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Remittance, Exchange Rate and Dutch Disease: The Case of Bangladesh

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Bangladesh had historically relished the fortune of being a labor surplus nation and therefore had accumulated remittances in large volumes over the last four decades. Thus, the concept of remittance-effectiveness in shaping the economy of Bangladesh emerges with utmost significance and importance amidst researchers and policy makers all around the globe. The aim of this paper is to identify the dynamics of real exchange rate movements following inflow of remittances in Bangladesh over the period of 1980 to 2013 and whether such movements caused Dutch disease problem in the country. This paper fills the gap in the empirical literature using the ARDL bounds testing approach to investigate the causal relationship between foreign remittance and real exchange rate exclusively in the context of Bangladesh. Augmented Dickey Fuller (ADF) test, ARDL cointegration test, ARDL Error Correction Model (ECM) approach and ARDL Engle-Granger causality test are used in the paper. The results confirm that there is a negative correlation between remittance and real exchange rate which implies that a rise in the volume of remittance inflows exert appreciative pressures on Bangladesh's real exchange rate. However, such real exchange rate movements were not translated into Dutch disease problems.

Field of Research: Economics

1. Introduction

The association between inflow of emigrants' remittances and Real Exchange Rate (RER) movements in the recipient country has gained utmost importance globally. Researchers and policy makers all around the world, like Tuuli (2015) and Barrett (2014) for Ghana and Jamaica respectively, have endeavoured their lives in investigating this crucial relationship and have questioned the effectiveness of such inflows of foreign currency in the light of the Dutch disease problem. It has been widely acknowledged, for example Edsel (2010), in literature that external financing is an indispensable development tool for underdeveloped nations that are striving to attain economic growth. Researchers have revealed external capital inflows, particularly in the form of foreign aid and remittance, generate wealth for the recipient nation which in turn reduces poverty and supports economic advancement policies of the nation (among others, Keynes, 1929 and Woodruff and Zanteno, 2007). However, Chami et al. (2006) have also found evidences contradicting the economies of remittance inflows in the economy and have asserted that a sudden surge in remittances could actually boomerang and exert negative externalities hampering the growth prospects of the developing nations in particular.

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There are four major channels through which foreign currency flows inside an economy. These include Official Development Assistance (ODA) or foreign aid, Foreign Direct Investment (FDI), international remittance, and portfolio investment. However, amongst these four, remittance is considered to be the most stable source of foreign currency (Frankel, 2011). Moreover, in comparison to foreign aid remittance is considered to be a relatively better source simply because it does not have any repayment obligations attached to it (Ratha and Mohapatro, 2007).

The development roles of remittances in an emerging economy are referred to be multi-dimensional in nature. Inflows of emigrants' remittances affect both micro and macroeconomic indicators of the recipient country. For instance, at microeconomic level remittance supplements the household income of the remitter. As a result, the household's purchasing power increases which is synonymous to an improvement in its standard of living and poverty level. Conversely, the impact of remittances at macroeconomic level is much more dispersed and complicated. Remittances play crucial roles in dictating the overall growth of the economy. All developing countries are in capable of financing the necessary investments due to insufficiency of capital. Thus, remittances along with other sources of external finance help to mitigate the resource gap by supplementing the national savings in the respective remittance-recipient countries. Furthermore, remittance contributes to the home country's foreign exchange reserve which can be used to finance the import bills without exerting additional fiscal burden. It also affects the labor market which in turn leads to changes in domestic wage and price levels in the economy as well. Thus, many studies have strongly advocated that remittance inflows do generate positive impacts on the recipient nation through reduction in income inequality and poverty levels and also foster economic growth and development in the long run.

Although the benefits associated with remittance inflows have been recognized in various empirical literatures, many other studies have taken an alternate stand by pointing out the fact that an abrupt surge in remittance can actually exert macroeconomic challenges whereby the growth prospects of the home countries could be put under scrutiny. According to Barajas et al. (2010), large flows of foreign currency via the mode of remittance may actually lead to widening of the current account deficits by triggering imports at the expense of exports. As a result, the positive impacts of remittances could be easily off-set by the negative externalities associated with such capital inflows. Moreover, remittances can also stimulate appreciation in the real exchange rate causing Dutch disease problems whereby the home countries' growth prospects would be compromised to a great extent.

Van Wijnbergen (1986) defined Dutch disease as the aftermath of an increase in the inflow of foreign currency that stimulates a rise in the price of non-tradable goods relative to that of tradable goods in the recipient country, leading to an appreciation (decline) in its RER. According to Barder (2006), Dutch disease can be also be referred to as an appreciation in the real exchange rate following huge inflow of foreign currency whereby causing harm to the long run economic growth prospects of the nation. Dutch disease is a concern for policymakers since it reduces the effectiveness of foreign currency inflows in attainment of socio-economic development goals of the home economy.

Bangladesh has been historically receiving foreign currencies in the form of aids, foreign investments and more importantly from migrated workers' remittances. It has been estimated that remittances in Bangladesh accounts for more than 35% of the country's export income. In addition, it is the second largest contributor to Bangladesh's foreign currency reserve after the export receipts of the Ready Made Garments (RMG) sector. Historical trends show a clear picture of the nation's vast dependent on external inflow of capital as all the sources have experienced growth in volumes. Moreover, it is worth mentioning that over the years, the total volume of remittances has surpassed all the other three foreign currency sources. Remittances over the last three decades have increased by more than 32 times from total remittance received worth 338.67 million US dollars in 1980 to a staggering 10.85 billion US dollars in 2010 (World Bank, 2016). Although total remittances received has increased significantly over the years, it has recently been increasing at a decreasing rate; from a remittance growth rate of 135.95% on average between 2000 and 2005 to about 133.22% on average between 2005 and 2010. This negative trend can be attributed to the fact that the share of semi and unskilled workers in the total labor force of Bangladesh has simultaneously increased with time.

