AN ECONOMETRIC APPROACH TO DETERMINE THE IMPACT OF REMITTANCES AND SOCIO-ECONOMIC VARIABLES ON POVERTY AND GROWTH RATE

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بسم الله الرحمن الرحيم

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Submitted By

FIDA HUSSAIN

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

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Certificate

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Fida Hussain

A DISSERTATION SUBMITTED IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF THE **MS IN STATISTICS**

We accept this dissertation as conforming to the required standard.

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DEPARTMENT OF MATHEMATICS & STATISTICS
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PAKISTAN

2016

DEDICATION

To My Grand Father

Sardar Feroz Din (Late)

To My Family

For the endless support and patience

To My Teachers

For the constant source of knowledge and inspiration

Forwarding Sheet by Research Supervisor

The thesis entitled **"AN ECONOMETRIC APPROACH TO DETERMINE THE IMPACT OF REMITTANCES AND SOCIO-ECONOMIC VARIABLES ON POVERTY AND GROWTH RATE"** submitted by **FIDA HUSSAIN** (Registration # 21-FBAS/MSST/S13) 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 IIU Islamabad rules and regulations.

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Acronyms

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criteria
ARDL	Autoregressive Distributed Lag
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Square
ECM	Error Correction Model
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
IEQ	Income Inequality
ln	Natural Logarithm
MWALD	Modified Wald
ODA	Official Development Assistance
OLS	Ordinary Least Square
P	Poverty (Headcount Ratio)
PBS	Pakistan Bureau of Statistics
PCY	Per Capita Income
PCE	Private Consumption Expenditure
PDI	Personal Disposables Income
REM	Remittances

SC	Schwarz Information Criteria
SPDC	Social Policy and Development Centre
SUR	Seemingly Unrestricted Regression
TDO	Trade Openness
T-Y	Toda and Yamamoto
VAR	Vector Autoregressive
WDI	World Development indicators

ABSTRACT

The present study investigates the impact of remittances and socio-economic variables on poverty and economic growth in Pakistan over the time period 1976 to 2013.We used the autoregressive distributed lag (ARDL) model using a two equation technique that includes co-integration and error correction model (ECM).The co-integration model estimates the long run relation that exists between the regressand and explanatory variables, ECM determines the short run relationship between remittances, poverty and their determinants. Toda and Yamamoto (T-Y) technique is used for the causality analysis. The results demonstrate the existence of a positive and significant relationship between remittances and economic growth in the long run. The gross fixed capital formation has a positive and significant impact on economic growth in long run and short run. Official development assistance has a positive and significant impact on economic growth in the long run. In the poverty model the results indicate that the coefficient of per capita income is negative and statistically significant in the short run. The negative sign of per capita income indicates a positive impact on poverty reduction. The results suggest that an increase in remittance can directly lead to poverty reduction in the long run. This may be due to the fact that remittances directly increase the income of poor people, smooth the household consumption and ease capital constraints. The Gini coefficient of income inequality has positive relation in long run and short run with poverty. So the importance of remittances inflows cannot be denied in the terms of growth enhancement and poverty reduction that consequently improves the social and economics of recipient country. For both model CUSUM and CUSUMSQ showed the long run and short run estimate are stable and there is no any structural break. The result of granger non causality indicates the bi-directional causality between private consumption expenditure and poverty. Moreover, unidirectional causation is noted from personal disposable income to poverty.

Chapter 1

Introduction

The proposed work is designed to investigate, the short run and long run effects of remittances and socio-economic variables on poverty and economic growth by using the Autoregressive Distributed Lag (ARDL) approach for annual time series data for the period 1976-2013 in Pakistan.

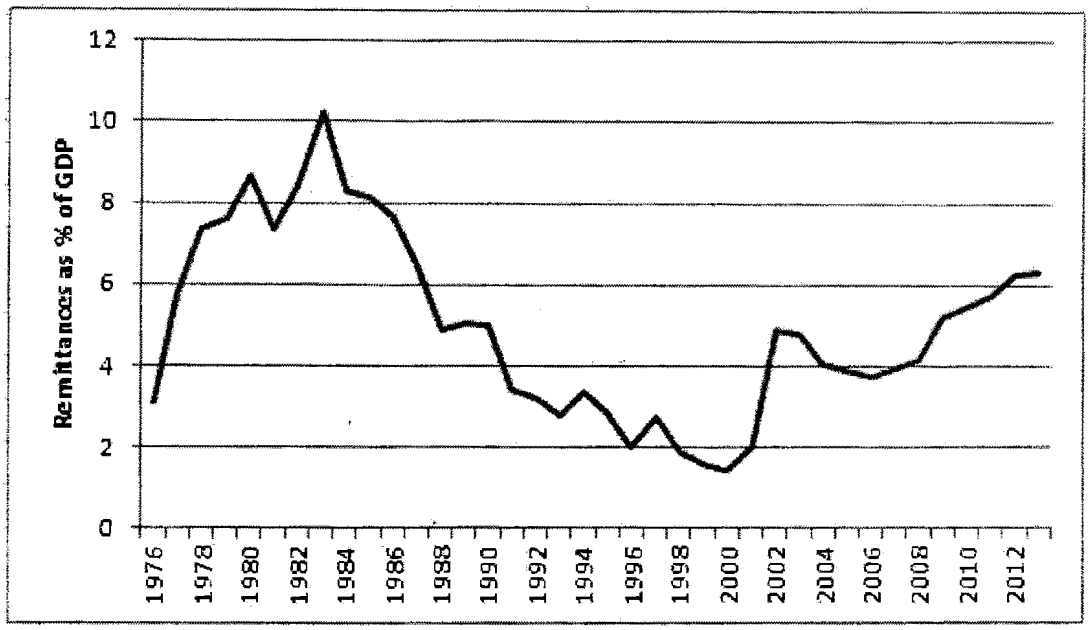
The term remittances refers primarily to the money, migrants send back to family (and perhaps other community members) in the country of origin (or, sometimes, third countries).The size of the flows suggests that the topic of remittances extends beyond the money itself, affecting migrant-sending countries in quite broad ways, beyond the individuals who are the direct recipients. Remittances are second largest source of financial inflow to several developing countries. Remittances contribute to economic growth and to the livelihood of people worldwide. Inflows of the remittances support the economy of the recipient countries in different natural hazards and financial shocks.

South Asia is cheap labor provider in the whole world and the reason behind its rapidly increasing population. A large number of developed countries concentrate on South Asian countries to overcome the labor deficiency and the skilled labor hiring to work in their countries. So the economies development of Asia, especially Pakistan, Bangladesh and India also support this work to enable young people and stabilize the economy through remittances.

1980s seemed, by all accounts, to be a brilliant period for Pakistan when about half of the inflow of remittances to South Asia was incorporated compared with twelve percent in 2009.As per official information remittances inflow to Pakistan reduced from US$1467 million in 1991 to US$ 1086 million in 2000/01 however later on the remittances recorded a substantial increase to US$ 5.6 billion in 2008-09 and around US$ 11 billion in 2010 and 2011. The inflow of remittances during the fiscal year 2013 is 14.6 billion US$ (World Bank 2013). Pakistan has received a significant amount of remittances during the most recent four decade. Major sources of remittances for Pakistan are Saudi

Arabia, The United States and The United Arab Emirates. The United Arab Emirates and economic growth can be achieved by foreign remittance as it supports the persons for their consumption expenditure. Role of remittance for economic development of Pakistan can never be overlooked as it provides employment opportunity, poverty reduction, get better standard of living, prevent from the crises of balance of payment, increase foreign exchange reserve, less volatility on exchange rate and improved credit rating of country. The contrast views about relationship of GDP and Remittances have been shown in the literature. The relationship depends on motives of remitter that either he is transfering money for consumption purpose or for investment purpose. The existing literature shows Positive relationship among GDP and Remittances if the person transfers money for consumption purpose while negatively related when sending money for investment purpose.

Remittances as a percentage of GDP started to decline after 1983 according to World Bank data Figure 1.1 and reached in minimum levels during 1990s.The decade of 1990s is conserved to lost decade in Pakistan's history due to worst economic performance mainly caused by political instability after the return of democracy to the country. This ratio started to rise again in 2002 and aftermath of 9/11 incidents, the inflow of remittances increased and their underlying trend is upward since then.



Source: Author's construct, using data from world development indicators (2012)

Figure 1.1: Remittances inflows as percentage of GDP

As indicated by world bank (2013) Pakistan is positioned at seventh top migration nation with 4.7 million exiled people and eleventh top remittances getting nation with 14.6 billion US$. The inflow of remittances performs an important role in reduction of poverty in developing countries. In fact Poverty is a worldwide phenomenon that cultivate in developing countries. There is not unique definition of poverty. Generally poverty is measure on incomes base. As per this approach "an individual is termed poor if his or her financial gain level less than some minimum level necessary to fulfill basic needs. This least level is known as the poverty line". What's crucial to guarantee fundamental needs varies across time and societies. Therefore, definition of poorness differs with reference to time and place, and every country uses lines that are acceptable to its level of development, social norms and values. In Pakistan calorie based poverty line has been used (Economic Survey), "Expenditure on calorie intake of 2550 calories per adult equivalent per day, at the side of consumption expenditure on non food items, is totality to build a poverty line".

Pakistan has a population of 189 million approximately. In Pakistan intensity of poverty increases day by day and more than 40% individuals reside below the poverty level. Sustainable Development Policy Institute (SDPI) carries out a study to explore poverty level in Pakistan. SDPI exposed that every third Pakistani lives his/her life below the poverty line. Baluchistan is facing the severe economic condition about 52% individuals living the below poverty line, 33% of Sindh, 32% of KPK and 19% individual in Punjab are facing the poverty.

In Pakistan, there is large scale inequality in the income distribution. The main cause for poverty is improper distribution of growth and developments among all groups. Consequently country is facing a major financial gap among different segments. As a result country face very high income gap between different classes. The reason of this income gap is lack of justice. Because of which only the top ten percent of the nation is getting richer day by day while the low income class is getting poorer day by day. Consequently, the middle income class which is the backbone of any country is suffering more. The government and also the establishment have didn't management to control the rising poverty within the country.

Ratha et al. (2010) carry out a study to assess the effect of remittances in developing countries, the results indicate that remittances influence economic growth and play a role in poverty alleviation. Further, the author claim that magnitude of recorded remittances to developing countries has increased over the last decade, reaching US$336 billion in 2008; in the early 1990s remittances totaled less than US$50 billion annually.

Khathlan (2012) explored a study to check the effect of remittance on growth. To take a look the long run and short run relationship between economic growth and its determinants author apply autoregressive distributed lag approach. The empirical findings indicate a positive influence of remittances on growth in the long run and short run.

Javid *et al.* (2012) examined the consequence of remittances inflow on poverty and economic growth in Pakistan using time series data .They used autoregressive distributed lag approach for estimation. The finding shows a positive effect of remittances on economic growth in the long run however remittances are inversely linked with economic

growth in the short run. He likewise asserts remittances are inversely related with poverty in Pakistan in the long run.

Faridi and Mehmood (2014) carry out a study to inspect the effect of remittances on poverty in Pakistan. To found the empirical result they use ordinary least square (OLS) approach by utilizing the time series data from 1972 to 2010. The findings demonstrate that worker's remittances are inversely associated to poverty. One percent rise in remittances leads to 10 percent decline in poverty and one percent rise in GDP descends poverty by 0.83 percent. Inflation and poverty is positively related to each other, i.e. 1% rise in inflation increases 1.63% poverty in Pakistan.

Shafiq *et al.* (2012) assessed the influence of remittances and economic growth on poverty in Pakistan. They used data from period 1978 to 2010.To find the co-integration they adopted Johanson Juselius technique, and to explore the long term and short term association vector error correction model (VECM) is applied. The finding of study shows that remittances and growth are inversely linked with poverty in the long run.

Objectives of the study:

The major objectives of the proposed work are to trace the effect of remittances on poverty and economic growth in Pakistan. In doing so, the study intends:

- To evaluate the relationship between remittances and economics growth.
- To investigate the impact of remittances on poverty.
- To check the causality between poverty and its indicators.

Chapter 2

Literature Review

Many researchers have taken a close look at the impact of remittances on developing countries as well as on both receiving and sending countries. Numerous studies have explored that remittances effect economic growth positively and reduced poverty. Variety of studies are accessible that inspected the influence of remittances on poverty and growth rate in Pakistan however majority of them base on survey knowledge. The present study adds to available literature by practically analyzing the impact of remittances on poverty and economic growth.

