Rajshahi University journal of social science and business studies **ISSN 2309-0898**
Vol. 26 (2018), pp 57-69

Nexus between Remittance and the Real Exchange Rate: Evidence from Bangladesh

Zulan Dhar[1]

Abstract

The inflow of remittances is one of the dominant sources of external income in the developing countries which compensate for the receiving country's trade deficits. Despite their apparent benefits, remittances also exert negative influences on the economy. One of the adverse consequences of remittance inflow is the appreciation of real exchange rate of the host country as suggested by the Dutch disease phenomenon. However, the empirical evidence on the impact of remittances on the host country's real exchange rate is ambiguous. This paper investigates the effect of workers' remittances on the equilibrium real exchange rate in Bangladesh. For this purpose, this study uses annual data of Bangladesh for the periods 1980 to 2018 and Johansen cointegration technique and vector error correction model (VECM) to estimate the relationship. This study finds a statistically significant long-run relationship between workers' remittance and the real exchange rate. However, remittance do not appreciate the real exchange rate of Bangladesh in the long-run and do not deteriorate the international competitiveness of domestic production as such. Thus, higher remittance inflow does not cause Dutch disease risk in Bangladesh. Thus, Bangladesh can receive more overseas workers' remittance into its economy without any fear of Dutch disease effects.

Keywords: Exchange rate; Remittance; Dutch disease; Cointegration; Vector Error Correction Model

1 Introduction

Remittance is the transfer of income from overseas countries to the home country by overseas workers or non-residents. Like foreign debt, official development assistance (ODA), and foreign direct investment (FDI), remittance is also one of the major forms of external capital inflows in developing countries. The amount of remittance transfer to low and middle-income countries has increased steadily internationally in recent years. According to the World Bank the highest amount of remittances was sent globally in 2018 (World Bank, 2019a).

Overseas remittances play a significant role in the development of a country by raising its foreign exchange reserves. In the developing countries like Bangladesh, it contributes a lot to the socio-economic development of the country, especially to the rural areas of the country. It enhances national income and per capita GNP. The steady inflow of international remittance is instrumental for maintaining steady foreign exchange reserves in the country. Nowadays, workers' remittance is being treated as a dominating source of external capital inflows for developing countries compared to other types of capital inflows such as FDI, ODA, external debt, portfolio investment (Roy and Dixon, 2016). There are no

[1] Assistant Professor, Department of Economics, University of Chittagong, Chittagong 4331, Bangladesh; Email: zulaneco@yahoo.com

future repayment obligations and sets of political and economic preconditions in receiving remittance, while these are obvious in other forms of external capital inflows. Despite these advantages, however, recipient countries may experience some macroeconomic challenges, especially the emergence of Dutch Disease. In other words, excessive remittance inflows lead to an appreciation of the real exchange rate that would further deteriorate the competitiveness of tradable goods (Barajas et al., 2011). On the other hand, remittance inflow can improve the international competitiveness of domestic production by depreciating a country's real exchange rate (Rahman et al., 2013). So, detecting the relationship between workers' remittance inflows and the real exchange rate is necessary for an economy to formulate appropriate economic policies.

Bangladesh received the third-highest amount of remittance (USD 15.5 Billion) in South Asia in 2018 from its overseas workers or non-residents[2], after India and Pakistan, and 11th highest recipient globally, which was 5.4 percent of GDP in the year (World Bank, 2019b). Bangladesh mainly depended upon external debt and foreign aid for implementing development projects after its independence due to the shortage of natural resources and capital endowments. But now remittance is the major source of foreign capital inflows, which was about 5.4 percent of GDP in the fiscal year 2018-19. Remittance is already playing a significant role as the key driver of economic growth and poverty reduction in Bangladesh. The role of remittance in the country's foreign exchange reserves development and import financing is undeniable. In the 2018-19 fiscal year, foreign exchange reserves were USD 32 billion, in which the amount received through remittance was USD 15.4 billion, which was 30 percent of the country's total import payments.

The principal objective of this study is to detect empirically the long-run equilibrium relationship between workers' remittance and the real exchange rate and evidence of Dutch disease problem for the economy of Bangladesh. Bangladesh being one of the largest remittance receiving countries of the world, answer to this important relationship can be of interest to the policy makers of the country. However as documented in the literature review section there is a dearth of studies which investigates the relationship between remittance and real exchange rate for Bangladesh. This study thus contributes to the empirical literature which looks at the possible adverse effect of foreign remittance on the economy of Bangladesh.