Historically, Bangladesh had followed two exchange rate regimes. Initially a fixed exchange rate framework was practiced from January 1972, just after the country achieved its independence. This was followed until May 2003 whereby a transition from fixed to floating exchange rate regime took place. This transition was attributed to meet up the economic demand and to comply with the aid-conditionality put forward by the International Monetary Fund (IMF). In order to comply with such conditions, the Bangladesh Bank issued a circular stating- effective from 31st May, 2003, the Bangladesh Bank floated its exchange rate and followed a fully market based exchange rate for Taka. Following this transition in exchange rate regime Bangladesh managed to achieve positive impacts on its macroeconomic development indicators.

There had been a few numbers of studies on the relationships between remittances, exchange rates and Dutch disease problem in context of Bangladesh. However, to the best of our knowledge, there has were no exclusive study on this causality using the Autoregressive Distributed Lag (ARDL) Bound testing approach. Our paper fills this gap by applying this methodology using Bangladeshi annual time series data from 1980 to 2013 for robust results. The following two questions are specifically addressed in this paper:

1. Is there any long run relationship between inflow of remittance and real exchange rate movements in Bangladesh?

2. Is there any causality between inflow of remittance and real exchange rate movement in Bangladesh?

3. Is there any evidence of the Dutch disease problem in Bangladesh?

According to the findings from our paper, it is clear that there exists a negative relationship between inflow of remittance and RER in context of Bangladesh which is pretty much in line with Hassan and Holmes (2013) which asserted that inward foreign currencies in the form of remittances leads to the RER appreciation in the recipient countries. However, our findings also show that the problem of Dutch disease is not experienced in the country which contradicts

to the conclusions made by Kyzy (2012) in context of a panel of six Commonwealth of Independent States (CIS) countries. Thus, Bangladesh can continue to enhance it remittance inflows without the fear of its economy being adversely affected.

The remainder of the paper is structured as follows. Section 2 provides the literature review followed by the section 3 that discusses the attributes of data and the methodology of research. Moving on, the subsequent sections 4 and 5 provide discussions on econometric test results and concluding remarks followed by policy recommendations.

2. Literature Review

Section 2 is split into between two subsections- Theoretical Frameworks and Empirical Findings. Over the years, the causal relationship between remittance inflow and real exchange rate of the recipient country had been the topic of numerous empirical studies in context of both developing and developed countries. In addition, the Dutch disease problem arising from such foreign currency inflow induced real exchange rate misalignment had also been focused in most of those studies. Empirical findings of various coinciding studies provided mixed results with respect to existence of Dutch Disease in the home countries.

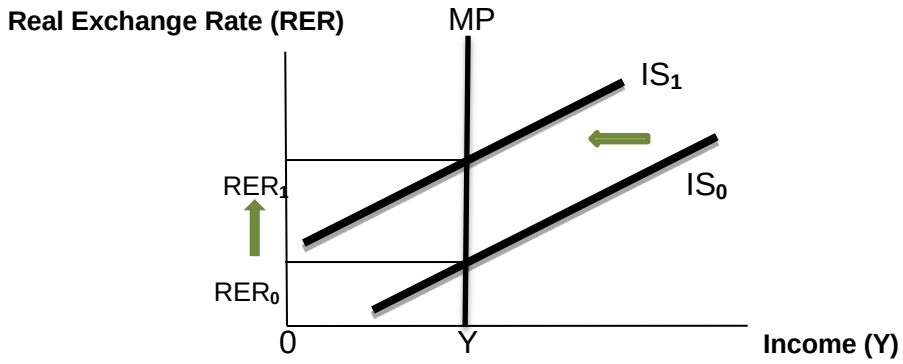
2.1 Theoretical Frameworks

Van Wijnbergen (1986) and Corden and Neary (1982) provide the main neoclassical theoretical framework for analyzing the relationship between exogenous flow of capital and the Dutch disease phenomenon in the recipient country. They show that an increase in inflow of foreign currency is synonymous to an increase in income of the capital-recipient country whereby its local demand for both tradable and non-tradable goods would rise which is referred as the 'spending effect.' Following this surge in demand, the prices of the non-tradables, which are determined domestically via the interaction of domestic demand-supply market forces, would increase. In contrast, the prices of tradables would remain unchanged since these are exogenously determined in the international market. As a result, the home country's real exchange rate will appreciate possibly leading to the Dutch disease problem. Moreover, they also assert that the spending effect is coupled with a 'resource switch effect' whereby resources would be reallocated from production of tradable goods to comparatively more lucrative and profitable production of non-tradable goods. This is because a rise in local demand and willingness to spend on consumption of non-tradables lead to a rise in corresponding prices and labor wages. Hence, resources are shifted to the non-tradable goods sector at the expense of the tradable goods sector. This in turn hampers the growth in volume of exports further attributing to the Dutch disease epidemic.

The IS-MP Framework also provides insights on real exchange rate movements following huge inflow of foreign capital leading to Dutch disease problems in the home economy. According to this theory, a rise in foreign flows of currencies would trigger imports in the home country minimizing its net exports value. In addition, due to the negative relationship between imports and expenditure function the IS curve in Figure 1 will shift to the left (from IS_0 to IS_1) which will then be reflected through depreciation (increase) in the RER (from RER_0 to RER_1).

This theory backs up the findings of studies like Izquierdo and Montiel (2006) and Barrett (2014) where inflow of remittances led to RER depreciations.

Figure 1: IS-MP Framework



2.2 Empirical Findings

There had been no general consensus on the behavior of RER movements following inflow of emigrants' remittances. In many studies remittance was associated with RER appreciations causing Dutch disease problem. In contrast, few other studies have concluded remittance generating depreciating pressures on RER whereby the presence of Dutch disease could not be confirmed. The causality between remittance and RER was probed by Hassan and Holmes (2013). They used data from 1987 to 2010 in context of 24 high remittance dependent nations including Bangladesh. Panel cointegration techniques and quantile regression analysis were the preferred instruments that were tapped to draw conclusions on the remittance-RER nexus. The study was based on the theoretical frameworks of spending and resource movement effects of external capital flows on the recipient economy. In the regression model, RER was expressed as a function of remittance and other fundamentals attributing to RER movements. The findings revealed that the positive impacts of remittance were off-set by the adverse effects of remittance inflow whereby all the 24 countries covered in the study experienced Dutch disease problem following RER appreciation. Furthermore, the results showed evidences of a positive relationship between the size of RER and the magnitude of RER appreciation following inflow of remittance.