Khathlan (2012) investigated the influence of remittances and socio-economic variable on economic growth for Pakistan. He applies the log linear modeling to compute the link between remittances and economic growth.To trace the long run and short run relationship, he used autoregressive distributed lag (ARDL) technique.The empirical finding shows that remittances are positively associated with growth in the long run and short run.

Imai *et al.* (2012) evaluated the effect and volatility of remittances in 24 Asian countries by using annual panel data.The findings of study show that remittances contribute positively in economic growth but the precariousness is harmful for economic growth. They also argue that remittances have a influence to poverty reduction in Asian countries.

Kumar (2011) studies the role of effect of remittances and exports on economics growth for Pakistan by utilizing time series data from 1976 to 2009.The empirical result declared from this technique, show that in the long run remittances contribute about 0.08% to GDP, the contribution of remittances to GDP is negative in short run. Export has positive and significant impact on GDP and contributes 0.15% in the long run and 0.09% in short run.

Odionye and Emerole (2015) were trying to estimate the impact of international remittances on the Nigerion Economy. They took dependent variable remittances and

independent variables real exchange rate (RER) and real interest rate (RIR). The bound test is used to inspect the long run and short run effect taking time series data from 1981 to 2010. The finding shows a positive influence of remittances on Nigerion Economy in the long run.

Samuel *et al.* (2013) assessed the effect of remittances, real gross domestic product, inequality, human capital, real private investment, inflation, trade openness, real interest rate and government expenditure on poverty in Ghana. They used time series data from 1980- 2010, under the bounds test approach. Their finding suggested that 1% increase in remittances would decrease 1.17% poverty in the long run and 2.98% short run.

Adams (1991) evaluated the effect of remittances on poverty in rural Egypt, Using household survey 1986 and 87 and originate that the number of poor family diminished by 9.8 percent when estimated per capita household income included international remittances.

Javid *et al.* (2012) verify the consequence of remittances on growth and poverty by using two different models. They used Bounds test approach with time series data. The empirical finding shows that there a constructive relationship among remittances, growth and poverty over the long run. However, remittances are inversely associated with economic growth and poverty in the short run.

Lucas (2004) argued that international remittances help to overcome poverty in recipient countries through the rise in their income and smoothing their consumption. It also investigated that remittances facilitate the recipient to spend in physical and human capital.

Moghal and Diawara (2009) carry out a study to trace the effect of remittances on both poverty and inequality in Pakistan. The results demonstrate that the international remittances reduced inequality and poverty. They also found the separate negative influence of remittances on inequality and poverty received from Middle East.

The United Nations (2011) conduct a study in seventy seven developing countries to evaluated the significance of remittances on poverty by using unbalanced panel data for

the period 1980 to 2008. Three Stage Least Square (3SLS) estimation method is used for analysis, the analysis is divided into two sections. Firstly, the analysis is undertaken for all 77 developing countries and findings show that on average 10 percent increase in remittances causes about 3.1 percent decline in headcount ratio and 3-5 percent poverty gap in developing countries. Secondly, the separate analysis is conducted for the countries with remittances as a percentage of GDP of 5 percent or more. For this, 29 developing and 21 Asian developing countries are considered. The empirical analysis shows that on average 10 percent increase in remittance shows that 3.9 percent reduction in poverty headcount ratio and 3-3.5 percent decline in poverty gap in developing countries which have 5 percent or more share of remittances in GDP.

A study by World Bank (2007) explored the influence of remittances on human capital and poverty in eleven Latin American countries by using national representative household survey. The main findings of study showed that remittances reduced poverty level in recipient countries and had positive significant influence on health and education.

Iqbal and Sattar (2005) evaluated that remittances enhance the economic growth by increasing the balance of payment, dropping the dependence on exterior borrowing and current account deficit. Saddiqui and Kemal (2006) identified that during nineties decline in remittances rises poverty in Pakistan.

Qayyum *et al.* (2007) assessed the influence of remittances on poverty and economic growth under the mechanism of bounds test approach. The result showed that the inflow of remittances can lead to sustainable growth rate and improve the living standard of the poor household in the long run.

Ukeje and Obiechina (2013) considered a log liner modeling to determine the impact of worker's remittances, foreign direct investment, export and foreign exchange on nominal gross domestic product in Nigeria, utilizing time information from 1970 to 2010.To observe the long run and short run effect they used Johansen Co-integration approach. The finding demonstrated that worker's remittances have positively effect on economic growth in the long run and short run.

Faridi and Mehmood (2014) determine the impact of foreign aid, remittances, private investment life expectancy, education expenditure, inflation, government expenditure, gross domestic product on poverty in Pakistan for the time period 1972 to 2010.Using the Ordinary Least Square (OLS) method. They used log-log modeling. The empirical results show that worker's remittances are inversely associated to poverty. 1 percent rise in remittances leads to 10 percent decline in poverty and 1 percent rise in GDP descends poverty by 0.83 percent. Inflation and poverty is positively related 1% rise in inflation increases 1.63% poverty in Pakistan.

Hussain and Anjum (2014) explored the effect of workers' remittances on economic growth for Pakistan, during the time span of 1973 to 2011.They took the dependent variable gross domestic product while the remittances, financial development, inflation, trade openness, term of trade, world GDP growth, government expenditure and exchange rate as independent variables. In this study, to achieve target, generalized method of moment (GMM) is used. The finding of study showed that workers' remittances as well as GDP are statistically significant and play a positive role in Pakistan economy.

Dilshad (2013) determined the effect of remittances, working labour force and gross fixed capital formation on economic growth in Pakistan. He utilizes time information for the period 1991 to 2012.To evaluate the link between the explanatory and response variables regression and correlation analysis is employed. The study recognized a noteworthy association among remittances and economic growth in Pakistan. In addition, the author suggested that Pakistan should formulate such policies which ensure easier, faster and legal inflow.

Shafiq *et al.* (2012) assessed the effect of remittances and economic growth on poverty in Pakistan. They utilized the time information from period 1978 to 2010.To find the co-integration they adopted Johanson Juselius technique, and to see the long run and short run relationship vector error correction model (VECM) is employed. Economic growth and remittances have negative effect on poverty in the long run. The finding shows that 1% raise in economic growth reduced 0.53% poverty similarly 1% raise in remittances alleviate 38% poverty in Pakistan.

Alimi and ofonyelu (2013) considered a study to examine the co-integration and causality between foreign interest rate, expected rate of inflation, real interest rate, and nominal effective exchange rate. To investigate causality and the long run relationship among the variables they used Johnson co-integration approach and Toda Yamamoto procedures under the modified Wald test (MWALD) respectively. The empirical finding demonstrates that long run relationship exists among the variables. Unidirectional causality is noted between expected inflation and nominal interest rate.

Ahmed *et al.*(2011) explored the effect of money supply ,remittances and export on economic growth in Pakistan. By using the data from 1976 to 2009.In study they used autoregressive distributed lag (ARDL) technique to inspect the long run and short run relationship between dependent variable and its determinants. The empirical result shows that remittances are significant at 1% and a 1% rise in remittances increases 0.02% economic growth in the long run and 0.034% in the short run.

Chapter 3

Materials and Methods

3.1. Source of Data

The methodology adopted for the study is discussed in this chapter. The issues discussed include the econometric framework for the study. Time series data is used from 1976 to 2013. All data used in analysis were taken from World Development indicators (WDI), Pakistan Bureau of statistics (PBS) and Social Policy and Development Centre Karachi (SPDCK). Our concerned variables are, Per Capita Income (PCY), Official Development Assistance (ODA), Gross Fixed Capital Formation (GFCF), Poverty Headcount (P),Trade Openness (TO), Income Inequality (INE), Real Gross Domestic Product (RGDP), Remittances (R), Inflation (IN) Private Consumption Expenditure (PCE) and Disposable Personal Income (DPI).

3.2. Variables Description

3.2.1 Real Gross domestic product

Real gross domestic product (RGDP) is the aggregate of all goods and services which are produced in an economy within a particular year and it is computed by utilizing the prices of chosen base year.

3.2.2 Remittances

The term remittances refers to amount of foreign exchange that migrants earn and sent back to their dependants in their homeland, family or place of origin.

3.2.3 Gross Fixed Capital Formation

Gross fixed capital formation presents the net increase in physical resources within a measurement period (investment – disposals). It excludes the consumption of

fixed capital, and does not include purchase of land. It is a part of expenditure approach to calculate GDP.

3.2.4 Inflation

Inflation is an important and widely talked about concept in the modern economics. In simple word, inflation means a situation in which there is a continuous rise in general price level.

3.2.5 Official Development Assistance

Official development assistance is characterized as government aid which is used to improve the economic development and welfare of developing countries. Loans and credits for military purposes are excluded. Assistance may be proportionate bilaterally, from contributor to beneficiary, or forwarded by a multilateral development organization such as the United Nations or the World Bank.

3.2.6 Poverty

The easiest approach to compute the amount of poverty is the head count ratio it just adds up the number of individuals falling below the poverty line and sometimes expressed as a proportion of the total population. National assessments depend on population-weighted sub-group estimates from household surveys .The poverty line is defined as based on calorie requirement of 2550 per day plus other basic needs of a person. The selection of poverty line at 2550 calorie is decided by data availability and is widely used by Social Policy and Development Centre (SPDC) and Some Author's Jamal (2006). Qayyum (2007). Javid (2012) and Faridi(2014).

3.2.7 Trade Openness

Openness is known as percentage trade of gross domestic product. Trade is the sum of exports and imports of goods and services as a proportion of gross domestic product.

3.2.8 Per capita Income

In order to know the average income of people in a country, per capita income is calculated i.e. income per head of population. It is obtained when national income is divided by population of a country.

3.2.9 Income Inequality

Income inequality describes how the income is distributed among individuals and household and it is measures by the Gini index. To calculate Gini index we draw the lorenz curve. To draw the lorenz curve we rank group of countries or countries in ascending order according to the percentage population they contain and ratio between the percentage of income they received. We take cumulative percentages of total income along horizontal axis and cumulative number of recipients along vertical axis, beginning with the poorest individual or family unit. One measure is to express the area enclosed between the Lorenz curve and 45 degree line as a ratio of the total area under the 45 degree line. This is a Gini index which varies from zero (complete equality) to one (complete inequality).

3.2.10 Private Consumption Expenditure

Private consumption is termed as the price and consumption of goods and services purchased and consumed by the household.

3.2.11 Disposable Personal Income

Disposable personal income or (disposable income) is the total net amount left with the individuals and households when they have paid direct taxes.

$$DPI = PI - PT$$

Where

PI=Personal income

PT=Personal taxes

3.3 Model Specification

In the proposed study we see the effects of remittances on economic growth and poverty in Pakistan. In doing so we tend to establish following two independent models

3.3.1 Growth and Remittances:

Many studies have used remittances and gross fixed capital formation to analyze the relationship between remittances and economic growth (Ukeje and Obiechina 2013, Khathlan 2012, Kumar 2011, Samuel *et al.* 2013, Javid *et al.* 2012,Dilshad 2013). In light of available literature we classify an empirical to investigate the effect of remittances and some socio-economic variables on economic growth. We include inflation, official development assistance and trade openness in our model. As the high inflation rate reduces economic growth therefore inflation is included in model. Official development assistance causes a rise up in real gross domestic product through the investment came from official assistance. These amount if productivity rested lead to higher level of output. Open trade in case of high quality product and having elastic demand is also helpful to push up the real gross domestic product. Free trade generates competitiveness and through information technology promotes export and creates more employment which ultimately enhances the economic growth. On the basis of above, we decided to use the following econometric model:

$$lnRGDP_t = \gamma_0 + \gamma_1 lnR_t + \gamma_2 lnGFCF_t + \gamma_3 lnIN_t + \gamma_4 lnODA_t + \gamma_5 lnTO_t + \varepsilon_t \quad (1)$$

3.3.2 Remittances and Poverty:

In Pakistan a number of studies analyze the remittances and poverty relationship (Shafiq *et al.* 2012, Faridi and Mehmood 2014, Moghal and Diawara 2009, Javid *et al.* 2012).We introduced per capita income and income inequality in our model which is the key indicator of poverty. An increase in per capita income improves the living standard of households and reduces the poverty. We include the income inequality in our model to check how the income is distributed among individuals and household in our country. On the basis of above, we decided to use the following econometric model.

$$lnP_t = \alpha_0 + \alpha_1 lnPCY_t + \alpha_2 lnINE_t + \alpha_3 lnR_t + \omega_t \quad (2)$$

Where,

- RGDP: Real Gross Domestic Product
- R: Remittances
- GFCF : Gross Fixed Capital Formation
- IN: Inflation
- ODA: Official Development Assistance
- P: Poverty (Headcount Ratio)
- TO: Trade Openness
- PCY: Per Capita Income
- INE: Income Inequality
- PCE: Private Consumption Expenditure
- DPI : Disposables Personal Income

Where the all entire variables are previously defined. ε and ω stand for the usual error terms at time't' in model 1 and 2 respectively and 'ln' denotes the natural logarithm.

