run causality running from investment towards real gross domestic product. To measure the short term causality between the trade openness and real gross domestic product we equate the co-efficient of $\ell_5 = 0$ in the null hypothesis. Results of Wald Test explains that the probability value is more than 5% so we cannot reject the null hypothesis which indicates that there is a no short run causality running from trade openness towards real gross domestic product. To measure the short term causality between the labor force and real gross domestic product we equate the co-efficient of $\ell_6 = 0$ in the null hypothesis. Results of Wald Test explains that the probability value is more than 5% so we cannot reject the null hypothesis which indicates that there is a no short run causality running from labor force towards real gross domestic product. To measure the short term causality between the gross capital and real gross domestic product we equate the co-efficient of $\ell_7 = 0$ in the null hypothesis. Results of Wald Test explains that the probability value is less than 5% so we reject the null hypothesis which indicates that there is a short run causality running from gross capital towards real gross domestic product. To measure the short term causality between the human development index and real gross domestic product we equate the co-efficient of $\ell_8 = 0$ in the null hypothesis. Results of Wald Test explains that the probability value is more than 5% so we cannot reject the null hypothesis which indicates that there is a no short run causality running from human development index towards real gross domestic product.

Table 4.9 Speed of Adjustment for Disequilibrium

Dependent Variable DLNRGDP				
Variables	Coefficient	Std. Error	t-statistic	P Values
DLNPR(-1)	-0.261988	0.01131	-23.1742	0.0368
DLNINV(-1)	-0.901982	0.79689	-1.13187	0.0512
DLNTO(-1)	-0.357315	0.23015	-1.55251	0.3237
DLNLF(-1)	0.909909	0.11985	7.59181	0.0169
DLNGC(-1)	0.537463	0.84858	0.63336	0.4336
DGHDI(-1)	-11.14381	2.40647	-4.63077	0.03825

Because the variables are co integrated or variables are moving in the same direction and their long run relationship have been proved in the Cointegration test so we have run restricted VAR i.e. vector error correction model. Table 4.9 explains the results of vector error correction estimates. Results briefly explain the short term disequilibrium of the variables with respect to their corrections. As we can see that test statistic of the personal remittance is 23.1742 which are significant, furthermore it explains that short term disequilibrium wbich was created between personal remittance and real gross domestic product also the error term is correcting disequilibrium is 26 percent on tbe yearly basis or the speed of the adjustment is 26 percent annually. We can also say that error term is adjusting the previous period disequilibrium between the real gross domestic product and personal remittance at the rate of 26 percent annually. The value of test statistic of investment is also significant which explains that short term disequilibrium which was created between investment and real gross domestic product and this disequilibrium is adjusted by error term by one percent annually. The value of the test statistic of trade openness is not significant which indicate there is no short term disequilibrium between trade openness and real gross domestic product .The test statistic value of gross capital was not found significant which indicate that the series is already in its equilibrium position and no fluctuations were found in the series in the short run. The value of the test statistic of labor force is also found significant which indicate that there is short term

disequilibrium between the labor force and the real gross domestic product and this short term disequilibrium was adjusted every year and this short term removed yearly by 90 percent. The value of the test statistic of growth human development index is 4.63077 which indicate that there is short term disequilibrium between the growth human development index and the real gross domestic product and this short term disequilibrium was corrected yearly by 11.143 percent annually.

Table 4.10: Diagnostic Test Results (Residuals)

Diagnostic	Test Statistic	P Values
Serial correlation LM Test	1.68834	0.2038
White Hetrosedasticity Test	0.406105	0.9546
Jarque-Bera Test(Normality)	1.859747	0.3946

Serial correlation is checked under the null hypothesis that there is no serial or auto correlation exist in the model and in our case we accept this null hypothesis and also F-statistic is also not significant which also gives indication of no auto correlation in the model.

As we compare the probability that is p value is 20.38 percent which is more than 5 percent meaning that we cannot reject the null hypothesis which implies that there is no serial correlation in model.

Table 4.10 also explains the results about the error term that whether the variance of error term is constant or not commonly known as the hetrosedasticity test, by using the white test under the null hypothesis that variance of error term is constant.

From the above table it is verified the p value is very high and it is more than 5 percent so we cannot reject the null hypothesis which gives the indication that there is no hetrosedasticity in the residuals. It can be seen from the table 4.10 that null hypothesis is not rejected which implies that result of the hypothesis is not significant, which implies

that there is no problem of hetrosedasticity in the error term i.e. variance of residuals are constant.

The normality of the residual is tested by Jarque-Bera test under the null hypothesis that residual is normally distributed. In the above table probability value is 39.46 percent which is more than 5 percent so we cannot reject the null hypothesis which indicates that residuals are normally distributed.

Table 4.11: Correlation Analysis

Correlation P Values	DLNRGDP	DLNPR	DLNINV	DLNTO	DLNLF	DLNGC	DGHDI
DLNRGDP	1.000000						

DLNPR	-0.327548	1.000000					
	0.0648	-----					
DLNINV	0.254507	-0.093414	1.000000				
	0.1401	0.5935	-----				
DLNTO	-0.173325	0.067001	0.238753	1.000000			
	0.3194	0.7022	0.1672	-----			
DLNLF	-0.071951	-0.026804	-0.090870	0.121469	1.000000		
	0.6813	0.8785	0.6037	0.4870	-----		
DLNGC	0.282827	-0.130857	0.341840	0.193740	-0.085413	1.000000	
	0.0997	0.4537	0.1401	0.2648	0.6257	-----	
DGHDI	-0.251073	0.152156	-0.057588	0.059708	-0.015397	-0.052364	1.000000
	0.1457	0.3829	0.7425	0.7333	0.9300	0.7651	-----

Table 4.11 Correlation matrix shows the relationship among the variables. By looking at the table it is verified that all variables are non significiant which implies that there is no problem of multicollinearity in the model. Above table also satisfy that all the variables are independent and no problem of multicollinearity as the r is very low also insignificant.