Kyzy (2012) analysed panel data from 1998 to 2011 for six Commonwealth of Independent States (CIS) countries and explained the relationship between remittances and RER using fixed-effects least squares model with and without instrumental variables. With regards to methodology of the study, ordinary least squares fixed effect estimation techniques were applied. Furthermore, Augmented Dickey Fuller (ADF) unit root test and Dubin-Wu-Hausman specification test were also run for checking whether or not the regression is spurious. The results indicated that inflow of workers' remittances in the six countries led to loss of competitiveness of their respective export sector leading to the Dutch disease phenomenon. This finding was in line with that of Barajas et al. (2010) in which remittances were found to cause macroeconomic challenges in the recipient economies.

In anticipation of identifying the macroeconomic impacts and Dutch disease problem of remittances in Bangladesh, Rabbi et al. (2013) incorporated annual time series data from 1971 to 2011 using a couple of estimation techniques. They resorted to employment of Johansen cointegration test and vector error correction models to analyse both long and short run associations between the variables considered. In their model, real effective exchange rate was shown as a function of remittances received and quite a number of other controlled variables. The findings from the study showed that there were long run cointegrating relationships between the variables. Moreover, it was also found that the variables were also related in the short run and inflow of remittance in Bangladesh had led to loss of its export competitiveness causing the adverse Dutch disease problem. Similar results were found in other studies like that by Chowdhury and Rabbi (2011).

It is widely acknowledged in theory that resource poor countries are heavily dependent on external inflow of funds in the form of foreign aid and remittances mainly. Hence, a very recent study by Eromenko (2016) on the possible Dutch disease effects on two resource poor countries Kyrgystan and Tajikistan revealed that these two nations have not been subject to any form of Dutch disease problem following inflow of remittances. He used annual time series data from 2002 to 2013. In the empirical model, RER was held as the dependent variable while remittances, oil prices, government expenditure, broad money (M2) and international reserves were classified as the independent variables. The model was estimated using Dynamic Least Squares (DOLS) method.

Roy and Rahman (2014) uniquely focused on inflation in order to examine the presence of any Dutch disease problem following emigrants' remittances in Bangladesh by using monthly time series data ranging from July 2003 to July 2013. The underlying reasoning behind consideration of inflation was the fact that RER movements are explained by relative price of tradables and non-tradables whereby a rise in the remittance recipient country is synonymous to a fall in the relative price leading to a RER appreciation. In their model, inflation was considered to be the dependent variable while remittance and other controlled variables were referred to as the regressor. Furthermore, inflation was disaggregated into general inflation and food inflation. Johansen cointegration technique was employed to determine the long run relationships between the variables while the vector error correction model approach provided the short run associations. The results provided evidences that remittance inflows exerted inflationary pressures and appreciated the RER. It is worth mentioning that the pressure on food inflation was two and half times more than on general inflation which has different policy implications.

The remittance-Dutch disease nexus was also probed by Owusu-Sekyere et al. (2014) using annual time series data from 1980 to 2008 for a panel of 34 Sub-Saharan African nations. The study was based on the theoretical framework proposed by Montiel (1999, 2003) whereby RER was expressed as a function of its real fundamentals including remittances. Dynamic panel estimation techniques like Feasible Generalized Least Squares (FGLS) estimation approach were used in order to identify the relationship between the concerned variables. The results confirmed that inflow of foreign remittances on average triggered RER appreciation in all 34 countries. However, it is worth mentioning that such appreciations did not result in loss of export competitiveness and therefore was not translated in Dutch disease problems. The authors also

concluded that despite having appreciative pressures on the RER, there was no evidence of the Dutch disease problem because of the governments' efficient monetary market interventions and fiscal expenditure programs towards the tradable good sector.

Using bounds-testing approach to cointegration (Ratha (2013) investigated both short run and long run associations between remittances and Dutch disease phenomenon in context of five countries including China, India, Lesotho, Mexico and Philippines. Annual data of different time periods between 1975 and 2011 was tapped to draw conclusions on this relationship. The study followed the model put forward by Bourdet and Falck (2006) in which Real Effective Exchange Rate (REER) was expressed as a function of remittance and other controlled variables. The findings revealed that the Dutch disease phenomenon was valid for Philippines in the short run while for China Dutch disease took place only in the long run. Moreover, inflow of remittance did not lead to Dutch disease problems in India and Mexico.

3. Empirical Model And Data Description

Following Edwards (1989) and Montiel (1999), RER is expressed as a function of its real fundamentals, particularly focusing on the sources of foreign currency inflow. Incorrect sentence provided. This particular model was used in several empirical literatures and its regressors are quite appropriate in theoretically explaining the movements in a country's RER.

The regressors in our model include remittance, foreign direct investment, foreign aid and trade openness index. This model depicts the spending effect and resource movement hypotheses put forward by Corden and Neary (1982) which states that a rise in relative spending in the non-traded goods sector and a factor reallocation from production of tradables to non-tradables will exert appreciative pressures on the home country's real exchange rate.

$$RER = \alpha o + \alpha 1(REM) + \alpha 2(FDI) + \alpha 3(FAID) + \alpha 4(OPEN) \qquad \text{(i)}$$

where RER is the bilateral real exchange rate, REM is the inflow of emigrants' remittances, FDI is the foreign direct investment inflow, FAID is the net official development assistance received and OPEN is the degree of trade openness. For all the variables mentioned in equation (i), we pooled annual time series data of Bangladesh from 1980 to 2013 using various data sources.