This study uses a log linear modeling design to quantify the remittances - growth and poverty - remittance relationship in Pakistan .Log linear modeling is better than different methodologies on theoretical and empirical grounds and it's more likely to search out evidence of a deterrent effect then a linear form, as suggested Layson (1983), Cameron (1994), Kalim and Shahbaz (2009) and Khalid (2012).

3.4 Stationary Test

3.4.1 Unit Root

In econometric studies time series data are used widely; it present particular problems for econometrician. The majority of experimental work that depends upon on time series data assumes that the underlying time series is stationary. The choice of acceptable co-integration technique based on the integration order of all variables. Currently we have a tendency to discuss the way to check existence of unit root in the time series data. To observe such issue we apply the Augmented Dickey Fuller test (ADF). ADF test is one of

the generally exploit methodologies of unit root test that has turned out to be more famous over the numerous previous years.

3.4.2 Augmented Dickey Fuller Test

In 1984 Dickey and Fuller have developed a test referred as the Augmented Dickey Fuller (ADF).To remove problem of autocorrelation, in the regression equation the lag of first difference of response variable is included. The regression equation is presented in the following three forms which are used in this study.

Without drift and trend

With drift

$$\Delta X_t = \partial X_{t-1} + \sum_{j=1}^{k} \gamma_i \Delta X_{t-1} + \epsilon_{1t} \quad (3)$$

$$\Delta X_t = \varphi_o + \partial X_{t-1} + \sum_{j=1}^{k} \gamma_i \Delta X_{t-1} + \epsilon_{2t} \quad (4)$$

With both drift and trend

$$\Delta X_t = \varphi_o + \mu T + \partial X_{t-1} + \sum_{j=1}^{k} \gamma_i \Delta X_{t-1} + \epsilon_{3t} \quad (5)$$

Where

$\Delta X_t = X_t - X_{t-1}$

=Number of lags in dependent variable

$\epsilon_{1t}, \epsilon_{2t}$ *and* ϵ_{3t} are disturbance terms

The ADF test practice is similar for equation (3) ,(4) and (5) but the critical values of tau (τ) test are not seem to be same for every of the three specification, the null hypothesis is that $\delta = 0$ i.e ($H_o : \partial = 0$) mean that the time series have unit root or nonstationary. The

alternative hypothesis is that $\delta < 0$ i.e ($H_A : \partial \neq 0$); this implies that the variable have not unit root, using tau (τ) statistics. At 95 percent confidence level, if the p-value is smaller than or equals to 0.05, we tend to reject H_o otherwise we accept H_A.

3.5 Lag Order Selection:

For unbiased, consistent and reliable results appropriate lag order selection is very important. Inappropriate lag order selection causes the biased and serial correlation in the results. To pick the ideal lag length of the time series variables, range of criterion is accessible for the lag length choice like Schwarz information criteria, Likelihood ratio, Akaike information criteria, Hannan-Quinn and Final prediction error. The appropriate lag length plays an important rule for estimation, as too several lags reduce the power of the test because of the estimation of extra parameters and lost degrees of freedom. On the other hand, excessively few lags may not capture the dynamics of the particular error Correction method leading to poor estimates of coefficients and its standard errors. According to Pesaran and Shin (1997) for small sample size the ARDL-AIC and the ARDL-SC estimates are very similar.

3.6 Co-integration Analysis

If a set of time-series variables is integrated separately by a similar order, and if a minimum of a linear combination of these variables is stationary, then the variables is said to be co -integrated. This means there exists equilibrium between two or more variables. Testing for co-integration implies testing for presence of such a long run relationship between economic variables. Distinctive strategies are accessible for the co-integration, for example, the Johansen's co-integration practice, Engle Granger procedure, Autoregressive Distributed lag (ARDL) method of co-integration etc.

Residuals based test of co-integration is practiced by Engle Granger. Engle Granger methodology needs each one of the variables should be integrated of the same order. However, Engle Granger method has some weakness. It is not appropriate when variables are integrated of different order. Since the Engle Granger technique is based on two steps,

any error presented in the initial step might hold over into the second step, making the result unreliable.

For the implementation of Johansen's co-integration technique, order of integration of the considerable number of variables should be same. This method is not applicable once the variables have completely different order of integration, particularly when certain variables are I(0) Pesara *at el.* (2001).

3.7 The ARDL Co-integration Approach

Autoregressive Distributed lag (ARDL) technique of co-integration is developed Pesaran *et al.*(2001) to overcome the problem of Engle Granger procedure, the Johansen's co-integration procedure and such other techniques. The ARDL procedure has some advantages over the above mentioned techniques. Firstly, it is the more appropriate technique to find the co-integration relationship among the variables when the small sample is small, Ghatak and Siddiki (2001) conversely, Johansen's co-integration method is appropriate in large sample. It means that the ARDL provide solution for biasness in small sample size Chaudhry (2006).

A second point of interest of ARDL system is that it is suitable apart from whether the regressors are integrated of I(1) and/or I(0), however the other techniques of co-integration require same order of integration of all of the regressors. It implies that the ARDL practice maintains a strategic distance from the pre testing issue related with standard co-integration, which needs that the variables be already integrated of order I(0) or I(1) Pesaran et al.(2001).

In Addition, the ARDL technique gives unbiased and valid estimates of long run model even when a few of the regressors are endogenous Pesaran and Shin (1999).Moreover we can introduce a dummy variable in co-integration test process under the ARDL technique, that is not allowed in Johansen's methodology.

Therefore, due to specified preferences, we utilized the ARDL technique of co-integration to investigate the effect of remittances on economic growth and poverty.

As demonstrated by Pesaran *et al.*(2001),the ARDL procedure depends upon the following two steps. Within the initial step, we apply F-test to ensure the presence of any long term relationship among the variables of interest. The second step of the examination is to evaluate the coefficients of the long-run relationship and decide their values, followed by the estimation of the short-run elasticity of the variables with the error correction representation of the ARDL model. The speed of adjustment to equilibrium will be determined by applying the ECM version of ARDL.

For co-integration analysis we apply the bounds test. To examine the long-term relationship among the variables added in model (1) and (2) we adopt the following two versions of the ARDL model.

$$\begin{aligned} lnRGDP_t = \alpha_o &+ \sum_{j=1}^{k} \pi_{1j}\, \Delta lnRGDP_{t-i} + \sum_{j=1}^{k} \pi_{2j}\, \Delta lnR_{t-i} + \sum_{j=1}^{k} \pi_{3j}\, \Delta lnGFCF_{t-i} \\ &+ \sum_{j=1}^{k} \pi_{4j}\, \Delta lnINF_{t-i} + \sum_{j=1}^{k} \pi_{5j}\, \Delta lnODA_{t-i} + \sum_{j=1}^{k} \pi_{6j}\, \Delta lnTO_{t-i} \\ &+ \tau_1 lnRGDP_{t-1} + \tau_2 lnR_{t-1} + \tau_3 lnGFCF_{t-1} + \tau_4 lnINF_{t-1} \\ &+ \tau_5 lnODA_{t-1} + \tau_5 lnTO_{t-1} + \mu TREND + \varepsilon_t \end{aligned} \quad (3)$$

We have already defined all the variables and Δ is first difference operator. The coefficients $\pi_{1j}, \pi_{2j}, \pi_{3j}, \pi_{4j}$ π_{5j} and π_{6j} indicate the short run dynamics of model to be assessed through the error correction structure $\tau_1, \tau_2, \tau_3, \tau_4, \tau_5$ and τ_6 shows the long run coefficients. α_o is the intercept , ε_t is error term and 'k' denotes the lag length of autoregressive method.

We apply the bound test to follow whether or not there exist the long run relationship among the variables by comparing all evaluated coefficients of lagged level variables equal to zero. Bound test depends on the F- statistics or (Wald statistics) with the following null and alternative hypothesis.

$H_o = \tau_1 = \tau_2 = \tau_3 = \tau_4 = \tau_5 = \tau_6 = 0$ (Concerned variable are not co-integrated) against the alternative hypothesis H_1: Atleast one of $\tau_i \neq 0 \ \forall = 1.....6.$ (Concerned variable are co-integrated). We tend to compare the estimated value of F-statistics with the basic critical value of bound test given by Pesaran et al. (2001). Two asymptotic basic quality limits give, a lower value assuming the regressors are I(0) and an upper value accepting the regressors are absolutely I(1). Computed F- statistics is compared with critical value of bound test if the computed value of F-statistics above the upper critical value of bound test, then we are able to be dismiss the invalid speculation of no long run relationship among the variables in spite of integration for the time series, on the other hand, null hypothesis cannot be rejected if the calculated F- statistic falls below the lower critical value. Lastly, if the calculated value of F- statistic falls between the lower and upper critical values then result is inconclusive

When it is accommodated that variables are co-integrated, the long run model can be assessed as:

$$lnRGDP_t = \theta_o + \sum_{j=1}^{k} \tau_1 \, lnRGDP_{t-i} + \sum_{j=0}^{k} \tau_2 \, lnR_{t-i} + \sum_{j=0}^{k} \tau_3 \, lnGFCF_{t-i} + \sum_{j=0}^{k} \tau_4 \, lnINF_{t-i} + \sum_{j=0}^{k} \tau_5 \, lnODA_{t-i} + \sum_{j=0}^{k} \tau_6 \, lnTO_{t-i} + \mu TREND + \vartheta_t \quad (4)$$

As we have already defined all the variables, we apply Akaike information criterion (AIC) to decide about lags of the variables, the estimation of equation (4) is involved in selecting the order of ARDL long run model.

For the estimation of short run parameter we apply error correction model. The standard ECM is specified as follows:

$$\Delta lnRGDP_t = \beta_o + \sum_{j=1}^{k} \delta_1 \Delta lnRGDP_{t-i} + \sum_{j=1}^{k} \delta_2 \Delta lnR_{t-i} + \sum_{j=1}^{k} \delta_3 \Delta lnGFCF_{t-i} + \sum_{j=1}^{k} \delta \Delta lnINF_{t-i} + \sum_{j=1}^{k} \delta_5 \Delta lnODA_{t-i} + \sum_{j=1}^{k} \delta_6 \Delta lnTO_{t-i} + \mu TREND + \vartheta ECM_{t-1} + v_t \quad (5)$$

Where k denotes optimum lag length of each variable in autoregressive process. $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5 and\ \delta_6$ Show the short-run coefficients and ϑ is an indicator of the speed of alteration to the long run stability and its predictable sign is negative.

We stated poverty and remittances model for the long. run and short run period as following.

$$\Delta lnP_t = \beta_o + \sum_{l=1}^{m} \mu_{1l} \Delta lnP_{t-l} + \sum_{l=0}^{m} \mu_{2l} \Delta lnPCY_{t-l} + \sum_{l=0}^{m} \mu_{3l} \Delta lnINE_{t-l} + \sum_{l=0}^{m} \mu_{4l} \Delta lnR_{t-l} + \alpha_1 lnP_{t-1} + \alpha_2 lnPCY_{t-1} + \alpha_3 lnINE_{t-1} + \alpha_4 lnR_{t-1} + \xi TREND + \omega_t \quad (6)$$

As we have already defined all variables and Δ is used for difference operator. $\mu_{1l}, \mu_{2l}, \mu_{3l} and\ \mu_{4l}$ are short run coefficients and $\alpha_1, \alpha_2, \alpha_3 and\ \alpha_4$ are the long run coefficients, β_O is intercept and 't' is time trend in the ARDL model. ω_l is error term and 'm' denotes the lag length of autoregressive process.

We apply the bound test to follow whether or not there exist the co-integration among the variables by comparing all evaluated coefficients of lagged level variables equal to zero. Bound test depends on the F- statistics or (Wald statistics).We carry out the test under the following null and alternative hypothesis.

$H_o: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ (Concerned variable are not co-integrated) against the alternative is $H_1: Atleast\ one\ of\ \alpha_i \neq 0\ \ \forall$ i=1...4. (Concerned variable are co-integrated).When it is confirm that co-integration exists among the variables; we established the long run model as following:

$$lnP_t = \alpha_o + \sum_{i=1}^{m} \alpha_1\, lnP_{t-i} + \sum_{i=0}^{m} \alpha_2\, lnPCY_{t-i} + \sum_{i=0}^{m} \alpha_3\, lnINE_{t-i} + \sum_{i=0}^{m} \alpha_4\, lnR_{t-i} + \xi TREND + v_t \quad (7)$$

We apply Akaike information criterion (AIC) to decide about lags of the variable, the estimation of equation (4) is involved in selecting the order of ARDL long run model..

