THE EFFECT OF REMITTANCE INFLOWS ON REAL EXCHANGE RATE: THE CASE OF CIS COUNTRIES

By

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Abstract

In this thesis, I analyze the effect of remittances on real effective exchange rate in the case of Commonwealth Independent States (CIS). Over past decade remittances have been growing drastically in the CIS and have become an important source of financial inflows. I test whether high remittance inflows lead to appreciation of real exchange rate, which is one of characteristics of the Dutch disease. Panel data for seven CIS countries over the time period 2004-2018 is investigated using OLS fixed-effects and 2SLS with instrumental variables. The findings suggest that there is a significant and positive effect of remittances on the real exchange rate. Workers' remittances cause Dutch disease effect.

Keywords: Remittances, Real Effective Exchange Rate, Appreciation, Dutch Disease

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List of Abbreviations

ADF	Augmented Dickey-Fuller
CIS	Commonwealth of Independent States
FDI	Foreign Direct Investment
LMIC	Low- and Middle-Income Countries
IMF	International Monetary Fund
REER	Real effective exchange rate
VAR	Vector Autoregressive
WBI	World Bank Indicators

Introduction

In recent years, the relationship between remittances and macroeconomic development of a country has been subject to extensive inquiry yet the debate still remains inconclusive. Literature on the effect of remittances indicates that at the country level higher remittances inflow is associated with lower level of poverty and higher growth rates (Adams et al. 2005; Acosta et al. 2012). Steady flow of remittances can reduce volatility in income, which leads to improvement in social indicators since income volatility and growth are inversely correlated (Hassan and Homes, 2014). Another effect of remittances inflow is an improvement of financial sector by easing the credit constraint on investment (Hassan and Homes, 2014). On the other hand, the magnitude of flows relative to the size of receiving economies implies that remittances can also usher in a number of challenges. Although inflows ease external financing constraints and therefore hold the potential for higher investment by developing countries, a high level of remittances can impact macroeconomic stability (Amuedo-Dorantes and Pozo 2004; Lopez et al 2007; Bourdet and Falck 2006) by being a huge capital inflow and, in the worst case, may facilitate the emergence of the Dutch disease[1]. To sum up, the effect of remittances appears to be ambiguous at best.

Commonwealth of Independent States (CIS) countries became a part of international labor in 1991 when the Soviet Union collapsed. Starting from that, a large number of people started to migrate to seek better living conditions, in particular, workers were attracted by higher salaries. A sample of destination countries is big, but the focus of

[1] International Monetary Fund's World Economic Outlook 2005 and Work Bank's Global Economic Prospects,2006

migrants from CIS were Russia and Kazakhstan. Such a situation arises mostly due to the following reasons: no visa requirements to pass through the border for the CIS citizens, low costs of emigration as well as shared language of communication.

The sample of countries analyzed in this research are Armenia, Belarus, Georgia, Kyrgyzstan, Moldova, Tajikistan and Ukraine. Although Armenia, Belarus, Georgia exited the CIS agreement in 2009, they still share a set of socio-economic characteristics pertaining to the region as a whole. Turkmenistan and Uzbekistan are excluded from the sample due to the lack of relevant data. Russia and Kazakhstan are not included in the sample since these countries do not receive but rather send a substantial amount of remittances. CIS countries (a sample of 7 countries) have been exhibiting the common trend over the past 15 years – a high migration outflow and consequently a large amount of remittances inflow. The value of international remittances to these 7 countries has increased from 693.74 mln USD in 1997 to 24213 mln USD in 2017, or in other words increased more than thirtyfold during the period. According to the Migration and Remittances Factbook (2014), Tajikistan, Kyrgyzstan, Moldova and Armenia occupy 1st, 2nd, 5th, and 11th positions respectively in the ranking of countries with regards to the remittance-to-GDP ratio. In the sample, countries' remittances-to-GDP range from 1.5% in Belarus to 41.7% in Tajikistan for the year 2014.

For some countries, remittances as a source of financial inflows exceed other inflows such as FDI or foreign aid. Based on the existing literature, remittances are viewed as a stable source of external financing; the 2008 financial crisis serves as evidence (O'Hara

et al, 2009). A reduction in the value of remittances of 20% in 2008 is lower than the 54% decline in the value of FDI.

Remittances sent by migrant workers to their home countries correspond to a capital inflow similar to that analyzed by the Dutch disease theory. Capital inflow is assessed against the effects of new discoveries on exchange rate and the country's competitiveness (Corden and Neary, 1982). Remittances inflow can put pressure on the real exchange rate due to an increase in demand for local currency since remittances are usually received in foreign currency. Therefore, it seems important to analyze and regulate the effect of remittances inflow on real exchange rate. This research investigates whether an increase in international remittance inflows is associated with appreciation of the local currency.

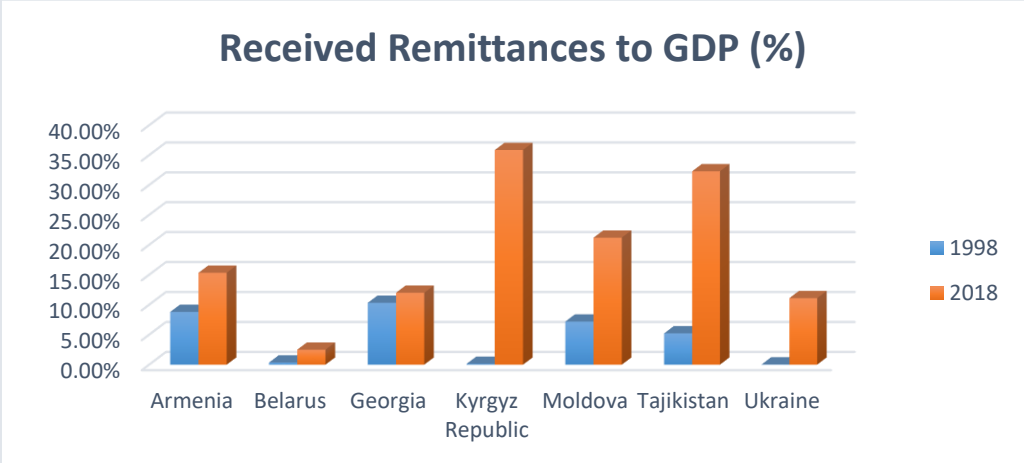
Long panel data consisting of the sample of 7 countries and 15 years as the time period is analyzed using OLS fixed-effects model. Fixed-effects model is applied to capture any unobserved country-specific effects in the series. Moreover, 2SLS estimation model with instrumental variables is implemented to deal with a potential endogeneity problem. The analysis indicates that workers' remittances sent from abroad lead to the appreciation of the real exchange rate.

