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The Determinants of Real Exchange Rate Volatility with Emphasis on Remittances: Selected Developing Countries

Rahman Saadat [1*], Payam Naderi[2]

[1]Department of Economics, Management and Administrative Sciences, University of Semnan, Semnan, Iran
[2] Department of Economics, University of Semnan, Semnan, Iran

Abstract
Remittances are one of the financial inflows that can affect the economic growth of emerging and developing countries through the exchange rate volatility channel. Many small open economies are vulnerable to volatilities and changes in capital inflows so that sudden changes in the exchange rate can affect economic growth negatively by declining investment, trade volume, and profitability. In this study, the effect of the factors that have an impact on the real exchange rate volatility has been investigated and empirically analyzed by using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Panel Vector Autoregressive (P-VAR) approaches in the selected developing countries including Iran over the period 1980-2017. The results indicated that remittances had a positive and significant effect on the exchange rate volatility of the studied countries so that an increase in remittances caused volatilities in the real exchange rate. In addition, among other explanatory variables, foreign direct investment and government expenditures had the most negative and positive effects on real exchange rate volatilities respectively.

Keywords: Remittances, Real Exchange Rate Volatility, GARCH, P-VAR.

JEL Classification: F24, F31, C58, C32, C33

*Corresponding Author, Email: saadatrah@semnan.ac.ir

1. Introduction

Over the past few decades, the changes in foreign exchange regimes have attracted more attention to the issue of exchange rates and its volatilities, especially in developing countries, as a key factor in policymaking and economic decision-making. The national currencies are affected not only by domestic economic policies of the home country but also by economic and political events around the globe. Changes and volatilities of the real exchange rate have a set of changes in the domestic and foreign sectors of each country which affect the economic performance of the country. Continuous uncertainty and frequent volatilities in exchange rates by reducing investment in economic activity will lead to a reduction in trade and the movement of capital inflows. Therefore, exchange rate volatilities can impact the national currency by affecting the cost of imported goods and the value of exported goods. Exchange rate volatilities can lead to lose out of some of the economic enterprises in the field of export and import by missing their position and competitiveness in the international market (Manafy-Anvar, et al., 2015).

In the same vein, due to the inflow of foreign funds and capitals, such as remittances and foreign direct investment to developing countries during recent years, the exchange rate of the host countries has undergone changes and volatilities that have affected other macroeconomic variables. Remittances are one of the largest sources of financial flows for developing countries, which can lead to a balanced consumption and financial and macroeconomic stability in the recipient countries (Ahmed, et al., 2011). In some cases, if the flows of remitted funds by workers are too large relative to the size of the recipient economies, they experience exchange rate appreciation which reduces the competitiveness of the tradable sector (Lopez, et al., 2007). Remittance funds that are sent to individuals and households can improve the credit quality of the countries and be useful for developing projects and infrastructure finance through access to international capital markets (Kapur, 2005). A significant increase in such a financial inflow may lead to greater financial fragility and real exchange rate appreciation in the economy (Combes, Kinda, & Plane, 2011). Given that many small open economies are vulnerable to volatilities and changes in capital inflows, they may face sudden changes in nominal and real exchange rates (Keefe, 2014). Sudden changes in the exchange rate can have a negative effect on growth and decrease it by declining investment, the volume of trade, and profitability (Canales-Kriljenko, & Habermeier, 2004). The impact on trade and investment activity is rooted in the behavior of risk-averse importers and exporters who are faced with greater uncertainty regarding profitability when exchange rates are volatile. These economic agents will react to volatile exchange rates by decreasing their supply of and demand for goods, in turn adversely affecting economic growth (Keefe, 2014).

An increase in the population of developing countries, due to social and cultural structures, can lead to migration. As a result, by increasing economic activities, more income is earned by migrants. Hence, a large volume of foreign currencies that enter the developing countries can lead to economic problems such as an imbalance in demand and supply in labor markets, goods and services, and other sectors of the economy. Therefore, it is observed that the effect of financial inflows such as remittances on the exchange rate plays an important role in policymaking and achieving the desired goals of economic policymakers in developing countries, which includes the main purpose of the present research. There are a number of differences between the current study and the earlier ones.

As far as the volatility of a variable like exchange rate represents the degree to which changes of a variable over time, the larger the magnitude of a variable change, or the more quickly it changes over time, the more volatile it will be. So, it often occurs more in the real world. Therefore, the most important element is using the volatility of the real exchange rate, which is one of the main arguments and hot topics in recent years especially in Iran's economy, with emphasis on inflows of remittances. The estimation technique is also different, as it determines the severity and share of each influential factor in the volatility of the real exchange rate. In addition, investigating the remittances' effect on exchange rate volatility is relatively a recently-noticed variable in Iran's economy. Thus, in this study, the goal is to

answer the questions of whether the inflow of remittances causes real exchange rate volatility, and second, in addition to the remittances, what other variables and factors influence the volatility of the real exchange rate. To this end, the authors use 14 developing countries' data from 1980 to 2017, by applying Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Panel Vector Autoregression (PVAR) methods. The paper is organized into six sections. In Section 2, the literature review is presented. Section 3 introduces the model and specifies the variables. In Section 4, the model is estimated and research questions are answered. Finally, Section 5 refers to conclusions and suggestions.

2. Literature Review

2.1 Research Background

Obstfeld and Rogoff (1998) argue that the exchange rate volatility causes a high cost for the domestic economy. They show that households and firms are affected by direct and indirect channels through these volatilities. The direct channel is based on the assumption that people are not satisfied with the exchange rate volatilities, as they cause volatilities in their consumption and leisure. The indirect channel assumes that firms seek to eliminate future risks caused by exchange rate volatilities by invoicing higher prices in the form of risk premium.

The high exchange rate volatilities increase the risk factor of domestic firms in international trade which may lead to higher prices to maintain optimum risk level (Giannellis, & Papadopoulos, 2011). In recent decades, the spectral analysis has been conducted to study the volatilities of macroeconomic and financial time series, including exchange rates. In the meantime, several studies have tried to find out the variables or factors that trigger the exchange rate volatilities (e.g. Kanas, 2002; Devereux, & Lane, 2003; Ganguly, & Breuer, 2010; Giannellis, & Papadopoulos, 2011). Kanas (2002) showed that the stocks return volatilities of the origin country are the key factor of exchange rate volatilities in three industrialized countries, including the US, UK, and Japan. Ganguly and Breuer (2010) demonstrated that, in developing countries, the nominal exchange rate volatility is about 1.5 to 2 times higher than the real exchange rate volatility so that the relative price volatilities have a greater contribution to the real exchange rate volatilities. Devereux and Lane (2003) found that standard optimal currency area variables (e.g. trade interdependence, economic shocks) had the same effects on developing and developed countries in explaining bilateral exchange rate volatility.

Furthermore, the effect of monetary variables on the exchange rate volatilities has been studied in various studies (e.g. Broda, 2004; Dornbusch, 1976; Ganguly, & Breuer, 2010; Giannellis, & Papadopoulos, 2011; Dominguez, et al., 2013). Giannellis and Papadopoulos (2011) investigated some European Union economies and found that interest rates, as a proxy for monetary shocks, impacted the foreign exchange markets. Also, Ganguly and Breuer (2010) showed that changes in the M2 and interest rates had a stabilizing effect on the residual volatility of both nominal and real exchange rates in developing countries. Dominguez, et al. (2013) explained that daily sales of foreign reserves can lead to domestic currency appreciation and at the same time decline the exchange rate volatility. On the other hand, Broda (2004) found that up to one-third of the exchange rate volatility can be generated by shocks to terms of trade under the floating exchange rate regime.