Real Exchange Rate (RER): The bilateral real exchange rate is defined as the purchasing power of two currencies relative to one another. It is of great significance compared to nominal exchange rate, because the cost of buying a product in one country may not be same as the cost of buying that same product in another country due to different associated inflationary rates across the nations. In our study, the real exchange rate is calculated by taking the weighted average of bilateral exchange rates of Bangladesh and United States, adjusting with relative price levels of both the countries which is shown in equation (ii).

$$RER = NER_{BDT/USD} * (CPI_{US} / CPI_{BD}) \qquad \text{(ii)}$$

Remittance (REM): Remittance is formally referred to as the sum of workers' remittances, employee compensations, and migrants' transfers which is either used for consumption of invested in the home economy (WDI, 2016). Relevant annual time series data regarding personal remittance inflow in terms of current US dollars from 1980 to 2013 in Bangladesh were acquired from WDI (2016) website.

Foreign Direct Investment (FDI): Apart from remittances, foreign direct investments are also associated to inflow of foreign exchange which is particularly important for developing countries. An increase in foreign direct investment is expected to create job opportunities within the home economy which will ultimately increase local spending expenditure in both the tradable and non-tradable sectors. As result the price of non-tradable goods relative to that of the tradable goods would increase leading to real exchange rate appreciation. In our study, we have pooled annual time series FDI inflows data for Bangladesh in terms of current US dollar from WDI (2016).

Foreign Aid Inflow (FAID): In our paper we have considered net official development assistance received (in terms of current US dollars) as proxy for aids received by Bangladesh from international donors. According to WDI (2016), net official development assistance consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC).

Trade Openness (OPEN): In context of our model, trade openness is seen as a determinant of the real exchange rate in the sense that an increase in trade openness will lead to depreciation in host country's real exchange rate. This is because under government's trade liberalization policy the barriers associated with international trade are reduced whereby the economy becomes more open to engage in trade with foreign countries. As a result price of import items will fall which will stimulate a shift in demand from local non-tradable goods to imported goods. Thus the demand for and the price of non-tradable goods will fall leading to a further depreciation in real exchange rate. In our model, we have expressed trade openness as a ratio of the sum of exports and imports to the GDP of the host economy. The higher the ratio the greater is the degree of trade openness and vice versa. Annual time series data ranging from the year 1980 up to 2013 has been pooled from WDI, 2016.

4. Methodology

4.1 Testing the variables for Unit Root

There are several ways of testing for the presence of a unit root. However, the popular test for unit roots is Augmented Dickey Fuller (ADF) tests. The ADF test is run based on equation (i) which is a modification of the DF test and involves augmenting the DF equation by lagged values of the dependent variable, and hence ensuring that the error process is residually uncorrelated.

It also captures the possibility that the dependent variable is characterized by a higher order autoregressive process.

$$\Delta Y_t = \alpha + (\beta - 1)\, Y_{t-1} + \delta\, \Delta Y_{t-1} + \Psi T + e_t \qquad \text{(iii)}$$

In case of the ADF test the following testing procedure has been performed:

H0: β—1=0 [i.e. the Y_t is non-stationary]

HA: β—1≠0 [i.e. the Y_t is stationary]

If the observed data exhibits an increasing or decreasing trend, it is very crucial to include the time trend in the unit root test procedure. Here it is mentionable that unit root tests have non-standard and non-normal asymptotic distribution which are highly affected by the inclusion of deterministic terms, e.g., constant, time trend etc. A time trend is considered an extraneous regressor whose inclusion reduces the power of the test. However if the true data generating process were trend stationary, failing to include a time trend also results in a reduction in power of the test. In addition, this loss of power from excluding a time trend when it should be present is more severe than the reduction in power associated with including a time trend when it is extraneous.

We cannot rely upon the usual t-statistic since Y_t can be non-stationary; rather we need to use specially tabulated McKinnon τ (tau) statistics values. If the computed value of τ is absolutely greater than the critical DF value, we may reject the null hypothesis of non stationarity, with α level of significance and accept the alternative hypothesis of stationarity. Otherwise we do not. One of the most important issues in conducting the unit root test is to select the appropriate lag length. One approach is to include a relatively long lag length and select the model by the usual t-test. If the t-statistics on lag p is insignificant at some specified critical value, the regression should be repeatedly estimated using a lag length p-1 until the lag is significantly different from zero. Microfit 4.1 software automatically selects the most significant lag length based on this criterion.

4.2 The ARDL Approach of Cointegration

Pesaran et al (1996) and Pesaran and Shin (1995) introduces the ARDL approach of cointegration which is becoming very popular now a days in the field of econometric analysis. Recently, the ARDL approach to cointegration has been more preferable to other conventional cointegration approaches such as Engle and Granger (1987) and Johansen and Juselius (1980). The main advantage of this procedure is that it can be applied irrespective of whether the variables are I(0) or I(1) and this avoids the pre testing problems associated with standard cointegration analysis which requires the classification of the variables into I(1) and I(0). In addition the ARDL approach also gives more robust results when the sample size is small. Thus the ARDL approach of cointegration avoids the use of ADF unit root tests and autocorrelation function tests for testing the order of integration. However, some researchers state that, the ARDL procedure will crash in the presence of I (2) series. According to Ouattara (2004), the implementation of unit root tests in the ARDL procedure might still be necessary in order to ensure that none of the variable is integrated of order 2 or beyond.

The ARDL procedure involves two stages. At the first stage, the long run relationship between the variables under investigation is tested by computing the F-statistics for testing the significance of the lagged levels of the variables in the error correction form

of the underlying ARDL model (Pesaran and Pesaran, 1996). They have tabulated two sets of values for different number of regressors (k) and whether the ARDL model contains an intercept and/or trend. One set assumes that all the variables in the ARDL model are I(1), whereas another assumes all the variables are I(0).

If the computed F-statistics falls above the upper critical value, the null hypothesis of no long run relationship can be rejected without needing to know the orders of integration for the time series. Conversely, if the computed F value is below the lower critical value, the null hypothesis cannot be rejected. Finally, if the computed statistics falls within the critical value band, the result is inconclusive.

The second step of the ARDL procedure is to estimate the long run and the short run coefficients and their inferences provided that we have already established the long run relationship between the variables.