For the estimation of short run parameter we apply correction model connected with the long run estimate. The standard ECM is specified as follows:

$$\Delta \ln P_t = \phi_o + \sum_{i=1}^{m} \psi_1\, \Delta \ln P_{t-i} + \sum_{i=0}^{m} \psi_2\, \Delta \ln PCY_{t-i} + \sum_{i=0}^{m} \psi_3\, \Delta \ln INE_{t-i} + \sum_{i=0}^{m} \psi_4\, \Delta \ln R_{t-i} + \xi TREND + \delta ECM_{t-1} + \epsilon_t \quad (8)$$

Where m denotes optimum lag length of each variable in autoregressive process, $\psi_1, \psi_2, \psi_3\ and\ \psi_4$ shows short-run coefficients of the model and δ is an indicator of the speed of change to the long run stability and its expected sign is negative.

3.8 Diagnostic Tests of the Model

We used the Diagnostic test in order to check whether the model conforms to basic classical assumption of Ordinary Least square (OLS) regressions such as no serial correlation, no heterosecdasticity, normality and correct functional form.

In classical linear regression model a key assumptions are that the variance of each error term conditional on chosen value of the exogenous variable is some constant number.This assume homosecdasticity,its violation becomes heterosecdasticity.In heterosecdasticity the estimates of regression are unbiased but their variances are biased.

The term serial correlation refers to the term in which the residuals in the time series data are correlated over the time. In the present study to check normality and functional form of the model we use the Jarque Bera (JB) test.and Ramsey's RESET test under the null hypothesis that the model is correctly specified respectively.

3.9 Stability Test

After a brief description of above mentioned diagnostic tests, we apply the informal stability test to look at whether the long run and short run coefficients of growth and poverty model are stable for the whole time period of study. For this reason we use the methodology proposed by Brown *et al* (1975) and Pesaran *et al* (2001), base on cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) test, under the null hypothesis that all the coefficients are stable. The cumulative test uses the cumulative sum of recursive residuals based on the first "n" observation and is updated recursively and plotted against break point. The CUSUMSQ makes use of the squared recursive residuals and follows the same pattern. If the plot of the CUSUM and CUSUMSQ move between the critical bound at 5 percent level of significance then the estimated coefficient are said to be stabled...

3.10 Granger Causality Test

To examine the causality, an assortment of techniques available relying upon the distinctiveness of time series data. Granger non causality, ARDL modeling causality proposed by Pesaran and Shin (1998), DP nonparametric causality test developed by Diks and Panchenko (2006), Johnson and Juselius (1990) ECM causality and Toda and Yamamoto (1995) multivariate model causality are considered as the standard causality test.

The present study follows Toda and Yamamoto (1995). This is widely known as the Toda and Yamamoto (1995) augmented Granger Causality. T-Y multivariate modeling test has several point of interest over other available techniques. Unlike Johnson and Juselius ECM causality needed same order of integration of all time series

The T-Y methodology is practicable when the underlying variables are either integrated of the different order or same order. Subsequently T-Y technique provides the strategy to test non causality regardless whether the variables are integrated of order I(0), I(1) or I(2).On the other hand in the above mention situation, the Error Correction Model (ECM) is inappropriate for Granger non Causality test. Further the T-Y technique gives the rid of pretesting of co-integration of the series. This strategy gives the chance of testing for the causality between integrated variables basis on asymptotic theory. T-Y procedure will be applicable until the optimal lag length (m) is greater than maximum order of integration(q^{max}) Kuzozumi and Yamamoto (2000).

Test Procedure

The dynamic granger causality test is preformed as follows:

Step 1:

Testing for the unit root of the variables and determining the maximum order of integration order (q^{max}).

Step 2:

Automatically determined the most favorable lag length (m) of the time series variables for the estimation of augmented VAR ($m + q^{max}$) different criteria are available consisting on Schwarz information criteria, Likelihood ratio, Akaike information criteria, Annan-Quinn and Final prediction error.

Step 3:

In this step we set our null and alternative hypotheses.

Step 4:

We used modified Wald test (MWALD) for the estimation of chi-square value that is asymptotically normally distributed by imposing restriction on parameter VAR (m) from VAR ($m + q^{max}$).

In order to carry out T-Y procedure for our concerned variables that is poverty (Pov), private consumption expenditure (PCE) and disposable personal income (DPI).We present the model in the following augmented VAR system of equations:

$$lnPOV_t = \alpha_o + \sum_{j=1}^{m} \gamma_{1j}\, lnPOV_{t-j} + \sum_{p=m+1}^{qmax} \gamma_{2p}\, lnPOV_{t-p} + \sum_{j=1}^{m} \Psi_{1j}\, lnDPI_{t-j} + \sum_{p=m+1}^{qmax} \psi_{2p}\, lnDPI_{t-p} + \sum_{j=1}^{m} \phi_{1j}\, lnPCE_{t-j} + \sum_{p=m+1}^{qmax} \phi_{2p}\, lnPCE_{t-p} + \omega_{1t} \quad (9)$$

$$lnDPI_t = \beta_o + \sum_{j=1}^{m} \eta_{1j}\, lnDPI_{t-j} + \sum_{p=m+1}^{qmax} \eta_{2p}\, lnDPI_{t-p} + \sum_{j=1}^{m} \lambda_{1j}\, lnPOV_{t-j} + \sum_{p=m+1}^{qmax} \lambda_{2p}\, lnPOV_{t-p} + \sum_{j=1}^{m} \theta_{1j}\, lnPCE_{t-j} + \sum_{p=m+1}^{qmax} \theta_{2p}\, lnPCE_{t-p} + \omega_{2t} \quad (10)$$

$$lnPCE_t = \delta_o + \sum_{j=1}^{m} \xi_{1j}\, lnPCE_{t-j} + \sum_{p=m+1}^{qmax} \xi_{2p}\, lnPCE_{t-p} + \sum_{j=1}^{m} \tau_{1j}\, lnPOV_{t-j} + \sum_{p=m+1}^{qmax} \tau_{2p}\, lnPOV_{t-p} \sum_{j=1}^{m} \upsilon_{1j}\, lnDPI_{t-j} + \sum_{p=m+1}^{qmax} \upsilon_{2p}\, lnDPI_{t-p} + +\omega_{3t} \quad (11)$$

Subsequent to developing the augmented VAR system of equations, it is assessed from seemingly unrestricted regression (SUR). For the value of chi-square statistic that is asymptotically normally distributed we apply the standard modified Wald test (MWALD) for parameter restriction on VAR (m) from VAR (m $+q^{max}$).

We consider equation (9) to check the hypothesis that disposable personal income (DPI) does not Granger cause poverty (Pov) if $\psi_{1j} = 0 \forall j$; likewise private consumption expenditure (PCE) does not Granger case poverty (Pov) $\phi_{1j} = 0 \forall j$; Similarly, in equation (10) poverty (Pov) does not Granger cause disposable personal income (DPI) if $\lambda_{1j} = 0 \forall j$; likewise private consumption expenditure (PCE) does not Granger case disposable personal income (DPI) if $\theta_{1j} = 0 \forall j$; Respectively in equation (11), poverty (Pov) does not Granger cause private consumption expenditure (PCE) if $\tau_{1j} = 0 \forall j$; and disposable personal income (DPI) does not Granger cause private consumption expenditure (PCE) if $\upsilon_{1j} = 0 \forall j$

Chapter 4

Results and Discussions

4.1 Augmented Dickey Fuller Test

As we used time series data in this study, therefore before conducting the co-integration test it is necessary for us to make sure that all the variables are stationary or not. Since the bound test is suitable while the variables are integrated of order I(0) or I(1). Thus, the application of the unit root test in the ARDL technique may at present be important to guarantee none of variable are I(2) or beyond. To decide the order of integration of the variables we apply the Augmented Dicky-Fuller (ADF) test to decide the issue of unit root.

Table 4.1: Test of Non-Stationarity of Variables

S/No	Variable at level and first difference	Intercept but no trend	Intercept and trend
1	lnRGDP	-1.776202	-2.537024
	ΔlnRGDP	-4.534645***	-4.773079***
2	lnR	-1.532534	-1.669935
	ΔlnR	-5.518777***	-5.479146***
3	lnGFCF	-1.242040	-2.163359
	ΔlnGFCF	-5.883119***	-5.833405***
	lnIN	-2.556903	-2.531645

4	ΔlnIN	-6.492733***	-6.403635***
5	lnTO	-3.05019**	-2.998037
	ΔlnTO	-7.417125***	-7.451979***
6	lnODA	-3.258575**	-5.524785***
	ΔlnODA	-7.281740***	-7.175791***
7	lnP	2.6948	-3.2480*
	ΔlnP	-8.3299***	-6.3538***
8	lnINE	-6.4191***	-5.4331***
	ΔlnINE	-6.659***	-6.5699***
9	lnPCY	0.0344	-1.1869
	ΔlnPCY	-4.8742***	-4.8470***

***, ** &* are use to show significance at 1%, 5% and 10% levels.

The analysis of Augmented Dicky-Fuller (ADF) is shown in the table 4.1 above. The unit test was completed in the level and first differences with constant and trend in the regressions. The unit root test demonstrate that RGDP, R, GFCF, IN, and PCY variables are stationary in their first difference i.e. I (1), TO, ODA, INE and P are stationary at level i.e. I(0). Our findings show that most of the series are stationary to the first order, which suggests that we are able to test a possible long run relationship among gross domestic products, poverty and their explanatory variables as presented in chapter three. Such result of stationary test does not permit us to work with the Johansen methodology of co-integration. This is the most important justification to work with Auto regressive distributed lag (ARDL) approach developed by Pesaran *et al.* (2001).Before applying the

bound test, we go ahead for specification and estimation of ARDL model for economic growth .To decide the optimum lag length of model we apply Akaike Information Criterion (AIC). Akaike Information Criterion (AIC) estimates the top 20 ARDL models as shown in Figure 4.1. An ARDL (2, 2, 2, 2, 1, 0) is finally selected from top 20 models because it minimizes AIC.

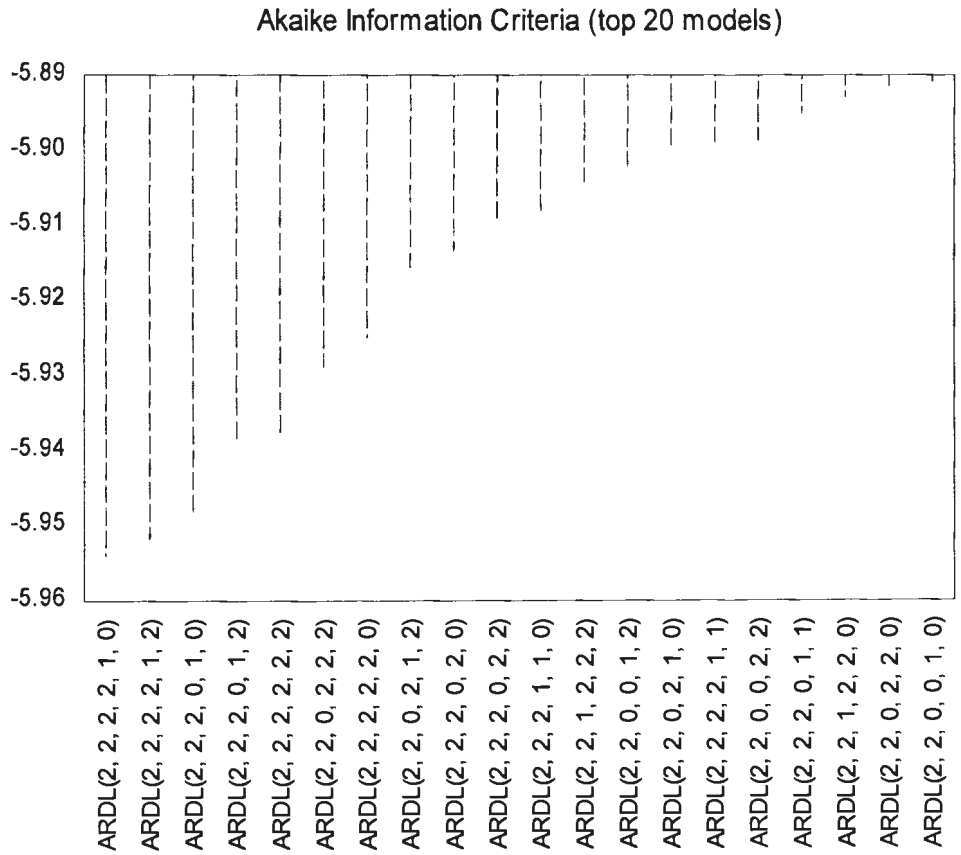
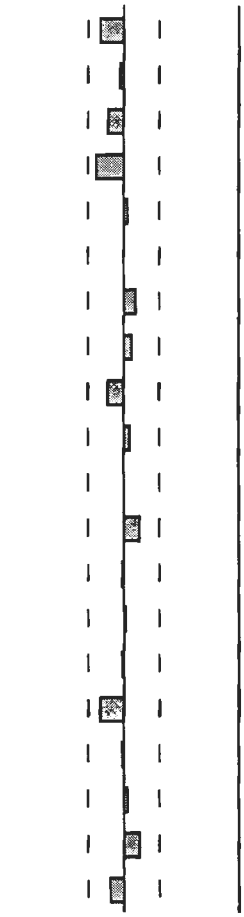


Figure 4.1: ARDL Model Selection Criteria for Economic Growth

After the selection of ARDL (2, 2, 2, 2, 1, 0) model, it is essential to make sure is the error term of model is serially independent. For this purpose we present the correlogram Figure 4.2 where Ac indicates (Autocorrelation), PAC indicates (Partial Autocorrelation) Q-stat indicates (Q statistics) and Prob is probability value. We have shown this correlogram up to 20 lags. P-value indicates that there is no autocorrelation in the model residuals.