Amuedo-Dorantes and Pozo (2004) investigated the effect of the workers' remittances on the real exchange rate, using the fixed-effects model in 13 Latin American countries. The results indicated that the remittances have the ability to appreciate the real exchange rate in the receiving countries. The results also showed that the doubling of the ratio of remittances to the gross domestic product (GDP) will increase the exchange rate by 22%.

Izquierdo and Montiel (2006) studied the effect of the remittances on the exchange rate during the period 1985-2004 using the Panel co-integration approach and VAR model focusing on six Central American and Caribbean economies. Contrary to the findings of other studies, the results of this study showed that in Honduras, Jamaica, and Nicaragua, remittances do not have any effect on the exchange rate. The results also pointed to the positive effect of remittances on the exchange

rate in El Salvador and a negative impact on the exchange rate in Dominica. Lopez, et al. (2007) investigated a similar effect in their study. They found that when the flows of remitted funds by workers were too large relatives to the size of the recipient economies, they experienced exchange rate appreciation that reduced the competitiveness of the tradable sector.

Carrera and Restout (2008) examined the long-run exchange rate behavior for 19 Latin American countries. By determining the factors that affected the exchange rate, they found that high ratio of government expenditures to GDP, factors productivity growth, a positive shock to balance of trade, increase in foreign capital inflows and net foreign assets, had a positive impact on the real exchange rate of the studied countries, while the increase in trade openness led to real exchange rate depreciation.

Acosta, et al. (2009) examined the effect of the inflow of remittances and the development of the financial sector on the real exchange rate in 109 developing and transitioning countries. The results showed that remittances can increase the real exchange rate, but the severity of this effect was weak in countries with less developed financial markets. They also concluded that developed financial sectors can effectively lead the remittances towards investment opportunities.

Barajas et al. (2010), using the Panel co-integration approach, found that the effect of the remittances inflow on the real exchange rate equilibrium was not as large as the sign and level of significance which depends on the country and other explanatory variables of the model. Additional examinations showed that countries with a low degree of openness or a low level of capital account stock were more likely to experience exchange rate appreciation.

Bakardzhieva, et al. (2010) estimated the effects of capital and financial inflows to 57 developing countries, including African, European, Asian, Latin American, and Middle Eastern countries on the exchange rate. By using the GMM method, they found that portfolio investment, foreign borrowing, and foreign aid led to real exchange rate appreciation, while remittances had different effects on the exchange rate in different countries. It was also observed that foreign direct investment did not have an effect on the real exchange rate. In another study, Bayangos and Jansen (2011) sought to investigate the effect of migrants and workers' remittances on the competitiveness of the country's economy by introducing a system of simultaneous equations in their study. By using the Dutch disease effect and considering the effects of the labor market, they found that remittances had a positive impact on the real exchange rate.

Hassan and Holmes (2012) examined the long-run relationship between the real exchange rate and remittances by using the Panel co-integration approach in less developed countries. The results indicated that remittances led to real exchange rate appreciation. In addition, they found the direction of causality from remittances to the exchange rate in the short-run by using the panel ECM model. These results were similar to the findings of Combes et al. (2011) study. They used a similar way to examine and analyze the effect of capital inflows and the flexibility of the exchange rate on the real exchange rate in developing countries. Using the OLS estimation approach along with the traditional IS-MP model, Barrett (2013) attempted to investigate the relationship between remittances and the real exchange rate in Jamaica. The results of the study indicated that the remittances flow led to real exchange rate depreciation in the home country. Moreover, government spending and terms of trade also had a significant impact on the exchange rate.

Ajao and Igbekoyi (2013) used the GARCH model to evaluate the volatilities of the real exchange rate, and the error correction model was used to determine the real exchange rate volatility. The results showed that the most influential factors of the real exchange rate in Nigeria are openness of the economy, interest rate movements, government expenditures, and lagged exchange rate. In another study, Keefe (2014) examined the effect of remittances on the exchange rate using panel analysis for developing countries. The results indicated that remittances reduce the exchange rate in countries with high levels of dollarization and vulnerable to extreme exchange rate volatilities.

2.2 Remittances

Remittances are defined as the money sent by someone who is working abroad for the person or family living in the home country (Vaaler, 2011). Compared to foreign direct investment

(FDI), the amount of remittances is low (US$ 150 to US$ 250), but the number of sends is repeated 12 to 20 times a year (Yang, 2011). The largest share of total remittances, which is about 60-70 percent, called "personal transfers"; most of which are related to the workers who live more than one year in another country and send money to their home country. 20 to 25 percent of the total remittances are related to compensating employees and the income of immigrants who live in another country for less than one year. The other two parts of the total remittances that are insignificant are: 1) Social benefits (e.g. social security payments) and 2) Physical capital transfer in form of commodities (e.g., car, home appliances, and hi-tech devices) which migrants take to their homeland (IMF, 2009).

In various studies, although altruism has been mentioned as the main reason and motive to remit, loan repayment and personal preferences, such as savings and investment, are also expressed as other objectives by researchers (Chowdhury, 2011). Remittances play a significant role in the countries' economy and, consequently, have a significant effect on the economic growth of the host country through direct and indirect channels in different sectors of the economy (Rao, & Hassan, 2011).

2.3 Determinants of Exchange Rate

The exchange rate is one of the most important policy-making variables in the economy that links the commodity and asset markets in two different countries and shows the international competitiveness of economies. Volatilities and exchange rate changes can cause instability and have a significant impact on the movement of capital, international trade, and economic growth (Insah, & Charaah, 2013). Changes and volatilities cause a lot of economic costs which may have a negative impact on price stability, financial stability, corporate profitability, and overall macroeconomic balance (Benita, & Lauterbach, 2007).

The remittances can have potential effects on the real exchange rate from 3 channels.

First, remittances can affect the external equilibrium of the economy with an increase in the net foreign assets of a country. For example, when the external equilibrium of an economy is established, any current account imbalance with a sustainable flow of international capital will be offset. So, any change in the net foreign asset position of a country will lead to a change in the real exchange rate balance.

Second, the remittances can also affect the internal equilibrium of the economy, which is known as a situation that labor and domestic capital are efficiently utilized. If remittances lead to an increase in demand for services, inflation in this sector, which is generally non-tradable, will lead to an increase in real exchange rates (Balassa-Samuelson effect).

Third, the impact of remittances on the real exchange rate through its effect on economic growth (Acosta, et al., 2007). The acceleration in the economic growth rate reduces the net accumulation of foreign assets as a percentage of GDP and as a result, the real exchange rate reduces. On the other side, if the net foreign asset position of a country is negative compared to other countries in the world, an increase in the growth rate will reduce the ratio of obligations to gross domestic product (Lopez, et al., 2007).

Most developing countries suffer from volatilities and exchange rate changes that the intensity of this instability is larger and more severe in emerging economies (Calderon, 2004). Since exchange rate uncertainties are one of the main obstacles to the success of macroeconomic policies, policymakers are interested to know the exchange rate instability factors to limit them as much as possible.