Table 4.12: Ramsey Test for Goodness of Fit

Ramsey Test		
	Test Statistic	P Value
F-Statistic	253.5844	0.0000

As we see that the null hypothesis is rejected then it indicates that F-statistic is significant which indicate that our model is fitted well or our data is good fitted.

Table 4.13: Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	P Values
DLNINV does not Cause DLNRGDP and	0.10351	0.9020
DLNRGDP does not Cause DLNINV	6.07135	0.0065
DLNTO does not Cause DLNRGDP and	1.01462	0.3755
DLNRGDP does not Cause DLNTO	3.44990	0.0458
DLNPR does not Cause DLNRGDP and	1.50474	0.2395
DLNRGDP does not Cause DLNPR	2.19198	0.1305
DLNLF does not Cause DLNRGDP and	0.56520	0.5746
DLNRGDP does not Cause DLNLF	0.39912	0.6747
DLNGC does not Cause DLNRGDP and	0.36599	0.6968
DLNRGDP does not Cause DLNGC	6.32917	0.0054
DGHDI does not Cause DLNRGDP and	0.67364	0.5179
DLNRGDP does not Cause DGHDI	1.34486	0.2769

Table 4.13 explains the pair wise relationship or bivariate relationship or two way relationship between two variables. Results of the table explain that whether the dual directional relationship between the two variables exists or relationship is uni-directional or there is no direction of the relationship between the variables.

All the variables are checked their direction of dual relationships with real gross domestic product. As we can see from the above table that relation between investment and real gross domestic product is significant and has a uni-directional relationship in and in this uni-directional relationship real gross domestic product is leading variable and investment is following variable. Relation between trade openness and real gross domestic product is uni-directional and significant in which real gross domestic product is leading and trade openness is dependent variable. The relationship between personal remittance and the real gross domestic product is not significant .The results shows that the human development index and real gross domestic product are not significant. Relation between real gross domestic product and gross capital is significant and unidirectional and real gross domestic product is the leading variable.

Table 4.14: Hetrosedasticity Test: ARCH EFFECT

Hetrosedasticity Test		
	Test Statistic	P Value
F-statistic	99.67032	0.0000

Table 4.14 explains the results about the error term that whether the variance of error term is constant or not commonly known as the hetrosedasticity test, by using the white test under the null hypothesis that residual variance is constant, or model has no ARCH affect. It can be seen from the table 4.14 that result of the hypothesis is significant, which implies that there is problem of hetrosedasticity in the error term i.e. variance is not constant of error term, or there is ARCH affect in the model. Calculated value of the F-statistic is 99.67 and whicb is highly significant as when we compares it to the Probability value which is less 5 percent.

Table 4.15: Auto Regressive and Volatility Clustering Test

Variable	Coefficient	Std. Error	t-Statistic	P Values
C	-0.014211	0.022377	-0.635072	0.5309
DLNPR	-0.148670	0.048147	-3.087845	0.0046
DLNINV	-0.001383	0.522154	-0.002649	0.9979
DLNTO	-0.213254	0.141220	-1.510083	0.1426
DLNLF	-0.028378	0.083398	-0.340275	0.7363
DLNGC	0.081326	0.535582	0.151846	0.8804
DGHDI	-6.083286	3.363662	-1.808531	0.0817
AR(1)	0.516146	0.181366	2.845882	0.0084

Table 4.15 explains that whether the lag effect or difference effect of one year is significant to the previous year or not by using the t test distribution under the null hypothesis that lags effect is independent to the previous lag period.

As the probability value is less than 5 percent so we reject the null hypothesis which indicates that lag of time period does affect the lag of the previous time period. Auto regressive term also explains that one term is dependent on its previous lag term. Clustering volatility means that period of low volatility are followed by periods of low volatility for a long period and periods of high volatility will be followed by periods of

high volatility for a long period and this will confirm by cluster volatility test. It is also confirm by the Clustering Volatility is also can be explain by the following figure.