	AC	PAC	Q-Stat	Prob*
1	-0.206	-0.206	1.6580	0.198
2	-0.026	-0.072	1.6860	0.430
3	-0.141	-0.170	2.5140	0.473
4	-0.258	-0.355	5.3606	0.252
5	0.035	-0.175	5.4160	0.367
6	-0.003	-0.161	5.4164	0.492
7	0.113	-0.083	6.0193	0.537
8	0.080	-0.053	6.3351	0.610
9	-0.144	-0.233	7.3826	0.597
10	0.042	-0.118	7.4754	0.680
11	-0.008	-0.054	7.4791	0.759
12	0.139	0.116	8.5826	0.738
13	-0.023	-0.010	8.6127	0.802
14	0.017	0.064	8.6302	0.854
15	-0.009	0.119	8.6357	0.896
16	-0.213	-0.072	11.752	0.761
17	-0.019	-0.077	11.777	0.813
18	0.038	-0.030	11.887	0.853
19	0.135	0.073	13.361	0.820
20	-0.133	-0.292	14.875	0.784

Figure 4.2: Correlogram for Error Term of Economic Growth Model

4.2 Co-integration Result

In the initial step of bounds test approach we estimate the ARDL model which is presented in equation (3) by using the suitable lag length. In the present study we use two lags for the estimation of ARDL model which is decided by Akaike Information Criteria. To check the joint significance of the coefficient specified in equation (3) we carry out the Wald test (bound test) by imposing the restriction on estimated long run coefficient of Trade openness, Gross domestic product, Inflation, Remittances, Gross fixed capital formation, ,Official development assistance.

Table 4.2: ARDL Bounds F-Test for Economic Growth Model

Test statistic	Value	K
F-Statistic	8.9474	5

We compare the calculate F-statistics value with lower and upper bound critical values given in table 4.3

Table 4.3: Critical Value of Bound Test for Economic Growth Model

Level of Significance	Lower Bound, I(0)	Upper Bound, I(1)
10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

The calculated value of F statistics is 8.9474 which exceed the upper bound critical value at 1 percent level of significance this imply that the null hypothesis $H_0 = \tau_1 = \tau_2 = \tau_3 = \tau_4 = \tau_5 = \tau_6 = 0$ (Concerned variable are not co-integrated) against the alternative hypothesis is H_1: Atleast one of $\tau_i \neq 0 \ \forall$ i= 1.....6.(Concerned variable are co-integrated). is rejected on the basis of critical values of bound test at 1% level of significance. Thus long run relationship exists among Inflation, Trade openness, Official development assistance, Gross domestic product, Remittances, Gross fixed capital formation.

4.3 Long-run Estimation of Economic Growth Model

It is confirmed that long run relationship exist between real gross domestic product and its determinants. Optimum lag length two is chosen by using Akaike Information Criterion (AIC). To get the long run coefficients we estimate the equation (12) which is selected on the bases of Akaike Information Criterion (AIC) as shown in figure 4.1.The findings are shown in table 4.4.

$$\begin{aligned} lnRGDP = \theta_o &+ \theta_1 lnRGDP(-1) + \theta_2 lnRGDP(-2) + \theta_3 lnR + \theta_4 lnR(-1) \\ &+ \theta_5 lnR(-2) + \theta_6 lnGFCF + \theta_7 lnGFCF(-1) + \theta_8 lnGFCF(-2) \\ &+ \theta_9 lnINF + \theta_{10} lnINF(-1) + \theta_{11} lnINF(-2) + \theta_{12} lnODA \\ &+ \theta_{13} lnODA(-1) + \theta_{14} lnTO + \mu TREND \end{aligned} \quad (12)$$

Table 4.4: Long Run Estimates for Economic Growth Model Using the ARDL (2, 2, 2, 2, 1, 0)

Response variable is lnRGDP				
Regressor	Coefficients	Standard Error	T-Statistic	P-values
Constant	4.9461	0.3190	15.5040	0.0000***
lnR	0.0565	0.0138	4.0981	0.0006***
lnIN	-0.0232	0.0142	-1.6250	0.1198

lnGFCF	0.3442	0.0859	4.0030	0.0007***
lnODA	0.0513	0.0262	1.9551	0.0467**
lnTO	-0.0233	0.0829	-0.2816	0.7811
Trend	0.0245	0.0011	22.9769	0.0000***

*** &** indicate significance at 1% & 5% levels.

The table 4.4 represents the estimate of long run relationship between lnR, lnIN, lnGFCF, lnODA and lnTO as specified in equation (4). The result indicates that a positive relationship between economic growth and remittances in long run, a one percent increase in remittance increases economics growth by about 0.0565 percent. The coefficient of gross fixed capital formation has a positive sign thus an increase in gross fixed capital formation by 1 percent leads to 0.3442 percent increase in economic growth in the long run. The results show that official development assistance is significant at 5 percent level of significance, one percent raise in official development assistance leads to 0.0513 percent raise in economic growth. Inflation coefficient is negative and insignificant. As expected, the inflation rate effect the economic growth negatively because inflation led to a general rise in the price level in the economy which leads high cost of manufacturing activities. So the high speed of inflation discourages high cost asset and lowers the export competitiveness of the country. The coefficient of trade openness is negative and insignificant, negative sign of trade openness could be due to inappropriate import of consumption goods.

4.4 Short-run Error Correction Estimates for Economic Growth Model

After estimating the long run coefficient of the growth model it's provide support us for an error correction model (ECM) mechanism presented as in equation (13) to assess the short run dynamic. The result are shown in table 4.5

$$D(lnRGDP) = \gamma_o + \gamma_1 D\big(lnRGDP(-1)\big) + \gamma_2 D\big(lnRGDP(-2)\big) + \gamma_3 D(lnR) + \gamma_4 D\big(lnR(-1)\big) + \gamma_5 D\big(lnR(-2)\big) + \gamma_6 D(lnGFCF) + \gamma_7 D\big(lnGFCF(-1)\big) + \gamma_8 D\big(lnGFCF(-2)\big) + \gamma_9 D(lnINF) + \gamma_{10} D\big(lnINF(-1)\big) + \gamma_{11} D\big(lnINF(-2)\big) + \gamma_{12} D(lnODA) + \gamma_{13} D\big(lnODA(-1)\big) + \gamma_{14} D(lnTO) + \mu TREND + \vartheta ECM(-1) \quad (13)$$

Table 4.5: Short Run Error Correction Estimates of Economic Growth Model Using ARDL (2, 2, 2, 2, 1, 0)

Response variable is lnRGDP				
Regressor	Coefficients	Standard Error	T-Statistic	P-values
ΔlnR	-0.0302	0.0106	-2.8522	0.0098***
ΔlnR(-1)	-0.0568	0.0122	-4.6548	0.0002***
ΔlnIN	-0.0100	0.0073	-1.3593	0.1892
ΔlnIN(-1)	0.0097	0.0067	1.4586	0.1602
ΔlnGFCF	0.1456	0.0475	3.0648	0.0061***
ΔlnGFCF(-1)	0.0699	0.0431	1.6208	0.1207
ΔlnODA	-0.0042	0.0088	-0.4790	0.6371
ΔlnTDO	-0.0111	0.0386	-0.2882	0.7762
TREND	0.0117	0.0022	5.1805	0.0000***
ECM(-1)	-0.4761	0.0932	-5.1074	0.0001***

*** show the significance at 1% level.

The table 4.5 represents the estimate of Short run relationship among lnR, lnIN, lnGFCF, lnODA and lnTO as specified in equation (5).The result shows that short run remittances have a small negative effect of about -0.03 percent on economic growth. Inflation coefficient is negative and insignificant. Gross fixed capital formation is significant at 1 percent level of significance and has positive effect on economic growth it contributes about 0.1456 percent in short run. In short run official development assistance and trade openness are insignificant and have negative effect. The findings indicate that the error correction term for the estimated equation is statistically significant and has correct negative sign. Error correction term (ECM) is an indicator of speed of convergence to the long run equilibrium. The coefficient of ECM is -0.4761 which shows that 47.61% of any past deviation will be corrected in current period.

Table 4.6: Diagnostic tests for Economic Growth Model

Diagnostic	Test Statistics	P-valve
LM Serial correlation Test	0.8662	0.4374
ARCH Heterosecdasticity Test	1.0161	0.4777
Ramsey Test	1.5587	0.2270
Normality Test	1.8312	0.4003

Table 4.6 indicates that all the diagnostic tests are satisfactory. To detect autocorrelation Lagrange multiplier LM test is used the P- value reveal that there is no evidence of autocorrelation. ARCH is the lagrange multiplier for heterosecdasticity and indicates that there is no heterosecdasticity. Moreover, model is specified well which is indicated functional form (Ramsey) Test. In addition the model satisfies Jarque Bera normality test, which indicate the error is normally distributed in the model.

4.5 Stability Tests for Economic Growth Model

Figure 4.3 and 4.4 indicate the ressult of CUSUM and CUSUMSQ respectively.It is clearly indicated from figure 4.3 and 4.4 both the CUSUM and CUSUMSQ plots lie within the 5 % critical bound, which shows that the long run and short run estimates are stable and there is no any structural break.