In addition to the remittances that affect the exchange rate, there are some other factors and variables that affect the exchange rate, which will be described in the following.

- Foreign direct investment: According to the integrated trade models, in the developing countries that are price takers, the inflow of capital, depending on whether it is used for domestic financing or capital accumulation in tradable or non-tradable sectors, leads to an increase or decrease in the exchange rate. If the capital flow is used for domestic financing, it will increase the payment power and demand for tradable and non-tradable goods, which will lead to an increase in the real exchange rate and trade deficit. But if capital inflow led to capital accumulation, the orientation of this capital towards tradable or non-tradable goods will have a great role in the change of the exchange rate (Kosteletou, & Liargovas, 2000; Lartey,

2007).

- Government expenditures: The effect of fiscal expenditures on the exchange rate depends on the sectors in which the costs are incurred. If the spending is disproportionately decreased in the non-tradable sector, the relative price of non-tradable goods will increase, and as a result, the real exchange rate will increase (Carrera & Restout, 2008).

- Productivity Growth: According to Balassa-Samuelson, technological advances occur in the tradable sector in comparison to the non-tradable sector of the economy. Productivity increase in the tradable sector of goods and services will push up wages in this sector, which consequently increases the relative prices of non-tradable goods. In this research, the authors use GDP per capita as a proxy for the productivity variable.

- Interest rate: By an increase in the world interest rate, capital outflow will be increased which will weaken the real exchange rate in the long-run. But in the short-run, higher interest rates may reduce the relative price of non-tradable goods by reducing domestic savings, and thus to reduce the real exchange rate (Amuedo-Dorantes & Pozo, 2004; Gente & Leon-Ledesma, 2006).

- Terms of trade: terms of trade is defined as the ratio of export prices to import prices (Griffoli et al., 2015). Terms of trade has two opposing effects on the exchange rate. First, the improvement of terms of trade induces a positive income-effect which leads to real exchange rate appreciation. Second, the substitution-effect makes the consumption of imported goods relatively more expensive. Consequently, there would be a shift of demand from tradable goods towards non-trade goods which leads to real exchange rate appreciation (Chowdhury, & Rabbi, 2014).

- Trade openness: trade openness affects the real exchange rate through two channels. First, the increase in the openness variable, such as a decline in tariff, leads to a drop in the price of imported goods in the home country. This, in turn, will increase demand for imported goods and reduce demand for non-tradable goods, and as a result, the real exchange rate depreciates. Second, if monopoly is taken place in the non-tradable sector, it increases the rigidity degree of the aggregate price, while tradable goods provide the possibility and context for the adjustment of the domestic price index (Carrera & Restout, 2008).

3. Methodology and Data

3.1 Data Analysis

In this study, the authors used annual data for 14 developing countries (Indonesia, Iran, Pakistan, Burkina Faso, Cameroon, Egypt, Madagascar, Tunisia, Colombia, Costa Rica, Dominican Republic, Guatemala, Jamaica, and Mexico) from 1980 to 2017, which were extracted from the International Monetary Fund (IMF), United Nation Conference on Trade and Development (UNCTAD) and the World Bank (WB). The authors chose the above countries due to limitations in data availability.

A summary of the variables' descriptions and their sources are presented in Table 1.

Table 1. Data Description and Sources

Variables	Description	Source(s)
NER	Official exchange rate (LCU per US dollar, period average)	IMF
CPI	Consumer price index (2010=100)	WB
Rem	Personal remittances, received (current US dollar)	WB/UNCTAD
FDI	Foreign direct investment, net inflows (current US dollar)	WB
GS	General government final consumption expenditure (current US dollar)	WB
TROP	Total exports and imports as a share of gross domestic product	WB/UNCTAD
TOT	Export price index to import price index	WB
RIR	Real interest rate in the United States	IMF
GDPpc	Gross Domestic Product per capita (current US dollar)	WB

Source: Authors

The remittances inflows to studied countries are shown in Figure 1.

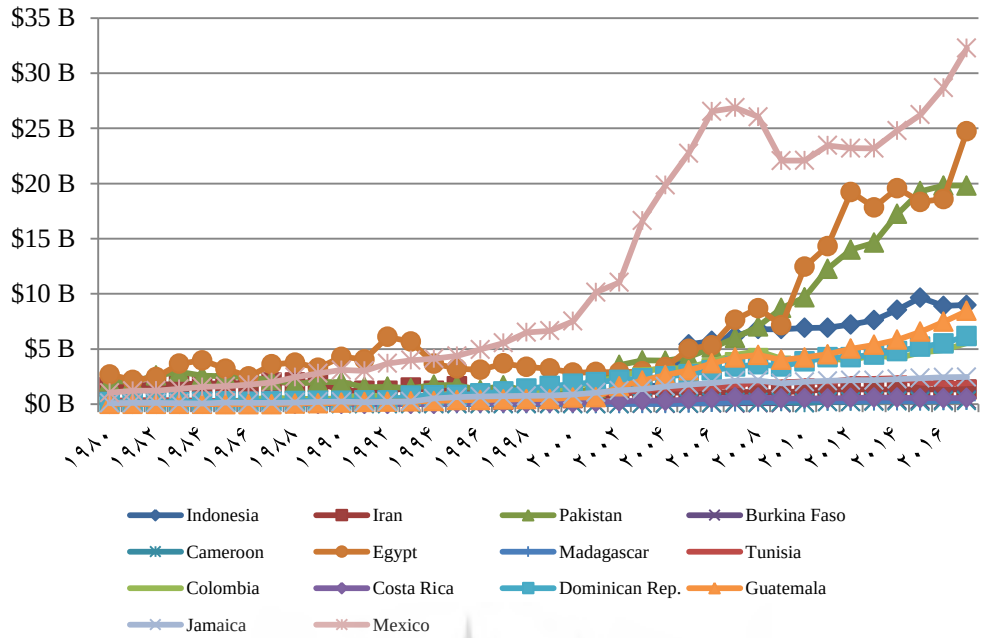

Figure 1. The remittances inflows to studied countries over the period 1980-2017 (Source: World Bank)
Source: Authors

As it can be seen from Figure 1, Mexico, Egypt, and Pakistan respectively have the highest rate of remittances inflow compared to other countries. The descriptive statistics of the variables are presented in Table 2. The statistics include mean, median, standard deviation, minimum value, and maximum value.