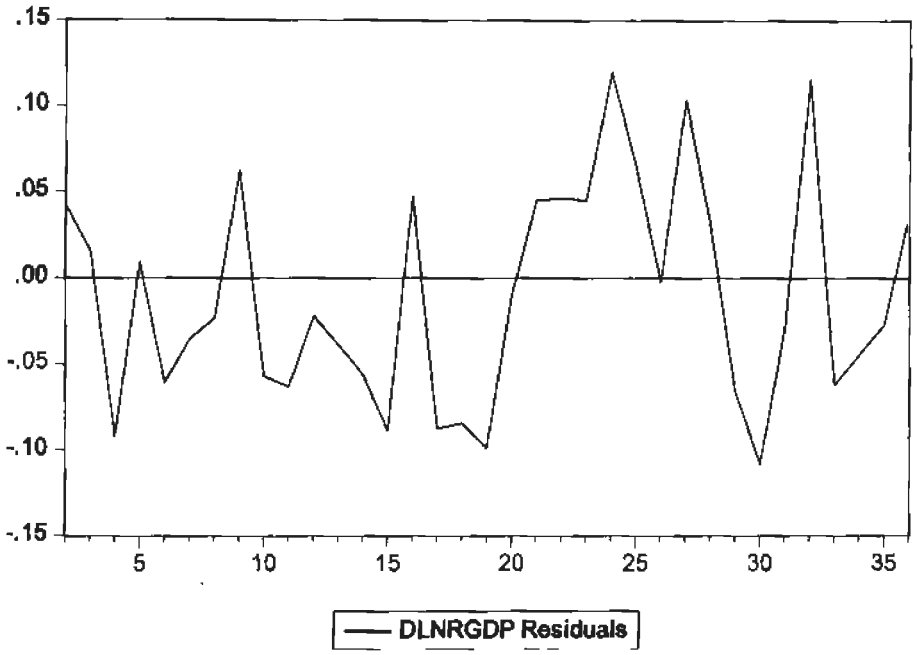


Figure 4.4: Residuals (Volatility Clustering)

Clustering volatility explaining that five years period of low volatility are followed by another five years periods of low volatility for a long period for twenty years and then periods of high volatility for next five years will be followed by periods of another five years high volatility for a long period of fifteen years. Auto regressive test is also explaining that the lag effect or difference effect of one year is significant to the previous year which gives us the permission to validity to run ARCH.

Table 4.16: ARCH (Auto Regressive Conditional Hetrosedasticity)

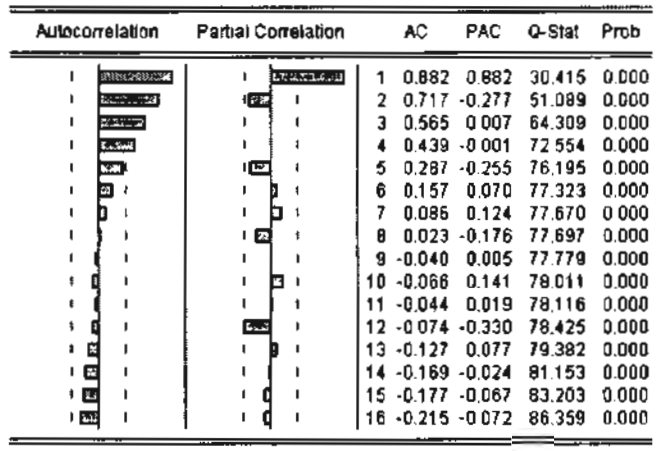
Variable	Coefficient	Std. Error	Z-Statistic	P Values
DLNPR	0.248828	0.042663	5.832407	0.0000
DLNINV	-3.517582	1.135627	-3.097481	0.0020
DLNTO	1.205052	0.426251	2.827093	0.0047
DLNLF	2.820589	0.311748	9.047644	0.0000
DLNGC	5.330279	1.142287	4.666321	0.0000
DGHDI	9.652425	6.025111	1.602033	0.1091
C	0.003930	0.009310	0.422092	0.6730
RESID(-1)	2.121045	0.758875	2.794986	0.0052

Table 4.16 determines the ARCH affects that how the one term is significant with the next term. If the constant term is not included then all the variation is included in the residual term. As it is shown in the table 4.16 that the coefficient of arch effect is less than 5 percent indicating that null hypothesis is rejected meaning that arch effect is effecting the volatility of dependent variable i.e. real gross domestic product. Arch effect shows the previous base volatility of the model. Rejection of the null hypothesis also indicating that volatility in the real gross domestic product is influence by the arch. Arch is basically the internally effect of real gross domestic product. The results of the model are significant which explains that the one term is dependent on its previous lag term. So there exist auto regressive conditional hetrosedasticity in the model.

Table 4.17 :(Generalized Auto Regressive Conditional Hetrosedasticity) (GARCH)

Variable	Coefficient	Std. Error	Z-Statistic	P Values
DLNPR	0.241538	0.052682	4.584860	0.0000
DLNINV	-3.539819	0.603004	-5.870312	0.0000
DLNTO	1.652020	0.707017	2.336607	0.0195
DLNLF	2.381083	0.346228	6.877207	0.0000
DLNGC	5.407287	1.063639	5.083760	0.0000
DGHDI	11.72271	6.424507	1.824686	0.0680
C	0.001134	0.003902	0.290650	0.7713
RESID(-1)	-0.129445	0.035906	-3.605108	0.0003
GARCH(-1)	1.204306	0.079010	15.24237	0.0000