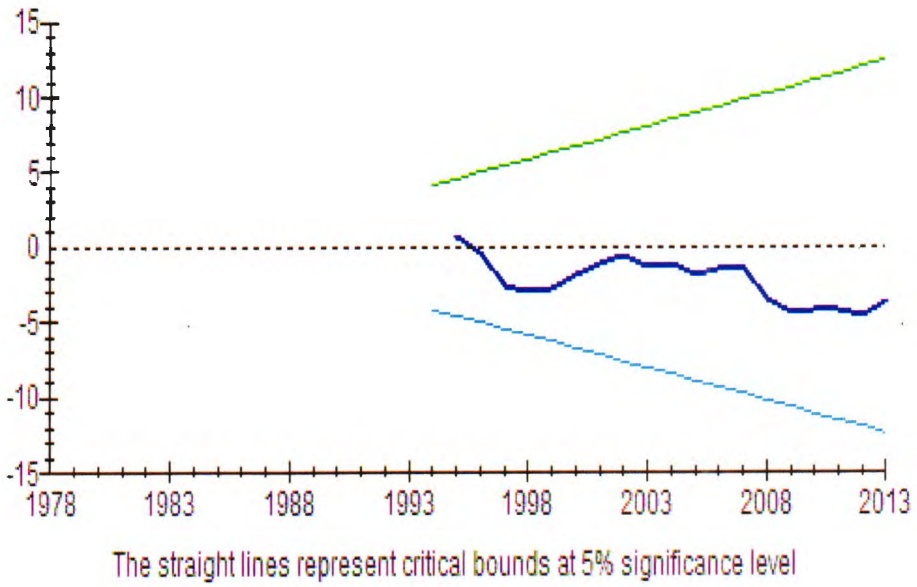


Figure 4.3: CUSUM Plot For Economic Growth Model

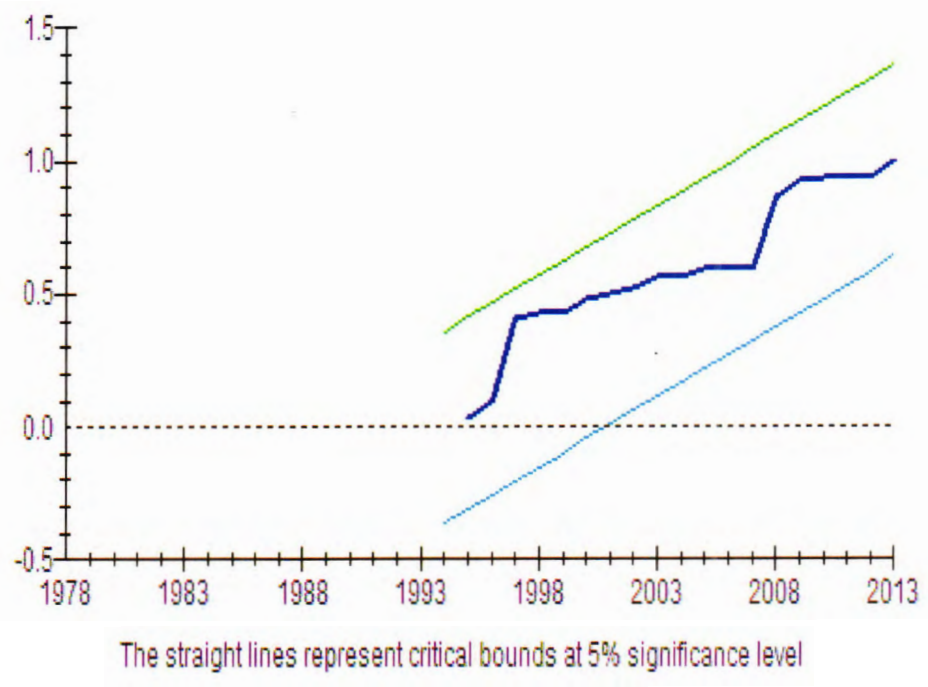


Figure 4.4: CUSUMSQ Plot for Economic Growth Model

The figure 4.5 presents the graph of economic growth model. Actual and fitted line is particularly near each other. In residual graph, there are some point which are outside the interval but mostly point are inside the limits. Its means the residual of growth model are stable.

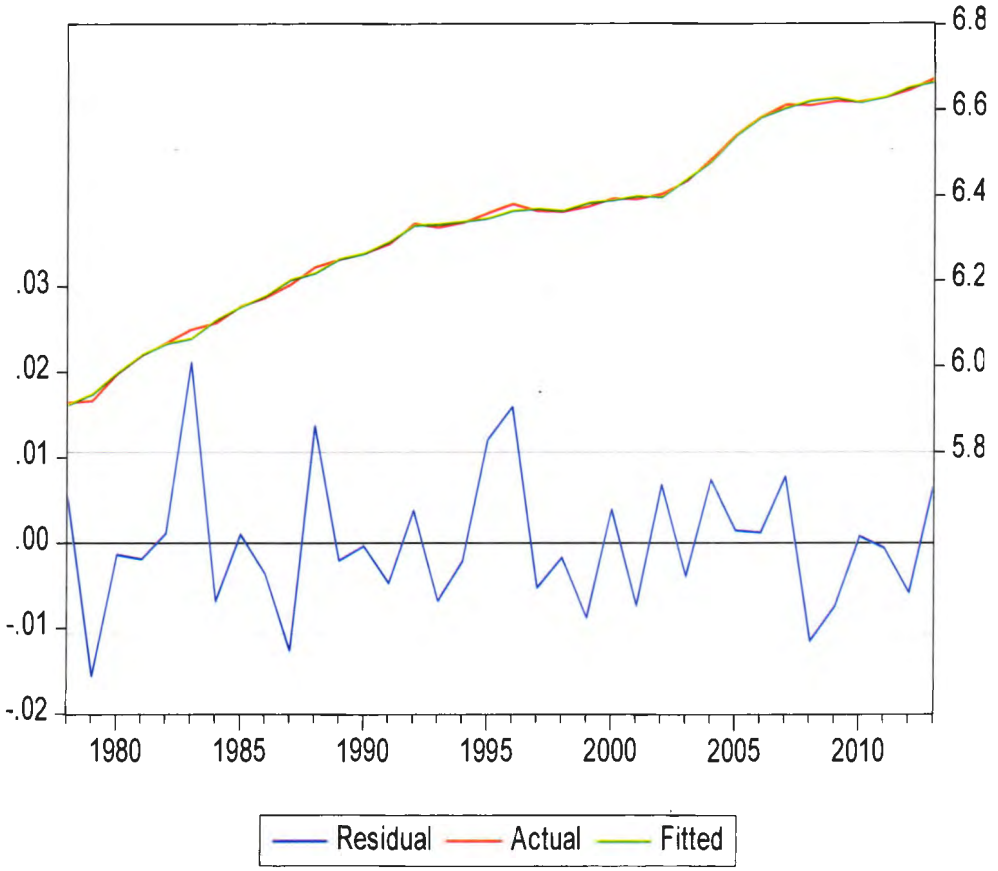


Figure 4.5: Actual, Fitted, Residual Graph of Economic Growth Model

Now we specified the ARDL model between poverty and its determinants. For the selection of maximum lag length of ARDL model we use Akaike Information Criterion (AIC). We select an ARDL (1, 2, 1, 2) among the top 20 models figure 4.6 because it minimizes the AIC as compared to other models.

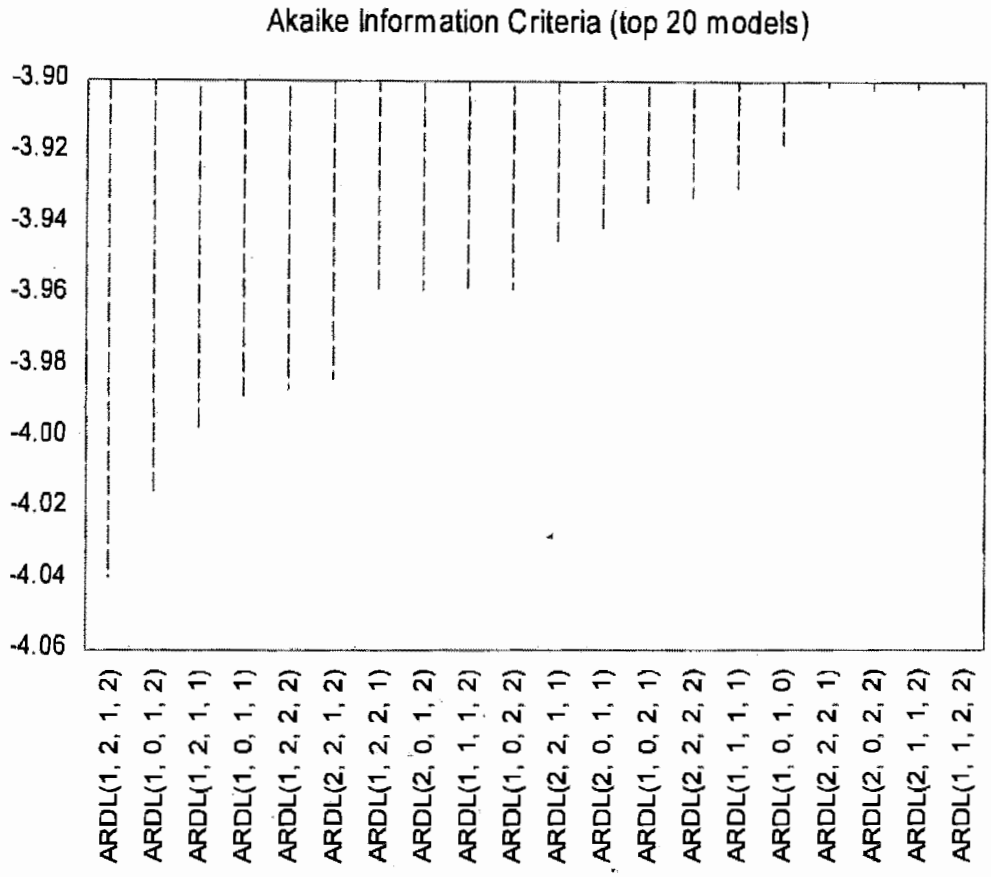
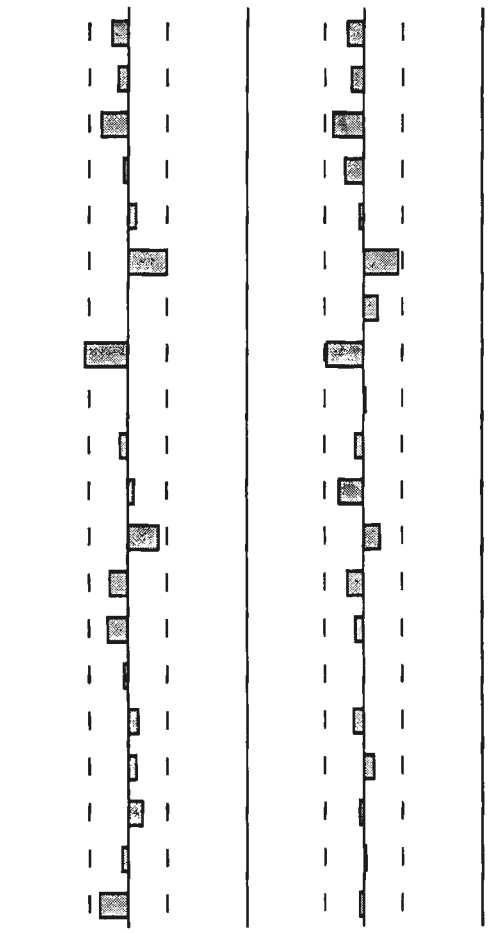


Figure 4.6: ARDL Model Selection Criteria for Poverty

After the selection of ARDL model it is important to check the autocorrelation in model to get the consistent estimates. To detect this problem we present the correlogram figure 4.7.Where Ac (Autocorrelation), PAC (Partial Autocorrelation) Q-stat (Q statistics).It is clear from the correlogram there is no indication of autocorrelation in model.



	AC	PAC	Q-Stat	Prob*
1	-0.149	-0.149	0.8432	0.358
2	-0.088	-0.112	1.1456	0.564
3	-0.234	-0.274	3.3522	0.340
4	-0.042	-0.160	3.4273	0.489
5	0.079	-0.028	3.6954	0.594
6	0.346	0.305	9.0291	0.172
7	-0.008	0.126	9.0322	0.250
8	-0.378	-0.327	15.885	0.044
9	0.007	0.016	15.888	0.069
10	-0.074	-0.080	16.168	0.095
11	0.043	-0.222	16.268	0.131
12	0.271	0.134	20.394	0.060
13	-0.168	-0.148	22.048	0.055
14	-0.188	-0.072	24.223	0.043
15	-0.039	-0.008	24.324	0.060
16	0.084	-0.083	24.802	0.073
17	0.074	0.092	25.192	0.090
18	0.131	-0.046	26.494	0.089
19	-0.059	0.009	26.772	0.110
20	-0.249	-0.036	32.122	0.042

Figure 4.7: Correlogram for Error Term of Poverty Model

Now we perform bounds test approach of co- integration on model which is specified in equation (6) by using the suitable criteria for lag length selection. In doing so we used Akaike Information Criterion (AIC) and two lags are decided from this criteria for the estimation ARDL model. For the joint significance of the coefficient indicated in equation (6), to complete Wald test (bound test) we impose the restriction on estimated long run coefficient of Poverty, Remittances, Per capita income and income inequality.

Table 4.7: ARDL Bounds F-Test for Poverty Model

Test statistic	Value	K
F-Statistic	7.7726	3

We compare the calculate F-statistics value with lower and upper bound critical values given in table 4.8

Table 4.8: Critical Values of Bound for Poverty Model

Level of Significance	Lower Bound, I(0)	Upper Bound, I(1)
10%	3.47	4.45
5%	4.01	5.07
2.5%	4.52	5.62
1%	5.17	6.36

The computed value of F statistics 7.7726 is higher than upper bound critical value at 1 percent level of significance so the null hypothesis of $H_o: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ (Concerned variable are not co-integrated) against the alternative is $H_1: Atleast\ one\ of\ \alpha_i \neq 0\ \forall$ i=1...4. (Concerned variable are co-integrated) is rejected on the basis of critical values at 1% level of significance, which shows that long term relationship exists among Poverty, Per capita income ,Remittances, and income inequality.

