CHAPTER FIVE

MACRO ECONOMIC DETERMINANTS OF REMITTANCES IN BANGLADESH

5.1. Introduction

Remittances being unilateral transfers, they do not create any future liabilities such as debt servicing or profit transfers and remittances are argued to have a tendency to move counter cyclically with the GDP in recipient countries, as migrant workers are expected to increase their support to family members during down cycles of economic activity back home so as to help them in compensating for the loss family income due to unemployment or other crisis-induced reasons (Ojapinwa, 2012). Remittances are generally a less volatile, hence more dependable, source of funding than private capital inflows and foreign direct investment (FDI) (Ratha, 2003).

Remittances are unrequited non-market personal transfers between households across countries which differ from official aid flows (IMF, 2008). Generally, a large number of labor workers are going to different destinations host countries from excess labor supply home countries and sending, so called remittances, to their beloved ones, from host countries to home countries. Bangladesh is one of them that are receiving remittances a remarkable per cent of country's GDP every year. We can say that Bangladesh is quite dependent on these remittances. Role of remittances are no doubt incredible in Bangladesh. The amount of migrant's remittances varies country to country due to different reasons.

5.2. Determinants of Remittances

According to Ojapinwa (2012), migrants send remittances back to their families for different reasons. Some may remit for selfish reasons (in favour of themselves) while others may remit in favour of their family and friends they left behind. There are two main approaches for analyzing remittances. The first is the "portfolio" approach while the second is the altruism approach .The portfolio approach sees remittances as a self interest controlled capital transfer to diversify the migrant's savings. Portfolio motives come out of investment opportunities and saving differentiation while the altruistic approach sees remittances as a transaction that benefits the receivers who were left behind by the migrant without any demand on the receiver from the remitter.

The decision to remit is a complex phenomenon involving other factor than the motivation to help finance current (as opposed to future) consumption spending of family members and relatives back home (Russell, 1986).There are so many factors that can influence the flow of remittances from the host countries to home countries. These are altruism, exchange motive, loan repayment, insurance, inheritance, investment, political stability. Besides these there are some macro economic factors such as home and host country GDP, exchange rate, money supply, interest rate, inflation, crude oil price in international market, wage rate, number of migrants and the relative rates of return of different financial and real assets may affect the flow of remittances. Behind the causes of remittances flow in the home countries we can mention different important determinants like income differentials, high inflation in home country as well as the host countries.

Other factors that can influence both migrants and remittances are transportation and telecommunication costs, remittance transfer mechanism or costs, economic policies etc. If migrants can visit home more frequently or can more easily in touch with their families in the home country they may remit more. Also we can expect, during or after natural disasters or economic downturn or any economical shocks in the home country, large amount of remittances will arrive to the home country. So there are so many factors that can affect the inflow of remittances. In this regard, the main aim is to find out the important determinants that affect the remittances in Bangladesh.

Migrant workers send about 80% of their earnings from the host countries to their home countries. As a result a trend of higher savings ratio is being found to the remittance receiving families than the non remittances families (Mahmud and Osmani, 1980).

5.3. Variables, Data Source and Period of the Study

To determine the macroeconomic determinants of remittances we use annual data covering the period 1977-2014 for all variables. In our estimation we use annual data rather than quarterly data containing more observations over the same period, because it is now well-known that unit root and cointegration tests require a long time span of data rather than merely a large number of observations. There is no gain in switching from low frequency to high frequency data and merely increasing the number of observations (Al-Assaf and Al-Malki, 2014). To find out the macroeconomic

determinants of remittances Bangladesh we collect annual data covering period from 1977 to 2014 from Bangladesh Bank(BB) ,Bureau of Manpower, Employment and Training(BMET), World Development Indicator (WDI), World Bank(WB) and STATISTA(http://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/).

Table 5.1 Description of Variables:

S.No.	Variables	Description	Source
1	LREM	Natural Log of Remittances	BMET
2	LMW	Natural Log of Migrant Workers	BMET
3	LINF	Natural Log of GDP Deflator (Proxy for inflation)	WDI, World Bank
4	LGDPPC	Natural Log of Per Capita Gross Domestic Product(GDPPC)	WDI, World Bank
5	LEX	Natural Log of Nominal Exchange Rate (Bangladesh Taka per US$)	WDI, World Bank
6	LCOP	Natural Log of Crude Oil Price (in U.S. Dollars per barrel)	STATISTA http://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/
7	LDIR	Natural Log of Deposit Interest Rate	WDI, World Bank

Source: Author

Table 5.2: Descriptive Stats: Common Sample (1977-2014)

	LREM	LMW	LINF	LGDPPC	LEX	LCOP
Mean	3.793011	5.199419	2.002937	-2.847286	1.606054	3.092116
Median	3.719724	5.301175	2.038035	-2.847135	1.613094	2.900834
Maximum	5.064344	5.942035	2.501396	-2.073315	1.913086	3.960867
Minimum	2.097466	4.196591	1.311300	-3.700114	1.176558	2.322686
Std. Dev.	0.813425	0.440308	0.315921	0.437247	0.222228	0.449133
Skewness	-0.123954	-0.450973	-0.389836	-0.043186	-0.505847	0.556950
Kurtosis	2.271111	2.492583	2.292318	2.108711	2.226184	2.244345
Jarque-Bera	0.938500	1.695715	1.755444	1.269606	2.568669	2.868661
Probability	0.625471	0.428332	0.415729	0.530040	0.276835	0.238275
Sum	144.1344	197.5779	76.11160	-108.1969	61.03005	117.5004
Sum Sq. Dev.	24.48145	7.173219	3.692832	7.073835	1.827262	7.463643
Observations	38	38	38	38	38	38

Source: Author

5.4. Rationale behind the Selection of Variables

It is natural to consider that if the migrant workers in abroad increases then the amount of remittances will increase in the home country. From Global Economic Prospects, World Bank (2006) we can say that low skill workers send a higher proportion of their lower income. Although compositional features of migrants are also important determinants of remittances, but we have taken, in our study, just all the migrant workers' remittances in total, not separating as skilled, unskilled or semi-skilled workers.

We have selected Per Capita GDP of Bangladesh as one of important macroeconomic determinants of inflow of remittances in Bangladesh. The economical conditions of home country may influence the altruistic motive of remitters in sending remittances because during adverse economic situations in the home country the family income at home may fall. So during down turn in the home country migrant workers may send more remittances to their family members at home. We have taken Per Capita GDP in Crore Bangladesh Taka of Bangladesh as a determinant of remittances.

Inflation is being taken as another macroeconomic determinant of remittances in our study. Higher inflation at home country means less purchasing power of remittance receiving families. In that situation migrant workers can send more remittances to the home country from host country. We have taken GDP Deflator of Bangladesh as a proxy for the inflation in Bangladesh as it is available during our study period (1977-2014).

The nominal exchange rate is a significant explanatory variable of migrant remittances (Ojapinwa, 2012). Exchange rate also may become endogenous to remittances in Bangladesh. During depreciation or devaluation of home currency the migrants are become better-off as their income increases in the domestic currency. So for portfolio motive they will send more remittances to their home country during home currency depreciation. So in floating exchange rate regime the exchange rate may be found as an important determinant of remittances in Bangladesh. We have taken exchange rate as BDT/US$ as a determinants.

Rate of interest in the home country also played an important role to motivate remitters to send more remittances when rate of interest is higher for better portfolio management of their earnings at abroad. So, annual deposit rate of interest is one of the

important determinants of remittances. But due to model specification problems, we have not taken the annual deposit rate of interest as determinants of remittances as the variable is stationary at the level according to ADF unit root test.

Crude oil prices have great impact on the economy of oil rich countries. Their income mainly depends on the oil price. Bangladeshis are going to mainly migrated to the oil rich countries where there are huge demand for unskilled and semi skilled labors. When oil price increases the demand for labor also increases .So remittances in Bangladesh is quite dependent on this oil prices. We have taken in our study the crude oil price in Bangladesh Taka per barrel. The price of oil has been converted from US Dollar per barrel into Bangladesh Taka per barrel by using nominal exchange rate of Bangladesh Taka per US Dollar.