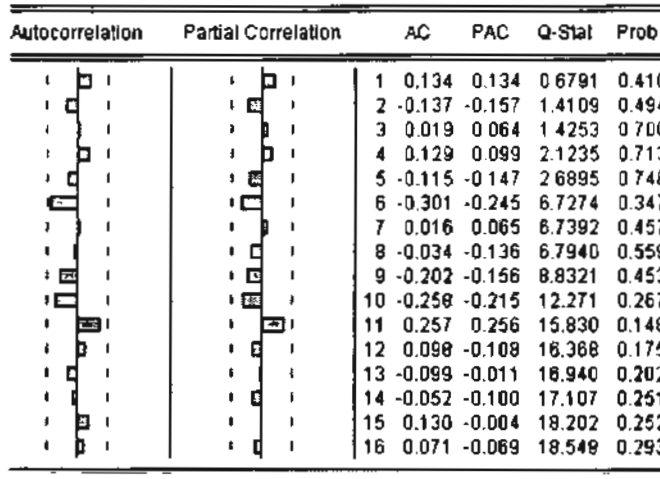
The results of the Table 4.17 are significant which determines that volatility of one error term will affect the significance of the volatility of the next term. Generalized auto regressive conditional hetrosedasticity explains that if one term is volatile then due to it next term will maintain the volatility and will also be significant and the results in the above table also that generalized auto regressive hetrosedasticity exist and the volatility does exist among the residual terms. Generalized auto regressive hetrosedasticity explains that previous year residual variance or the volatility of real gross domestic product. Generalized auto regressive hetrosedasticity effect is the internal cause of volatility of real gross domestic product. Table also indicates that personal remittance is the external cause of volatility of real gross domestic product meaning that the volatility of the personal remittance also influence the volatility of real gross domestic product and personal remittance is influencing the real gross domestic product positively because the coefficient of personal remittance is positive. So we can say that remittances influence real gross domestic product positively. Volatility of the trade openness, lf and gross capital also influence the volatility of real gross domestic product positivity. Volatility of investment also influences the volatility of the real gross domestic product but negatively. Coefficient of the growth human development index is not significant which indicate that growth human development index does not influence the volatility of the real gross domestic product.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.882	0.882	30.415	0.000
		2	0.717	-0.277	51.089	0.000
		3	0.565	0.007	64.309	0.000
		4	0.439	-0.001	72.554	0.000
		5	0.287	-0.255	76.195	0.000
		6	0.157	0.070	77.323	0.000
		7	0.086	0.124	77.670	0.000
		8	0.023	-0.176	77.697	0.000
		9	-0.040	0.005	77.779	0.000
		10	-0.066	0.141	78.011	0.000
		11	-0.044	0.019	78.116	0.000
		12	-0.074	-0.330	78.425	0.000
		13	-0.127	0.077	79.382	0.000
		14	-0.169	-0.024	81.153	0.000
		15	-0.177	-0.067	83.203	0.000
		16	-0.215	-0.072	86.359	0.000

Figure 4.5: Correlogram of Transformed RGDP at Level

Cross correlogram explains that stationary of real GDP under the hypothesis that real GDP is stationary against thealternative hypothesis that real GDP is not stationary. In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics as all the prob values are less than 5 % so we reject the null hypothesis and conclude that real GDP is not stationary at level.

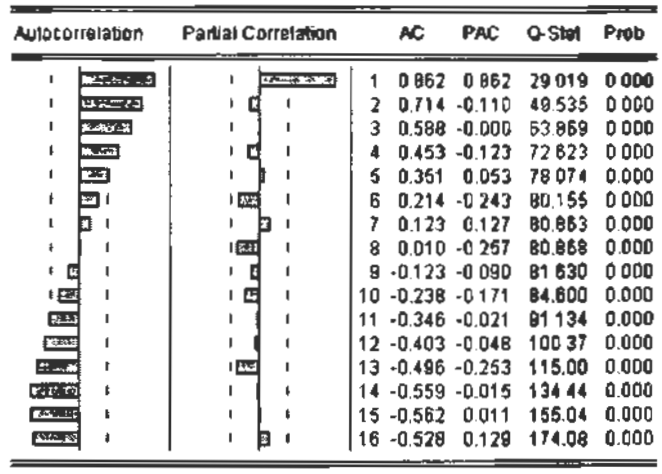


Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.134	0.134	0.6791	0.410
		2	-0.137	-0.157	1.4109	0.494
		3	0.019	0.064	1.4253	0.700
		4	0.129	0.099	2.1235	0.713
		5	-0.115	-0.147	2.6895	0.748
		6	-0.301	-0.245	6.7274	0.347
		7	0.016	0.065	6.7392	0.457
		8	-0.034	-0.136	6.7940	0.559
		9	-0.202	-0.156	8.8321	0.453
		10	-0.258	-0.215	12.271	0.267
		11	0.257	0.256	15.830	0.148
		12	0.098	-0.108	16.368	0.175
		13	-0.099	-0.011	16.940	0.202
		14	-0.052	-0.100	17.107	0.251
		15	0.130	-0.004	18.202	0.252
		16	0.071	-0.069	18.549	0.293

Figure 4.6: Correlogram of Transformed RGDP at First Difference

Cross correlogram explains that stationary of real GDP at first difference under the hypothesis that real GDP is stationary against the alternative hypothesis that real GDP is not stationary.

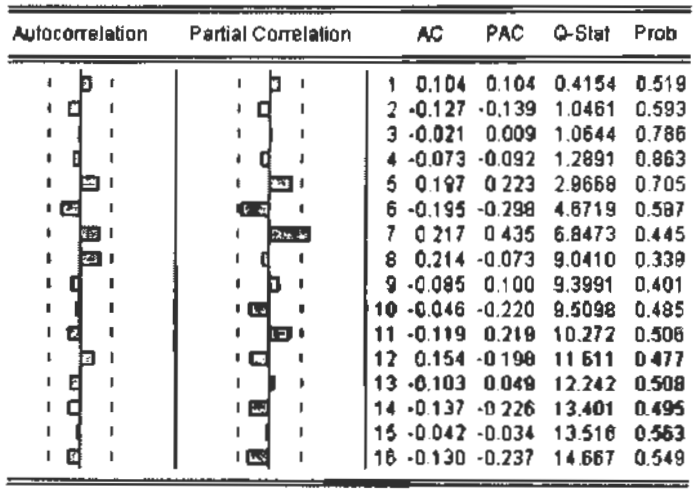
In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics as all the prob values are more than 5 % so we cannot reject the null hypothesis and conclude that real GDP is stationary at first difference.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.862	0.862	29.019	0.000
		2	0.714	-0.110	49.535	0.000
		3	0.588	-0.000	63.869	0.000
		4	0.453	-0.123	72.623	0.000
		5	0.351	0.053	78.074	0.000
		6	0.214	-0.243	80.155	0.000
		7	0.123	0.127	80.863	0.000
		8	0.010	-0.257	80.868	0.000
		9	-0.123	-0.090	81.630	0.000
		10	-0.238	-0.171	84.600	0.000
		11	-0.346	-0.021	91.134	0.000
		12	-0.403	-0.048	100.37	0.000
		13	-0.496	-0.253	115.00	0.000
		14	-0.559	-0.015	134.44	0.000
		15	-0.562	0.011	155.04	0.000
		16	-0.528	0.129	174.08	0.000