The paper is organized as follows. The following section provides an overview and briefly describes the trend of remittance inflows to the region. The third section provides a background on the macroeconomic development of countries as well as reviews the existing literature on the effect of remittances on exchange rate. The fifth section outlines the theory and is followed by description of data and methodology. Finally, results of the empirical testing of the theory are discussed. The final section concludes.

1. Trends in Remittance Inflows

There is an ongoing growth of migration in the CIS countries leading to high levels of remittances that are sent to the region. Remittance flows to low- and middle-income countries (LMICs) reached $528 billion in 2018, an increase of 10.8 percent over 2017. According to O'Hara's et al. (2009), remittance inflows are the crucial source of financing the huge external trade deficits in Armenia, Georgia, Kyrgyzstan, Moldova and Tajikistan. The figure 1 compares magnitude of remittances inflow in 1998 to the flows experiences after 20 years later for the sample of CIS countries. For example, while workers' remittances in Kyrgyz Republic amounted to 0.13 % in 1998, they had grown to 35.1 % by 2018. The upward trend is also observed in Moldova: the share of remittances to GDP increased from 7.19 % in 1998 to 20.5 % in 2018.

Figure 1. Received remittances as a share of GDP



Source: estimated based on the data by national statistical committees of countries

Additional evidence of the increasing importance of workers' remittances is displayed in Table 1. Remittances inflows are significantly larger than foreign direct

investment (FDI) in CIS countries. Table 1 compares the size of remittances inflows against another source of capital flows, foreign direct investment.

Table 1. Remittances inflows to GDP and Foreign Direct Investment inflows to GDP (both given in percentage).

Country	Capital inflows	2016	2017
Armenia	Remittances received	13.1	13.3
	Foreign Direct Investment	3.2	2.2
Belarus	Remittances received	2.0	2.3
	Foreign Direct Investment	2.6	2.3
Georgia	Remittances received	10.6	11.9
	Foreign Direct Investment	10.9	12.1
Kyrgyz Republic	Remittances received	29.3	32.9
	Foreign Direct Investment	9.1	-1.4
Moldova	Remittances received	21.5	20.2
	Foreign Direct Investment	1.4	2.0
Tajikistan	Remittances received	26.9	31.3
	Foreign Direct Investment	3.5	1.5
Ukraine	Remittances received	10.1	10.8
	Foreign Direct Investment	3.7	2.5

Source: World Bank Indicators

The main destinations for migrants from many CIS countries are Russia and Kazakhstan. A share of remittances which come from Russia and Kazakhstan is quite substantials. According to the Central Bank of Russian Federation, there is an increasing

trend of remittances outflow from Russia to CIS countries; inflow has increased from $4673 million in 2006 to $7003 million in 2017. The same pattern is observed regarding the remittances outflow from Kazakhstan to CIS. Kazakhstan sent $100 million to CIS in 2000 and $3400 million in 2017. The share of remittances, which come from Russia and Kazakhstan to CIS countries, is large and varies from 60 to 90 percent of total inflows, except for Moldova. Moldova has received 32 percent of its total remittances from Russia (Central Bank of Moldova) in 2017, and the remaining part of the remittances – from non-CIS countries (mostly from Italy, USA, Germany and Romania).

Russian Federal Migration Service data indicates that, on average, 367 thousand citizens of Tajikistan, and 134 thousand citizens of Kyrgyzstan had permission to work in the Russian Federation during 2010-2014. However, O'Hara et al. (2009) show that the statistic is likely not to be fully reflective of the real situation. An important factor that should be considered in the analysis is a difference between official estimated numbers of migrants and unofficial approximations. According to the estimation of Russian official services, the number of migrant workers from CIS was 270 thousand in 2008. However, estimations attempting to account for illegal immigration indicate approximately 7.3 million migrants (O'Hara et al., 2009).

