An empirical analysis of the relationship between remittances and the real effective exchange rate for Tajikistan

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東北公益文科大学総合研究論集第36号 抜刷

2019年7月30日発行

研究論文

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Abstract

Using a combination of vector autoregressive (VAR) modelling and the Granger causality test, this study examines the relationship between remittances and the real effective exchange rate (REER) in the case of Tajikistan. The paper contributes to empirical studies on the relationship between remittances and REER in a country with remittance inflows equal to a significant share of its gross domestic product (GDP). The research results are based on the logarithmic difference of seasonally adjusted quarterly data demonstrating a short term bidirectional causality between remittances and REER.

Keywords: remittances, REER, Tajikistan

1. Introduction

In Tajikistan, personal remittances received from abroad, comprised of personal transfers and employee compensation, were equal to 20.2% to 49.3% of the gross domestic product (GDP) for the period 2005 to 2016, fluctuating between 26.9% to 49.3% of GDP from 2007 to 2016[1]. Such a vast inflow of foreign currency could be associated with changes in important macroeconomic fundamentals.

The relationship between remittance inflow and the exchange rate in remittance-recipient countries has attracted many researchers. The existing studies show depending on the specifics of the economy an inflow of remittances could be associated with the appreciation or depreciation of the exchange rate, or the relationship could be statistically insignificant (e.g., Amuedo-Dorantes and Pozo, 2004; Lopez, Bussolo, and

[1] Source: World Bank

Molina, 2007; Acosta, Lartey, and Mandelman, 2009; Ball, Cruz-Zuniga, Lopez, and Reyes, 2008; Barajas, Chami, Hakura, and Montiel, 2010; Kamar, Bakardzhieva, and Naceur, 2010).

Due to the lack of data and low number of observations, the relationship between remittances and the real effective exchange rate (REER) in the case of Tajikistan has not been researched properly. The National Bank of Tajikistan does not report REER time series in a manner appropriate for use in estimates. The REER data used in this paper are calculated by the author.

The paper contributes to empirical studies on the relationship between remittances and REER in the case of a country with remittance inflows equal to a significant share of the GDP.

The next two sections present the empirical analysis and concluding remarks.

2. Empirical analysis

In estimation, logarithmic differences of seasonally adjusted quarterly data were used on remittance inflows and REER for the period of 2005 Q1 to 2016 Q4. REER is measured as the nominal exchange rate of the national currency of Tajikistan (the Somoni) against a weighted average of four foreign currencies (main trade partners Russia, China, Turkey and Kazakhstan) adjusted by the relative price (foreign price divided by domestic price).

The nominal exchange rate is as reported by the National Bank of Tajikistan. The price level and the weight of trade with the main trade partners are as reported by the national statistics of Tajikistan. The price levels for trading partners are as reported by the national statistics of Kazakhstan and the Organisation for Economic Co-operation and Development (OECD) statistics[2]. The nominal exchange rates are used as amount of national currency (the Somoni) per unit of foreign currency, and an increase in REER is a depreciation for the Somoni.

The remittance data are valued in millions of USD. The data on remittances are

[2] Data for Russia, China and Turkey are from OECD statistics.

prepared based on data from the Central Bank of the Russian Federation and the World Bank's World Development Indicators. The national bank and statistics from Tajikistan do not provide appropriate data on remittance inflows. The data are based on prices for the first quarter of 2010. The summary statistics are presented in Table 1. The total number of observations is 48. The means of the logarithmic values show a depreciating trend for REER and an increasing trend for remittances. Standard deviation for the logarithmic values show more volatility for remittances as compared with REER.

Table 1. Summary statistics

Variables	Observations	Mean	Std. Dev.	Min.	Max.
ln REER	48	4.5660	0.0912	4.3898	4.7334
ln Remittances	48	6.0458	0.6515	4.4280	6.7196
Δ ln REER	48	0.0076	0.0320	-0.0495	0.1313
Δ ln Remittances	48	-0.0082	0.1820	-0.5114	0.5825

Note: Author's calculations.

A combination of vector autoregressive (VAR) modelling and the Granger causality test were used to examine the relationship between remittances and REER. Pre-tests for a unit root and cointegration are required before estimating the VAR model. If the first differences of the variables do not have a unit root and there is no cointegration relation (long run relationship) between variables, the VAR model can be used. Otherwise, a vector-error correction model (VECM) should be used.

The Phillips-Perron test for unit root statistics (Table 2) rejects the null hypothesis of a unit root at the 1% significance level for logarithmic differences of the variables.

Table 2. Phillips-Perron test for unit root

Variables	Observations	Test statistics
Δ ln REER	47	-6.333***
Δ ln Remittances	47	-4.831***

Note: Author's calculations. *** mean the rejection of the null hypothesis of a unit root at the 1% significance level.

Next, the cointegration relationship between the variables is checked using the logarithmic values. First, the selection-order criteria is used to define the appropriate number of lags. The Schwarz Bayesian information criterion (SBIC) chose one lag, while other criteria such as the sequential likelihood-ratio (LR) test, the Akaike information criterion (AIC) and Hannan–Quinn information criterion (HQIC) chose four lags (Table 3).

Table 3. Selection-order criteria

Lag	LR	AIC	HQIC	SBIC
0		-0.4964	-0.4663	-0.4153
1	186.05	-4.5430	-4.4527	-4.2997*
2	10.169	-4.5923	-4.4419	-4.1868
3	14.403	-4.7378	-4.5273	-4.1701
4	15.866*	-4.9166*	-4.6459*	-4.1867

Note: Author's calculations.