Figure 4.7: Correlogram of Transformed PR at Level

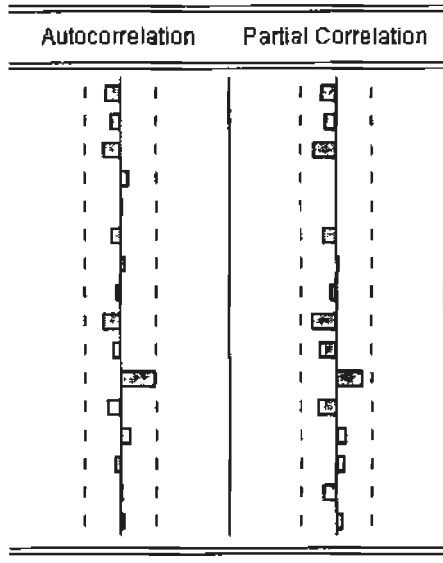
Cross correlogram explains that stationary of personal remittances under the null hypothesis that personal remittances is stationary against the alternative hypothesis that personal remittances is not stationary.In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics, as all the probability values are less than 5 % so we reject the null hypothesis and conclude that personal remittances is not stationary at level.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.104	0.104	0.4154	0.519
		2	-0.127	-0.139	1.0461	0.593
		3	-0.021	0.009	1.0644	0.786
		4	-0.073	-0.092	1.2891	0.863
		5	0.197	0.223	2.9668	0.705
		6	-0.195	-0.298	4.6719	0.587
		7	0.217	0.435	6.8473	0.445
		8	0.214	-0.073	9.0410	0.339
		9	-0.085	0.100	9.3991	0.401
		10	-0.046	-0.220	9.5098	0.485
		11	-0.119	0.219	10.272	0.506
		12	0.154	-0.198	11.611	0.477
		13	-0.103	0.049	12.242	0.508
		14	-0.137	-0.226	13.401	0.495
		15	-0.042	-0.034	13.516	0.563
		16	-0.130	-0.237	14.667	0.549

Figure 4.8: Correlogram of Transformed PR at First Difference

Cross correlogram explains that stationary of personal remittances at first difference under the null hypothesis that personal remittances is stationary against the alternative hypothesis that personal remittances is not stationary. In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics as all the probability values are more than 5 % so we cannot reject the null hypothesis and conclude that personal remittances is stationary at first difference.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.140	-0.140	0.7277	0.394
		2	-0.093	-0.115	1.0577	0.589
		3	-0.171	-0.209	2.2155	0.529
		4	0.080	0.007	2.4781	0.649
		5	0.022	-0.008	2.4982	0.777
		6	-0.089	-0.118	2.8445	0.828
		7	0.025	0.011	2.8733	0.896
		8	-0.031	-0.052	2.9189	0.939
		9	-0.168	-0.236	4.2927	0.891
		10	-0.080	-0.167	4.6155	0.915
		11	0.325	0.249	10.230	0.510
		12	-0.126	-0.176	11.119	0.519
		13	0.084	0.094	11.530	0.567
		14	-0.064	0.072	11.783	0.624
		15	0.013	-0.131	11.794	0.695
		16	0.032	0.052	11.865	0.753

Figure 4.9: Correlogram for Residuals of Remittances and Growth

Cross correlogram explains that stationary for residuals of Remittances and Economic growth at first difference under the null hypothesis that variables are stationary under the altenative hypothesis variables are not stationary. In the above figure AC indicate the (autocorrelation) PAC indicate the Partial auto correlation and Q-Stat indicates the Q-statistics as all the prob values are more than 5 % so we cannot reject the null hypothesis and conclude that residuals data series is stationary at first difference.