2. Correlation between Remittances and Real Exchange Rate in CIS countries

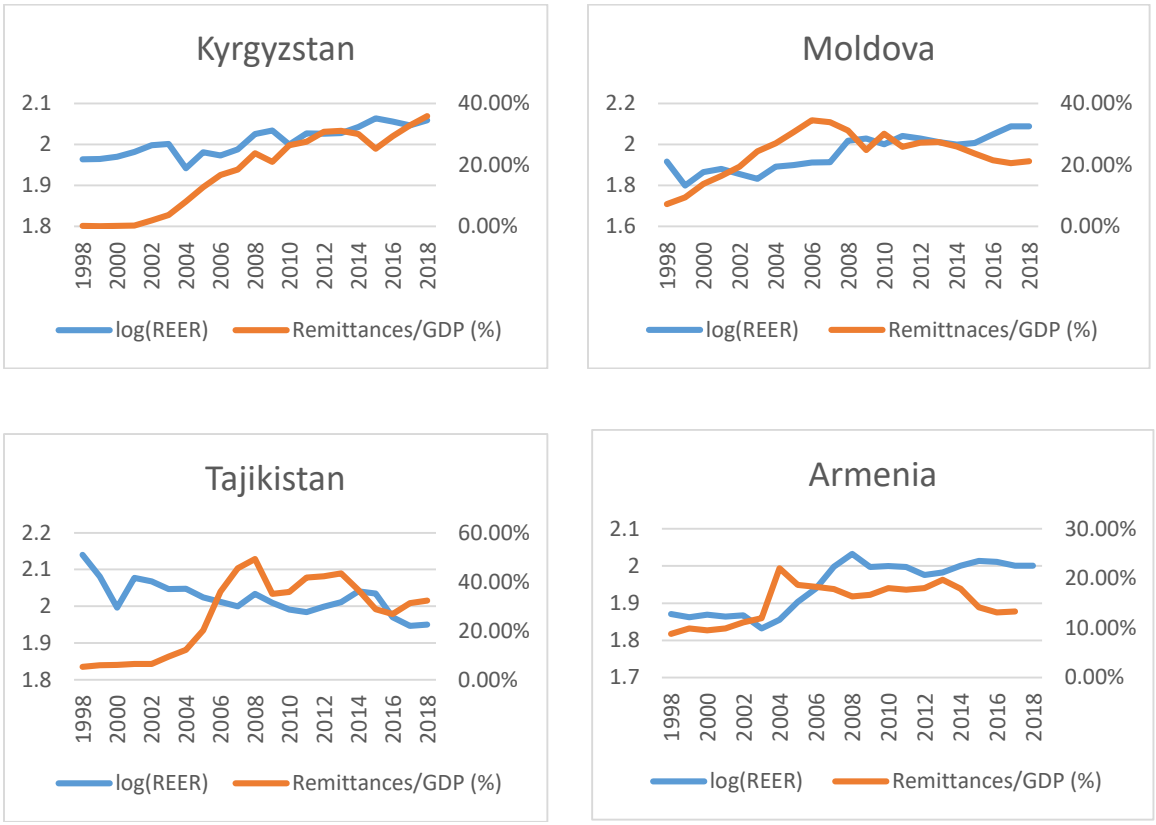
According to previous studies, there is exists a positive relationship between remittances and the real exchange rate for developing countries (Bourdet and Falck. 2006; Vargas-Silva 2009) . The key difference of CIS countries and the other low-income countries is that most remittances come from Russia, in contrast to other low-income countries in which the sources of remittances are usually advanced economies. Remittance outflows from Russia behave rather differently than those from developed countries. For instance, the former increased by a factor of 2.6 during the boom years (2004 to 2008), whereas the remittances from the US to the rest of the world experienced a surge 58% (IMF, 2006).

Figure 2 shows the preliminary evidence of real exchange appreciation following an increase in remittance inflows for selected countries. Kyrgyzstan, and Moldova are Tajikistan are among the top ten remittance receivers (percentage of GDP) in the world (Appendix, Figure 1) and the positive correlation between main variables is more revealed for them.

Kyrgyzstan has adopted the floating exchange rate policy with no pre-determined path for the exchange rate. The policy makes it possible to respond promptly to the problems arising from having to adapt to changes on world markets. An adoption of the floating exchange rate system means that the exchange rates of foreign currencies against the national currency are based on the supply and demand on the domestic currency market. The National Bank of the Kyrgyz Republic, without interfering directly in the process of setting exchange rates, fixes the rate that was set on the free market. Bank of Moldova

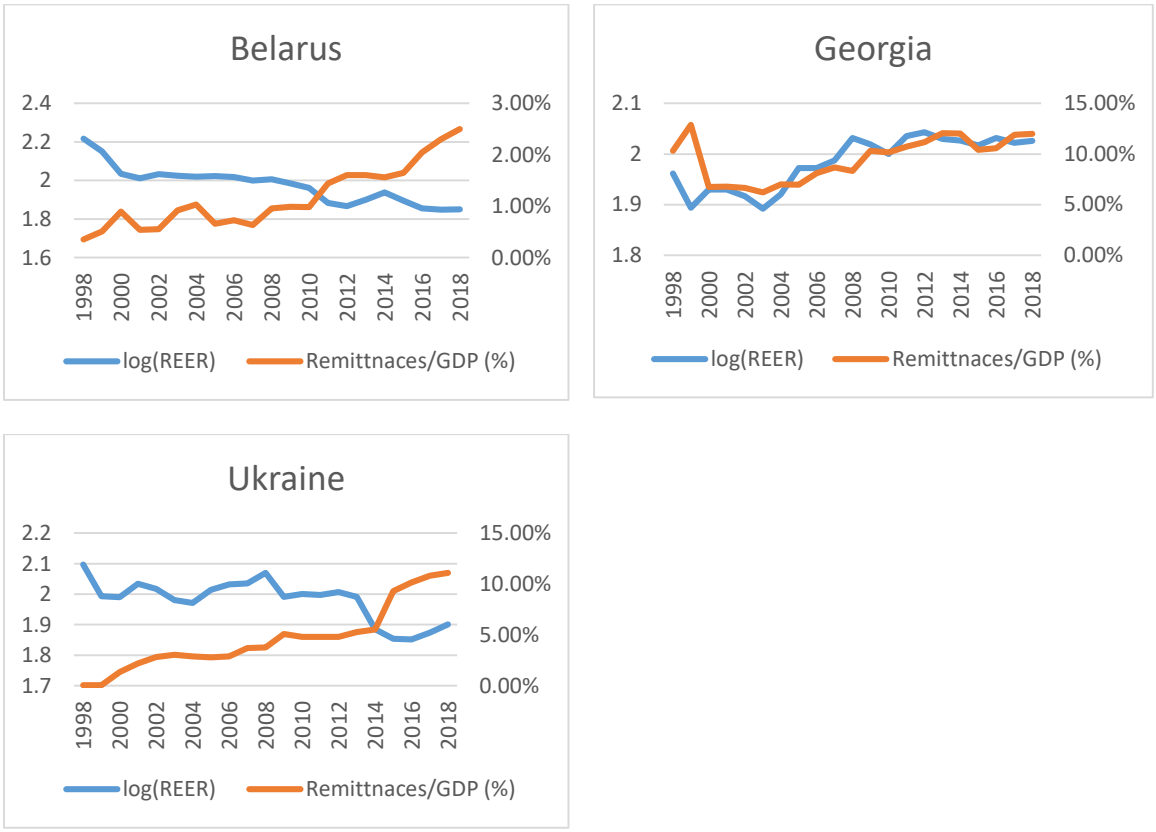
continues to maintain a floating exchange rate regime and establishes the official exchange rate of its national currency against USD based on the exchange rates prevailing in the domestic foreign exchange market. Tajikistan is also assumed to have maintained a floating exchange rate regime; however, the IMF (2016) classified the de-facto exchange rate regime to the category of "other managed arrangement".