The rest of the paper is organized as follows: Section Two reviews the existing empirical literature on this issue, Section Three highlights the trends of remittance inflows in Bangladesh, Section Four represents the methodology of the study, Section Five demonstrates the results of econometric analysis, and finally, Section Six concludes the study.

2 Literature review

Many empirical studies have investigated the causal relationship between workers' remittance inflows and real exchange rate in context of both developing and developed

[2] According to information of the Economic Relations Division, Government of the People's Republic of Bangladesh, it is perceived that about 10 million Bangladeshis are living overseas countries, of which around 2.4 million Bangladeshis are living abroad permanently either as citizens or with other valid documents in as many as 162 countries (Monem, 2018).

countries. Most of those studies have focused on Dutch disease problem to analyze the relationship between these two variables. Findings of these empirical studies present mixed results with respect to existence of Dutch disease problem in the recipient countries. Some studies revealed that remittance inflows appreciate the real exchange rate and consequently prove the existence of Dutch disease. In contrast, some other studies found that remittance inflows depreciate the real exchange rate, which did not confirm Dutch disease problem.

Bourdet and Falck (2006) investigate the Dutch disease argument for Cape Verde using time series data for the period 1980-2000. They find workers' remittance has a positive influence on the real exchange rate that would imply deterioration of competitiveness of domestic production. Tuuli (2015) finds that increasing remittance leads to an appreciation in the real exchange rate in the long run. But in the short run, remittance does not Granger cause the real exchange rate. Amuedo-Dorantes and Pozo (2004) conduct a test on the impact of remittances on the real exchange rate using panel data from 13 Latin and Caribbean countries: Argentina, Belize, Bolivia, Colombia, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Peru, and Trinidad & Tobago. They reveal that remittance imposes an economic cost on the tradable sector by hurting its competitiveness. Similarly, in their study regarding the Dutch disease argument in South Asian Countries (Bangladesh, India, Pakistan, and Sri Lanka), Roy and Dixon (2016) failed to reject the hypothesis that there exists a significant positive influence of remittances on the real exchange rate. Hassan and Holmes (2013) examine data of 23 developing countries for the period of 1987-2018 using a panel cointegration approach and find a small inelastic long-run relationship between the two which ensures Dutch disease in high remittance countries. Using a one-step system Generalized Method of Moments specification within a simultaneous equation approach with the data set for 1995 to 2014 from selected 41 developing countries, Polat and Andr´es (2019) showed that workers' remittances appreciate the real exchange rate at their levels and also create the Dutch disease for this country group.

In contrast, using panel cointegration for the data of 10 developing countries, Ozcan (2011) finds no strong positive influence of remittances that appreciate the real exchange rate and creates Dutch disease. Similarly, Brahim et al. (2017) conducted a cross-country analysis using data from nine MENA[3] countries between 1980 and 2015. They find a negative impact of workers' remittance on the real effective exchange rates in the long-run and do not find any evidence of Dutch disease risk in the MENA region. Elbadawi et al. (2008) conducted a panel estimation using data set from 39 conflict and 44 non-conflict countries between 1970 and 2004. Their study reveals that although post-conflict countries receive larger aid flows and remittances, these two are not traced for overvaluation of the real exchange rate. Similarly, Prakash and Mala (2016) do not find any impact on the real effective exchange rate in the long-run using the VECM technique, and they reject the claim on the Dutch disease risk in Fiji as a result of remittance.

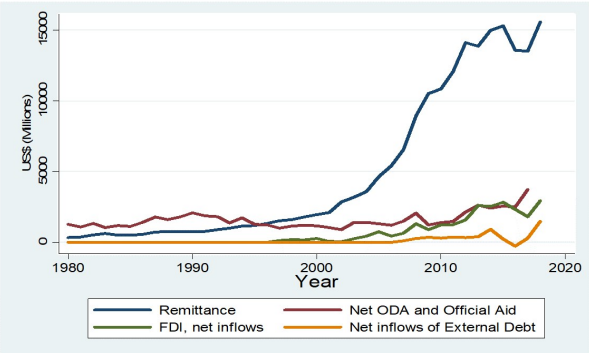
[3] MENA is an acronym of the Middle East and North Africa region. There are 19 countries in the region: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen.