The ARDL framework takes the following form:

$$\Delta Y_t=\beta_0+\Sigma\beta_1\Delta Y_{t-1}+ \Sigma\beta_2\Delta X_{t-1}+ \beta_3 Y_{t-1}+ \beta_4 X_{t-1}+\varepsilon_t \qquad \text{(iv)}$$

ARDL model is very sensitive in choosing the order of the distributed lag function and including the trend in the model. In Microfit 4.1 software we can have an automatic choice of selecting the appropriate model. Regarding trend, the significance of the trend variable has to be checked.

Although Narayan and Smyth (2006) argues that “in spirit of the bounds test, a model with a time trend is invalid because for the model to be valid there should be only one long run relationship. If someone includes time trend in the model one may end up with more than one possible cointegration relationship: one with a time trend and one without a time trend”. But in this article time trend has been included just to check whether cointegration test is trend sensitive or not. In addition a clear indication of trend is observed from the plotted level variables.

4.3 The Johansen Procedure

Finally, the Johansen procedure is applied to test for cointegration. This method provides a unified framework for estimation and testing of cointegration relations in the context of Vector Autoregressive (VAR) error correction models. The Johansen procedure also provides more robust results when there are more than two variables. For this approach one has to estimate an Unrestricted Vector of Autocorrelation of the form:

$$\Delta X_t=\alpha +\theta_1\Delta X_{t-1}+\theta_2\Delta X_{t-2}+\ldots\ldots+\theta_{k-1}\Delta X_{t-k-1}+ \theta_k \Delta X_{t-k}+u_t \qquad \text{(v)}$$

Where Δ is the difference operator, X_t is a (n*1) vector of non-stationary variables (in levels) and ut is also the (n*1) vector of random errors. The matrix θ_k contains the information on long run relationship between variables. If the rank of θ_k=0, the variables are not cointegrated. On the other hand if rank (usually denoted by ‘r’) is equal to one, there exists one cointegrating vector and finally if 1<r<n, there are multiple cointegrating vectors. Johansen and Juselius

(1990) have derived two tests for cointegration, namely the trace test and the maximum eigenvalue test. The trace statistic evaluates the null hypothesis that there are at most r cointegrating vectors whereas the maximal eigenvalue test, evaluates the null hypothesis that there are exactly r cointegrating vectors in X_t.

4.4 Causality Tests

According to cointegration analysis, when two variables are cointegrated then there is at least one direction of causality. Some recent research has indicated that the existence of non-stationary series data can give misleading conclusions in the Granger causality test. It is only possible to infer a causal long run relationship between non stationary time series when the variables are cointegrated (Engle and Granger, 1987).

Granger (1988) has explained that for cointegrated time series, it is very important to include the error correction term in the tests. Otherwise the standard Granger test may provide invalid causal information. In addition, the inclusion of the error correction term helps us to distinguish between short run and long run causality. The lagged change in the independent variables represent the short run causal impact whilst the significance of the error correction term gives the information on long run causality (Razzaque and Ahmad,2000).The standard Granger causality follows the F-test whereas the causality test with error correction term follows the t-test.

If Y and X are the variables of interest, then the Granger causality test determines whether past values of Y add to the explanation of current values of X as provided by information in past values of X itself. If past changes in Y does not help explain current changes in X, then Y does not Granger cause X .Similarly, we can investigate whether X Granger causes Y by interchanging them and repeating the process. There are four likely outcomes in the Granger causality test: (1) neither variable Granger cause each other, (2) Y causes X but not otherwise, (3) X causes Y but not otherwise, (4) both X and Y Granger cause each other. These methodologies are important in answering our research questions in the sense that all the causality tests would help us to conclude the direction of causality between remittance inflows and RER movements in Bangladesh which in turn would help us to determine whether the problem of Dutch disease exists or not in the country.

5. Results

The empirical results obtained by employing different econometric tools are presented below:

5.1 Unit Root Test Results

We first carried out the ADF test to check whether or not our variables are stationary in order to avoid a spurious regression. The results from the ADF tests are summarized in Table 1. From this table we can see that all our variables are stationary at their levels, I(0). However, they all become stationary at their first differences, I(1). Thus, the problem of the regression analysis being a spurious one is avoided.

Table 1: Augmented Dickey Fuller Unit Root Test

Panel 1: Levels I(0)			
	ADF Statistics (Only Constant)	**ADF Statistics (Constant & Trend)**	**Decision Considering Trend**
RER	-2.0044	-1.2231	Non Stationary
REM	-0.21590	-1.4968	Non Stationary
FDI	-0.26308	2.4701	Non Stationary
FAID	-1.2479	-1.2885	Non Stationary
OPEN	0.27555	-2.4123	Non Stationary
Panel 2: First Differences I(1)			
	ADF Statistics (Only Constant)	**ADF Statistics (Constant & Trend)**	**Decision**
DRER	-4.1617	-4.5861	Stationary
DREM	-4.4427	-4.7074	Stationary
DFDI	-6.0016	-6.1970	Stationary
DFAID	-3.6715	-3.7385	Stationary
DOPEN	-4.7997	-5.3623	Stationary

Table: Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root				
Level of Significance	**Levels**		**First Differences**	
	No Trend	**With Trend**	**No Trend**	**With Trend**
1%	-3.5547	-4.1348	-4.1383	-3.5572
5%	**-2.9157**	**-3.4935**	**-3.4952**	**-2.9167**
10%	-2.5953	-3.1753	-3.1762	-2.5958

5.2 ARDL Cointegration Test Results

Firstly, the order of lags on the first differenced variables was obtained from unrestricted VAR model by means of AIC. In this paper, based on the Akaike Information Criteria (AIC) value, lag 4 is taken as an optimal level. The cointegration results are summarized in Table 2.

Table 2: ARDL Cointegration Test(F Test)

Order of Lag	F Statistics without Trend[p-value]	F Statistics with Trend [p-value]
4	F(5,7)=5.1561 [0.027]	F(5,6)=3.9080 [0.064]

This table shows that, the computed F statistics (without trend) in lag 4 is higher than the lower and upper bound critical values of 2.649 and 3.804 at the 5% significance level making it significant. Moreover, when trend is considered, then the computed F statistics with lag 4 are significant at 5% significance level (lower bound critical value is 2.782 and upper bound critical value is 3.827). All these results appear to indicate that null hypothesis of no cointegration is rejected and provide evidence for the existence of a long run relationship between our variables. This allows us to proceed in the second stage of the ARDL model which is estimation of the slope coefficients. The signs and the values of the long run coefficients are given in Table 3.