5.5. Estimation Techniques

Most of the economic series are not stationary in their levels and we know non stationary time series may give us spurious regression results. So, to estimate our relationship between remittances and its explanatory variables, we need to check the stationarity of every series. So stationarity in the series are very essential to estimate any model. Again making non stationary variables to stationary variables by differencing the variables may puts shadows on the long-run information that may remain in the data. To overcome these problems we use Johansen's (1991) cointegration technique, which has emerged as the most powerful and popular method in this area.

We have taken all the variables in logarithmic form to make them stationary at lesser order of integration. Further the coefficients of log linear model provide elasticities which can be interpreted in the form of percentages and thus free from quantification of variables under evaluation.

We use the Augmented Dickey-Fuller (ADF) unit root test on our six variables LREM, LMW, LGDP, LEX, LCOP and LDIR to test the stationarity. Finally, cointegration analysis has been applied to find out whether these explanatory variables are the determinants of remittances or not in Bangladesh. We employ the Johansen (1991) cointegration and Vector Error Correction (VECM) approach, using annual data from 1977–2014 to estimate the model of Macroeconomic Determinants of Remittances in Bangladesh.

The main purpose of this study is to examine the determinants of remittances in Bangladesh. We present the following basic mathematical specifications of the remittances inflow function:

$$LREM = f(LINF, LGDPPC, LEX, LCOP, LMW, LDIR) \quad (5.1)$$

As we have annual data covering 1977 to 2014 and sample size is only 38. The sample size may not be feasible to find the influence of all the six variables remittances by applying cointegration technique due to lesser number of observations and more number of variables causing the loss of degree of freedom in the analysis. Therefore we drop two variables LMW and LDIR. LDIR may not be used in cointegration technique as it I (0) variable, hence we drop it. Again we drop LMW, because we know, migrant workers are directly related to remittance flows. Hence we take only four explanatory variables LINF, LGDPPC, LEX and LCOP on account of the above mentioned limitation.

So our target is to estimate the following equation:

$$LREM_t = \alpha + \beta_1 LINF_t + \beta_2 LGDPPC_t + \beta_3 LEX_t + \beta_4 LCOP_t + \varepsilon_t \quad (5.2)$$

Where, $\alpha = constant, \varepsilon_t = error\ term,\ \beta_1 \lesseqgtr 0,\ \beta_2 \lesseqgtr 0,\ \beta_3 \lesseqgtr 0,\ \beta_4 > 0$

5.6. Empirical Findings

The results of ADF unit root test of our model's variables have been presented in Table 5.2. It has been observed that all variables exhibit integrated order one except one variable LDIR. This means that the series LREM, LMW, LINF, GDP, LEX, and LCOP are non-stationary in level but they become stationary in first differences. The variable LDIR is a stationary at the level. So we cannot use LDIR in the Johansen Cointegretion test along with other variables.

Table 5.3: Result of Augmented Dickey-Fuller (ADF) Unit Root Test

Variables	Level				First Difference				Order of Integration I(d)
	Intercept		Trend &Intercept		Intercept		Trend &Intercept		
	ADF Stat.	Prob.#	ADF Stat.	Prob.#	ADF Stat.	Prob.#	ADF Stat.	Prob.#	
LREM	-2.2913	0.1800	-3.1021	0.1207	-4.3222*	0.0016	-4.5369*	0.0047	I(1)
LMW	-1.6395	0.4512	-2.7103	0.2392	-3.5586**	0.0126	-3.7527**	0.0329	I(1)
LINF	-4.0086*	0.0036	-2.8277	0.1975	-4.9665*	0.0003	-5.0847*	0.0011	I(1)
LGDPPC	-1.4719	0.5365	-3.489**	0.0554	-5.5699*	0.0000	-5.3121*	0.0006	I(1)
LEX	-2.7238***	0.0802	-2.1224	0.5160	-4.0925*	0.0030	-4.8776*	0.0020	I(1)
LCOP	-1.3479	0.5968	-2.0179	0.5727	-5.2912*	0.0001	-5.2122*	0.0008	I(1)
LDIR	-3.2567**	0.0247	3.6097**	0.0430	-4.6457*	0.0007	-4.6276*	0.0038	I(0)

Note: *, **and *** indicate No Unit Root at 1%, 5% and 10% respectively.

MacKinnon (1996) one-sided p-values.

Source: Author

Table 5.4: Optimum Lag Selection for VAR Model

Lag	AIC	SC	VAR Residual LM Stat (at Lag 1)	Prob.	Remarks	Decision
1	-22.80	-21.49	53.51	0.0008	VAR Residuals are serially correlated	Optimum Lag of the VAR is 4 according to AIC
2	-23.74	-21.32	25.68	0.4250	VAR Residuals are not serially correlated	
3	-24.46	-20.91	43.34	0.0128	VAR Residuals are serially correlated	
4*	**-26.38**	**-21.67**	**28.69***	**0.2773***	**VAR Residuals are not serially correlated**	
5	-28.80	-22.91	NA(at lag 1) 164.04 (at Lag 2)	NA(at lag 1) 0.0000 (at Lag 2)	VAR Residuals are serially correlated	

Source: Author

Table 5.5: VAR Lag Order Selection Criteria

Endogenous variables: LREM LINF LGDPPC LEX LCOP
Exogenous variables: C
Sample: 1977 2014
Included observations: 34

Lag	LogL	LR	FPE	AIC	SC	HQ
0	217.6110	NA	2.55e-12	-12.50653	-12.28206	-12.42998
1	437.3251	361.8821	2.75e-17	-23.96030	-22.61351*	-23.50101
2	475.1160	51.12886*	1.44e-17	-24.71271	-22.24359	-23.87067
3	506.0467	32.75012	1.34e-17	-25.06157	-21.47013	-23.83679
4	553.4512	36.25049	6.77e-18*	-26.37948*	-21.66572	-24.77195*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author

Table 5.6: Result of Cointegration Test

Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
Trend assumption: Linear deterministic trend
Series: LREM LINF LGDPPC LEX LCOP
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.809172	138.0780	69.81889	0.0000
At most 1 *	0.750655	81.76098	47.85613	0.0000
At most 2 *	0.536669	34.53776	29.79707	0.0132
At most 3	0.210282	8.381085	15.49471	0.4256
At most 4	0.010369	0.354403	3.841466	0.5516

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.809172	56.31702	33.87687	0.0000
At most 1 *	0.750655	47.22322	27.58434	0.0001
At most 2 *	0.536669	26.15667	21.13162	0.0090
At most 3	0.210282	8.026682	14.26460	0.3760
At most 4	0.010369	0.354403	3.841466	0.5516

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author

Table 5.7: Cointegration Equation 1

1 Cointegrating Equation(s):	Log likelihood	512.5707		
Normalized cointegrating coefficients (standard error in parentheses)				
LREM	LINF	LGDPPC	LEX	LCOP
1.000000	0.353989 (0.32851)	-0.579587 (0.21379)	-2.179613 (0.16110)	-0.470892 (0.03644)

Source: Author

In the cointegretion test, both trace and maximum-eigenvalue tests suggest that there are at least three cointegration vectors are present. It means there may be long-run relationships among the variables. However, the value of LREM is normalised to one, and after this we get the cointegrating equation (equation 5.3) as follows, with the standard error in parentheses:

$$LREM = \underset{(0.329)}{-0.354}\, LINF + \underset{(0.214)}{0.578}\, LGDPPC + \underset{(0.161)}{2.180}\, LEX + \underset{(0.036)}{0.471}\, LCOP \qquad (5.3)$$

Although there are three cointegretion relationships are present in remittance but we follow Al-Assaf and Al-Malki (2014), and we can consider there are at least one cointegration relationship between remittances flows and related macroeconomic explanatory variables. Hence we use one cointegretion equation in the VECM.