4.6 Long-run Estimation of Poverty Model

It is confirmed that long run relationship exist among the variables. Optimum lag length two is selected by using Akaike Information Criterion (AIC). To get the long run coefficients we estimate the equation (14) which is chosen by Akaike Information Criterion (AIC) as shown in figure 4.6.The results are given table 4.8.

$$lnP = \beta_o + \beta_1 lnP(-1) + \beta_2 lnPCY + \beta_3 lnPCY(-1) + \beta_4 lnPCY(-2) + \beta_5 lnR + \beta_6 lnR(-1) + \beta_7 lnINE + \beta_8 lnINE(-1) + \beta_9 lnINE(-2) + \xi TREND \quad (14)$$

Table 4.9: Long Run Estimate of Poverty Model Using the ARDL (1, 2, 1, 2)

Response variable is lnP				
Regressor	Coefficients	Standard Error	T-Statistic	P-values
Constant	2.2058	1.0125	2.1788	0.0394**
lnPCY	-0.0108	0.0733	-0.1472	0.8842
lnR	-0.0526	0.0233	-2.2511	0.0338**
lnINE	0.7405	0.2312	3.2028	0.0038***
Trend	-0.0224	0.0035	-6.3501	0.0000***

*** &** shows the significance at 1% & 5% levels.

The table 4.9 represents the estimate of long run relationship between lnPCY, lnR, and lnINE as specified in equation (7).The finding shows that the coefficient of per capita income is negative which is consistence with theory but it is insignificant. The result suggests that perhaps it is due to worsen the income distribution. Remittances are inversely related to poverty. The estimated coefficient is negative (-0.0526) and

statistically significant at 5 percent level of significance. So one percent rise in remittance would lead to 0.05 percent fall to the poverty. The coefficient of income inequality (Gini coefficient) came out positive and significant as expected. The result indicates that 1 percent increase in income equality predicts 0.7405 increase in poverty.

4.7 Short-run Error Correction Estimates for Poverty Model

After estimating the long run coefficient of the poverty model it's provide support us for an error correction model (ECM) mechanism presented as in equation (15), which is used to estimate the short run dynamic. Results are given in table 4.5

$$D(lnP) = \alpha_o + \alpha_1 D\big(lnP(-1)\big) + \alpha_2 D(lnPCY) + \alpha_3 D\big(lnPCY(-1)\big) + \alpha_4 D\big(lnPCY(-2)\big) + \alpha_5 D(lnR) + \alpha_6\big(lnR(-1)\big) + \alpha_7 D(lnINE) + \alpha_8 D\big(lnINE(-1)\big) + \alpha_9 D\big(lnINE(-2)\big) + \xi TREND + \varphi ECM(-1) \quad (15)$$

Table 4.10: Short Run Error Correction Estimates of Poverty Model Using ARDL (1, 2, 1, 2)

Response variable is lnP				
Regressor	Coefficients	Standard Error	T-Statistic	P-values
ΔlnPCY	0.0092	0.0963	0.0951	0.9250
ΔlnPCY(-1)	-0.1465	0.0776	-1.8883	0.0711*
ΔlnR	0.0392	0.0242	1.6186	0.1186
ΔlnINE	0.2402	0.0941	2.5522	0.0175**
ΔlnINE(-1)	-0.1519	0.0966	-1.5732	0.1288

Trend	-0.0194	0.0037	-5.2547	0.0000***
ECM(-1)	-0.8667	0.1894	-4.5761	0.0001***

***, **&* are used to shows significance at 1%, 5% & 10% levels.

The result in table 4.10 indicates that impact of per capita income on poverty alleviation is positive .It implies that the negative sign of coefficient of per capita indicate a positive effect on poverty reduction. The estimated coefficient of per capita income is significant, one percent raise in per capita income lead to 0.1465 percent reduction in poverty. Remittances have lagged negative impact on poverty in short run which might be due to the transaction cost associated with migration. Consistence with the long run results, the coefficient of income inequality (Gini coefficient) is positive and statistically significant at 5 percent. The results suggest that 1 percent increase in income inequality will raise the poverty level by 0.2402 percent. The finding indicates that for the estimated equation the coefficient of error correction term (ECM) is negative and significant. The value of coefficient is -0.8667 which indicate that 86.67 % of any past deviation will be corrected in the current period.

Table 4.11: Diagnostic Tests for Poverty Model

Diagnostic	Test Statistics	P-valve
LM Serial correlation Test	0.8375	0.4461
Heterosecdasticity ARCH Test	0.5598	0.8297
Ramsey Test	0.1974	0.6601
Normality Test	2.1791	0.3364

Table 4.11 present the results of diagnostic test. LM test indicate that there is no evidence of autocorrelation, ARCH is the lagrange multiplier for heterosecdasticity and indicates that there is no heterosecdasticity. Moreover, model is specified well which is indicated functional form (Ramsey) Test. In addition the model satisfies Jarque Bera normality test, which indicate the error is normally distributed in the model.

4.8 Stability Tests for Poverty Model

Figures 4.8 and 4.9 present the graphs of CUSUM and CUSUMSQ .It is clear from figures 4.8 and 4.9 both CUSUM and CUSUMSQ lie within 5% critical bound. Its means long run and short run estimates are stable and there is not any structural break.

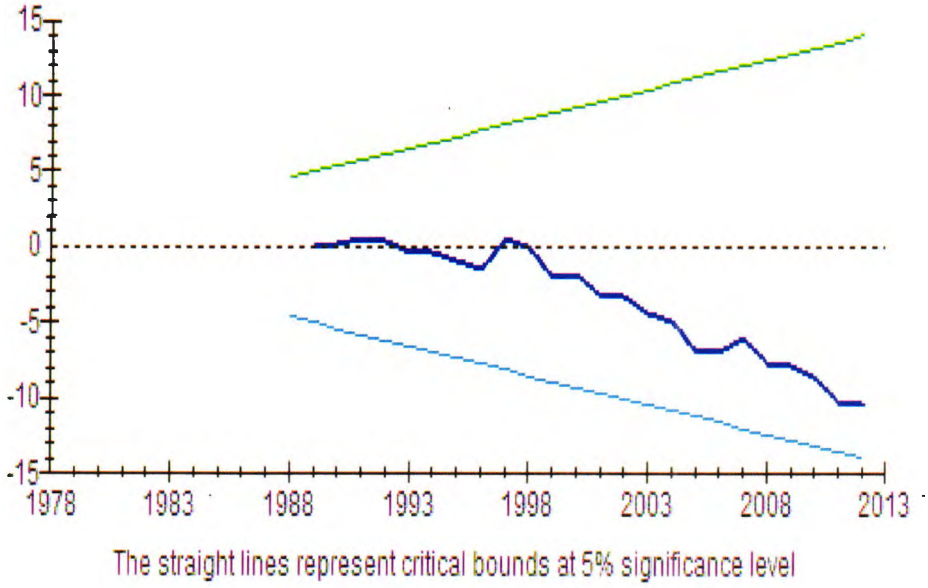


Figure 4.8: CUSUM Plot for Poverty Model

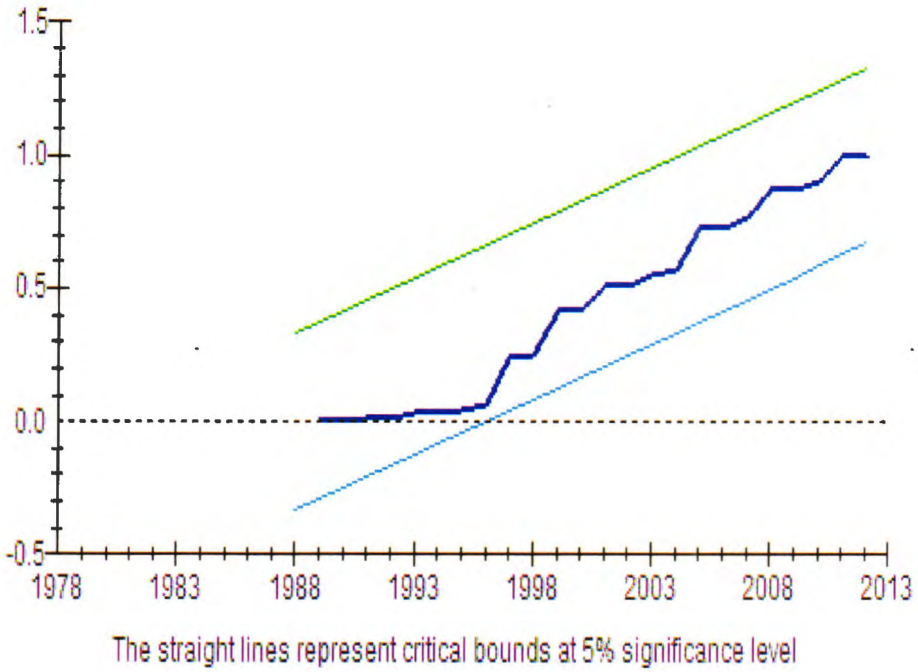


Figure 4.9: CUSUMSQ Plot for Poverty Model

Figure 4.10 shows that actual fitted and residual graph of poverty model. Actual, fitted lines are close. In residual graph mostly points are inside the limit which indicates that the residuals are stable.

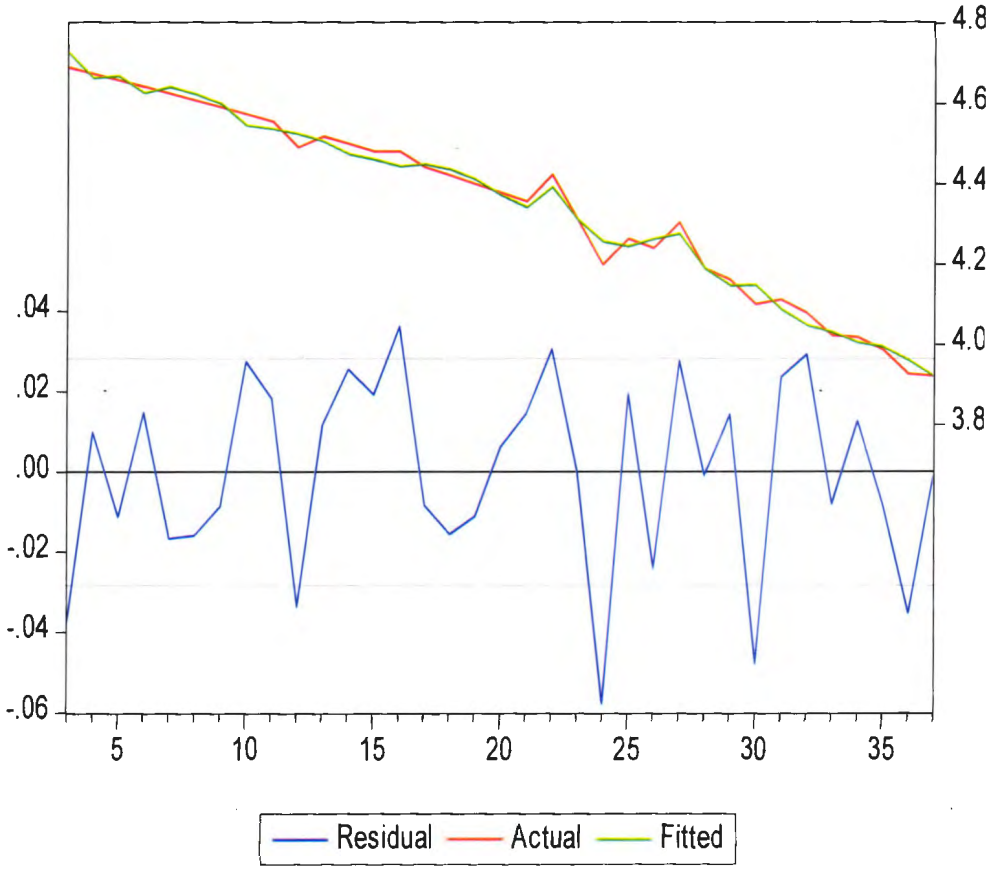


Figure 4.10: Actual, Fitted, Residual Graph for Poverty Model

4.9 Granger Causality Test

The data is time series, to legalize the order of integration of the variables. We apply Augmented Dicky-Fuller (ADF) test to determine the issue of unit root.