Table 3: Estimated long run coefficients result using ARDL(1,1,0,0,0) based on Akaike Information Criteria (AIK)

Dependent Variable: RER						
The Long Run Coefficients Result ARDL(1,1,0,0,0)						
Without Trend				With Trend		
Regressors	Coefficient	T-Ratio		Regressors	Coefficient	T-Ratio
REM	-3.7036	-2.0980 [0.046]		REM	-2.2190	-2.0343[0.053]
FDI	0.59945	0.085458[0.933]		FDI	-0.43621	-0.10072[0.921]
FAID	-0.00000007	-2.0954 [0.046]		FAID	-0.00000006	-2.7395[0.011]
OPEN	1.0039	2.4442 [0.022]		OPEN	0.28262	0.82229[0.419]

Note: Here lag 4 is considered because Trend is significant only in lag 4 and it is also used to check ARDL cointegration test.

From this table we can see that, without considering the trend, the slope coefficient of remittance is -3.7036 which is statistically significant at 5% level of significance. It implies that an increase in remittance flows into the home country would lead to an appreciation (decline) of the RER holding everything else equal. Similarly, the coefficient of FAID is -0.00000007 and we also find it to be statistically significant at 5% level of significance. Moreover, the coefficients of FDI and OPEN are 0.59945 and 1.0039 which imply that a rise in volume of inward FDI and/or an increase in openness index would depreciate the RER *ceteris paribus*. This is in line with the conclusions by Chowdhury and Rabbi (2013) stating that a rise in trade openness coupled with nominal devaluation of Bangladeshi Taka could aggravate the country's export competitiveness. After estimation of the long run coefficients, we obtain the error correction representation of our ARDL model. The estimations of the ECM are provided in Table 4.

Table 4: Estimated Error Correction Model in ARDL(3,1)

ECM-ARDL: Dependent Variable dRER		
Regressors	Coefficient	T-Ratio [Prob.]
dREM	0.96083	2.1201 [0.043]
dFDI	0.12522	0.0852 [0.933]
dFAID	-0.0000000145	-2.0337 [0.052]
dOPEN	0.20970	2.9545 [0.006]
dINT	8.6096	3.0182 [0.005]
ECM(-1)	-0.20889	-3.5536 [0.001]

The ECM coefficient shows how slowly/quickly variable return to equilibrium and it should be negative, less than 1 and highly significant, which is the case here. According to Bannerjee, Dolado and Mestre (1998) a highly significant error correction term is a further proof of the existence of a stable long-term relationship. The estimated coefficient of the ECM (–1) is equal to –0.20889, suggesting that deviation from the long-term path is corrected by almost 21 per cent in the following year which implies that the adjustment takes place moderately.

5.3 Engle-Granger ARDL Causality Test Results

The Engle-Granger causality tests is done to detect both short run and long run causalities between the variables in order to understand how changes in the regressor affect movements in the real exchange rate. The results of the relationship between real exchange rate and its fundamentals are reported in Tables 5a, 5b, 5c, and 5d.

Table 5a: Causality Test Statistics between RER and REM

Dependent Variable: DRER			
Null: REM does not cause RER			
Regressor	Coefficient	T-Ratio	P-Value
INT	-0.13555	-0.3968	0.695
DREM	1.3739	2.7055	0.011
DRER(-1)	0.33345	2.0304	0.052
RES(-1)	-0.18473	-2.1313	0.042
Dependent Variable: DREM			
Null: RER does not cause REM			
Regressor	Coefficient	T-Ratio	P-Value
INT	0.11792	0.9838	0.334
DRER	0.15972	2.8891	0.007
DREM(-1)	0.17534	0.8630	0.395
RES(-1)	0.05086	1.7328	0.094

From Table 5a we can see strong bidirectional causalities between RER and REM in the short run since both the error correction terms (t-ratios 2.7055 and 2.8891) are highly significant. Similarly, in the long run we also see bidirectional causalities between these two variables and both the error correction terms (t-ratios -2.1313 and 1.7328) are statistically significant at 10% significance level.

Results reported in Table 5b show that there are no causal relationships between RER and FDI, neither in the long run nor in the short run since the error correction terms are not significant at 10% level of significance. Thus, it suggests that inward FDI has no influence on RER movements in Bangladesh.

Table 5b: Causality Test Statistics between RER and FDI

Dependent Variable: DRER			
Null: FDI does not cause RER			
Regressor	Coefficient	**T-Ratio**	**P-Value**
INT	0.15329	0.40899	0.686
DFDI	-0.37577	-2.2863	0.821
DRER(-1)	0.36648	1.9289	0.064
RES(-1)	-0.12718	-1.3310	0.194
Dependent Variable: DFDI			
Null: RER does not cause FDI			
Regressor	**Coefficient**	**T-Ratio**	**P-Value**
INT	0.048986	1.2284	0.230
DRER	-0.012914	-0.66760	0.510
DFDI(-1)	-0.36480	-2.0918	0.046
RES(-1)	0.0086333	0.80477	0.428

In Table 5c, we can see that in the short run a weak unidirectional causality runs only from RER to FAID since the associated error correction term (t-ratio -1.6929) is weakly significant at 10% significance level. However, in the long run we also see a week unidirectional causality but this time its direction runs from FAID to RER. This implies that prolong inflows of FAID stimulates RER movements in Bangladesh.