We can set a VECM for the macroeconomic determinants remittances with three maximum order of lags and four explanatory variables of remittances in the model. Therefore the model is as follows:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{3} \beta_i \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=1}^{3} \delta_{ij} \Delta x_{j,t-i} + \gamma_0 ECT_{t-1} + \varepsilon_t \qquad (5.4)$$

Where, j=1, 2…k

y_t = flows of remittances,

$x_{j,t}$= macroeconomic determinants of remittances,

$\Delta y_t, \Delta x_{j,t}$ are the differences in the variables that capture short-run dynamics,

ECT_{t-1} = the error correction term, derived from the long run cointegration relationship and measures the magnitude of the past disequilibrium,

γ_0 = the deviation of the dependent variables from the long run equilibrium (speed of adjustment to the equilibrium)

ε_t =serially uncorrelated error terms

Our specific error correction model is based on the following equation (k=4):

$$\begin{aligned}\Delta LREM = \alpha_0 &+ \beta_1 \Delta LREM_{t-1} + \beta_2 \Delta LREM_{t-2} + \beta_3 \Delta LREM_{t-3} + \beta_4 \Delta LINF_{t-1} \\ &+ \beta_5 \Delta LINF_{t-2} + \beta_6 \Delta LINF_{t-3} + \beta_7 \Delta LGDPPC_{t-1} + \beta_8 \Delta LGDPPC_{t-2} \\ &+ \beta_9 \Delta LGDPPC_{t-3} + \beta_{10} \Delta LEX_{t-1} + \beta_{11} \Delta LEX_{t-2} + \beta_{12} \Delta LEX_{t-3} \\ &+ \beta_{13} \Delta LCOP_{t-1} + \beta_{14} \Delta LCOP_{t-2} + \beta_{15} \Delta LCOP_{t-3} + \gamma_0 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (5.5)$$

Where,

$$ECT_{t-1} = \big(\mathrm{LREM}(-1) - 0.983572796823 * \mathrm{LINF}(-1) + 0.0356213369539 * \mathrm{LGDPPC}(-1)\ 0.989110657453 * \mathrm{LEX}(-1) - 0.555705887016 * \mathrm{LCOP}(-1)\big)$$

Equation (5.5) represents a VECM of the determinants of remittances. From the VECM model (See Appendix 5, Table 5.14). The results are presented in Table 5.8 and Table 5.9 for both long-run and short-run coefficients respectively, with the required diagnostic test below, with the required diagnostic test below.

Table 5.8: VECM Estimation of Macroeconomic Determinants of Remittances (Long-run Coefficients)

Dependent Variable: LREM(-1)			
Explanatory Variables	Coefficient	Standard Error	t-statistic
LINF(-1)	-0.354	0.329	-1.078
LGDPPC(-1)	0.580**	0.214	2.711
LEX(-1)	2.180*	0.161	13.529
LCOP(-1)	0.471*	0.036	12.921
C	-1.201	-	-

Note: *, and ** denote significant at 1%, 5% level respectively

Source: Author

Table 5.9: VECM Estimation of Macroeconomic Determinants of Remittances (Short-run Coefficients):

Dependent Variable: D(LREM)				
Explanatory Variables	Coefficients	Standard Error	t-statistic	Prob.
D(LREM(-1))	0.556**	0.215	2.587	0.0192
D(LREM(-2))	0.8838*	0.2802	3.1542	0.0058
D(LREM(-3))	0.9524*	0.2565	3.7130	0.0017
D(LINF(-1))	1.4056	2.4170	0.5816	0.5685
D(LINF(-2))	4.0607***	2.1303	1.9061	0.0737
D(LINF(-3))	-0.5596	1.9529	-0.2866	0.7779
D(LGDPPC(-1))	-0.8013	2.3896	-0.3353	0.7415
D(LGDPPC(-2))	-3.0411	2.1091	-1.4419	0.1675
D(LGDPPC(-3))	1.1615	2.0353	0.5707	0.5757
D(LEX(-1))	-0.3499	0.6845	-0.5112	0.6158
D(LEX(-2))	-1.1068	0.6795	-1.6289	0.1217
D(LEX(-3))	-3.0544*	0.8647	-3.5322	0.0026
D(LCOP(-1))	-0.6377*	0.1658	-3.8460	0.0013
D(LCOP(-2))	-0.5436*	0.1631	-3.3319	0.0039
D(LCOP(-3))	-0.3249**	0.1394	-2.3308	0.0323
C	-0.0081	0.0372	-0.2183	0.8298
ECT_{t-1}	-1.905*	0.439	-4.410	0.0004

Note: *,** and *** denote significant at 1%, 5% and 10% level respectively

R-squared	0.793	Akaike info criterion	-3.3304
Adjusted R-squared	0.598	Schwarz criterion	-2.5673
S.E. of regression	0.0393	Durbin-Watson stat	2.2742
Log likelihood	73.617	F-statistic	4.0696(0.0032)

Diagnostic Tests:

Histogram –Normality Test: Jarque- Bera : 0.4828(0.7855)

Serial Correlation LM Test : Breusch-Godfrey Serial Correlation LM Test:

F(2,15): 0.3638(0.7010), Chi-Square (2) : 1.5729 (0.4555)

Heteroskedasicity Test:

Breusch-Pagan-Godfrey: F(20,13) : 0.6388(0.8218), Chi-Square (20) :16.8524(0.6625)

ARCH : F(1,31) : 0.3412(0.5634), Chi-Square (1) : 0.3592(0.5489)

Note: Numbers in parentheses are p-values.

Source: Author

Long-Run Relationship among Variables:

From Table 5.8, we find that all the explanatory variables except LINF are highly statistically significant in the long-run relationship among the variables. We find Inflation in Bangladesh is not an important macroeconomic determinant of remittances. The coefficient of LINF is negative but insignificant. Value of coefficient of LINF is -0.354. That is, in Bangladesh remittances flow decreases during high inflation and increases during low inflation. This finding indicates that remitters are quite aware of the economic situation of their home countries. Remitters think not only about their family but also portfolio investment.

We find exchange rate as a positive determinant of remittances in Bangladesh. Coefficient of exchange rate is so high. It is about 2.18. This means 2.18 % amount of remittances increases due to 1% increase in exchange rate. Remitters are very sensitive about the exchange rate. We have taken exchange rate in our study as BT/US$. So 1% increase in exchange rate means 1% depreciation in the Bangladeshi Taka. That is, now 1 US$ can purchase more amount of Bangladeshi Taka. So now remitters may be so much motivated to send remittances to their family because their family members will be benefitted much. So we can say that when there is higher exchange rate in the home country the remitters will send so many remittances to their home country from the host country. So, lower inflation and higher exchange rates in the home country invite more remittances from the host countries to the home country.

We find another positive determinant of remittances, that is, crude oil prices (LCOP).Meaning that when the crude oil price increases, oil exporting countries get maximum benefits from the international markets. The economy of these countries will expand and create higher demand of labours. Again migrant workers from Bangladesh are going mainly to the oil exporting countries. So remittances to Bangladesh are quit dependent on the price of crude oil. So due to increase in crude oil price in the international market the remitters will send more remittances from their host country to home country. Hence Bangladesh will get more remittances from the oil exporting countries due to hike in the oil price.

We find the coefficient of LGDPPC as positively significant. The value of the coefficient of LGDPPC is 0.580. When per capita GDP of home country increases the remitters send more remittances to their family members at home. When per capita

GDP (we can consider it as a proxy of per capita income) increases in the home country then the family members of migrant workers may become richer too. So, migrant workers now may send more remittances to their family members due to progress in their home countries. This result also indicates that in Bangladesh remittances have positive impact on per capita GDP because the flows of remittances are increasing day by day.

It is also found that the coefficient of error correction term ($ECT_{t-1)}$ is negative and highly significant in the model. The coefficient value is -1.905 at 1% level of significant. This coefficient is also called the adjustment coefficient or speed of convergence and it implies that when remittances deviate from long run equilibrium, error correction term has an opposite adjustment effect and the deviation degree are reduced with very rapidly.

Short-Run Relationship among Variables:

We also note from the Table 5.9 that remittances have short-run positive impact on itself. That is, the amount of current remittances flow in Bangladesh depends on previous amount of remittances flows positively. The result has been verified by Wald test (Appendix 5, Table 5.19). Although inflation in Bangladesh has no any significant impact on the flow of remittances in the long-run but it has significant impact in the short-run. The result has been verified by Wald test (Appendix 5, Table 5.20).

On the other hand, exchange rate and crude oil price have negative short-run effect on the flow of remittances but they have positive impact on the flow of remittances in the long-run in the Bangladesh. Wald Tests (see Table 5.22 and Table 5.23, Appendix 5) have supported these results of short-run relationship among the variables.