Figure 2. Remittances and real effective exchange rate evolution for CIS countries



Source: International Monetary Fund (2018) and World Bank (2018)

Figure 2. Remittances and real effective exchange rate evolution for CIS countries (cont.)



Source: International Monetary Fund (2018) and World Bank (2018)

Remittances are a critical source of foreign inflow for Armenia and the country is among the 15 largest remittances recipients in the world. Regarding the exchange rate regime – Armenia has a free floating exchange rate policy with inflation targeting framework. Choosing the free floating regime gives an opportunity to the economy to soften the crises. Free floating exchange rate provides a certain degree of flexibility in monetary policy, regulates the exchange rate a lot more quickly than the prices and allows the country to avoid speculative attacks.

Figure 2 does not show a clear relation between remittances and the real exchange rate for Belarus and Ukraine. The economy of Belarus has a high degree of openness to

foreign trade. The exchange rate policy is fixed which eliminates exchange rate risks and stimulates increases trade and investment. Fixed exchange rate regimes provide greater certainty for exporters and importers and can exert a strong discipline on domestic firms and employees to keep their production costs under control to remain competitive in international goods markets. This argument is especially important for an open economy such as Belarus. Another potential benefit of a fixed exchange rate regime is that by providing a stable foreign value of the currency, the country might lower risk for international investors and thus encourage capital inflows. Ukraine implemented flexible exchange rate, which was later formalized within the framework of inflation targeting. Ukraine's economy is highly dollarized; hence the regime being implemented is indeed applicable.

Georgia has a floating exchange rate regime which is characterized by short-term fluctuations of the exchange rate and its capacity to absorb shocks. In the long run, the exchange rate is stable and is formed on the foreign exchange market. The National Bank of Georgia very mildly intervened with reserves in the foreign currency market to smooth the depreciation path.

For the low-income countries of CIS that are experiencing debt overhang and difficulties attracting foreign direct or financial investors, or are otherwise constrained in production by their inability to import materials, the contribution of remittances to economic expansion is crucial. As shown in the above figure, there is a positive correlation between remittances and real exchange rate for CIS countries. However, it is premature to make too much of the correlation between remittances and exchange rate without

controlling for other factors. The estimation and results section of this paper clarifies whether this relationship can be generalized and whether the correlation remains significant after controlling for other macroeconomic variables as well as accounting for endogeneity.

3. Literature Review: Theory on Dutch Disease

Worker's remittances are considered as a significant source of external financing for developing countries over past decades; however, such trend raises concerns about the potential costs that large sum of private transfers might inflict on receiving countries' economies. It's assumed that remittances acting like official foreign aid and resource windfalls can lead to the "Resource Curse" problem which inflicts slow growth. Examples of such phenomenon are natural gas in the Netherlands, oil in Norway and minerals in Australia; financial inflows came with the shrinking of manufacturing sectors. However, the effect of remittances differs from public transfers' effect. Workers' transfers imply no direct fiscal channel; they exert the resource curse only within the Dutch disease theoretical framework. In other words, the effect of capital inflows is traced through their effect on real exchange rate.

More precisely, theory tells that large inflows of capital can lead to appreciation of the real exchange rate and thus, to deterioration of a country's trade competitiveness. It's assumed that additional income in the form of remittances is mostly consumed on non-tradable goods and services. If such funds were otherwise channeled through investment, the real exchange rate appreciation would be attenuated or even disappear (Acosta et al., 2012 and Lopez et al.,2007).

Upward pressure on the exchange rate harms tradable sector, which can be explained by mechanism demonstrated in the Salter-Swan-Conder-Dornbusch model. The main assumption of the model is that prices for tradable goods are exogenously determined. The main idea of the model is related to "spending effect": an increase in remittances is

equivalent to an increase in income of households. This positive income shock results in extra spending on both tradable and non-tradable goods and services. These higher prices lead to expansion in the non-tradable sector (Lopez et al. 2007 and Corden et al 1982). an increase in the price of non-tradable sector relative to the prices of tradable translates into real exchange rate appreciation.

The neoclassical theoretical framework assumes that prices for tradable goods are equalized across countries, and changes in real exchange rate rise only from movements in the prices of non-tradable sector. Real effective exchange rate (REER) can be defined as a relative price of traded goods to non-traded goods in the domestic economy such that:

$$REER = \frac{P_t}{P_{nt}}$$

where P_t is the domestic currency price index of traded goods and P_{nt} is the domestic currency price index of non-traded goods (Montiel, 1999). A fall in the REER implies a real exchange rate appreciation and an increase in the opportunity cost of the production of tradable goods (Bourdet and Falck, 2006). An appreciation of the real exchange rate leads to deterioration of the country's external competitiveness, given unchanged relative prices of trading partners.

Moreover, the relative price change between tradable and non-tradable goods makes production in the latter more profitable – this is a "resource movement effect'. Output growth in the non-tradable sectors will push up factor demands, especially for those factors used intensively in these sectors. Resources from the tradable sector move to the non-tradable sector which might have a negative impact on tradable sector and its shrinking

(Ozcan,2011). Both the spending effect and the resource movement effect put upward pressure on the local currency.

The empirical literature on the effect of remittances on real exchange rate is still growing and different methods are used to estimate the correlation. Some studies (Saadi-Sedi et al., 2006; Bourdet et al. 2006, and Hyder et al., 2005) focus on country-specific analysis while others use panel data approach (Amuedo-Dorantes and Pozo 2004).

Most of the studies utilizing country-specific analysis implement cointegrating equations and vector autoregressive (VAR) models. The research by Bourdet and Falck (2006) on Cape Verde estimated the macroeconomic impact of remittances on the real exchange rate using cointegration equation and constructing a long-run equilibrium REER. The conclusion is that remittances give rise to a sort of Dutch disease effect and have adverse effect on competitiveness of tradable sector, however, the magnitude of this effect is small in comparison with the effect of foreign aid.