Table 5c: Causality Test Statistics between RER and FAID

Dependent Variable: DRER			
Null: FAID does not cause RER			
Regressor	**Coefficient**	**T-Ratio**	**P-Value**
INT	0.229997	0.63713	0.529
DFAID	-0.000000016	-1.4018	0.172
DRER(-1)	0.36477	2.0533	0.049
RES(-1)	-0.16202	-1.7183	0.097
Dependent Variable: DFAID			
Null: RER does not cause FAID			
Regressor	**Coefficient**	**T-Ratio**	**P-Value**
INT	0.00000077	1.3669	0.183
DRER	-0.00000047	-1.6929	0.102
DFAID(-1)	-0.22969	-1.2519	0.221
RES(-1)	-0.00000023	-1.5380	0.135

Finally, the results in Table 5d show that there is a unidirectional causality running from OPEN to RER only in the short run since the error correction term (t-ratio 2.0921) is strongly significant at 10% significance level. However, there is no evidence suggesting long run causality between these two variables from neither direction in Bangladesh.

Table 5d: Causality Test Statistics between RER and OPEN

Dependent Variable: DRER			
Null: OPEN does not cause RER			
Regressor	**Coefficient**	**T-Ratio**	**P-Value**
INT	-0.10796	-0.29955	0.767
DOPEN	0.249997	2.0921	0.046
DRER(-1)	0.45293	2.5972	0.015
RES(-1)	-0.14285	-1.6185	0.117
Dependent Variable: DOPEN			
Null: RER does not cause OPEN			
Regressor	**Coefficient**	**T-Ratio**	**P-Value**
INT	0.79966	1.5029	0.144
DRER	0.38491	1.5117	0.142
DOPEN(-1)	-0.12817	-0.72737	0.473
RES(-1)	0.097008	0.69241	0.494

6. Conclusions

The aim of this paper was to specifically investigate whether or not inflow of foreign currencies in the form of emigrant workers' remittances, affect real exchange rate movements in context of a developing country like Bangladesh, between 1980 and 2013. Our paper was based on the Dutch disease framework which asserts that inflow of international remittances lead to real exchange rate appreciation in the home economy and ultimately hampers its growth prospects scrutinizing its export comparativeness. Likewise Ratha (2013) we used ARDL bounds testing methods and found negative association between remittance and RER in Bangladesh whereby inward remittances exert appreciative pressures on the nation's RER. This is in line with the concluding remarks in studies by Sultonov (2011) for Tajikistan, Tuuli (2015) for Ghana and Khan (2016) for Pakistan. Thus, our results confirm a causal association between remittance

inflows and RER movements in Bangladesh during our period of study. This is to be mentioned that our findings are in contradiction to that made by Rabbi *et al.* (2013) in the manner that we find no evidence regarding the Dutch disease problem following inflow of remittance in Bangladesh. This is because, even though we find that remittance inflow triggers RER appreciation in Bangladesh but such real exchange rate appreciating pressures have not been translated into Dutch disease problems in Bangladesh. This is evident from the fact that the nation's economic growth and exports trends have projected a steady upward trend over the last four decades. Bangladesh has managed to sustain an annual economic growth rate of 6.34% on average since 2011(Amin and Murshed, 2016). Hence, it can be concluded that RER appreciation following inflow of remittances was ineffective in affecting the nation's growth prospects. Moreover, its export sector had also flourished with time which can be attributed to its booming ready-made garments sector. Thus, RER appreciations were unable to lessen Bangladesh's overall export competitiveness which provides further support in refuting the Dutch disease hypothesis in light of remittances. A possible reasoning for holding on to the export competitiveness could be the fact that Bangladesh is a country which is characterized by abundant supply of cheap labor and employment of such labor in production of goods and services keep cost of productions within favourable amounts. Moreover, any appreciative pressure on RER could have been counteracted through depreciation in RER following greater degree of trade openness and inflows of FDI in Bangladesh since our results confirm positive relationships between these variables and RER movements. Our concluding remarks imply that influx of remittances, despite having purchasing power to augment local demand and attributing to RER appreciation in the home country, not necessarily result in Dutch disease problems. This in turn calls for numerous policy implications in Bangladesh.

Remittance is the most crucial and stable source of foreign currency in a labour-surplus country like Bangladesh. It is acknowledged worldwide as a vital economic development tool that can spawn wonders if managed effectively. Hence, it is deeply recommended that the government should adopt necessary policies to encourage usage the remitted funds for investment purposes rather than being completely exhausted in consumption expenditure. This is crucial from the perspective that remittance is not only driven by altruistic motives of the emigrant workers but is also determined by self-interest motives for reinvestment at home (Fonchamnyo, 2012). Thus, the government should ensure conducive investment environment, initiating reallocation of remitted funds to local investments. In addition, it must also be ensure that these investments are biased toward the tradable sector rather than the non-tradable sector keeping inflation rates within manageable percentages. A possible way to enhancing such investments could be through the channel of export diversification whereby new products can be added to the export basket of Bangladesh. Furthermore, to counter the decreasing growth trends in remittance inflows in Bangladesh, it is ideal for the government to come up with widespread and multidimensional vocational training programs to upgrade the potential migrant workers' skill levels which would ensure better wage offerings abroad.

A major limitation faced during the research data inadequacy for which more controlled variables could not be included in our model. In addition, following unavailability of relevant data our sample size was relatively small compared to other time series studies done in different countries. For further research, we would like to extend our current analysis incorporating other less developed countries and employ various methodologies to check the robustness of our findings.

References

Amin, SB and Murshed, M 2016, 'The Economies of Cross-Border Electricity Trading in Bangladesh', in Khasru, SM (Ed.), 'Prospects & Challenges of Connectivity & Trading in Power & Energy: A Regional & International Perspective', Vol. 1, pp. 119-128, Dhaka, The Institute for Policy, Advocacy and Governance.

Bannerjee, A, Dolado, J and Mestre, R 1998, 'Error-correction Mechanism Tests for Cointegration in a Single-Equation Framework', *Journal of Time Series Analysis,* Vol. 19, pp. 267-283.

Barajas, A, Chami, R, Fullenkamp, C, Garpen, M and Montiel, P 2010, 'Do Workers' Remittances Promote Economic Growth'? *Washington D. C., International Monetary Fund.*

Barder, O 2006, 'A Policymaker's Guide to Dutch Disease: What is Dutch Disease and is it a Problem,' *Working Paper 91*, Center for Global Development.