The per capita GDP has no significant impact on the flow of remittances in Bangladesh in the short- run but it has positive impact in the long-run.

All the macroeconomic determinants of remittances identified in our model indicate that the altruism as well as portfolio motives decide jointly the flow of remittances from the host countries to home countries.

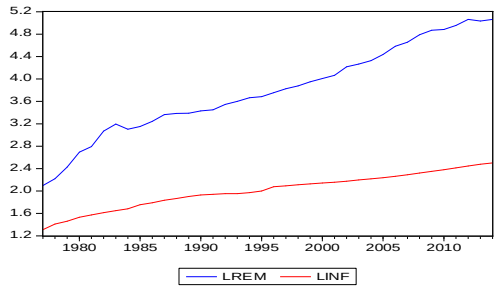
5.7. Summary and Conclusion

The aim of the chapter was to find out whether the macroeconomic factors such as number of migrant workers, interest rate (deposit), inflation (GDP deflator), exchange rate, per capita GDP of the home country and crude oil price can affect the remittance inflow in Bangladesh. Over the last decade workers' remittances played a crucial role in the economic development of the country .Using econometric techniques we find that all the above macroeconomic factors except inflation of home countries have significant impact on remittances. Crude oil price, exchange rate and per capita GDP have positive relationship with remittance inflow in Bangladesh. On the other hand increasing inflation reduces the flow of remittances in the country. During depreciation or devaluation of home currency the migrants are become better-off as their income increases in the domestic currency. So for portfolio motive they will send more remittances to their home country during home currency depreciation.

Crude oil prices have great impact on the economy of oil rich countries or on the host countries. Their income mainly depends on the oil price. Bangladeshis are going to mainly migrated to the oil rich countries where there are huge demand for unskilled and semi skilled labors. When oil price increases the demand for labor also increases and hence remittances increases in Bangladesh. When per capita GDP (we can consider it as a proxy of per capita income) increases in the home country then the family members of migrant workers may become richer too. So, migrant workers now may send more remittances to their family members due to progress in their home countries. This result also indicates that in Bangladesh remittances have positive impacts on per capita GDP because the flows of remittances are increasing day by day. All the macroeconomic determinants of remittances identified in our model indicate that the altruism as well as portfolio motives decide jointly the flow of remittances from the host countries to home countries.

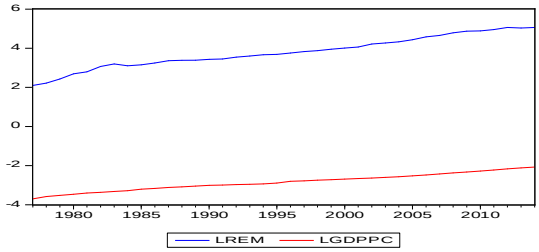
Appendix 5

Figure 5.1: Movement of Remittances and Inflation Rate



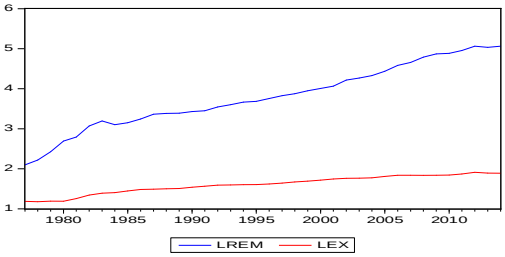
Source: Author

Figure 5.2: Movement of Remittances and Per Capita GDP



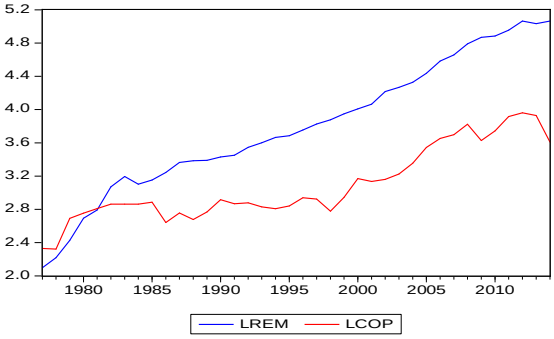
Source: Author

Figure 5.3: Movement of Remittances and Exchange Rate



Source: Author

Figure 5.4: Movement of Remittances and Crude Oil Prices



Source: Author

Table 5.10: Cointegretion Technique for Finding out the Determinants of Remittances in Bangladesh

Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
Trend assumption: Linear deterministic trend
Series: LREM LINF LGDPPC LEX LCOP
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.809172	138.0780	69.81889	0.0000
At most 1 *	0.750655	81.76098	47.85613	0.0000
At most 2 *	0.536669	34.53776	29.79707	0.0132
At most 3	0.210282	8.381085	15.49471	0.4256
At most 4	0.010369	0.354403	3.841466	0.5516

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.809172	56.31702	33.87687	0.0000
At most 1 *	0.750655	47.22322	27.58434	0.0001
At most 2 *	0.536669	26.15667	21.13162	0.0090
At most 3	0.210282	8.026682	14.26460	0.3760
At most 4	0.010369	0.354403	3.841466	0.5516

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LREM	LINF	LGDPPC	LEX	LCOP
-64.14547	-22.70681	37.17787	139.8123	30.20558
32.41895	-156.3424	64.69879	10.25413	-27.52077
5.500528	13.39470	-34.42627	37.38233	2.399701
0.049830	52.58299	-42.52906	-17.85208	14.72680
-11.47784	-73.90725	72.94069	15.35286	0.907064

Unrestricted Adjustment Coefficients (alpha):

D(LREM)	0.029692	0.009794	-0.010261	-0.007038	-0.000182
D(LINF)	-0.000831	0.009038	-0.000453	0.000764	0.000287
D(LGDPPC)	-0.000255	0.009423	0.000730	0.001105	0.000105
D(LEX)	0.003677	0.002176	-0.004481	-0.000956	-0.000564
D(LCOP)	0.008902	0.033867	0.040978	-0.024711	-0.002858

1 Cointegrating Equation(s): Log likelihood 512.5707

Normalized cointegrating coefficients (standard error in parentheses)

LREM	LINF	LGDPPC	LEX	LCOP
1.000000	0.353989	-0.579587	-2.179613	-0.470892
	(0.32851)	(0.21379)	(0.16110)	(0.03644)

Adjustment coefficients (standard error in parentheses)

D(LREM)	-1.904634 (0.43188)
D(LINF)	0.053334 (0.17047)
D(LGDPPC)	0.016339 (0.17475)
D(LEX)	-0.235872 (0.14085)
D(LCOP)	-0.571017 (1.42309)

2 Cointegrating Equation(s): Log likelihood 536.1823

Normalized cointegrating coefficients (standard error in parentheses)

LREM	LINF	LGDPPC	LEX	LCOP
1.000000	0.000000	-0.403480 (0.06539)	-2.008934 (0.11151)	-0.496742 (0.01946)
0.000000	1.000000	-0.497492 (0.03410)	-0.482158 (0.05816)	0.073025 (0.01015)