Hyder and Mahboob (2005) used cointegration technique to estimate the effect of remittances on the real effective exchange rate and found evidence for real exchange rate appreciation as a result of the increase in remittances in Pakistan during the period 1978-2005. They concluded that volatility in REER tend to be smaller in the countries with flexible exchange rate regimes compared to others. The same result, namely appreciation of currency, is obtained by Saadi-Sedi and Petri (2006) for Jordan over 1964-2005.

In stark contrast to inquiries summarized above, the study by Izquierdo and Montiel (2006) found inconclusive results for six Central American countries over the period 1960-2004 using VAR estimation technique. According to their research, remittances do not

have any effect on the REER in countries with large amounts of remittances (Honduras, Jamaica and Nicaragua). Remittances lead to depreciation of the real exchange rate in Dominican Republic and lead to real appreciation in El Salvador. Still, the results may be attributed to the methodology and country-specific characteristics.

There are also studies that use panel data approaches to analyzing the effect of remittances to the REER. Studies with panel data differ from each other by the size of datasets, methodology as well as findings. Acosta, Baer and Mandelman (2009) analyze a large sample including 109 developing countries in period of 1990-2003 and also find evidence for real exchange rate appreciation. Because the dataset contains a substantial number of countries and the extensive time period, Generalized Method of Moments (GMM) estimation is used in that paper. The advantage of GMM is that it helps to cope with potential endogeneity in all explanatory variables and in any unobserved determinants of real exchange rate.

Research papers with a shorter time-period or a smaller number of countries usually implement ordinary least squares (OLS) technique with fixed or random effects (Lopez et al. 2007 and Barajas et al. 2011). They use instrumental variables to address the issue of endogeneity. For instance, Lopez, Molina and Bussolo (2007) found support for real exchange rate appreciation as a result of increase in remittances for a panel of 20 countries over the time period 1990-2003. The difference of work by Lopez et al (2007) from other literature is that they use change in remittances as a dependent variable rather than the amount of remittances received. The same result (appreciation of the real exchange rate)

was obtained by Amuedo - Dorantes and Pozo (2004) for a panel data set with 13 Latin American and Carribean countries from 1978 – 1998.

However, not all studies confirm the occurrence of real exchange rate appreciation due to increased remittances. For instance, the analysis of 15 countries from the decade of the 90s suggests that higher remittances inflows are not associated with a decrease in growth in the manufacturing industries (Rajan and Subramaniam 2005). Mongardini and Rayner (2009) used a sample of 29 sub-Saharan African countries using a pooled means group estimator methodology and did not find evidence for significant effects of remittances on the long-run REER. They examined the long-run determinants of the REER while allowing for heterogeneous short-term dynamics across countries and argued that the effect of remittances to real appreciation would depend on the extent to which remittances were used for spending on non-tradable goods.

Ozcan (2011) found evidence for significant negative effect of remittances on real exchange rate using a sample of 10 developing countries in 1980-2009 period. Depreciation of real exchange rate is explained by the low financial development in the countries; selected countries are unable to properly channel remittances to investment in non-tradable sector.

To sum up, the review of existing literature illustrates that there are different findings to the same research question. Some researchers even find results that contradict the Dutch disease theory and vary by country and region-specific characteristics, time periods and econometric techniques. Based on the summary of previous studies on remittances and the real exchange rate (Appendix, Table 1), I choose main variables for

the empirical model which will be explained in greater detail in next section, data and descriptive statistics. The estimation technique chosen in this paper is OLS with fixed effects with and without instrumental variables.

4. Data and Descriptive Statistics

To examine the effect of remittances on real exchange rate, sample of 7 CIS countries in time period from 2004 to 2018 is used. Based on the literature review of the determinants of real exchange rate (Amuedo-Dorantes et al., 2004 and Lertey et al.2009), the following explanatory variables are included in the regression model:

- GDP per capita
- government expenditures
- terms of trade
- world interest rate

Real effective exchange rate. I use real effective exchange rate index as the dependent variable in my estimation. It is collected from International Financial Statistics (International Monetary Fund). Advantage of REER over real exchange rate is that it's a weighted average of country's currency in relation to an index or a basket of other major currencies.

Remittances. Remittances are measured as a ratio of remittance inflows to GDP. Personal remittances comprise personal transfers and compensation of employees (World Bank, 2017). Since this is a panel data analysis, it's reasonable to take into consideration the relative size of remittances inflow to the countries' economies. Compensation to employees includes the income of full and short-term workers who work in a country where they are not a resident or people employed by nonresident institutions. The data was collected from the central banking offices of each country in the panel and World Bank database.

GDP per capita. I use GDP per capita as a proxy indicator of *the Balassa-Samuelson effect* (Balassa, 1964; Samuelson, 1964). The effect predicts that a country will experience a real exchange rate appreciation if the productivity advantage in the tradable sector exceeds the productivity advantage in the non-tradable sector. Moreover, GDP per capita is also a proxy measure for differential technological progress. This differential is likely to occur in the tradable sector and, as explained by the "resource movement effect", there will be a resource shift from the non-tradable to the tradable sector causing a real exchange rate appreciation. The data was collected from the national statistical offices of the analyzed countries.

Government spending. Government expenditure as a percentage of GDP measures the expenditure side of fiscal policy on economic activity (Vegh, 2012). The variable is defined as the aggregate of "all government current expenditures for purchases of goods and services, expenditures on national defense and security (excluding, government military expenditures that are part of government capital formation" (World Bank Indicators, 2018). The effect of government spending on RER depends on the composition of the consumption of tradable and non-tradable goods. If government spending is biased toward the consumption of non-tradable goods, an increase in the overall spending will result in a real exchange rate appreciation.