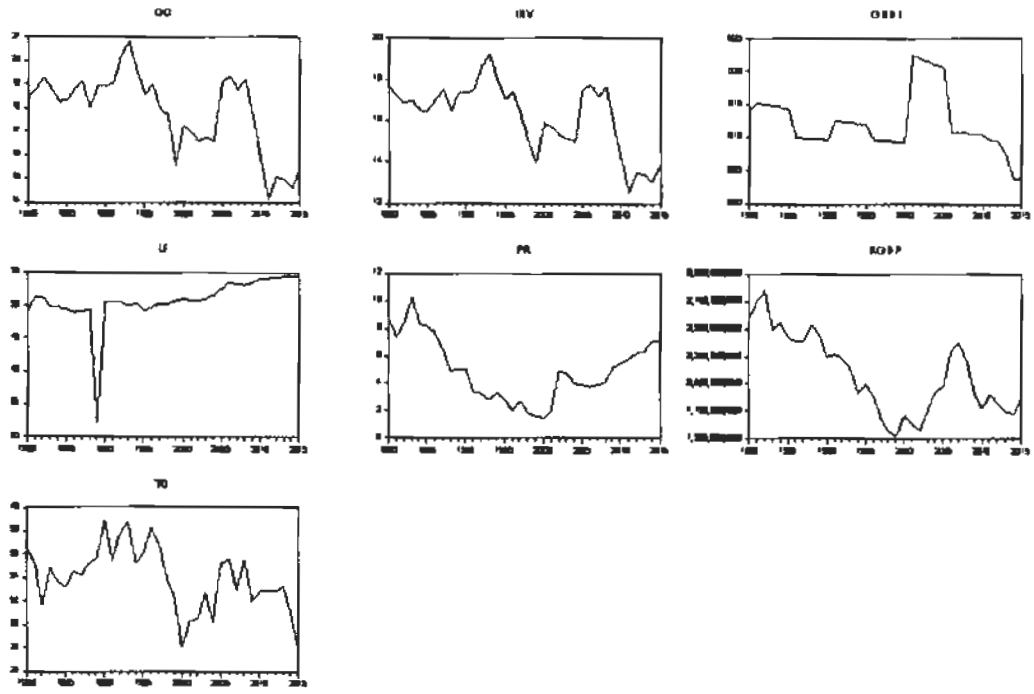


Figure 4.10: Plot showing the actual trend of Original Series

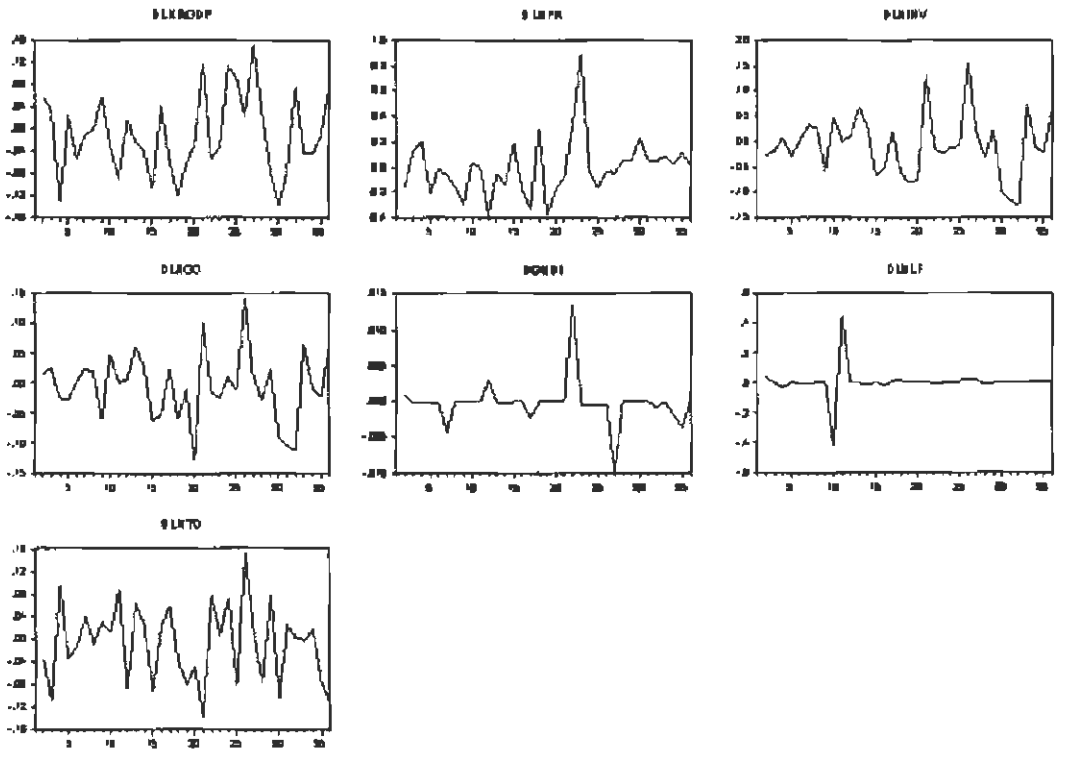


Figure 4.11: Plot showing the actual trend of Transformed Series at First Difference