Adjustment coefficients (standard error in parentheses)				
D(LREM)	-1.587127	-2.205419		
	(0.45279)	(0.99527)		
D(LINF)	0.346331	-1.394118		
	(0.10799)	(0.23738)		
D(LGDPPC)	0.321815	-1.467394		
	(0.10657)	(0.23425)		
D(LEX)	-0.165319	-0.423745		
	(0.15319)	(0.33672)		
D(LCOP)	0.526925	-5.497027		
	(1.48120)	(3.25584)		
3 Cointegrating Equation(s): Log likelihood 549.2606				
Normalized cointegrating coefficients (standard error in parentheses)				
LREM	LINF	LGDPPC	LEX	LCOP
1.000000	0.000000	0.000000	-2.875991	-0.562357
			(0.09398)	(0.04037)
0.000000	1.000000	0.000000	-1.551243	-0.007878
			(0.10547)	(0.04531)
0.000000	0.000000	1.000000	-2.148947	-0.162623
			(0.20511)	(0.08812)
Adjustment coefficients (standard error in parentheses)				
D(LREM)	-1.643566	-2.342857	2.090788	
	(0.41718)	(0.91761)	(0.47561)	
D(LINF)	0.343838	-1.400189	0.569430	
	(0.10802)	(0.23759)	(0.12315)	
D(LGDPPC)	0.325832	-1.457611	0.575027	
	(0.10611)	(0.23340)	(0.12098)	
D(LEX)	-0.189966	-0.483765	0.431772	
	(0.13216)	(0.29070)	(0.15067)	
D(LCOP)	0.752328	-4.948134	1.111394	
	(1.30137)	(2.86244)	(1.48364)	
4 Cointegrating Equation(s): Log likelihood 553.2740				
Normalized cointegrating coefficients (standard error in parentheses)				
LREM	LINF	LGDPPC	LEX	LCOP
1.000000	0.000000	0.000000	0.000000	-1.424440
				(0.43910)
0.000000	1.000000	0.000000	0.000000	-0.472866
				(0.23365)
0.000000	0.000000	1.000000	0.000000	-0.806773
				(0.32020)
0.000000	0.000000	0.000000	1.000000	-0.299752
				(0.15528)
Adjustment coefficients (standard error in parentheses)				
D(LREM)	-1.643917	-2.712935	2.390107	3.993871
	(0.39862)	(0.92376)	(0.51171)	(0.80839)
D(LINF)	0.343876	-1.360021	0.536942	-0.054155
	(0.10719)	(0.24839)	(0.13760)	(0.21737)
D(LGDPPC)	0.325887	-1.399527	0.528049	0.068595
	(0.10434)	(0.24180)	(0.13394)	(0.21160)
D(LEX)	-0.190013	-0.534047	0.472440	0.385993
	(0.13110)	(0.30381)	(0.16829)	(0.26587)
D(LCOP)	0.751096	-6.247530	2.162344	3.564891
	(1.22757)	(2.84474)	(1.57581)	(2.48947)

Source: Author

Table 5.11: Vector Error Correction Estimates with Three Cointegrating Equations

Sample (adjusted): 1981 2014 Included observations: 34 after adjustments Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1	CointEq2	CointEq3		
LREM(-1)	1.000000	0.000000	0.000000		
LINF(-1)	0.000000	1.000000	0.000000		
LGDPPC(-1)	0.000000	0.000000	1.000000		
LEX(-1)	-2.875991	-1.551243	-2.148947		
	(0.10005)	(0.11228)	(0.21836)		
	[-28.7466]	[-13.8154]	[-9.84141]		
LCOP(-1)	-0.562357	-0.007878	-0.162623		
	(0.04298)	(0.04824)	(0.09381)		
	[-13.0842]	[-0.16333]	[-1.73360]		
C	2.572115	0.518769	6.826236		
Error Correction:	D(LREM)	D(LINF)	D(LGDPPC)	D(LEX)	D(LCOP)
CointEq1	-1.643566	0.343838	0.325832	-0.189966	0.752328
	(0.44412)	(0.11499)	(0.11297)	(0.14070)	(1.38542)
	[-3.70071]	[2.99009]	[2.88431]	[-1.35018]	[0.54303]
CointEq2	-2.342857	-1.400189	-1.457611	-0.483765	-4.948134
	(0.97687)	(0.25293)	(0.24848)	(0.30947)	(3.04730)
	[-2.39832]	[-5.53581]	[-5.86616]	[-1.56320]	[-1.62377]
CointEq3	2.090788	0.569430	0.575027	0.431772	1.111394
	(0.50633)	(0.13110)	(0.12879)	(0.16040)	(1.57946)
	[4.12933]	[4.34352]	[4.46486]	[2.69179]	[0.70365]
D(LREM(-1))	0.328815	-0.230939	-0.257028	-0.045786	-1.069707
	(0.26484)	(0.06857)	(0.06736)	(0.08390)	(0.82615)
	[1.24157]	[-3.36780]	[-3.81548]	[-0.54572]	[-1.29480]
D(LREM(-2))	0.653569	-0.190699	-0.202585	0.048186	0.491331
	(0.28122)	(0.07281)	(0.07153)	(0.08909)	(0.87726)
	[2.32404]	[-2.61899]	[-2.83211]	[0.54087]	[0.56008]
D(LREM(-3))	0.701569	-0.074002	-0.036067	0.166890	0.154464
	(0.27002)	(0.06991)	(0.06868)	(0.08554)	(0.84232)
	[2.59818]	[-1.05847]	[-0.52512]	[1.95096]	[0.18338]
D(LINF(-1))	-0.251526	-1.148428	-1.049070	0.013706	2.093920
	(2.35582)	(0.60997)	(0.59923)	(0.74632)	(7.34887)
	[-0.10677]	[-1.88275]	[-1.75070]	[0.01836]	[0.28493]
D(LINF(-2))	1.200183	-0.567252	-0.517586	0.628952	5.293254
	(2.31232)	(0.59871)	(0.58816)	(0.73254)	(7.21315)
	[0.51904]	[-0.94746]	[-0.88001]	[0.85859]	[0.73383]
D(LINF(-3))	-0.910505	0.486300	-0.069091	-0.453075	2.100590
	(1.83705)	(0.47565)	(0.46727)	(0.58197)	(5.73059)
	[-0.49563]	[1.02239]	[-0.14786]	[-0.77851]	[0.36656]
D(LGDPPC(-1))	0.492195	1.434504	1.349256	-0.164834	-1.616980
	(2.27194)	(0.58825)	(0.57789)	(0.71974)	(7.08719)
	[0.21664]	[2.43859]	[2.33480]	[-0.22902]	[-0.22816]
D(LGDPPC(-2))	-0.168276	0.872673	0.815311	-0.368812	-6.468648

	(2.30777)	(0.59753)	(0.58701)	(0.73110)	(7.19897)
	[-0.07292]	[1.46047]	[1.38893]	[-0.50446]	[-0.89855]
D(LGDPPC(-3))	1.411790	-0.525089	0.102178	0.662326	-0.338658
	(1.87289)	(0.48493)	(0.47639)	(0.59333)	(5.84238)
	[0.75380]	[-1.08281]	[0.21449]	[1.11629]	[-0.05797]
D(LEX(-1))	-0.397919	-0.407611	-0.499332	0.115250	-0.717493
	(0.63168)	(0.16356)	(0.16067)	(0.20012)	(1.97050)
	[-0.62994]	[-2.49218]	[-3.10772]	[0.57592]	[-0.36412]
D(LEX(-2))	-1.336161	0.027902	0.155220	-0.199298	-1.044226
	(0.65082)	(0.16851)	(0.16554)	(0.20618)	(2.03019)
	[-2.05305]	[0.16558]	[0.93765]	[-0.96663]	[-0.51435]
D(LEX(-3))	-2.834900	-0.117998	-0.387086	-0.502608	-5.783293
	(0.80757)	(0.20910)	(0.20541)	(0.25584)	(2.51918)
	[-3.51040]	[-0.56432]	[-1.88442]	[-1.96456]	[-2.29571]
D(LCOP(-1))	-0.391835	0.179863	0.192908	0.036873	0.395068
	(0.21406)	(0.05542)	(0.05445)	(0.06781)	(0.66775)
	[-1.83050]	[3.24520]	[3.54297]	[0.54375]	[0.59164]
D(LCOP(-2))	-0.435285	0.128256	0.135024	-0.029065	0.088947
	(0.16882)	(0.04371)	(0.04294)	(0.05348)	(0.52661)
	[-2.57845]	[2.93424]	[3.14446]	[-0.54347]	[0.16890]
D(LCOP(-3))	-0.231561	0.070271	0.064060	-0.042638	-0.018701
	(0.14374)	(0.03722)	(0.03656)	(0.04554)	(0.44841)
	[-1.61092]	[1.88807]	[1.75204]	[-0.93632]	[-0.04170]
C	-0.003189	0.025539	0.033909	0.008673	0.247756
	(0.03493)	(0.00904)	(0.00888)	(0.01107)	(0.10896)
	[-0.09129]	[2.82388]	[3.81660]	[0.78383]	[2.27381]
R-squared	0.847023	0.832965	0.842397	0.869650	0.611023
Adj. R-squared	0.663450	0.632522	0.653274	0.713230	0.144250
Sum sq. resids	0.019360	0.001298	0.001253	0.001943	0.188396
S.E. equation	0.035926	0.009302	0.009138	0.011381	0.112070
F-statistic	4.614103	4.155627	4.454216	5.559721	1.309036
Log likelihood	78.76110	124.7030	125.3072	117.8438	40.08077
Akaike AIC	-3.515359	-6.217821	-6.253364	-5.814343	-1.240045
Schwarz SC	-2.662393	-5.364855	-5.400398	-4.961376	-0.387079
Mean dependent	0.069751	0.028512	0.040846	0.020619	0.025121
S.D. dependent	0.061928	0.015345	0.015519	0.021253	0.121148
Determinant resid covariance (dof adj.)		3.83E-19			
Determinant resid covariance		6.39E-21			
Log likelihood		549.2606			
Akaike information criterion		-25.83886			
Schwarz criterion		-20.90064			