Terms of trade. Net barter terms of trade are used as a proxy measure of terms of trade for the economy. This variable is calculated as the "percentage ratio of the export unit value indexes to the import unit value indexes, measured to the base year 2000" (World Bank Indicators, 2017). An improvement of the terms of trade is expected to cause an

appreciation of the real exchange rate (Hassan and Holmer, 2014). Changes in terms of trade affect movements in wages in tradable part and then wages in non-tradable sector through an income and substitution effects. Relative increase in prices of a country's tradable goods causes a substitution effect - domestic producers shift their production and resources to tradable sector. Relative wages of the tradable sector increase and the non-tradable sector as wages equalize in both sectors. There will be an increment in the overall price level and there will be real exchange rate appreciation. Thus, terms of trade measure how external demand and supply affect tradable part of economy.

World interest rate. Because other capital inflows can affect remittances, world interest rate is included in the model. The variable controls for changes in external financial conditions. US real interest rate on T-bills is a proxy for world interest rate. The data was collected from the IFS.

Primary School Gross Enrollment Rate. Ratio of total enrollment in primary education to the population of the age group corresponding to that level of education is added in the model as instrumental variable. The data is collected from World Bank.

GDP per Capita of Russia. GDP per capita of host country (Russia) is included in the estimation as second instrumental variable. The data is collected from World Bank.

Table 2 reports the summary statistics.

Table 2. Summary statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
REER	105	94.09586	14.67029	48	117.41
Remittances (as % of GDP)	105	16.58809	12.40257	.6367415	49.29017

Table 2. Summary statistics of variables (cont.)

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP per Capita	105	2478.824	1795.962	236.4902	8318.513
Gov. Spending	105	16.34919	3.573055	8.263922	25.87842
Terms of Trade	105	22.46391	6.825643	8.648256	39.49193
World Interest Rate	105	2.396667	1.151385	1.16	5.25
School Enrollment Rate	105	99.54632	5.889866	88.67093	124.8934
GDP per Capita (Russia)	105	8867.116	4675.557	2100.358	16007.09

5. Methodology

To consider the impact of workers' remittances on the macroeconomics, following formula is used:

$$q_t = f(Remit_t, GDP_t, GOV_t, TOT_t, WIR_t)$$

where q represents the real effective exchange rate (with a rise in q representing real exchange rate appreciation), *Remit* symbolizes transfers in the form of workers' remittances, *GDP* is GDP per capita, *GOV* is government spending, *TOT* is terms of trade and *WIR* is world interest rate, *t* is time-period of 2004-2018.

The model to estimate the effect of remittances on real effective exchange rate looks as follows:

$$REER_{it} = \beta_0 + \beta_1 Remit_{it} + \beta_2 GDP_{it} + \beta_3 Gov_{it} + \beta_4 ToT_{it} + \beta_5 WIR_t + u_i + \varepsilon_{it}$$

where *i* and *t* are country and time indices respectively. *REER* indicates real effective exchange rate (dependent variable), *Remit* is for main independent variable – received remittances share to GDP. The main goal is to estimate coefficient β_1 in the model, which shows the size of contribution of remittances into exchange rate movements. If $\beta_1 > 0$ and significant, it means that an increase in workers' remittances inflows leads to real exchange rate appreciation.

GDP per capita, government spending, terms of trade and world interest rates are the other explanatory variables included in the model. It is anticipated that the coefficient on GDP per capita is positive. Countries with higher per capita incomes will experience appreciating currencies. Impact of fiscal expenditures is unclear: countries experiencing greater amounts of government spending will also likely experience appreciating currencies if the expenditures fall disproportionally on non-traded goods and will likely

experience depreciation if government spending falls disproportionally on the traded goods sector. Shocks to the external terms of trade may also elicit real exchange rate movements. The world interest rate does not vary across countries, but it changes over time. Error term, u_t, captures unobserved country-fixed factors.

OLS fixed-effect in panel data is used as estimation method to capture for all unobserved country-specific characteristics that affect exchange rate and the change over time. Moreover, 2SLS with IV's (gross primary school enrollment rate and GDP per Capita of Russia) is implemented to deal with the endogeneity problem.

6. Estimation and Results

Before estimating the model, several operations on the data are performed. I took a logarithm of all variables since in the distribution of data some values are too large, and some are too small, thus outliers are eliminated. Moreover, Augmented Dickey-Fuller (ADF) test is conducted to verify whether a series is stationary or not. It is necessary to test for the presence of any persistence of a unit root since the lack of stationarity would violate the classical linear model assumptions. Null hypothesis states that the series is non-stationary, and the panels contain a unit root. The results of the ADF test are reported in the Table 3.

Table 3. The results of Panel Unit Root Test (ADF test)

Variables		Statistics	Prob.**
Log (REER)	Level	16.5323	0.2820
	First-Difference	68.3599	0.0000
Log (RemitToGDP)	Level	17.8279	0.2147
	First-Difference	80.8351	0.0000
Log (GDPperCapita)	Level	1.56892	1.0000
	First-Difference	45.2803	0.0000
Log (GovSpending)	Level	25.0319	0.0294
	First-Difference	65.3474	0.0000
Log (ToT)	Level	7.42715	0.9170
	First-Difference	46.4323	0.0000
World Interest Rate	Level	38.2135	0.0005
	First-Difference	27.3950	0.0171

According to the ADF test results, series for variables such as government spending and world interest rate are stationary, t statistics are significant and null-hypothesis that there is a unit root for series is rejected. However, for variables- real effective exchange rate, remittances, GDP per capita and terms of trade – t statistics are not significant. In other words, these series are non-stationary and there is a violation of linear model assumption for the least squares model. Processes with unit root can be made stationary through differencing, therefore, given the results from unit root test I transform the non-stationary series to stationary by first-differencing them.

Hausman specification test is a common practice to choose relevant method between fixed and random effects. Under null-hypothesis, it's assumed that the preferred model is random effects; the alternate hypothesis is that the model is fixed effects. The test results indicate that null hypothesis is rejected, in other words, coefficient under fixed-effects specification is consistent and efficient and random effect model will lead to bias results (Appendix, Table 2).

I use ordinary least squares with fixed-effects (OLS FE) model to account for country-specific characteristics (heterogeneity). The fixed-effects model helps to take into account any country specific unobserved factors which are time-invariant and may affect real exchange rate. Additionally, Cross-section SUR was selected while specifying settings for the GLS weights to control for presence of cross-section heteroscedasticity. White period standard errors are used to check for any robustness towards heteroscedasticity across standard errors and covariance statistics.