Table 2. Descriptive Statistics

	Mean	Median	Std	Minimum	Maximum
RER.vol	0.1176	0.0887	0.1136	05-E4.65	0.7571
LRem	20.0077	20.4202	2.2758	11.5129	24.0146
LFDI	19.8186	20.0835	2.2095	10.0718	24.5763
LGS	22.0369	21.9992	1.6154	18.9175	25.7898
LTROP	3.9375	3.9181	0.3872	2.6496	4.8323
LTOT	0.06-	0.0641-	0.3761	1.0121-	1.7875
LRIR	1.4112	1.6307	0.5826	0.1496	2.1656
LGDPpc	7.2784	7.2459	0.9839	5.2631	9.3419

Source: Authors

3.2 Estimation of Exchange Rate Volatility

The volatility and uncertainty of economic variables, including the exchange rate, can affect the performance of other economic variables. Various methods are presented for measuring and calculating the volatilities of an economic variable. Some of these include Moving Average Standard Deviation (MASD), Generalized Autoregressive Conditional Heteroskedasticity (GARCH), Hodrick-Prescott (HP) filter which is proposed by Hodrick and Prescott (1997) and Band-Pass (BP) filter which is proposed by Baxter and King (1999), and Christiano and Fitzgerald (2003) (Afonso, & Furceri, 2008; Cariolle, 2012). The method used in this study is Generalized Autoregressive Conditional Heteroskedasticity (GARCH). The reason for using the GARCH model is the existence of small and large forecasting errors in macroeconomic variables such as inflation, exchange rate and so on, since the time series of these variables may illustrate different trends during the time. In other words, they may have little volatility in some years and high volatility in other years. In this condition, it is expected that the variance is not fixed during the random trend of time series and it is a function of the behavior of residuals. So, The GARCH model allows the conditional variance to be present upon previous lags.

In Autoregressive Conditional Heteroskedasticity (ARCH) models, which introduced for the first time by Engel (1982), the mean equation is expressed as below:

$$X_t = \lambda_0 + \sum_{i=1}^{p} \lambda_i X_{t-i} + u_t \quad , \quad u_t|\psi_{t-1} \sim N(0, h_t^2) \qquad (1)$$

In equation (2), conditional variance is the weighted mean square error of the past forecast:

$$h_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, u_{t-i}^2 \qquad (2)$$

Bollerslev (1986) generalizes the simple ARCH model with the parsimonious. The GARCH model allows the conditional variance to be present upon previous lags:

$$h_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, u_{t-i}^2 + \sum_{i=1}^{p} \beta_i \, h_{t-i}^2 \qquad (3)$$

In Equation (3), h_t^2 is the conditional variance of u_t.

The most general form of Generalized Autoregressive Conditional Heteroskedasticity, GARCH (1,1), is as follows:

$$h_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1}^2 \qquad (4)$$

Therefore, the index of the real exchange rate volatility is defined as the standard deviation of the conditional variance (h_t).

Thus, in this study, firstly, the exchange rate[1] behavior for each country is predicted by using the ARIMA model to determine the optimum lag. Then, correlation and heteroskedasticity tests are performed and the exchange rate volatility index is calculated using the GARCH (1,1) model. Eventually, the standard deviation of the variance equation is extracted as the real exchange rate volatility for each country.

3.3 Modeling and variables introduction

In order to investigate the relationship between remittances and exchange rate, according to Alberola et al. (1999), we assume that there are two countries in the world which are producing only two products: tradable good (T) and non-tradable good (N). The real exchange rate (q) is defined as the ratio of the price of domestic goods (p) to the price of foreign goods (p^*) in the consumption basket, and expressed in domestic currency as follows:

$$q = p - (s + p^*) \qquad (5)$$

where s is the logarithm of the nominal exchange rate, defined as the price of foreign currency in terms of the domestic currency. Therefore, an increase in q represents an appreciation of the real exchange rate. The consumer price index (CPI) for each country is a weighted-average of the tradable, non-tradable, and imported (tradable) prices, all expressed in their own currency:

$$p = (1 - \alpha_N - \alpha_T)p_T + \alpha_N p_N + \alpha_T(s + p_T^*) \qquad (6)$$

$$p^* = (1 - \alpha_N^* - \alpha_T^*)p_T^* + \alpha_N^* p_N^* + \alpha_T^*(p_T - s) \qquad (7)$$

Where αs are the weights of the respective goods in the consumer basket. Substituting equations (6) and (7) in (5), assuming that $\alpha_N = \alpha_N^*$, and by rearranging terms we obtain the following equation:

$$q = (1 - \alpha_T - \alpha_T^*)q_X + \alpha_N q_I \qquad (8)$$

Where q_x and q_I are the ratio of the price of domestic tradable goods to foreign tradable goods and the ratio of the price of non-trade goods to tradable goods, respectively, between countries.

$$q_X = [p_T - (s + p_T^*)] \qquad (9)$$

$$q_I = [(p_N - p_T) - (p_N^* - p_T^*)] \qquad (10)$$

The first component of equation (8) ($(1 - \alpha_T - \alpha_T^*)q_X$) captures the competitiveness of the economy and determines the evolution of the foreign asset position, while the second component ($\alpha_N q_I$) plays a basic role in adjusting demand surplus across sectors in the economy. Each relative price adjusts in order to achieve equilibrium in one of the markets, and thus q_x and q_I can be represented as the external and the internal relative prices, respectively. The exchange rate equilibrium ($\bar{q}$) requires a simultaneous equilibrium in both markets.

External Equilibrium

Portfolio models of real exchange rate determination focus on the equilibrium of assets that are defined as the access of agents to the foreign asset stock. In addition, the accumulation of net foreign assets (F) which is represented by the current account balance (CA) is equal to the trade balance (NX), plus net income of the residents receive on F, plus the net current transfer from abroad (T). For simplicity, we assume that the only transfer in this economy is the remittances (R). So we can write:

$$\Delta F = CA = XN + i^* F + T = CA = XN + i^* F + R \qquad (11)$$

where, i^* is the international interest rate, which we assume given. For convenience, we focus on

[1] In this study, the growth rate of the real exchange rate is used as the first difference of the logarithm of the exchange rate as follows:

$$\Delta \log(RER_t) = \log(\frac{RER_t}{RER_{t-1}})$$

the direction of the ratio of the foreign asset stock to GDP, which can be written:

$$\Delta f = ca = xn + (i^* - g)f + r \quad (12)$$

where, f, xn, and r are ratios of F, XN and R to GDP, and g is economic growth. If the Marshall-Lerner condition holds, an increase in the relative price of domestic tradable goods (q_x) will lead to a consumption shift toward foreign tradable goods and worsens the trade balance. According to this, a trade balance can be considered as a percentage of GDP (xn):

$$xn = -\gamma q_x \quad , \quad \gamma > 0 \quad (13)$$

The capital account deficit reflects the desired net foreign assets accumulation by the country of origin, which is assumed to depend on the difference between the current asset level (f) and the optimal equilibrium level ($\bar{f}$).

$$\Delta f = ca = a(\bar{f} - f) \quad , \quad \alpha > 0 \quad (14)$$

Equation (14) shows that if the actual position of net foreign asset is below its desired level, the agents will proceed to accumulate assets in order to reach the desired level. On the contrary, if f is greater than $\bar{f}$, the agents will reduce the asset holdings until they reach the desired level ($\bar{f}$). Regarding equations (12), (13), and (14) and rearranging them for q_x, we get:

$$q_X = \frac{a(f - \bar{f})}{\gamma} + \frac{(i^* - g)}{\gamma} f + \frac{1}{\gamma} r \quad (15)$$

Equation (15) shows that the external real exchange rate depends on (i) the difference between the equilibrium and current holding assets; (ii) the current stock of net foreign assets (f); and (iii) the ratio of remittances to GDP. Assuming f=$\bar{f}$, the external equilibrium of the real exchange rate ($\bar{q}_X$) is expressed as:

$$\bar{q}_X = \frac{(i^* - g)}{\gamma} \bar{f} + \frac{1}{\gamma} r \quad (16)$$

According to Equation (16), (i) improvement in the equilibrium of net foreign asset position ($\bar{f}$) leads to real exchange rate appreciation; (ii) increase in the global interest rate (i^*), also leads to real exchange rate appreciation; (iii) higher economic growth rate accompanied by a lower equilibrium real exchange rate, and (iv) increase in the ratio of remittances to GDP associated with real exchange rate appreciation.