In the case of Bangladesh, the majority of the researchers have tried to find out the growth impact of remittance inflows. Only a few empirical studies have been done focusing on this issue depending on the data set from Bangladesh. For example, using cointegration technique and VECM, and data from 1971 to 2008, Chowdhury and Rabbi (2013) investigate the effects of remittance inflows on the real exchange rate movements in Bangladesh. The results of their study suggest that remittance inflows significantly appreciate the real exchange rate and hurt the international trade competitiveness of Bangladesh. Amin and Murshed (2017) also examine the real exchange rate movements of Bangladesh as a result of remittance inflows using annual data from 1980 to 2013. Applying the ARDL bounds testing approach they also find that influx of remittances causes the real exchange rate appreciation. It can be noted that alongside remittance, these previous studies considered only a few control variables as determinants of the real exchange rate in their analysis. The present study uses most recent data, and include a number of control variables as compared to the previous studies, and thus provide more updated information about the relationship between remittance and real exchange rate in Bangladesh.

3 Trends of remittance inflows in Bangladesh

Bangladesh has been experiencing an upward trend in remittance inflows for the last three decades. Bangladesh received USD 338.67 million remittances in 1980 that increased to USD 15316.69 million in 2018 (Table A2 in Appendix). Figure 1 shows the trends of remittance inflows, Net ODA, FDI, and external debt for 1980 to 2018. The amount of remittance continuously incremented over the four decades with some minor fluctuations. From 1980 to 2001, it increased very slowly. There was a sharp increase in remittances between the years 2001 and 2013. After 2013, it increased with some fluctuations. The figure also demonstrates that after 1996, workers' remittances outraced all other series: FDI, ODA, and external debt. It means that remittance became the major source among all the inflows and sufficient to fill the sustained trade deficit in Bangladesh. Bangladesh received the highest USD 15.4 billion remittances in 2018 that was 5.4 percent of GDP in the year, and the FDI amount was approximately USD 3.0 billion (World Bank, 2019b). The percentage share of two other sources (ODA and External debt) is negligible, and it was less than one percent.

Figure 1: Comparison among external incomes



Source: Constructed by the author based on data from World Development Indicators 2019, World Bank.

4 Methodology

4.1 Data

The sample period for investigation is the period from 1980 to 2018. The empirical analysis of this study employs annual secondary data collected from World Development Indicators 2019 (World Bank, 2019c), World Economic Outlook Database (International Monetary Fund, 2019), and Bangladesh Bank Open Data Initiative (Bangladesh Bank, 2019).

The most important task is the construction of the real exchange rate (*RER*) for a country before investigating its determining factors. There is a debate among economists regarding the method of calculating *RER*. Some of them advocate for a bilateral rate, and others suggest using a multilateral rate. However, this study follows the method suggested by Kamal (2015). According to the method, the *RER* is defined as nominal exchange rate times the ratio of the US consumer price index (*CPI*) to the domestic *CPI*. A list of the variables used in the analysis along with their definitions and sources is given in the appendix table A1.

4.2 Descriptive statistics of variables

Table 1 shows the summary statistics of the variables that are included in the model. Before performing any regression analysis, it is necessary to understand the characteristics of the variables. Generally, values for skewness zero ($\beta_1 = 0$) and kurtosis three ($\beta_2 = 3$) demonstrate that the variable is normally distributed. It is seen from Table 1 that the frequency distributions of all variables are not normal. If the value of skewness lies between -0.5 and 0.5, the distribution is approximately symmetric. According to this, the distributions of *RER*, *TOP*, *MS*, *TOT*, and *GE* are symmetric. On the other hand, all variables fall under the extreme platykurtic distribution except *FDI*.