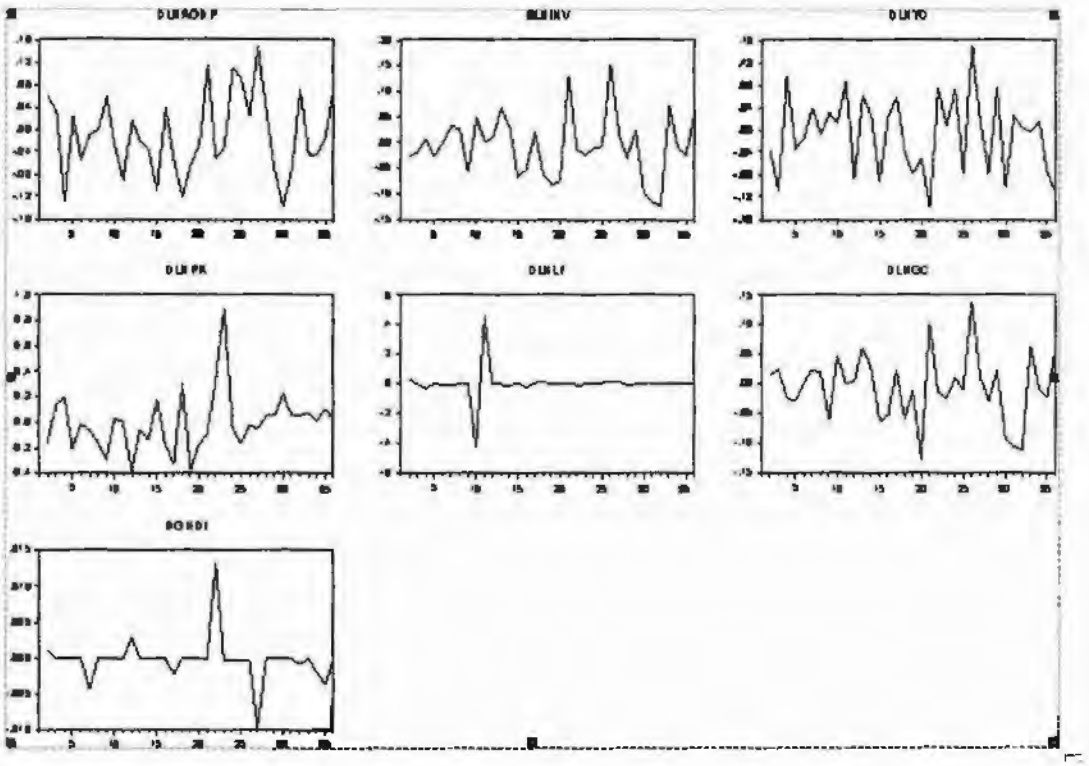


Figure 4.12: Plot Showing the Residual Graph of Whole Series

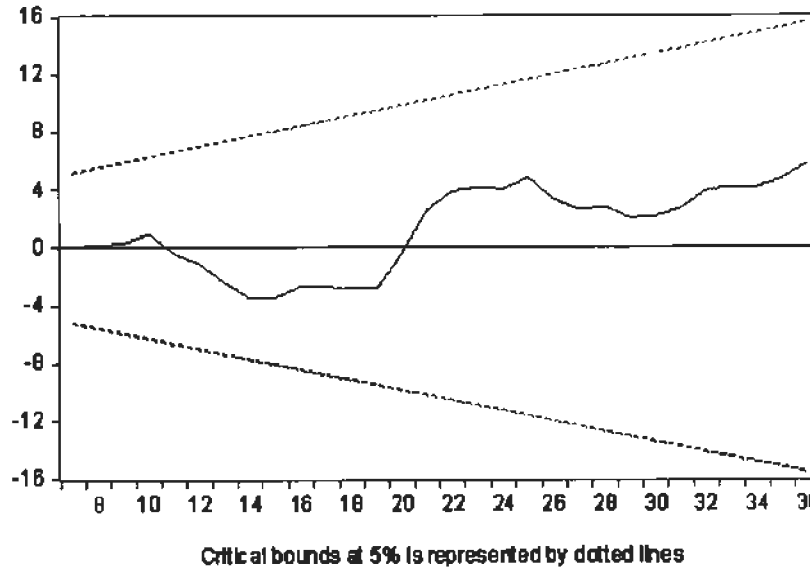


Figure 4.13: CUSUM Plot for Remittances and Economic Growth

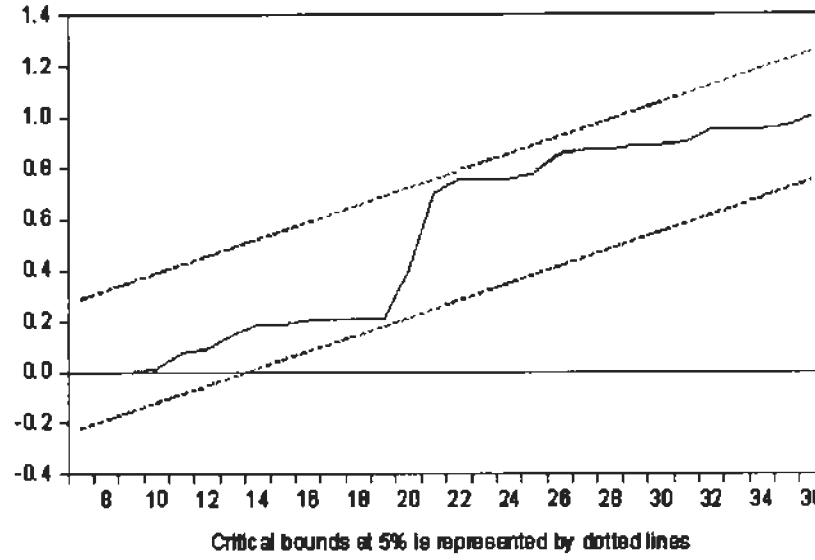


Figure 4.14: CUSUMSQ Plots for Remittances and Economic Growth

Figure 4.13 and 4.14 represent the result of cumulative sum and cumulative sum of squares respectively. Graph of the both plots displaying that plots are lying within the

limits of five percent critical bounds, which indicates that the short term estimates and long term estimates are at their equilibrium point meaning that estimates are stable which

Also confirm that our dependent variable RGDP is stable and there is no structural break.