Internal Equilibrium

The differential behavior of sectoral relative prices between countries determines the evolution of the internal real exchange rate. Industrial sector prices are in turn related to the evolution of its productivity. These notions can be illustrated using a simple model with two production factors, labor (L), and capital (K). Output in each sector is determined by a Cobb-Douglas production:

$$Y_N = A_N L_N^{\delta} K_N^{1-\delta} \quad , \quad \delta < 1 \quad (17)$$

$$Y_T = A_T L_T^{\theta} K_T^{1-\theta} \quad , \quad \theta > 0 \quad (18)$$

where, δ and θ represent the intensity of labor in each sector. The labor force is completely movable between the sectors of the economy (but not across countries), thus the nominal wage rate equals:

$$W_T = W_N = W \quad (19)$$

The value of the labor marginal product is paid to it ($\frac{dY_i}{dL_i} = \frac{W}{p_i}$). Under the Cobb-Douglas production function, the ratio of marginal productivity is equal to the ratio of average productivity:

$$\frac{dY_T/dL_T}{dY_N/dL_N} = \frac{\theta Y_T/L_T}{\delta Y_N/L_N} \quad (20)$$

According to (16), the logarithm of sectoral price differential is equal to the labor productivity differentials plus a drift capturing the relative intensity of labor. Thus, equation (20) reduces to:

$$\bar{p}_N - \bar{p}_T = \log\left(\theta/\delta\right) + [(y_T - y_N)] \quad (21)$$

By neglecting the constant part of equation (21) and taking into account $n = [(y_T - y_N) - (y_T^* - y_N^*)]$, the internal equilibrium exchange rate is as follows:

$$\bar{q}_I = \bar{n} \quad (22)$$

Therefore, in line with the arguments posed by Balassa (1964) and Samuelson (1964), the productivity differentials between the tradable and non-tradable goods sectors to the foreign country would also affect the real exchange rate evolution. In particular, the productivity achieved in the domestic tradable sector relative to the domestic non-tradable sector will lead to

real exchange rate appreciation.

Now, if the recipient country of remittances spends part of it on non-trade goods, the demand surplus will draw labor out of the export sector. According to (17) and (18) $\frac{dy}{dL} < 0$, it can be shown that the productivity of the non-tradable sector (y_N) decreases and the productivity of the tradable sector (y_T) will increase. That is:

$$(y_T - y_N) = \eta r \quad , \quad \eta > 0 \qquad (23)$$

As a result, the remittances will lead to real exchange rate appreciation in the internal real exchange rate.

On the whole, according to the above arguments, it can be expected that the remittances will affect both the internal equilibrium and the external equilibrium of the economy, and high rates of remittances would be accompanied by higher real exchange rates.

Within the framework of the research literature, the model of the present study which is used by Carrera and Restout (2008) and Amuedo-Dorantes and Pozo (2004) is as follows:

$$\begin{aligned} RER.vol_{it} = {} & \alpha_{0i} + \alpha_{1i} LRem_{it} \\ & + \alpha_{2i} LFDI_{it} + \alpha_{3i} LGS_{it} \\ & + \alpha_{4i} LTROP_{it} \\ & + \alpha_{5i} LTOT_{it} \\ & + \alpha_{6i} LRIR_{it} \\ & + \alpha_{7i} LGDPpc_{it} + u_{it} \end{aligned} \qquad (24)$$

where:

RER.vol: real exchange rate volatility of country i at time t;

LRem: remittances into country i at time t (US$);

LFDI: foreign direct investment into country i at time t (US$);

LGS: government spending in country i at time t (US$);

LTROP: trade openness of country i at time t (total exports and imports to gross domestic product);

LTOT: terms of trade in country i at time t (export price index to import price index);

LRIR: real interest rate in the United States (the index for real-world interest rates);

LGDPpc: gross domestic product per capita (a proxy for productivity) and

u_t: error term.

All variables are in form of a natural logarithm, except for the RER variable.

The real exchange rate (RER) is calculated as follows:

$$RER_i = NER_i \times \frac{CPI_{US}}{CPI_i} \qquad (25)$$

In equation (25), RER_i is the real exchange rate of country i, NER_i is the nominal exchange rate of country i, CPI_{US} is the US consumer price index, CPI_i is the consumer price index of country i.

3.4 Vector Auto-regression (VAR)

Sims (1980) introduced firstly the Vector Auto-regression model in order to reveal the co-integration between variables based on its own lag values and lag values within all the other variables. VAR models, which were applied to time series, were used for panel data by Holtz-Eakin, Newey and Rosen (1988) for the first time. Love and Zicchino (2006) used panel vector auto-regression methodology by combining the traditional VAR approach in which all the variables are considered internal and panel-data approach in which unobserved individual heterogeneity is included (Guris et al., 2016).

The important point in VAR models is the interpretation difficulties of the estimated coefficients. For this reason, the behavior of the Impulse Response Function (IRF) is investigated over time. The impulse response function shows the reaction of each of the endogenous variables of the model to an error term (Mohammadi, & Mahmoudi, 2017). Another structural analysis in vector autoregression models is Variance Decomposition (VD) that measures the contribution of each shock to the variance of the endogenous variables of the system (Sameti, et al., 2015).

3.5. Stability and Cointegration of Variables

In order to estimate the regression equation (20) and deduce the results, it is first necessary to examine the stationary of time series by performing unit root test. Unit root tests of panel data have several types, the most common ones are: Levin, Lin & Chu (LLC) test (2000), Im, Pesaran and Shin (IPS) test (2003), Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. The results of variables unit root tests are presented in Table 3.

Table 3. Panel Unit Root Test Results

Variables		LLC		IPS		ADF (Fisher)		PP (Fisher)		
		Statistic	Prob	Statistic	Prob	Statistic	Prob	Statistic	Prob	
RER.vol	Level	12.1235-	0.0000	12.1676-	0.0000	125.365	0.0000	146.625	0.0000	I(0)
	First diff.	-	-	-	-	-	-	-	-	
LRem	Level	1.1421-	0.1267	3.1658	0.9992	10.1129	0.9992	16.5329	0.9573	I(1)
	First diff.	15.9366-	0.0000	16.6471-	0.0000	272.545	0.0000	314.83	0.0000	
LFDI	Level	1.6826-	0.0462	0.2456	0.597	22.7379	0.746	26.9771	0.5195	I(1)
	First diff.	19.8238-	0.0000	21.4969-	0.0000	336.536	0.0000	409.961	0.0000	
LGS	Level	3.78221	0.9999	6.6883	1.0000	2.6781	1.0000	3.1156	1.0000	I(1)
	First diff.	16.9596-	0.0000	16.7137-	0.0000	264.7	0.0000	268.794	0.0000	
LTROP	Level	0.2825-	0.3888	1.7533-	0.0398	40.1515	0.0641	35.9978	0.1427	I(1)
	First diff.	17.3988-	0.0000	18.4913-	0.0000	304.833	0.0000	358.765	0.0000	
LTOT	Level	2.66-	0.0039	3.1671-	0.0008	52.637	0.0032	48.5087	0.0094	I(0)
	First diff.	-	-	-	-	-	-	-	-	
LRIR	Level	3.83468-	0.0001	2.3609-	0.0091	38.8801	0.0829	15.9173	0.967	I(0)
	First diff.	-	-	-	-	-	-	-	-	
LGDPpc	Level	2.2631	0.9892	4.6107	1.0000	7.3529	1.0000	6.8222	1.0000	I(1)
	First diff.	17.9856-	0.0000	17.6968-	0.0000	282.264	0.0000	293.106	0.0000	

Source: Authors

As it can be seen from Table 3, real exchange rate volatility, terms of trade, and real interest rate variables are stationary at level, but remittances, foreign direct investment, government expenditures, and gross domestic product per capita variables are stationary at first order which is so-called integrated of order one. Therefore, the variables don't have a non-stationary problem, and there would be no spurious regression.