However, there is a problem with the fixed effects least squares model in the estimation, which is endogeneity in remittances and exchange rate relationship. As well as inflow of remittances may lead to appreciation of currency, exchange rate changes also may lead to larger or smaller send remittances. Lopez et al (2007) maintain that overvalued exchange rate may lead to a decrease in amount of remittances send by migrants

The results of OLS with fixed-effect estimation are presented in Table 4: coefficient on remittances is significant and positive. Findings suggest that one percent increase of remittances to GDP ratio increases the real exchange rate by 8 percent. As it was expected, GDP per capita and government spending have positive and significant effect on the REER The Balassa-Samuelson has anticipated effect. Coefficient on terms of trade is negative, in other words, the overall spending effects overweight income effects. World interest rates measured by US short-term real interest rates show very small yet statistically significant results.

Table 4. GLS fixed-effects regression estimates

Dependent variable: log of real effective exchange rate (q)	
Regressors	Coefficient
Remittances to GDP (*Remit) (log)*	0.080*** (0.015)
GDP per Capita (*GDP) (log)*	0.221*** (0.034)
Gov. spending (*GOV)(log)*	0.069** (0.027)
Terms of Trade (*ToT) (log)*	-0.112*** (0.030)
World interest rates (*WIR)*	0.006** (0.003)
Constant	-0.223*** (0.0817)
Observations	98
R-squared	0.57
S.E. of regression	1.04
Durbin-Watson stat	2.37

Note: standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01

As it was mentioned earlier, there is a potential for endogeneity, therefore instrumental variables were included in the model. Remittances may respond to general economic conditions in the country of origin of remitter. In this case, if the home country is experiencing recession, it's expected that emigrants respond to the needs of family members back home with greater remittance flows. To account for this potential endogeneity issue, I use primary school enrollment rates (as suggested by Amuedo-

Dorantes and Pozo, 2004) and GDP per capita of host country (Russia) as instruments for workers' remittances. Results of the regression are presented in Table 5.

Table 5. Fixed effects and IV estimation results

Dependent variable: log of real effective exchange rate (q)	
Regressors	Coefficient
Remittances to GDP (*Remit) (log)*	0.211*** (0.058)
GDP per Capita (*GDP) (log)*	0.268*** (0.041)
Gov. spending (*GOV)(log)*	0.081** (0.026)
Terms of Trade (*ToT) (log)*	-0.028 (0.049)
World interest rates (*WIR)*	0.007** (0.004)
Constant	-0.251*** (0.079)
Observations	98
R-squared	0.45
S.E. of regression	1.09
Durbin-Watson stat	2.48

Note: standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01

Thus, the results illustrated by both tables confirm that there is a significant and positive relationship between remittances and real effective exchange rate. The least squares with fixed-effects model's estimation can be biased if there is an endogeneity problem The fixed-effects model with IVs (FE-IV) finds that one percent increase of the remittances to GDP ratio raises the real exchange rate by 21 percent.

Conclusion

According to IMF statistics (2014), remittances inflow overweight other external financial inflows and play an important role in the economy of CIS countries. Kyrgyzstan, Moldova, Tajikistan, and Armenia are among the ten top remittance receivers in the world (percentage of GDP). But the literature on the effect of remittances on the real exchange rate in developing countries is still growing. This paper attempts to add to the existing literature by exploring the relationship between remittances and exchange rate in the case of the CIS countries.

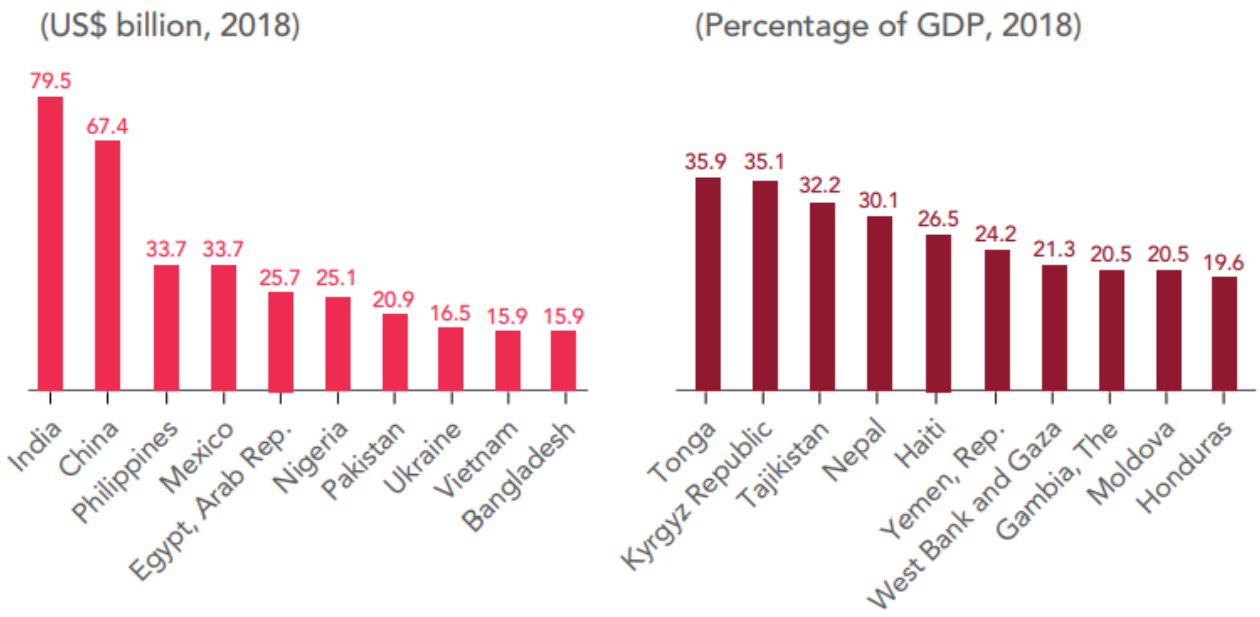
The research question is whether received remittances leads to the appreciation of real exchange rate for selected countries. Panel data of 7 countries within 2004-2018 period using OLS with fixed effects and 2SLS with instrumental variables estimation techniques are implemented in the analysis. Additional checks as unit root tests, transforming non-stationary series into stationary by first-differencing them and Hausman specification test are done. According to the estimation by panel OLS FE and additionally 2SLS with IV, there is a positive and significant relationship between remittances and the real exchange rate. It is found that a percent increase in remittances leads to 21 percent increase in the real exchange rate. Thus, the research provides empirical support to the belief that remittances inflow leads to currency appreciation in the CIS countries.