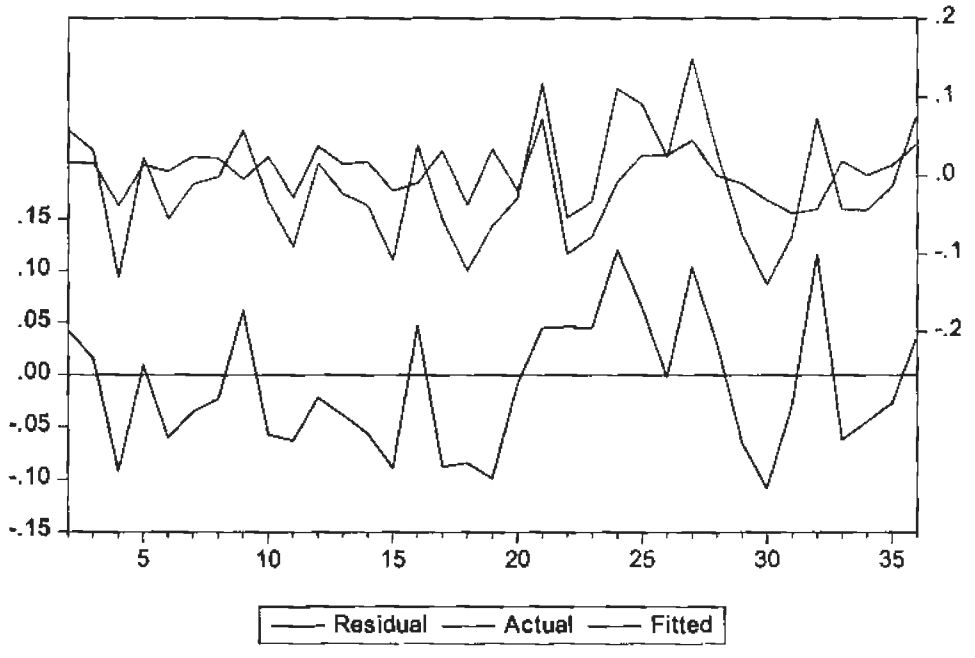


Figure 4.15: Actual, Fitted Residual Graph of Economic Growth

The figure 4.15 represents the graph of economic growth. In most of the series actual and fitted line is close to each other. Residual plot of the economic growth indicating that most of the points are within the limits but some of the points also lie outside the interval, which shows that residuals of the economic growth are stable.

CHAPTER 5

CONCLUSION

The ultimate target of this study was to look at the long term and short term influence of remittances on growth, the study also investigate the causality between the volatility of remittances on economic growth by using the sample period from 1980 to 2015. To check the stationary of the variables Augmented Dickey Fuller (ADF) test was used. Results of the Augmented Dickey Fuller test showed that variables were stationary at their first difference. Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion were used to determine the inclusion of the lags in the model and the results were giving the strong indication that we should include one lag in our final economic growth model.

Model summarized on that the long run causality by using the Johnson's Cointegration methodology. The results showed that long run causality or long run relationship was signposting from the independent variables i.e. personal remittance, investment, trade openness, labor force, gross capital and growth human development index to dependent variable i.e. to real gross domestic product, so there was long run association or long run relationship was found from independent variables towards dependent variable real gross domestic product. We have found that in the long run remittances have a positive impact on economic growth.

We used vector error correction model to check the short run causality among the variables and the results confirmed that different variables had different behaviors. There was no short run causality running from personal remittance, trade openness, labor force and human development index towards real gross domestic product. On the other hand there was a short run causality running from investment and gross capital towards real gross domestic product. Remittances had a negative impact in short run and this may be due to informal ways of transferring of cash.

Pair wise relationship or bivariate relationship or two ways relationship between two variables was verified by using the granger causality test. Dual relationship of all the variables was checked with real gross domestic product. Results showed that relation between personal remittances and real gross domestic product was not significant. Relation between three of the independent variables i.e. investment, trade openness and gross capital with real gross domestic product was unidirectional and significant and in this relation real gross domestic product was the leading variable. Economic growth model showed there was no indication of hetrosedcasticity and autocorrelation; in addition all the diagnostic and stability tests were satisfied by economic growth model.

In the current study to measure the influence of volatility on growth first hetrosedasticity test was used, by using the white test. The results of the hypothesis was significant, which implied that there was problem of hetrosedasticity in the error term i.e. variance was not constant of error term, or there was ARCH affect in the model. After the confirmation of the hetrsedasticity in the error term ARCH and GARCH models were utilized to examine the impact of volatility on growth.

Auto regressive volatility test also explained that one term was dependent on its previous lag term. Auto Regressive Test also explained that the lag effect or difference effect of one year was significant to the previous year which gives us the permission to validity to run ARCH.

The results of the model were significant which indicated that the one term was dependent on its previous lag term. So there exist auto regressive conditional hetrosedasticity in the model. The study found that generalized auto regressive hetrosedasticity exist and the volatility does exist among the residual terms. Generalized auto regressive hetrosedasticity explained that previous year residual variance. The findings of the study also indicate that volatility of the personal remittance also influences the volatility of real gross domestic product and personal remittance was influencing the real gross domestic product positively. Volatility of the trade openness and gross capital also influence the volatility of real GDP positivity. Volatility of investment also affects the volatility of the real GDP product but negatively. Human development index does not influence the volatility of the real gross domestic product.

Future Recommendations

It is recommended in the light of the results of this study that government should take keen interest in enhancing the economic growth. From the research results it is clear that remittances are contributing in economic growth. Government should encourage the workers that they should send the remittances through formal and legal channels. Government can play its part in this regard by reducing the taxes on remittance amount. According to the World Bank (2006) report almost fifty percent remittances remains unregister and unrecorded due to cheaper and speedier transfer of channels. If the government does not take necessary steps it will not be easy for the policy makers to specifically study and access the impact of remittances.

In this study we have used annual time series data study recommends that if the semi-annual or quarterly data is available then more precise results may be drawn which will be fruit-full for the policy makers in the future.

CHAPTER 6

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