Table 4.12: Test of Non-Stationarity of Variables

S/No	Variable at level and first difference	Intercept but no trend	Intercept and trend	Order of Integration
I	lnP	2.6948	-3.2480*	I(0)
	ΔlnP	-8.3299**	-6.3538**	

2	lnDPI	-1.4664	-3.5881*	I(0)
	ΔlnDPI	-6.2724**	-6.3754**	
3	lnPCE	-1.6447	-1.0453	(1)
	ΔlnPCE	-5.0844**	-5.3261**	

**, &* are use to show significance at 1% & 5% levels.

Table 4.12 Shows that the unit root test were done in the level and first differences. The unit root test exhibits that Poverty (P) and Disposable personal income (DPI) are stationary in their level i.e. I (0), Private consumption expenditure (PCE) is stationary at first difference i.e. I(1).The result shows that the maximum order of integration of concerned variables is one i.e. ($q^{max} = 1$). Which fulfills the basic requirement of the T-Y technique for granger non causality inference. In the next step, we get the maximum lag length (m) of the concerned variable under the unrestricted VAR mechanism. Table 4.13 present the result of VAR which demonstrates that consistence highest lag length is (m=2)

Table 4.13: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	4.1609	NA	0.0002	-0.0644	0.0674	-0.0184
1	127.1396	218.6287	$3.36x10^{-7}$	-6.3966	-5.8688	-6.2124
2	146.6979	31.5105*	$1.89x10^{-7}$*	-6.9832*	-6.0594*	-6.6608*

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

As the lag length has been conformed, Now we estimate the augmented VAR (m $+q^{max}$) that is VAR (3).We check all diagnostic test and stability condition of VAR (3) as shown in table 4.14.

Table 4.14: Diagnostic Test Results of VAR (3)

Diagnostic	Test Statistics	P-valve
Serial correlation LM Test	14.5450	0.1042
White Heterosecdasticity Test	108.0624	0.4802
Normality Test	2.5538	0.8624
VAR stability	No root lies outside the unit circle	

LM test show that there is no evidence of autocorrelation, ARCH is the lagrange multiplier for heterosecdasticity and indicates that there is no heterosecdasticity.Further the model satisfy the normality test. Inverse roots of the characteristic AR polynomial are presented in Figure 7.Its is clear from Figure 7 that VAR (3) is stable because roots do not lie outside the unit circle.

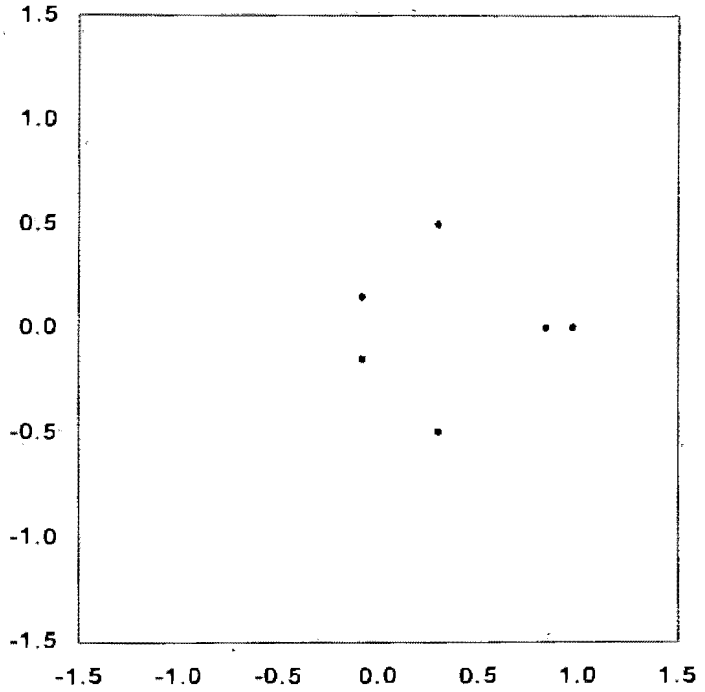


Figure 4.11: Inverse Roots of AR Characteristic Polynomial

Before going on to granger non causality test, we practical the diagnostic test on each endogenous equation of the VAR system. The results is given in table 4.15

Table 4.15: Diagnostic Tests of Estimated Endogenous Equations

Equations	Serial correlation LM Test	Normality Test	White Heterosecdasticity Test	CUSUM Test
lnP	2.6800 (0.0899)	0.4934 (0.7813)	0.6725 (0.4182)	Within limits
lnDPI	1.8181 (0.1849)	0.0447 (0.9778)	1.0441 (0.3145)	Within limits
lnPCE	0.6310 (0.4348)	1.5777 (0.4543)	0.2003 (0.6575)	Within limits

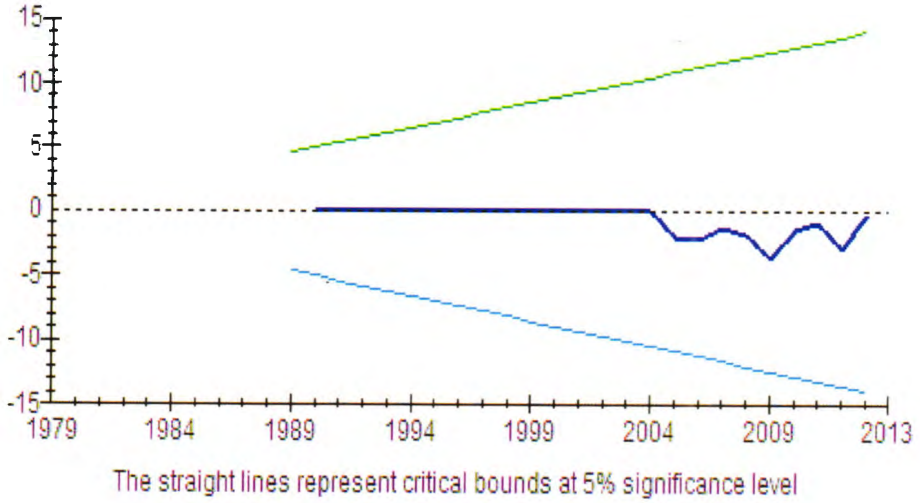


Figure 4.12: CUSUM Plot for Equation LPov

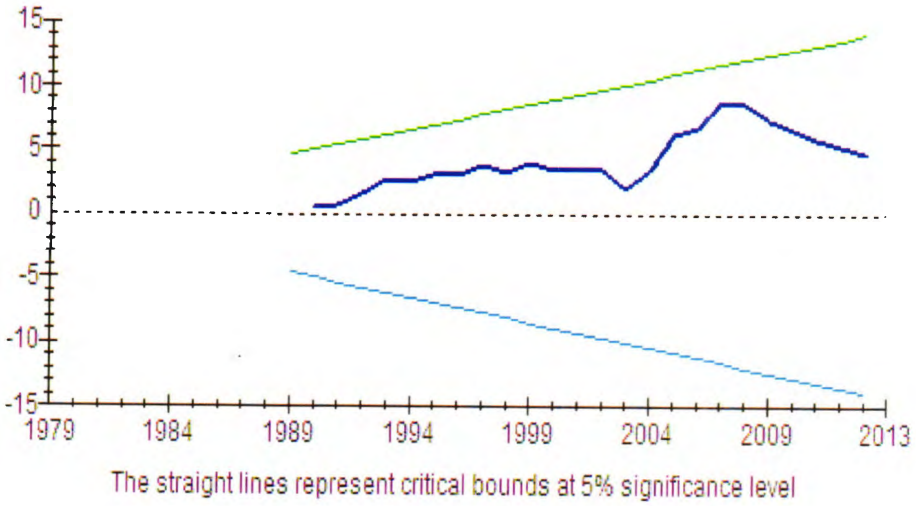


Figure 4.13: CUSUM Plot for Equation LDPI

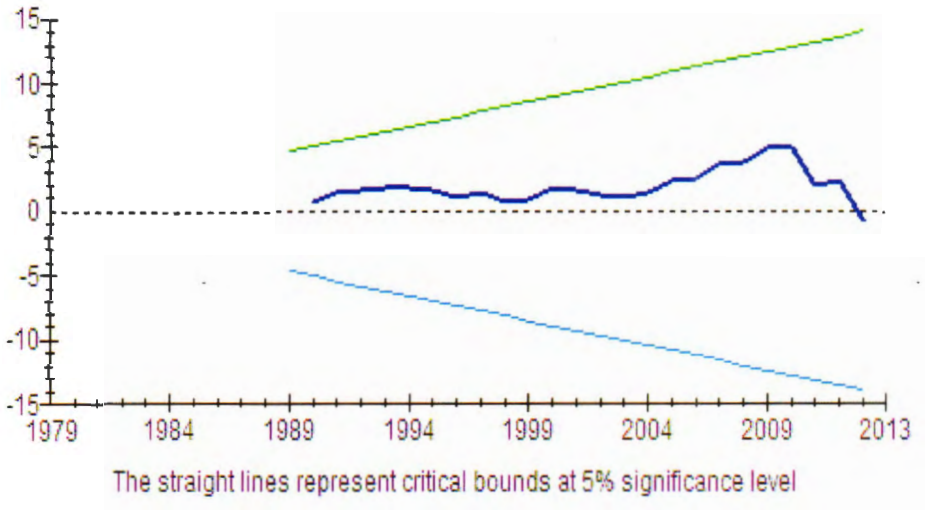


Figure 4.14: CUSUM Plot for Equation LPCE

Diagnostic test of endogenous equations are presented in table 4.15. LM test show that there is no of autocorrelation, ARCH is the lagrange multiplier for heterosecdasticity and indicates that there is no heterosecdasticity and each equation passes the normality test. Moreover, Figure 4.12, 4.13 and 4.15 shows that each CUSUM lies within 5% critical bound

Table 4.16: Results of Dynamic Granger Non-Causality

Dependent Variables	MWALD Test			
	Poverty	Disposable Personal Income	Private Consumption Expenditure	Causality Inferances
Poverty	.....	11.2169*** (0.0037)	50.1337*** (0.0000)	Pov←DPI Pov←PCE
Disposable Personal Income	1.0927 (0.7591)	.....	0.7598 (0.6839)	.....

Private Consumption Expenditure	12.6030*** (0.0018)	4.5743 (0.1016)	.....	PCE← Pov

*** show the significance at 1% level.

The result of granger non causality is given in table 4.15.The result indicates that bi-directional causality between private consumption. expenditure and poverty. Alternatively, Pov →PCE with chi square 12.6030 and Pov ← PCE with chi square 50.1337. Thus Pov ←→ PCE dually indicate the effect of private consumption expenditure and poverty. Moreover, unidirectional causation is noted from personal disposable income to poverty (DPI → Pov) at the 1% level.

4.10 Conclusion

The fundamental target of the present study is to look at the long run and short run impact of remittance and socio-economic variables on poverty and economic growth, the study also attempts to check the causality between poverty and some poverty indicator, over the sample period 1976 to 2013.The Augmented Dicky-Fuller (ADF) test obviously demonstrated that all the variables specified in both growth and poverty model are stationary at first difference except Official Development Assistance ,Poverty, Trade Openness and Income Inequality which are stationary at their level. The co-integration test finding shows that the long run relationship exists for both the poverty, growth model and between their determinants. We find a positive impact of remittances on economic growth in the long run. But remittances have negative impact on growth in the short time period. This may be due to informal inflow of remittances. In the long run and short run gross fixed capital formation is positively associated with growth. The finding identify that official development assistance has positive effects on economic growth. Moreover, the error correction term (ECM) for the estimated equation is statistically significant at one percent level and has correct negative sign. In addition, all the diagnostic and stability tests are satisfied by growth model.

In the poverty model the result shows per capita income alleviate the poverty in the short run. In the long run remittance is statistically significant and has negative impact on

poverty. The findings demonstrate that in short run and long run income inequality (Gini coefficient) is positively associated with poverty. Further, the model showed there was no evidence of heterosecdasticity and autocorrelation. And also model satisfies the normality and Reset specification test. Additionally the model passes through the stability test.

The present study carries out the dynamic causality among poverty, personal disposable income and private consumption expenditure for the Pakistan using the data ranges from 1976 to 2013.We use T-Y multivariate technique to check the causality in poverty, disposable income and private consumption expenditure. Highest order of integration is one and lag length is two, so we run the augmented VAR (3).The model satisfies all diagnostic test. The study finds significant bi-directional causality between private consumption expenditure and poverty. Uni-variant causality is noted from personal disposable income to poverty.

4.11 Recommendation

In light of the results of this study, it is recommended that government should take a keen interest in enhancing the economic growth and alleviation of poverty from the research results it is clear that remittances contribute in economic growth and assume an imperative part in reduction of poverty. As per World Bank (2006) report around 50 percent remittances are unrecorded and through informal channel due to speedier and cheaper mean of transfer. Government should formulate the policies that encourage the workers to send remittances through formal channel by reducing the cast of sending. Such policies help in availability of remittances data and increase the disposable income of migrants families. Without such development, it will not be easy for policy makers to specifically to study and access the impact of remittances.

Chapter 5

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