Table 1: Descriptive statistics of variables

Variables	N	Min	Max	Mean	SD	Variance	Kurtosis	Skewness
RER	39	49.92	85.56	68.17	9.17	9.17	2.21	0.21
REM	39	338.70	15317.00	4733.00	5372.00	5372.00	2.30	0.99
FDI	39	-6.66	2940.00	639.60	925.00	925.00	3.45	1.35
TOP	39	16.69	48.11	29.40	9.87	9.87	1.86	0.38
MS	39	14.06	65.85	37.66	17.70	17.70	1.57	0.32
TOT	39	56.54	162.30	100.40	29.88	29.88	1.72	-0.07
GE	39	10.03	14.61	12.22	1.18	1.18	2.26	0.32

4.3 Model specification

The main objective of this study is to check empirically whether the inflow of remittances has a positive influence on the real exchange rate. The null hypothesis for this study is that remittance inflows appreciate the real exchange rate in Bangladesh. In order to separate the connectivity between remittances and the real exchange rate, it is needed to consider all other potential factors that may affect the real exchange rate. After reviewing the available literature related to determinants of the real exchange rate, for example, Dreyer (1978), Campa (2002), Roy and Dixon (2016), and Barbosa et

al. (2017), factors, such as GDP per capita, degree of openness, money supply, FDI, terms of trade, ODA, government expenditure, are identified as the determinants of the real exchange rate. Most of the relevant economic variables are considered here based on the availability of data and the previous literature for examining the determinants of the real exchange rate in developing countries. After reviewing all the potential determinants of the real exchange rate, this study considers the final model below:

$$RER_t = f\,(REM_t, X_t) \qquad (1)$$

where, *RER* = Real exchange rate; *REM* = Remittance inflows; and *X* = A vector of control variables. The econometric specification of Equation 1 is as follows.

$$RER_t = \beta_0 + \beta_1 REM_t + \beta_2 FDI_t + \beta_3 TOP_t + \beta_4 MS_t + \beta_5 TOT_t + \beta_6 GE_t + \varepsilon_t \qquad (2)$$

where ε_t is the error term with the white noise properties, β_0 is a scalar parameter, and β_1-β_6 are the parameters of interest. All variables are in log forms. Definitions of all variables and data sources of the variables are presented in Table A1 in Appendix. A negative sign of the coefficient implies that an increase in the respective variable is expected to give rise to an appreciation of the *RER* and vice versa for a positive sign. A negative relation is expected between remittance and *RER* since it may cause an appreciation of the *RER* by changing the patterns of the demand for non-tradable and tradable goods. *FDI* raises the demand for domestic currency and swollen its value that leads to appreciating RER. That's why negative relation is expected between the two. There is a positive relationship between trade openness and *RER* since trade openness reduces the domestic price of tradables and demand for non-tradables, and subsequently, trade imbalance depreciates the *RER*. An increase in the money supply leads to inflation, which causes a fall in export demand, and depreciates the *RER*. In most cases, favorable terms of trade appreciates the *RER*; therefore, a negative relationship is expected between the two. The effect of government expenditure on *RER* is ambiguous. In most developing countries, a rise in consumption of non-tradables tends to appreciate the *RER*, while depreciation occurs if consumption of tradable goods increases.

4.4 Estimation method

To determine the long-run equilibrium relationship between the real exchange rate and remittances, this study uses the vector error correction model (VECM) depending on the cointegration test results. The number of sample observations is compatible with the cointegration technique. Most of the macroeconomic time series are non-stationary by their nature; that is, they have unit-roots. These series can be made stationary through differencing or detrending. The time series considered in this study are also likely to be non-stationary in their levels. Therefore, traditional empirical techniques such as the ordinary least squares (OLS) may not apply to such data since it may produce spurious regression. That's why the techniques of cointegration and error correction mechanism (ECM) are appropriate for handling non-stationary series (Gujarati, 2003, pp. 805-820).

Unit root tests: Macro economic aggregates like asset prices, real GDP, exchange rates, have non stationary properties and the main sources of this non stationarity are the trend, and structural break (Adejumo and Ikhide, 2019). The first step of any time series analysis is checking the non stationarity of variables by operating unit root tests. There are several

types of tests for diagnosing the non stationarity of time series variables. The most popular and commonly used Dickey-Fuller (DF) test is used in this study considering Equation 3:

$$\Delta Y_t = \beta_1 + \beta_2 t + \Delta Y_{t-1} + u_t \qquad (3)$$

where *t* is the trend variable in each case (Gujarati, 2003, p. 815). The DF test has the null hypothesis that the series has a unit root.