In order to investigate the existence of the long-run equilibrium relation between economic variables in panel data models, co-integration tests such as Kao are used in many studies by researchers. In the Kao test, the null hypothesis is based on the absence of co-integration between variables. The results of this test are presented in Table 4.

Table 4. Kao Test Result

	t - Statistic	Prob
ADF statistic	-3.372612	0.000

Resource: Research Findings

As it can be seen in Table 4, the probability of ADF statistic is less than five percent, meaning that it is significant. Thus, due to the rejection of the null hypothesis, the Kao test confirms the co-integration of variables.

4. Model Estimation

In this section, after determining the optimum lag of the VAR model by using the AIC, SC and HQ criteria, the effect of explanatory variables on the real exchange rate volatility is investigated using structural analysis of IRF and VD. As it can be seen in Table 5, one period lag is selected as the optimum lag length.

Table 5. Lag Length Selection

Lag	AIC	SC	HQ
0	11.68378	11.78502	11.72434
1	7.708357-	*6.797214-	*7.343308-
2	7.928316-	6.207269-	7.238779-
3	8.185827-	5.654875-	7.171802-
4	8.359998-	5.01914-	7.021485-
5	*8.513135-	4.362374-	6.850134-

* Optimum lag length

Source: Authors

The results of the structural analysis of impulse response functions are shown in the set of graphs in Figure 2. The horizontal axis represents the number of lag periods of the shock and the vertical axis represents the response of relevant dependent variables to independent variable impact.

As it can be seen in Figure 2, the response of real exchange rate volatility to remittances shock is positive which indicates that a surge in remittances inflow to a country increase the income of the recipient families and it's followed by an increase in demand for non-trade goods; and as a result, the exchange rate increases. But over time, the intensity of remittances shock decreases and moves toward the long-run equilibrium. Foreign direct investment shock has a negative impact on the exchange rate and causes volatility in the real exchange rate, which it reaches the maximum value of the impulse response in the fourth period, and then decreases gradually. Also, government expenditures shock has a positive impact on the real exchange rate and lead to volatility in the exchange rate. On the other

side, the response of real exchange rate volatility to trade openness, terms of trade, GDP per capita and the real interest rate shocks is negligible. Thus, it can be concluded that the shocks resulting from the inflow of remittances, foreign direct investment, and government expenditures have the most impact on the real exchange rate and cause volatility in the real exchange rate compared to other variables of the studied countries.

As previously stated, the purpose of calculating the variance decomposition is to determine the contribution of each shock to the variance of the endogenous variables of the system. The shocks or impulses that exist in the vector auto-regression models, that are organized using Chulsky's decomposition, indicate that each variable which appears earlier in the model is the most endogenous variable and the rest of the variables are mostly exogenous. The results of the variance decomposition are presented in Table 6.