Source: Author

Table 5.12: VEC Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h Sample: 1977 2014 Included observations: 34		
Lags	LM-Stat	Prob
1	30.72911	0.1981
2	36.48281	0.0646
3	30.80141	0.1957
4	30.55790	0.2041
5	31.24618	0.1810
6	25.50005	0.4346
7	23.45301	0.5511
8	21.53968	0.6622
9	19.07460	0.7935
10	24.03953	0.5171
11	27.11665	0.3501
12	21.39130	0.6706
Probs from chi-square with 25 df.		

Source: Author

Table 5.13.: VEC Residual Normality Tests

Orthogonalization: Residual Covariance (Urzua) Null Hypothesis: residuals are multivariate normal Sample: 1977 2014 Included observations: 34				
Component	Skewness	Chi-sq	Df	Prob.
1	0.072169	0.035129	1	0.8513
2	0.074308	0.037242	1	0.8470
3	-0.218827	0.322977	1	0.5698
4	-0.146984	0.145717	1	0.7027
5	0.251245	0.425757	1	0.5141
Joint		0.966822	5	0.9652
Component	Kurtosis	Chi-sq	Df	Prob.
1	0.675783	10.12053	1	0.0015
2	0.888596	8.218513	1	0.0041
3	0.840288	8.632906	1	0.0033
4	0.582326	11.01831	1	0.0009
5	0.816029	8.844852	1	0.0029
Joint		46.83511	5	0.0000
Component	Jarque-Bera	df	Prob.	
1	10.15566	2	0.0062	
2	8.255756	2	0.0161	
3	8.955883	2	0.0114	
4	11.16402	2	0.0038	
5	9.270609	2	0.0097	
Joint	99.92196	105	0.6217	

Source: Author

Table 5.14: Vector Error Correction Estimates with One Cointegrating Equation:

Sample (adjusted): 1981 2014 Included observations: 34 after adjustments Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1				
LREM(-1)	1.000000				
LINF(-1)	0.353989				
	(0.32851)				
	[1.07755]				
LGDPPC(-1)	-0.579587				
	(0.21379)				
	[-2.71095]				
LEX(-1)	-2.179613				
	(0.16110)				
	[-13.5292]				
LCOP(-1)	-0.470892				
	(0.03644)				
	[-12.9206]				
C	-1.200643				
Error Correction:	D(LREM)	D(LINF)	D(LGDPPC)	D(LEX)	D(LCOP)
CointEq1	-1.904634	0.053334	0.016339	-0.235872	-0.571017
	(0.43188)	(0.17047)	(0.17475)	(0.14085)	(1.42309)
	[-4.41010]	[0.31287]	[0.09350]	[-1.67467]	[-0.40125]
D(LREM(-1))	0.555957	0.023167	0.013838	-0.006176	0.093148
	(0.21490)	(0.08483)	(0.08695)	(0.07009)	(0.70813)
	[2.58701]	[0.27312]	[0.15914]	[-0.08812]	[0.13154]
D(LREM(-2))	0.883815	-0.025738	-0.036938	0.110948	0.884579
	(0.28020)	(0.11060)	(0.11337)	(0.09138)	(0.92329)
	[3.15425]	[-0.23272]	[-0.32581]	[1.21414]	[0.95808]
D(LREM(-3))	0.952408	0.120018	0.161219	0.231773	0.704205
	(0.25651)	(0.10125)	(0.10379)	(0.08365)	(0.84522)
	[3.71297]	[1.18540]	[1.55335]	[2.77061]	[0.83316]
D(LINF(-1))	1.405625	-0.758552	-0.794624	0.660083	-1.838629
	(2.41699)	(0.95402)	(0.97796)	(0.78824)	(7.96426)
	[0.58156]	[-0.79511]	[-0.81253]	[0.83741]	[-0.23086]
D(LINF(-2))	4.060697	0.807099	0.746452	1.573488	4.453369
	(2.13033)	(0.84087)	(0.86197)	(0.69475)	(7.01967)
	[1.90614]	[0.95984]	[0.86599]	[2.26481]	[0.63441]
D(LINF(-3))	-0.559607	0.247470	-0.393172	-0.237749	-1.457830
	(1.95287)	(0.77083)	(0.79017)	(0.63688)	(6.43494)
	[-0.28656]	[0.32105]	[-0.49758]	[-0.37330]	[-0.22655]
D(LGDPPC(-1))	-0.801329	1.090944	1.104502	-0.659799	1.119899
	(2.38964)	(0.94322)	(0.96689)	(0.77932)	(7.87415)
	[-0.33533]	[1.15661]	[1.14232]	[-0.84663]	[0.14222]
D(LGDPPC(-2))	-3.041107	-0.668148	-0.642985	-1.278221	-6.986810
	(2.10911)	(0.83249)	(0.85338)	(0.68783)	(6.94975)
	[-1.44189]	[-0.80259]	[-0.75345]	[-1.85833]	[-1.00533]
D(LGDPPC(-3))	1.161505	-0.474861	0.192068	0.538064	1.180690
	(2.03525)	(0.80334)	(0.82350)	(0.66375)	(6.70638)

	[0.57069]	[-0.59111]	[0.23323]	[0.81065]	[0.17605]
D(LEX(-1))	-0.349892	-0.305647	-0.385333	0.111850	-0.062528
	(0.68449)	(0.27018)	(0.27696)	(0.22323)	(2.25547)
	[-0.51117]	[-1.13129]	[-1.39131]	[0.50105]	[-0.02772]
D(LEX(-2))	-1.106762	0.300192	0.447194	-0.163116	0.262989
	(0.67946)	(0.26819)	(0.27492)	(0.22159)	(2.23890)
	[-1.62888]	[1.11932]	[1.62662]	[-0.73612]	[0.11746]
D(LEX(-3))	-3.054416	-0.088382	-0.325226	-0.608068	-4.573176
	(0.86473)	(0.34132)	(0.34989)	(0.28201)	(2.84938)
	[-3.53222]	[-0.25894]	[-0.92952]	[-2.15619]	[-1.60497]
D(LCOP(-1))	-0.637725	-0.041812	-0.037510	-0.019044	-0.410838
	(0.16582)	(0.06545)	(0.06709)	(0.05408)	(0.54638)
	[-3.84600]	[-0.63884]	[-0.55909]	[-0.35216]	[-0.75193]
D(LCOP(-2))	-0.543575	0.014236	0.014267	-0.049689	-0.405016
	(0.16314)	(0.06439)	(0.06601)	(0.05321)	(0.53758)
	[-3.33189]	[0.22107]	[0.21614]	[-0.93391]	[-0.75341]
D(LCOP(-3))	-0.324871	-0.025921	-0.037575	-0.060911	-0.426899
	(0.13938)	(0.05502)	(0.05640)	(0.04546)	(0.45928)
	[-2.33078]	[-0.47114]	[-0.66625]	[-1.33998]	[-0.92949]
C	-0.008124	0.015755	0.023011	0.008853	0.186337
	(0.03722)	(0.01469)	(0.01506)	(0.01214)	(0.12266)
	[-0.21826]	[1.07230]	[1.52778]	[0.72928]	[1.51917]
R-squared	0.792970	0.474656	0.460289	0.813051	0.412625
Adj. R-squared	0.598118	-0.019785	-0.047675	0.637099	-0.140199
Sum sq. resids	0.026201	0.004082	0.004290	0.002787	0.284487
S.E. equation	0.039259	0.015496	0.015885	0.012803	0.129362
F-statistic	4.069607	0.959986	0.906145	4.620866	0.746394
Log likelihood	73.61732	105.2236	104.3809	111.7134	33.07434
Akaike AIC	-3.330431	-5.189622	-5.140056	-5.571375	-0.945550
Schwarz SC	-2.567250	-4.426442	-4.376876	-4.808195	-0.182369
Mean dependent	0.069751	0.028512	0.040846	0.020619	0.025121
S.D. dependent	0.061928	0.015345	0.015519	0.021253	0.121148