Cointegration tests: Any regression between two non-stationary variables may produce a spurious regression. If they are cointegrated, the regression will not be spurious. If the order of integration of different time series has been detected, it is easy to determine a relationship among the series. If all of the time series variables are integrated of order d, and a linear combination of these series is integrated of the order less than d, then the set of variables is said to be cointegrated (Gujarati, 2003, pp. 805-822). Cointegration tests are helpful to detect long-run relationships among the variables if they have these relationships. Johansen (1991) test is the most popular among the available tests for cointegration. This test allows more than one cointegrating relationship.

The Max-Eigen value and Trace test are the two main tests in the Johansen cointegration testing format. The decision can be made by anyone of them. The null hypothesis for the Trace test is that the number of the cointegrating equation is H_0: r = r* < k, and the alternative hypothesis that H_a: r = k. The null hypothesis for the Maximum Eigen Value test is similar to the Trace test, but the alternative hypothesis is H_a: r = r *+1 (Johansen, 1991). All variables must be integrated of order one; I(1) to satisfy the Johansen test condition.

5 Results and discussion

5.1 Unit root and cointegration test results

The Results of the *DF* test are presented in Table 2. It is seen from Table 2 that all variables are non stationary at their levels; that is, they contain a unit root. But in the case of the first difference of variables, null hypotheses are not accepted. Thus, it is evident from the unit root tests is that all variables are stationary at their first differences; that is, they are integrated of order one, I(1). τ critical values: -4.26 at 1 percent level; -3.55 at 5 percent level; and -3.21 at 10 percent level have been reported for this test.

Table 2: Results of unit-root tests (DF)

	Levels		First Differences	
Variables	**Test Statistic**	**Lag length**	**Test Statistic**	**Lag length**
RER	-1.08	2	-4.72***	1
RER	-1.66	2	-5.39***	1
FDI	-3.73	1	-6.91***	0
TOP	-2.95	1	-6.58***	0
MS	-1.97	1	-4.91***	0
TOT	-2.39	1	-6.89***	0
GE	-3.51	1	-7.37***	0

Note: *** indicates the significance of test statistic at the 1 percent level.

Since all the variables are integrated of order one, we can perform the Johansen cointegration test. Only the results of the Trace test have been reported in Table 3. Trace statistics show the existence of cointegrating relationships. According to these results, it is clear that four cointegrating equations exist in the model. So, it is evident that there is a fixed long-run relationship between *RER*, *REM,* and all other control variables. The next step is to model the short-run relationship between the variables in question, which can be represented by a vector error correction model.

Table 3: Johansen tests for cointegration

Maximum Rank	Eigen value	Trace Statistic	5% critical value
0	.	188.19	124.24
1	0.80	129.42	94.15
2	0.75	77.60	68.52
3	0.56	47.47	47.21
4	0.44	25.88*	29.68
5	0.33	11.04	15.41
6	0.15	5.00	3.76
7	0.13		

5.2 Interpretation of vector error correction model

The results of the VECM are presented in Table 4; and Table 5. According to the information in Table 4, it can be constructed an error correction term equation (cointegrating equation) in the long-run model, which signifies the long-run relationship among the variables:

$$ECT_{t-1} = 1.00RER_{t-1} + 14.09REM_{t-1} - 3.94FDI_{t-1} + 22.19TOP_{t-1} - 5.07MS_{t-1} + 32.18TOT_{t-1} - 3.55GE_{t-1} - 290.03 \quad \ldots. \quad (4)$$

Table 4: Vector error correction estimates

Beta	Coefficient	Std Error	Z(t)	P>|z|
ce1				
RER	1.00	.	.	.
REM	14.09	2.60	5.41	0.00
FDI	-3.94	0.39	-10.17	0.00
TOP	22.19	3.93	5.64	0.00
MS	-5.07	3.30	-1.54	0.12
TOT	32.18	6.23	5.17	0.00
GE	-3.55	6.70	-0.53	0.60
Cons	-290.03	.	.	.