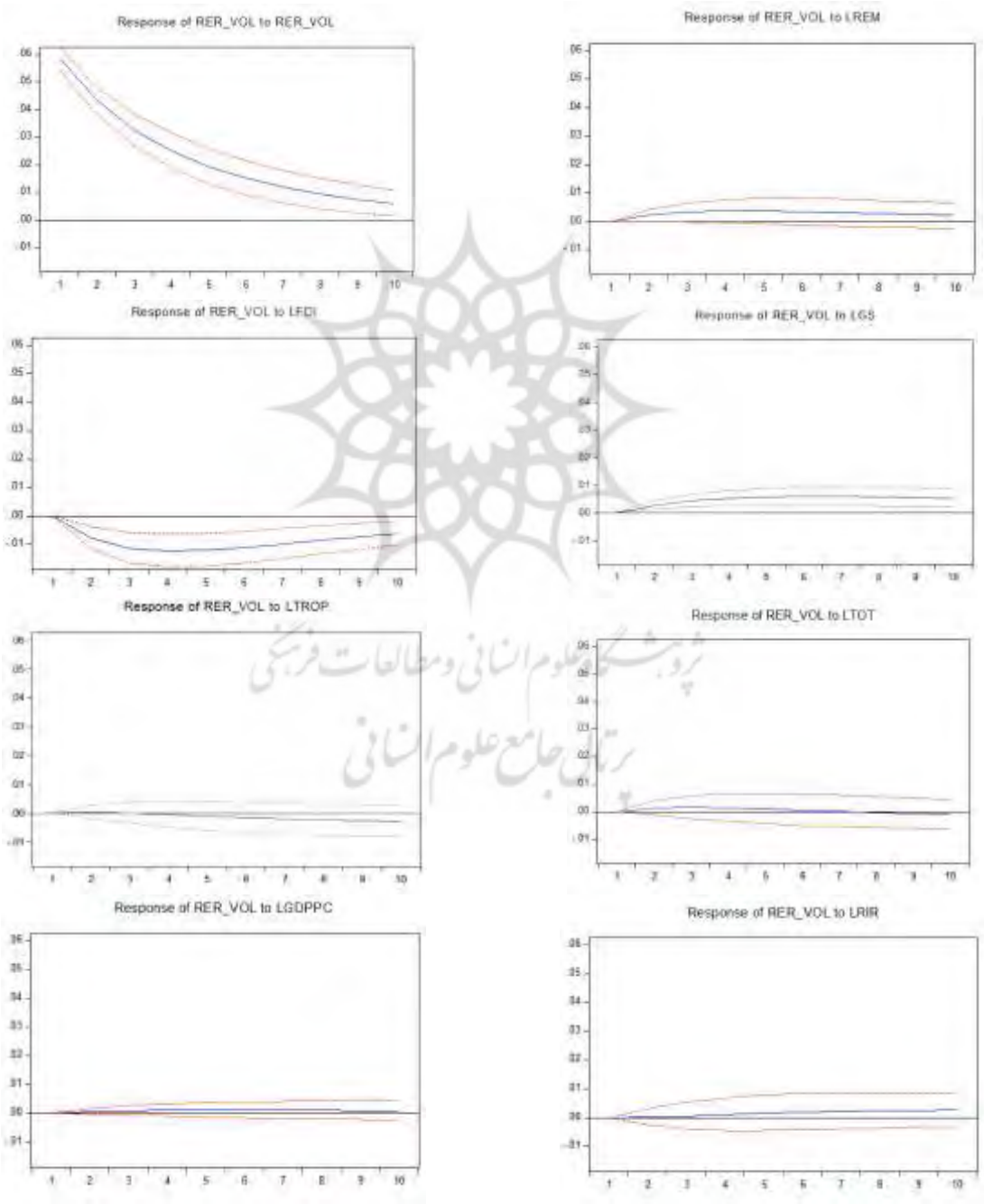

Figure 2. Impulse Response Functions

Source: Authors

Table 6. Variance Decomposition Results

Period	S.E.	RER.vol	LRem	LFDI	LGS	LTROP	LTOT	LRIR	LGDPpc
1	0.058438	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.073276	98.57233	0.106471	1.134460	0.145695	0.002146	0.032010	0.000344	0.006547
3	0.081256	96.35105	0.275891	2.862808	0.416403	0.001770	0.068040	0.004977	0.019064
4	0.086209	94.03270	0.455368	4.606881	0.754211	0.005171	0.091372	0.019415	0.034881
5	0.089505	91.93816	0.618171	6.104641	1.118807	0.020630	0.100677	0.047023	0.051892
6	0.091786	90.16697	0.754339	7.282689	1.485167	0.053144	0.100854	0.088190	0.068643
7	0.093404	88.71431	0.862704	8.157841	1.838750	0.103454	0.097772	0.140957	0.084214
8	0.094576	87.53665	0.946003	8.780548	2.171616	0.169019	0.096059	0.202030	0.098080
9	0.095440	86.58292	1.008303	9.207205	2.479889	0.245452	0.098550	0.267682	0.110002
10	0.096090	85.80692	1.053759	9.488510	2.762204	0.327784	0.106485	0.334395	0.119939

Source: Authors

The columns of Table 6 show the percentage of prediction variance as a result of various shocks. As the number of periods increases, the share of other explanatory variables increases. The results show that in the first period, 100 percent of the real exchange rate volatility is explained by its own disruptions. In the subsequent prediction, the variance of the real exchange rate volatility is gradually reduced by its own disruptions, and the share of the other variables' disruptions gradually increases. In the other words, when the length of a period increases, the effect of independent variables increases in the explanation of the exchange rate volatility. At the end of the tenth period, about 85 percent of real exchange rate volatility was caused by its own shock, while the share of remittances shock is 1.05% of the total shock. In addition to remittances, the share of the other variables' shocks which include foreign direct investment, government expenditures, trade openness, terms of trade, real interest rate and GDP per capita are 9.49%, 2.76%, 0.33%, 0.11%, 0.33%, and 0.12 %, respectively, of the forecast error variance over the long-run. In the meantime, remittances, foreign direct investment, and government expenditures shocks make the most volatility in real exchange rates compared to other variables shocks. Among these variables, foreign direct investment shock has the highest share of the total shock and disruptions the exchange rate and therefore lead to exchange rate volatility.

5. Conclusion

Remittances are one of the largest financial inflows to developing countries, which can lead to financial and macroeconomic stability in the recipient countries. But a significant increase in such financial inflows into countries may lead to financial system fragility and undesirable changes in the exchange rate. Given that many emerging and developing economies are vulnerable to volatilities and changes in capital flows, they may face sudden changes in the exchange rate. These sudden changes in the exchange rate can affect the growth by declining investment, volume of trade, and profitability. Therefore, in general, the inflow of capital to the country is accompanied by an increase in real exchange rates.

Thus, the present study examined the effect of influential factors on the real exchange rate volatilities with emphasis on remittances in selected developing countries over the period 1980-2017. The authors of the present study estimated the model by using GARCH and Panel VAR approaches for selected developing countries. According to the analysis of impulse response functions and variance decomposition, shocks caused by remittances lead to real exchange rate appreciation of the studied countries and cause volatility of the real exchange rate so that with an increase in the remittances inflow to countries, household income level rises and it followed by a surge in demand for non-trade goods. As a result, demand surplus will lead to higher exchange rates which can be imagined similar to the "Dutch disease" phenomenon.

By comparing the results of the current study with others, it can be concluded that the results are in line with the studies of Amuedo-Dorantes and Pozo (2004), Lopez, et al. (2007), Acosta et al. (2009) and Hassan and Holmes (2012). That is, mean remittances had a positive effect on the real exchange rate. In addition, foreign direct investment and government expenditures also play a significant role in the volatility of the real exchange rates in the studied countries, which impacts on the real exchange rate are negative and positive respectively. On the other hand, other variables including terms of trade, trade openness, real

interest rate, and gross domestic product per capita don't have a significant effect on the real exchange rate volatilities. Now, by knowing the factors and variables that impact the real exchange rate and cause volatility in it, they can be limited or controlled to reduce or eliminate the real exchange rate volatilities. We have to keep in mind that some of these variables which have appeared in the exogenous form are actually endogenous. By using and analyzing the endogenous form of them, we can make a better decision about influential factors, which another study is needed to investigate this issue. Therefore, it is suggested that to prevent the exchange rate volatilities, it is necessary to provoke the direction of financial and capital flows, such as remittances and FDI, according to the economic situation towards tradable and non-tradable sectors of the economy. For example, if a tradable sector of an economy is weaker than the non-tradable sector, it requires some motivating tools, to attract remittances, FDI, and such financial funds towards tradable sectors. Additionally, these findings can be helpful for other developing and growing economies

.

Notes

1. Studied countries are chosen due to data limitations for 38 years.

2. The total inflows of remittances to studied countries are US$ 99 billion in 2016, which is very significant.

3. By considering the internal and external equilibrium of the exchange rate, the existence of the relationship between the remittances and the exchange rate was recognized.

4. Estimating the real exchange rate volatility by obtaining the standard deviation of variance equation for each of the countries through the GARCH method.

5. Contributions of influential factors on the volatility of the real exchange rate are presented in Table 6.

6. Results can be generalized to other developing countries due to their structural similarities and a significant increase in remittances flows into those countries.

Disclosure Statement

No potential conflict of interest was reported by the authors of the present study.

References

1. Acosta, P. A., Baerg, N., & Mandelman, F. S. (2009). Financial Development, Remittances and Real Exchange Rate Appreciation. *Journal of Economic Review*, 94(1), 1-12.
2. Acosta, P. A., Calderon, C., Fajnzylber, P., & Lopez, H. (2007). What is the Impact of International Remittances on Poverty and Inequality in Latin America? *Journal of World Development* 36(1), 89-114.
3. Afonso, A., & Furceri, D. (2008). *Government Size, Composition, Volatility, and Economic Growth*. European Central Bank, Working Paper No. 849.
4. Ahmed, J., Zaman, K., & Shah, I. A. (2011). An Empirical Analysis of Remittances-growth Nexus in Pakistan Using Bound Testing Approach. *Journal of Economics and International Finance*, 3(3), 176-186.
5. Ajao, M. G., & Igbekoyi, O. E. (2013). The Determinants of Real Exchange Rate Volatility in Nigeria. *Academic Journal of Interdisciplinary Studies*, 2(1), 459-471.
6. Alberola, E., Cervero, S. G., Lopez, H., & Ubide, A. (1999). *Global Equilibrium Exchange Rates: Euro, Dollar, 'Ins,' 'Outs' and other Major Currencies in a Panel Cointegration Framework*. IMF, Working Paper No. 175, International Monetary Fund, Washington, DC.
7. Amuedo-Dorantes, C., & Pozo, S. (2004). Workers' Remittances and the Real Exchange Rate: A Paradox of Gifts. *Journal of World Development*, 32(8), 1407–1417.
8. Bakardzhieva, D., Naceur, S. B., & Kamar, B. (2010). *The Impact of Capital and Foreign Exchange Flows on the Competitiveness of Developing Countries*. International Money Fund (IMF) Working Paper No. 10/154.
9. Barajas, A., Chami, R., Hakura, D. S., & Monteil, P. (2010). *Workers' Remittances and the Equilibrium Real Exchange Rate: Theory and Evidence*. Working Paper 287, International Money Fund.
10. Barrett, K. (2013). *The Effect of Remittances on the Real Exchange Rate: The Case of Jamaica*. Caribbean Centre for Money and Finance, Working Paper.
11. Bayangos, V., & Jansen, K. (2011). Remittances and Competitiveness: The Case of the Philippines. *Journal of World*