Determinant resid covariance (dof adj.)	1.77E-18
Determinant resid covariance	5.54E-20
Log likelihood	512.5707
Akaike information criterion	-24.85710
Schwarz criterion	-20.81673

Source: Author

Table 5.15: VEC Residual Normality Tests

Orthogonalization: Residual Covariance (Urzua) Null Hypothesis: residuals are multivariate normal Sample: 1977 2014 Included observations: 34				
Component	Skewness	Chi-sq	Df	Prob.
1	0.057268	0.022120	1	0.8818
2	0.263794	0.469352	1	0.4933
3	-0.060672	0.024829	1	0.8748
4	-0.272708	0.501609	1	0.4788
5	-0.117883	0.093729	1	0.7595
Joint		1.111638	5	0.9531
Component	Kurtosis	Chi-sq	Df	Prob.
1	0.712401	9.779171	1	0.0018
2	1.137588	6.244235	1	0.0125
3	0.602141	10.82478	1	0.0010
4	0.828109	8.738994	1	0.0031
5	0.785836	9.112236	1	0.0025
Joint		44.69941	5	0.0000
Component	Jarque-Bera	df	Prob.	
1	9.801291	2	0.0074	
2	6.713587	2	0.0348	
3	10.84960	2	0.0044	
4	9.240603	2	0.0098	
5	9.205965	2	0.0100	
Joint	92.36544	105	0.8059	

Source: Author

Table 5.16: VEC Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h Sample: 1977 2014 Included observations: 34		
Lags	LM-Stat	Prob
1	27.51503	0.3307
2	24.90743	0.4676
3	27.40094	0.3362
4	19.65728	0.7646
5	30.02689	0.2233
6	28.35391	0.2918
7	33.42390	0.1208
8	14.89884	0.9437
9	17.07019	0.8792
10	16.24192	0.9074
11	27.73854	0.3200
12	28.74388	0.2748
Probs from chi-square with 25 df.		

Source: Author

Table 5.17: VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Sample: 1977 2014 Included observations: 34					
Joint test:					
Chi-sq	df	Prob.			
490.0576	480	0.3655			
Individual components:					
Dependent	R-squared	F(32,1)	Prob.	Chi-sq(32)	Prob.
res1*res1	0.990704	3.330579	0.4125	33.68395	0.3859
res2*res2	0.984613	1.999744	0.5154	33.47686	0.3955
res3*res3	0.994391	5.540067	0.3262	33.80929	0.3801
res4*res4	0.999771	136.4230	0.0677	33.99221	0.3718
res5*res5	0.999886	274.2083	0.0478	33.99613	0.3716
res2*res1	0.999858	219.3915	0.0534	33.99516	0.3717
res3*res1	0.999830	183.9193	0.0583	33.99422	0.3717
res3*res2	0.990294	3.188419	0.4206	33.67000	0.3865
res4*res1	0.997497	12.45342	0.2213	33.91490	0.3753
res4*res2	0.980089	1.538249	0.5740	33.32303	0.4027
res4*res3	0.970406	1.024691	0.6694	32.99379	0.4183
res5*res1	0.784310	0.113634	0.9943	26.66652	0.7334
res5*res2	0.990996	3.439622	0.4065	33.69388	0.3854
res5*res3	0.999853	213.2771	0.0542	33.99502	0.3717
res5*res4	0.976124	1.277582	0.6171	33.18821	0.4091

Source: Author

Table 5.18: Vector Error Correction Estimates with One Cointegrating Equation

Dependent Variable: D(LREM)
Method: Least Squares
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments

D(LREM) = C(1)*(LREM(-1) + 0.353989313582*LINF(-1) - 0.579586852562 *LGDPPC(-1) - 2.17961308762*LEX(-1) - 0.470891804325*LCOP(-1) - 1.20064271175) + C(2)*D(LREM(-1)) + C(3)*D(LREM(-2)) + C(4) *D(LREM(-3)) + C(5)*D(LINF(-1)) + C(6)*D(LINF(-2)) + C(7)*D(LINF(-3)) + C(8)*D(LGDPPC(-1)) + C(9)*D(LGDPPC(-2)) + C(10)*D(LGDPPC(-3)) + C(11)*D(LEX(-1)) + C(12)*D(LEX(-2)) + C(13)*D(LEX(-3)) + C(14) *D(LCOP(-1)) + C(15)*D(LCOP(-2)) + C(16)*D(LCOP(-3)) + C(17)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.904634	0.431880	-4.410099	0.0004
C(2)	0.555957	0.214903	2.587012	0.0192
C(3)	0.883815	0.280198	3.154248	0.0058
C(4)	0.952408	0.256508	3.712971	0.0017
C(5)	1.405625	2.416991	0.581560	0.5685
C(6)	4.060697	2.130328	1.906137	0.0737
C(7)	-0.559607	1.952874	-0.286555	0.7779
C(8)	-0.801329	2.389644	-0.335334	0.7415
C(9)	-3.041107	2.109108	-1.441892	0.1675
C(10)	1.161505	2.035249	0.570694	0.5757
C(11)	-0.349892	0.684489	-0.511172	0.6158
C(12)	-1.106762	0.679460	-1.628885	0.1217
C(13)	-3.054416	0.864730	-3.532218	0.0026
C(14)	-0.637725	0.165815	-3.845997	0.0013
C(15)	-0.543575	0.163143	-3.331889	0.0039
C(16)	-0.324871	0.139383	-2.330778	0.0323
C(17)	-0.008124	0.037224	-0.218258	0.8298

R-squared	0.792970	Mean dependent var	0.069751
Adjusted R-squared	0.598118	S.D. dependent var	0.061928
S.E. of regression	0.039259	Akaike info criterion	-3.330431
Sum squared resid	0.026201	Schwarz criterion	-2.567250
Log likelihood	73.61732	Hannan-Quinn criter.	-3.070164
F-statistic	4.069607	Durbin-Watson stat	2.274152
Prob(F-statistic)	0.003200		

Source: Author

Table 5.19: Wald Test on Coefficients of D (LREM (-1)), D (LREM (-2)) and D (LREM (-3))

Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	7.213864	(3, 17)	0.0025
Chi-square	21.64159	3	0.0001
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(2)		0.555957	0.214903
C(3)		0.883815	0.280198
C(4)		0.952408	0.256508
Restrictions are linear in coefficients.			

Source: Author

Table 5.20: Wald Test on Coefficients of D (LINF (-1)), D (LINF (-2)) and D (LINF (-3))

Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	3.722304	(3, 17)	0.0318
Chi-square	11.16691	3	0.0109
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(5)		1.405625	2.416991
C(6)		4.060697	2.130328
C(7)		-0.559607	1.952874
Restrictions are linear in coefficients.			

Source: Author

Table5.21: Wald Test on Coefficients of D (LGDPPC (-1)), D (LGDPPC (-2)) and D (LGDPPC (-3))

Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	1.599669	(3, 17)	0.2265
Chi-square	4.799006	3	0.1871
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(8)		-0.801329	2.389644
C(9)		-3.041107	2.109108
C(10)		1.161505	2.035249
Restrictions are linear in coefficients.			

Source: Author

Table 5.22: Wald Test on Coefficients of D (LEX (-1)), D (LEX (-2)) and D (LEX (-3))

Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	10.14675	(3, 17)	0.0005
Chi-square	30.44026	3	0.0000
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(11)		-0.349892	0.684489
C(12)		-1.106762	0.679460
C(13)		-3.054416	0.864730
Restrictions are linear in coefficients.			