Here, there are four significant coefficients (*REM*, *FDI*, *TOP*, and *TOT*), of which two have expected signs (*FDI*, and *TOP*). The positive coefficient sign for *REM* is the opposite of the Dutch disease hypothesis. It implies that an increase in remittance will cause depreciation (14.09 percent) of the real exchange rate in the long-run. This particular finding is consistent with Ozcan (2011), Brahim et al. (2017), Elbadawi et al. (2008), and Prakash and Mala (2016); and opposite to the findings of Chowdhury and Rabbi (2013),

and Amin and Murshed (2017). Similarly, the expansion of trade openness and improvement of terms of trade will also depreciate the real exchange rate. On the other hand, an increase in *FDI* will appreciate the real exchange rate. Table 5 shows the short-run coefficients of the model with an error correction term, which is also called the adjustment coefficient. Equation 5 specifies the vector error correction model:

$$\Delta RER_t = -0.0037ECT_{t-1} + 0.24RER_{t-1} - 0.16REM_{t-1} - 0.02FDI_{t-1} + 0.05TOP_{t-1} - 0.037MS_{t-1} - 0.15TOT_{t-1} - 0.18GE_{t-1} + 0.02 \quad (5)$$

The value of the error correction term (–0.0037) implies the previous year's deviation from long-run equilibrium is corrected in the current period with an adjustment speed of 0.37 percent. Surprisingly, there is a negative relationship between remittance and the real exchange rate in the short-run model, which supports the Dutch disease hypothesis. It implies that in the short-run, a 1 percent increase in remittance will appreciate the real exchange rate by 0.16 percent on average if the other things are held constant.

Table 5: Results of cointegration estimation

D_RER _ce1	Coefficient	Std. Error	Z(t)	P>|z|
L1.	-0.0037	0	-1.49	0.14
RER	0.24	0.18	1.35	0.18
REM	-0.16	0.07	-2.21	0.03
FDI	-0.02	0.01	-1.87	0.06
TOP	0.05	0.09	0.58	0.56
MS	-0.03	0.13	-0.23	0.82
TOT	-0.15	0.14	-1.05	0.3
GE	-0.18	0.15	-1.25	0.21
Cons	0.02	0.01	1.63	0.1
R-square	0.37			

5.3 Diagnostic tests

In general, the validity of any econometric model is subject to several diagnostic tests. To confirm the validity of estimated results, the two most important tests: The Jarque-Bera normality test and the Breusch-Godfrey serial correlation LM test, are carried out in this study. The results of these two tests confirm that the estimated model satisfies the desired econometric properties. The Jarque-Bera test (Table A3 in Appendix) confirms that the errors are normally distributed for all seven equations as well as overall for this model. The Breusch-Godfrey serial correlation LM test shows that there is no autocorrelation even at four lags (Table A4 in Appendix).

6 Conclusion

In the light of the Dutch Disease phenomenon, this study has looked at the effect of remittance flow on real exchange rate in Bangladesh. Using annual data for the periods 1980 to 2018, the study applies Johansen cointegration technique and VECM to examine the long-run equilibrium relationship between workers' remittance and the real exchange rate for the economy of Bangladesh. The results of the econometric analysis confirm that a stable long-run relationship between remittances and real exchange rate exists. However, the important finding of this analysis is that remittances appreciate the real exchange rate

in the short-run but depreciate it in the long-run. So, the empirical findings of this study reject the claim of the Dutch disease effects of remittance in the long-run. That is, a high inflow of remittances does not deteriorate the international competitiveness of domestic production. Among the control variables used in the analysis, trade openness, and terms of trade significantly depreciate the real exchange rate, whereas an increase in FDI leads to an appreciation of the real exchange rate in the long-run. This study, thus, suggests that Bangladesh can receive more overseas workers' remittance without any fear of Dutch disease effects. Finally, the government should formulate appropriate policies for utilizing these remittances into the productive sectors.

One of the limitations of the study is that it uses a relatively small sample size due mainly to the reason that data for many of the variables included in the analysis are not available prior to 1980. The small sample may not be compatible with Johansen cointegration test which typically requires large sample. Therefore, future research can be extended by using quarterly data to make the sample size larger. This will also be helpful to include a large number of control variables in the analysis.

References

Adejumo, Afolabi O., and Sylvanus I. Ikhide. "The Effects of Remittance Inflows on Exchange Rates in Nigeria." *The Journal of Developing Areas* 53, no. 1 (2019): 1-15.