Development, 39(10), 1834–1846.
12. Benita, G., & Lauterbach, B. (2007). Policy Factors and Exchange Rate Volatility: Panel Data versus a Specific Country Analysis. *International Research Journal of Finance and Economics*, 7(1), 7-23.
13. Broda, C. (2004). Terms of Trade and Exchange Rate Regimes in Developing Countries. *Journal of International Economics*, 63(1), 31-58.
14. Calderon, C. (2004). *Trade Openness and Real Exchange Rate Volatility: Panel Data Evidence*. Central Bank of Chile, Working Papers No. 294.
15. Canales-Kriljenko, J. I., & Habermeier, K. (2004). *Structural Factors Affecting Exchange Rate Volatility: A Cross-Section Study*. International Money Fund (IMF) Working Paper No. 04/147.
16. Cariolle, J. (2012). *Measuring Macroeconomic Volatility: Applications to Export Revenue Data, 1970-2005*. Foundation pour les etudes et recherchés sur le developpment international. Working paper No. I14.
17. Carrera, J. E., & Restout, R. (2008). *Long Run Determinants of Real Exchange Rates in Latin America*. GATE Working Paper No. 08-11.
18. Chowdhury, M. B. (2011). Remittances Flow and Financial Development in Bangladesh. *Journal of Economic Modeling*, 28(6), 2600-2608.
19. Chowdhury, M. B., & Rabbi, F. (2014). Workers' remittances and Dutch Disease in Bangladesh. *The Journal of International Trade and Economic Development*, 23(4), 455-475.
20. Combes, J., Kinda, T., & Plane, P. (2011). *Capital Flows, Exchange Rate Flexibility and the Real Exchange Rate*. Working Paper WP/11/9, International Money Fund.
21. Devereux, M. B., & Lane, P. R. (2003). Understanding bilateral exchange rate volatility. *Journal of International Economics*, 60(1), 109–132.
22. Dominguez, K. M., Fatum, R., & Vacek, P. (2013). Do sales of foreign reserves lead to currency appreciation? *Journal of Money, Credit and Banking*, 45(5), 867–890.
23. Ganguly, S., & Breuer, J. B. (2010). Nominal exchange rate volatility, relative price volatility, and the real exchange rate. *Journal of International Money and Finance*, 29(5), 840–856.
24. Gente, K., & Leon-Ledesma, M. A. (2006). Does the world real interest rate affect the real exchange rate? The south East Asian experience. *The Journal of International Trade & Economic Development*, 15(4), 441-467.
25. Giannellis, N., & Papadopoulos, A. P. (2011). What causes exchange rate volatility? Evidence from selected EMU members and candidates for EMU membership countries. *Journal of International Money and Finance*, 30(1), 39–61.
26. Griffoli, T. M., Meyer, C., Natal, J., & Zanetti, A. (2015). Determinants of the Swiss Franc real exchange Rate. *Swiss Journal of Economics and Statistics*, 151(4), 299-331.
27. Guris, S., Caglayan-Akay, E., Cakir-Zeytinoglu, F., Sacakli-Sacildi, I., & Sadic, C. (2016). The effect of tourism investments on tourism income in Turkey: Panel VAR approach. *European Scientific Journal*, 12(35), 59-72.
28. Hassan, G. M., & Holmes, M. J. (2012). *Remittances and the Real Effective Exchange Rate*. Department of Economics, University of Waikato.
29. Insah, B., & Chiaraah, A. (2013). Sources of real exchange rate volatility in the Ghanaian economy. *Journal of Economics and International Finance*, 5(6), 232-238.
30. International Money Fund (2009). *Balance of Payments and International Investment Position Manual (2009)*. Sixth Edition, Appendix 5: Remittances. Washington, DC.
31. Izquierdo, I., & Montiel, P. (2006). *Remittances and Equilibrium Real Exchange Rates in Six Central American Countries*. Williams College.
32. Kanas, A. (2002). Is exchange rate volatility influenced by stock return volatility? Evidence from the US, the UK and Japan 9. *Journal of Applied Economics Letters*, 9(8), 501-503.
33. Kapur, D. (2005). *Remittances: The New Development Mantra?* In S. Maimbo and D. Ratha (Eds.), Remittances: Development Impact and Future Prospects. Washington DC: The World Bank.
34. Keefe, H. G. (2014). *The Impact of*

Remittance Inflows on Exchange Rate Volatility: The Importance of Dollarization and development. Department of Economics, Fordham University New York.
35. Kosteletou, N., & Liargovas, P. (2000). Foreign Direct Investment and Real Exchange Rate Interlinkages. *Journal of Open Economies Review*, 11(2), 135–148.
36. Lartey, E. K. K. (2007). Capital inflows and the real exchange rate: An empirical study of sub-Saharan Africa. *The Journal of International Trade and Economic Development*, 16(3), 337-357.
37. Lopez, H., Molina, L., & Bussolo, M. (2007). *Remittances and the real exchange rate*. World Bank, Bank of Spain, Working Papers No. 4213.
38. Manafy-Anvar, V., Khodadad-Kashi, F., Biyabani, J., & Pasban, F. (2015). Determinants of real exchange rate changes and its impact on competitiveness in Iran's Economy (1979-2014). *Quarterly Journal of Economics*, 9(32), 1-23.
39. Mohammadi, H., & Mahmoudi, M. (2017). Investigating the impact of interest rates and selected variables of macroeconomics in Islamic and non-Islamic countries. *Quarterly Journal of Economic Modeling Research*, 7(28), 103-138.
40. Obstfeld, M., & Rogoff, K. (1998). *Risk and Exchange Rates*. NBER Working Paper No. 6694.
41. Rao, B. B., & Hassan, G. M. (2011). A panel data analysis of the growth effects of remittances. *Journal of Economic Modelling*, 28(1-2), 701-709.
42. Sameti, M., Sameti, M., & Molaesmaeili-Dehshiri, H. (2015). Analysis of the role of legal structure and security of property rights in attracting foreign direct investment with P-VAR approach: Oil exporting countries. *The Journal of Economy Policy*, 6(12), 155-177.
43. Vaaler, P. (2011). Immigrant remittances and the venture investment environment of developing countries. *Journal of International Business Studies*, 42(9), 1121-1149.
44. Yang, D. (2011). Migrant Remittances. *Journal of Economic Perspective*, 25(3), 129-152.