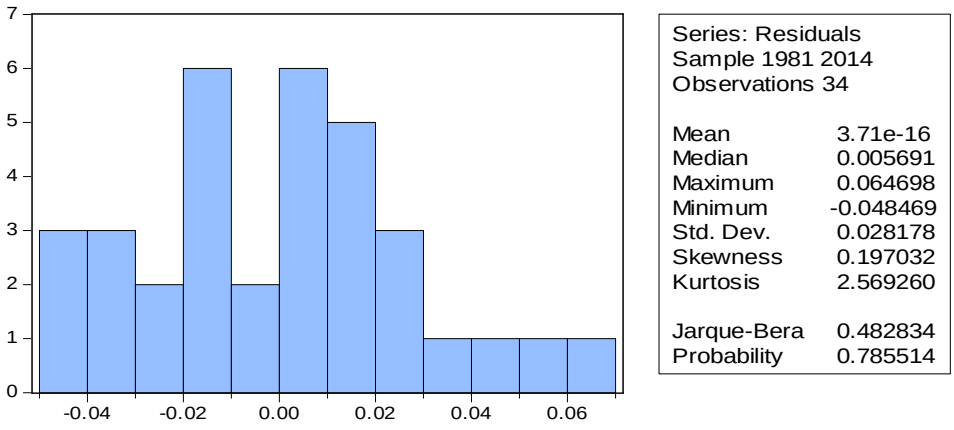
Source: Author

Table 5.23: Wald Test on Coefficients of D (LCOP (-1)), D (LCOP (-2)) and D (LCOP (-3))

Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	6.351086	(3, 17)	0.0044
Chi-square	19.05326	3	0.0003
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(14)		-0.637725	0.165815
C(15)		-0.543575	0.163143
C(16)		-0.324871	0.139383
Restrictions are linear in coefficients.			

Source: Author

Figure 5.5: Histogram- Normality Test:



Source: Author

Table 5.24: Serial Correlation LM Test: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.363802	Prob. F(2,15)		0.7010
Obs*R-squared	1.572938	Prob. Chi-Square(2)		0.4555
Test Equation: Dependent Variable: RESID Method: Least Squares Sample: 1981 2014 Included observations: 34 Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.158531	0.524174	0.302439	0.7665
C(2)	0.000665	0.228664	0.002908	0.9977
C(3)	-0.030935	0.325480	-0.095044	0.9255
C(4)	-0.137799	0.332197	-0.414812	0.6842
C(5)	0.465908	2.679853	0.173856	0.8643
C(6)	-0.956114	2.503244	-0.381950	0.7079
C(7)	0.089089	2.135496	0.041718	0.9673
C(8)	-0.475928	2.627455	-0.181137	0.8587
C(9)	0.919730	2.454267	0.374747	0.7131
C(10)	-0.212004	2.220751	-0.095465	0.9252
C(11)	0.366254	0.841356	0.435314	0.6695
C(12)	-0.365149	0.870552	-0.419446	0.6808
C(13)	0.542076	1.239471	0.437345	0.6681
C(14)	0.075604	0.210908	0.358470	0.7250
C(15)	0.035193	0.184318	0.190937	0.8511
C(16)	0.056112	0.169685	0.330685	0.7455
C(17)	-0.000461	0.038773	-0.011878	0.9907
RESID(-1)	-0.323408	0.385715	-0.838465	0.4149
RESID(-2)	0.023569	0.382770	0.061575	0.9517
R-squared	0.046263	Mean dependent var		3.71E-16
Adjusted R-squared	-1.098222	S.D. dependent var		0.028178
S.E. of regression	0.040816	Akaike info criterion		-3.260151
Sum squared resid	0.024989	Schwarz criterion		-2.407185
Log likelihood	74.42256	Hannan-Quinn criter.		-2.969265
F-statistic	0.040422	Durbin-Watson stat		1.952841
Prob(F-statistic)	1.000000			

Source: Author

Table: 5.25: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.638812	Prob. F(20,13)		0.8218
Obs*R-squared	16.85242	Prob. Chi-Square(20)		0.6625
Scaled explained SS	3.305728	Prob. Chi-Square(20)		1.0000
Test Equation: Dependent Variable: RESID^2 Method: Least Squares Sample: 1981 2014 Included observations: 34				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.117942	0.127491	0.925101	0.3718
LREM(-1)	0.006037	0.011729	0.514694	0.6154
LINF(-1)	-0.061156	0.084357	-0.724967	0.4813
LGDPPC(-1)	0.057395	0.077639	0.739253	0.4729
LEX(-1)	-0.001178	0.032431	-0.036326	0.9716
LCOP(-1)	-0.001973	0.003731	-0.528695	0.6059
LREM(-2)	-0.015653	0.011125	-1.406977	0.1829
LREM(-3)	0.008224	0.009975	0.824543	0.4245
LREM(-4)	-0.003006	0.008527	-0.352490	0.7301
LINF(-2)	0.170083	0.113994	1.492043	0.1596
LINF(-3)	-0.094180	0.098203	-0.959033	0.3550
LINF(-4)	-0.032721	0.065635	-0.498526	0.6264
LGDPPC(-2)	-0.165404	0.115617	-1.430617	0.1761
LGDPPC(-3)	0.087476	0.097665	0.895671	0.3867
LGDPPC(-4)	0.043361	0.068636	0.631752	0.5385
LEX(-2)	0.015822	0.034831	0.454254	0.6571
LEX(-3)	-0.011221	0.039092	-0.287040	0.7786
LEX(-4)	-0.002473	0.025603	-0.096586	0.9245
LCOP(-2)	0.003992	0.004226	0.944702	0.3620
LCOP(-3)	-0.005107	0.003171	-1.610677	0.1313
LCOP(-4)	0.003270	0.004445	0.735534	0.4751
R-squared	0.495660	Mean dependent var		0.000771
Adjusted R-squared	-0.280249	S.D. dependent var		0.000980
S.E. of regression	0.001109	Akaike info criterion		-10.49734
Sum squared resid	1.60E-05	Schwarz criterion		-9.554592
Log likelihood	199.4549	Hannan-Quinn criter.		-10.17584
F-statistic	0.638812	Durbin-Watson stat		2.709455
Prob(F-statistic)	0.821777			

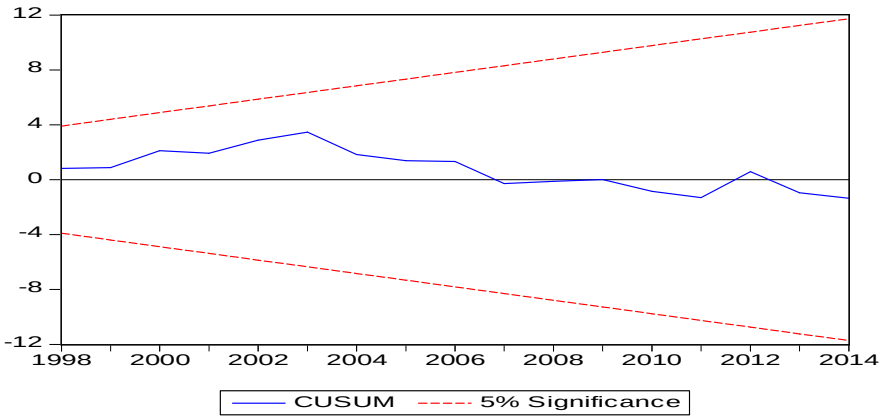
Source: Author

Table: 5.26: Heteroskedasticity Test: ARCH

F-statistic	0.341188	Prob. F(1,31)		0.5634
Obs*R-squared	0.359247	Prob. Chi-Square(1)		0.5489
Test Equation: Dependent Variable: RESID^2 Method: Least Squares Sample (adjusted): 1982 2014 Included observations: 33 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000868	0.000225	3.864443	0.0005
RESID^2(-1)	-0.104648	0.179157	-0.584113	0.5634
R-squared	0.010886	Mean dependent var		0.000785
Adjusted R-squared	-0.021021	S.D. dependent var		0.000991
S.E. of regression	0.001002	Akaike info criterion		-10.91561
Sum squared resid	3.11E-05	Schwarz criterion		-10.82491
Log likelihood	182.1075	Hannan-Quinn criter.		-10.88509
F-statistic	0.341188	Durbin-Watson stat		1.974587
Prob(F-statistic)	0.563371			

Source: Author

Figure 5.6: Stability Test (Recursive Estimation (CUSUM Test))



Source: Author