Amin, Sakib B., and Muntasir Murshed. "Remittance, Exchange Rate and Dutch Disease: The Case of Bangladesh." *International Review of Business Research Papers* 13, no. 2 (2017): 100-117.

Amuedo-Dorantes, Catalina, and Susan Pozo. "Workers' Remittances and the Real Exchange Rate: A Paradox of Gifts." *World Development* 32, no. 8 (2004): 1407-1417.

Bangladesh Bank. "Bangladesh Bank Open Data Initiative." *Economic Data*, 2019. www.bb.org.bd/econdata/.

Barajas, Adolfo, Ralph Chami, Dalia Hakura, and Peter Montiel. "Workers' Remittances and the Equilibrium Real Exchange Rate: Theory and Evidence." *Economía* 11, no. 2 (2011): 45-94.

Barbosa, LúcioOtávio, Frederico G. Jayme, and Fabricio José Missio. "Determinants of the Real Exchange Rate in the Long-Run for Developing and Emerging Countries: A Theoretical and Empirical Approach." *International Review of Applied Economics* 32, no. 1 (2017): 62-83.

Bourdet, Yves, and Hans Falck. "Emigrants' Remittances and Dutch Disease in Cape Verde." *International Economic Journal* 20, no. 3 (2006): 267-284.

Brahim, Mariem, Nader Nefzi, and Hamed Sambo. "Remittances and the Real Effective Exchange Rates in MENA Countries: What is the Long-run Impact?" CEPN Working Papers. Centre d'Economie de l'Université de Paris Nord, February 2, 2017. https://ideas.repec.org/p/upn/wpaper/2017-15.html.

Campa, Jose Manuel. "Exchange Rate Misalignment: Concepts and Measurement for Developing Countries, Lawrence Hinkle and Peter Montiel (Eds.), World Bank, 1999." *Journal of International Economics* 57, no. 1 (2002): 257-260.

Chowdhury, Mamta B., and Fazle Rabbi. "Workers' Remittances and Dutch Disease in Bangladesh." *The Journal of International Trade & Economic Development* 23, no. 4 (2013): 455-475.

Dreyer, Jacob S. "Determinants of Exchange-Rate Regimes for Currencies of Developing Countries: Some Preliminary Results." *World Development* 6, no. 4 (1978): 437-445.

Elbadawi, Ibrahim A., Linda Kaltani, and Klaus Schmidt-Hebbel. "Foreign Aid, the Real Exchange Rate, and Economic Growth in the Aftermath of Civil Wars." *The World Bank Economic Review* 22, no. 1 (2008): 113-140.

Gujarati, Damodar N. *Basic Econometrics*. New York: McGraw-Hill, 2003.

Hassan, Gazi M., and Mark J. Holmes. "Remittances and the Real Effective Exchange Rate." *Applied Economics* 45, no. 35 (2013): 4959-4970.

International Monetary Fund. "World Economic Outlook Database". 2019. https://www.imf.org/en/Publications/WEO/weo-database/2019/October.

Johansen, Soren. "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models." *Econometrica* 59, no. 6 (1991): 1551-1580.

Kamal, Khnd Md. "An ECM Approach for Long Run Relationship between Real Exchange Rate and Output Growth: Evidence from Bangladesh." *Dhaka University Journal of Science* 63, no. 2 (2015): 105-110.

Monem, M. 2018. "Engagement of Non-resident Bangladeshis (NRBs) in National Development: Strategies, Challenges and Way Forward." Economic Relations Division (ERD), Ministry of Finance, Bangladesh. https://issuu.com/bdundp/docs/engagement_of_nrbs.

Ozcan, Burcu. "The Relationship between Workers' Remittances and Real Exchange Rate in Developing Countries." *International Research Journal of Finance and Economics* 80 (2011): 84-93.

Polat, Burçak, and Antonio Rodríguez Andrés. "Do Emigrants' Remittances Cause Dutch Disease? A Developing Countries Case Study." *The Economic and Labour Relations Review* 30, no. 1 (2019): 59-76.

Prakash, Kushneel. A. and Anjani Mala. "Is the Dutch Disease Effect Valid in Relation to Remittances and the Real Exchange Rate in Fiji?" *Journal of the Asia Pacific Economy* 21 no. 4 (2016): 571-577.