Barrett, K 2014, 'The effect of Remittances on Real Exchange Rate: The case of Jamaica', *Caribbean Centre for Money and Finance.*

Chami, R, Cosimano, T and Gapen, M 2006, 'Beware of Emigrants Bearing Gifts: Optimal Fiscal and monetary Policies in the presence of Remittances', *IMF Working Papers 06/61.*

Chowdhury, M 1998, 'Resources Boom and Macroeconomic Adjustments: Papua New Guinea', *Doctor of Philosophy thesis, Australian National University.*

Chowdhury, M and Rabbi, F 2011, 'Workers' Remittances and Real Exchange Rate in Bangladesh: A Cointegration Analysis', paper presented to 40th *Australian Conference of Economists, Australian National University, Canberra.*

Chowdhury, M and Rabbi, F 2014, 'Workers' Remittances and Real Exchange Rate in Bangladesh', *The Journal of International Trade and Economic Development,* Vol. 23, Issue 4, pp. 455-475.

Corden, WM and Neary, JP 1982, 'Booming Sector and De-Industrialization in a Small Open Economy', *Economic Journal*, Vol. 92, pp. 825-848.

Edsel, BJ 2010, 'Do International Remittances cause Dutch Disease', *Munich Personal RePEc Archve,* Paper No. 23022. Retrieved from <https://mpra.ub.uni-muenchen.de/23022/>

Eromenko, I 2016, 'Do Remottance Cause Dutch Disease in Resource Poor Countries of Central Asia'? *Central Asia Economic Papers No. 18.*

Fonchamnyo, DC 2012, 'The Altruistic Motive of Remittances: A Panel Data Analysis of Economies in Sub Saharan Africa', *International Journal of Economics and Finance,* Vol. 4, No. 10, pp. 192-200.

Frankel, J 2011 'Are Bilateral Remittances Countercyclical?' *Open Economies Review, Springer,* Vol. 22, No. 1, pp. 1-16.

Hassan, GM and Holmes, MJ 2013, 'Remittances and the Real Effective Exchange Rate', *Applied Economics,* Vol. 45, pp. 4959-4970.

International Monetary Fund 2014, International Financial Statistics Yearbook, Washington D.C., IMF.

Izquierdo, A and Montiel, PJ 2006, 'Remittances and Equilibrium Real Exchange Rates in Six Central American Countries', Unpublished manuscript.

Johansen, S and Juselius, K 1990, 'Maximum Likelihood Estimation and Inference on Cointegration with Application to Money Demand,' *Oxford Bulletin of Economics and Statistics*, Vol. 52, No. 2, pp. 169-210.

Khan, Z 2016, 'Remittances Inflow and Real Exchange Rate: A Case Study of Pakistan Economy', *Journal of Chinese Economics,* Vol. 4, No. 2.

Keynes, JM, 1929, 'The German Transfer Problem', *Economic Journal,* Vol. 39. Pp. 1-17.

Montiel, PJ, 1999, 'Determinants of the lonf run equilibrium real exchange rate: An analytical model', in Hinkle, L. E. and Montiel, P. J. (Eds.), Exchange Rate Misalignment: Concepts Measurement for Developing Countries, New York, Oxford University Press.

Montiel, PJ 2003, '*Macroeconomics in Emerging Markets*', Cambridge University Press, UK.

Owusu-Sekyere, E, van Eyden, R and Kemegue, FM 2014, 'Remittances and the Dutch Disease In Sub-Saharan Africa: A Dynamic Panel Approach', *Contemporary Economics,* Vol. 8, Issue 3, pp. 289-298.

Pesaran, H, Shin, Y and Smith, RJ 1996, 'Bound Testing Approaches to the Analysis of Level Relationships,' *Journal of Applied Econometrics*, Vol. 16, No. 3, pp. 289-326.

Rabbi, F 2011, 'Remittances and Dutch Disease: Macroeconomic consequences in Bangladesh, *Masters in Commerce thesis, University of Western Sydney.*

Rabbi, F, Chowdhury, M and Hassan, MZ 2013, 'Macroeconomic Impact of Remittances and the Dutch Disease in a Developing Country', *American Journal of Economics.* Vol. 3, No. 5, pp. 156-160.

Ratha, D and Mohapatro, S 2007, 'Increasing the Macroeconomic impacts of Remittance on Development', paper presented at G8 Outreach Event on Remittances, Berlin, Germany, pp. 28-30.

Roy, R and Rahman, MM 2014, 'An Empirical Analysis of Remittance-Inflation Relationship in Bangladesh: Post-Floating Exchange Rate', retrieved from http://mpra.ub.ini-muenchen.de/55190.pdf.

Salter, WEG 1960, 'Internal and External Balance: The Role of Price and Expenditure Effects,' the *Economic Records*, Vol. 35, No. 71, pp. 226-238.

Samuelsson, P 1964, 'Theoretical Notes on Trade Problems,' *Review of Economics and Statistics,* Vol. 46, No. 2.

Sultonov, M 2011, 'Impact of Remittances on the Real Effective Exchange Rate of Tajikistan's National Currency', *Economics Bulletin,* Vol. 31, Issue 4.

Swan, TW 1960, 'Economic Control in a Dependent Economy,' *the Economic Record*, Vol. 36, No. 73, pp. 51-66.

Tuuli. M 2015, 'The Impact of Remittances on the Real Exchange Rate: Empirical Evidence from Ghana', *Journal of Economic Cooperation and Development*, Vol. 36, No. 3, pp. 43-66.

Wijnbergen, V 1986, 'Macroeconomic Aspects of the Effectiveness of Foreign Aid: On the Two-Gap Model, Home Goods Disequilibrium, and Real Exchange Rate Misalignment,' *Journal of International Economics,* Vol. 21, pp.23-36.

Woodruff, C and Zenteno, R 2007, 'Migration Networks and Microenterprises in Mexico', *Journal of Development Economics,* Vol. 82, pp. 509-528.

World Bank (2016). *World Development Indicators 2016*, Washington D.C.