Appreciation of real exchange rate is one of the characteristics of the Dutch disease and my analysis provides evidence for it. However, there still exists a need for further investigation and checking for all other symptoms of the Dutch disease. The appreciation of real exchange rate might produce a negative impact on the economies of recipient

countries. an REER appreciation may have an inverse relationship with the economy's rate of growth ('Dutch disease') in the case that non-tradable goods are inferior for growth in comparison to tradable goods. It might, for instance, be argued that an economy that does not produce enough import-substitutes or exportable goods will eventually face a foreign-exchange constraint on its growth. Thus, this paper can be valuable for further research on the relationship between remittances and the real exchange rate.

Appendix

Figure 1. Top Remittance Receivers in 2018



Source: Migration and Remittances. Recent Developments and Outlook, 2018

Table 1. Summary of studies on remittances and real effective exchange rate

Study	*Specification*	*Dependent Variable*	*Independent Variables*	*Estimator*	*Data Period*	*IVs*
Acosta, Baerg and Mandelman (2009)	$REER = \beta_0 + \beta_1 REM + \beta_2 Z + u$	Real effective exchange rate	Remittances (% of GDP), bank credits, bank deposits, GDP per capita, M2, terms of trade, GDP growth, trade openness	FE and GMM-IV	Panel, 1990-2003	internal, external

Amuedo-Dorantes and Pozo (2004)	$REER = \beta_0 + \beta_1 REM + \beta_2 Z + u$	Log of real exchange rate	Log of workers' remittances, log of foreign aid, log of GDP per capita,log of terms of trade, log of government expenditure and US interest rate	FE-IV	panel, 1979-1998	External
Bourdet and Falck (2006)	$REER_t = \beta_0 + \beta_1 REMRAT + \beta_2 Z$+u	Log of real effective exchange rate	Remittances (% of GDP), ODA (% of GDP), ratio of non0technical assistance to GDP, terms of trade, ratio of exports and imports to GDP, growth of domestic credit, technological progress	Cointegration equation	Time-series, 1980-2000	-
Hyder and Manhoob (2005)	$REER = \beta_0 + \beta_1 REMRAT + \beta_2 Z + u$	Real effective exchange rate	Remittances (as % pf GDP), trade openness, rea; investment to GDP, government consumption, ratio of capital to GDP, TFP	Granger cointegration	Time series, 1978-2005	-

Izquierdo and Montiel (2006)	$REER = \beta_0 + \beta_1 REMRAT + \beta_2 Z + u$	Real effective exchange rate	Workers' remittances to GDP, average labour productivity, net international investment position, government consumption, terms of trade and export plus import (% of GDP)	VAR	Time-series, 1960-2004	-
Lartey, Mamdelman and Acosta (2012)	$\Delta REER = \beta_0 + \beta_1 \Delta REMRAT + \beta_2 Z + u$	Real effective exchange rate	Remittances to GDP, FDI (%of GDP), non FDI private inflow, government expenditure growth, GDP per capita, M2, terms of trade, export plus import (% of GDP) , growth of GDP	System GMM	Panel, 1992-2003	internal, external
Lopez, Molina and Bussolo (2007)	$\Delta REER = \beta_0 + \beta_1 \Delta REMRAT + \beta_2 Z + u$	Change in log of real effective exchange rate	Change in remittances (% of GDP), per capita GDP growth, change in terms of trade, government consumption (% of GDP),	FE and FE-IV	panel	External

			US -6-month interest rate			
Ozcan (2011)	$REER = \beta_0 + \beta_1 REMRAT + \beta_2 Z + u$	Log of real effective exchange rate	Remittances (% of GDP), export plus imports (% of GDP), real per capita income, domestic credit to private sector, terms of trade, government consumption	FMOLS	Panel, 1980-2009	-

Table 2. Hausman Specification test results

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	5	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
D(LREMIT)	-0.095031	-0.097270	0.000036	0.7100
D(LGDP)	0.224902	0.220557	0.000022	0.3547
LGOV	0.085743	0.051412	0.000589	0.1572
D(LTOT)	-0.054107	-0.055011	0.000032	0.8732
WIR	0.010042	0.010085	0.000000	0.6973

Cross-section random effects test equation:
Dependent Variable: D(LREER)
Method: Panel Least Squares
Date: 05/30/19 Time: 22:31
Sample (adjusted): 2005 2018
Periods included: 14
Cross-sections included: 7
Total panel (balanced) observations: 98

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.275414	0.119123	-2.312019	0.0232
D(LREMIT)	0.095031	0.035619	2.667988	0.0091
D(LGDP)	0.224902	0.046161	4.872120	0.0000
LGOV	0.085743	0.042641	2.010833	0.0475
D(LTOT)	-0.054107	0.059389	-0.911065	0.3648
WIR	0.010042	0.005889	1.705330	0.0917

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.421267	Mean dependent var	0.000521
Adjusted R-squared	0.347243	S.D. dependent var	0.080695
S.E. of regression	0.065196	Akaike info criterion	-2.508547
Sum squared resid	0.365549	Schwarz criterion	-2.192021
Log likelihood	134.9188	Hannan-Quinn criter.	-2.380519
F-statistic	5.690958	Durbin-Watson stat	2.514311
Prob(F-statistic)	0.000001		

Cross-section random effects test equation:
Dependent Variable: D(LREER)
Method: Panel Least Squares
Date: 05/30/19 Time: 22:31
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