Rahman, Matiur, Andrew Foshee, and Muhammad Mustafa. "Remittances-Exchange Rate Nexus: The U.S.-Mexico Case." *The Journal of Developing Areas* 47, no. 1 (2013): 63-74.

Roy, Ripon, and Robert Dixon. "Workers' Remittances and the Dutch Disease in South Asian Countries." *Applied Economics Letters*23, no. 6 (2016): 1-4.

Tuuli, Maxwell. "The Impact of Remittances on the Real Exchange Rate: Empirical Evidence from Ghana."*Journal of Economic Cooperation & Development* 36, no. 3 (2015): 43-66.

World Bank. 2019a "Record High Remittances Sent Globally in 2018." https://www.worldbank.org/en/news /press-release/2019 /04/08/record-high-remittances-sent-globally-in-2018.

World Bank. 2019b "Migration and Remittances Data." https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data.

World Bank 2019c. "World Development Indicators-2019." Data Bank, 2019c. https://databank.worldbank.org/source/world-development-indicators.

Appendix

Table A1: Definition of variables and sources of data

Variables	Definition	Sources
RER: Log of real exchange rate	The real exchange rate is the product of the nominal effective exchange rate (Local currency per US$) and the ratio of US CPI to the domestic CPI (2010 = 100).	Bangladesh Bank, and World Development Indicators 2019
REM: Log of remittances received	The inflow of workers' remittances (Million US$).	Bangladesh Bank
FDI: Log of foreign direct investment	Net inflows of Foreign Direct Investment (Million US$).	World Development Indicators 2019
TOP: Log of trade openness	Trade openness is measured as the sum of exports and imports as a percentage of GDP.	World Development Indicators 2019
MS: Log of the money Supply	Broad money (% of GDP).	World Development Indicators 2019
TOT: Log of terms of Trade	Net barter terms of trade index (2000 = 100).	World Development Indicators 2019
GE: Log of govt. Expenditure	General government final consumption expenditure (% of GDP).	IMF World Economic Outlook Database-2019

Table A2: The Inflow of overseas workers' remittances

Time	Remittance inflows (Million US$)	Growth in remittance Inflows	Percentage of GDP
1980	338.67	–	1.87
1981	381.18	13%	1.88
1982	418.47	10%	2.84
1983	619.48	48%	3.65
1984	590.60	-5%	2.65
1985	441.60	-25%	2.26
1986	555.81	26%	2.65
1987	697.45	25%	3.08
1988	737.43	6%	2.87
1989	770.82	5%	2.63
1990	758.20	-2%	2.46
1991	764.04	1%	2.49
1992	847.97	11%	2.88
1993	944.00	11%	3.04
1994	1088.79	15%	3.41
1995	1197.63	10%	3.17
1996	1217.06	2%	2.90

1997	1475.40	21%	3.16
1998	1525.42	3%	3.21
1999	1705.74	12%	3.52
2000	1949.32	14%	3.69
2001	1882.10	-3%	3.90
2002	2501.13	33%	5.22
2003	3061.97	22%	5.31
2004	3371.97	10%	5.50
2005	3848.29	14%	6.69
2006	4801.88	25%	7.56
2007	5978.47	25%	8.24
2008	7914.78	32%	9.76
2009	9689.26	22%	10.27
2010	10987.40	13%	9.41
2011	11650.32	6%	9.38
2012	12843.43	10%	10.59
2013	14461.14	13%	9.25
2014	14228.26	-2%	8.67
2015	15316.91	8%	7.84
2016	14931.18	-3%	6.13
2017	12769.45	-14%	5.41
2018	15316.69	17%	5.68

Source: World Development Indicators-2019, World Bank.

Table A3: Results of the Jarque-Bera test

Equation	chi^2	Df	Prob>chi^2
D_RER	0.39	2	0.82
D_REM	0.67	2	0.72
D_FDI	0.84	2	0.66
D_TOP	4.08	2	0.13
D_MS	1.74	2	0.42
D_TOT	1.34	2	0.51
D_GE	2.01	2	0.37
ALL	11.07	14	0.68

Table A4: Results of the LM test

Lag	chi^2	Df	Prob>chi^2
1	54.09	49	0.29
2	49.75	49	0.44
3	56.46	49	0.22
4	36.67	49	0.90