The Lagrange-multiplier (LM) test suggests a model misspecification based on SBIC (Table 4). The test rejects the null hypothesis that no autocorrelation appears in the residuals for the first two orders.

Table 4. Lagrange-multiplier test based on SBIC

Lag	Test statistics	P
1	10.0719	0.0392
2	12.3831	0.0147
3	7.3089	0.1204
4	4.9870	0.2886

Note: Author's calculations.

The LM test based on the lag order selected by other criteria does not reject the null hypothesis that no autocorrelation appears in the residuals for any of the four orders tested. The test provides no suggestion of model misspecification (Table 5).

Table 5. Lagrange-multiplier test based on other criteria

Lag	Test statistics	P
1	2.6880	0.61132
2	0.8250	0.93506
3	2.0162	0.73277
4	3.5474	0.47071

Note: Author's calculations.

Using the Johansen test, cointegration is checked between the variables. The test (Table 6) does not reject the null hypothesis of no cointegrating equations for the models with one lag (as chosen by SBIC) and four lags (as chosen by other information criteria). The conducted analysis proves the appropriateness of the VAR model for our data.

Table 6. Johansen tests for cointegration

Lags	Maximum rank	Trace statistics	5% critical value
1	0	9.4916	15.41
	1	1.2956	3.76
4	0	13.4931	15.41
	1	2.8127	3.76

Note: Author's calculations.

The time series were analysed and the VAR model was found to be appropriate (as compared with VECM). Afterwards, the logarithmic differences in the data were used in a VAR model. The appropriate number of lags for the VAR model with the first differences of the variables is zero lags according to SBIC, and three lags according to other criteria (sequential LR test, AIC and HQIC). The selection-order criteria are reported in Table 7.

Table 7. Selection-order criteria

Lags	LR	AIC	HQIC	SBIC
0		-4.50958	-4.47951	-4.42848*
1	10.985	-4.57742	-4.4872	-4.33413
2	12.910	-4.68901	-4.53863	-4.28351
3	12.520*	-4.79173*	-4.5812*	-4.22403
4	6.4034	-4.75544	-4.48476	-4.02555

Note: Author's calculations.

Table 8 presents the estimation results for the 3rd order VAR model. The equation of the model was

$$y_{i,t} = c_i + a_{i,1} y_{1,t-1} + a_{i,2} y_{1,t-2} + a_{i,3} y_{1,t-3} + a_{i,4} y_{2,t-1} + a_{i,5} y_{2,t-2} + a_{i,6} y_{2,t-3} + \varepsilon_{i,t} \quad (1)$$

where each variable in the model has one equation and the current observation of each variable depends on its own lagged values as well as on the lagged values of the other variable.

Table 8. Estimation results for VAR model

Independent variables	Dependent variables			
	Δ ln REER		Δ ln Remittances	
	Coefficients	Standard Errors	Coefficients	Standard Errors
Δ ln REER L1	-0.0209	0.1475	1.4792**	0.6442
Δ ln REER L2	0.0426	0.1496	1.9492***	0.6532
Δ ln REER L3	0.0364	0.1419	0.3836	0.6197
Δ ln Remittances L1	-0.0603**	0.0300	0.0062	0.1312
Δ ln Remittances L2	-0.0386	0.0291	0.4038***	0.1269
Δ ln Remittances L3	0.0252	0.0314	0.4837***	0.1371
Constant	0.0051	0.0049	-0.0425**	0.0214

Note: Author's calculations. *** and ** mean statistically significant at the 1% and 5% significance levels.

The coefficients show remittance inflows in the previous quarter appreciate (decrease) REER in the current quarter. The impact is statistically significant at the 5% significance level. REER depreciation in the previous two quarters increases the inflow of remittances in the current quarter. The impact is statistically significant at the 1% and 5% significance levels. Remittance inflows are also affected by two and three quarters of lagged remittances.

The Lagrange-multiplier test for residual autocorrelation after VAR (Table 9) does not reject the null hypothesis that no autocorrelation appears in the residuals for any of the four orders tested. Thus, the VAR model in Table 8 is properly specified.

Table 9. Lagrange-multiplier test based on other criteria

Lag	Test statistics	P
1	2.6880	0.61132
2	0.8250	0.93506
3	2.0162	0.73277
4	3.5474	0.47071

Note: Author's calculations.

The Granger causality test after VAR (Table 10) shows the null hypothesises that remittances do not cause REER and REER does not cause remittances are rejected at the 5% significance level. Hence, remittances cause REER and REER cause remittances.

Table 10. Granger causality test

Null Hypothesis	Test statistics	P
Remittances do not cause REER	7.9155	0.048
REER does not cause Remittances	13.921	0.003

Note: Author's calculations.

3. Concluding remarks

We analysed the relationship between remittances and REER in the case of Tajikistan. The VAR model and Granger causality test were applied to logarithmic

differences of seasonally adjusted quarterly data. The estimate of the VAR model showed the inflow of remittances (in the previous quarter) appreciates REER (in the current quarter) and REER depreciation (in the past two quarters) increases the inflow of remittances (in the current quarter). The Granger causality test demonstrated the presence of causality from remittances to REER and from REER to remittances.

The impact of remittances on REER can be explained as the inflow of foreign currency increasing the demand for national currency, appreciating the REER temporarily. However, the impact of REER on remittances seems puzzling. The depreciating trend of REER can be explained by the remittance inflows into Tajikistan, which are associated with an increase in supply of national currency and increased imports. The increase in money supply and outflow of international currency cause REER to depreciate. The association between the depreciation of REER and the increase in remittances can be explained by a poor economic environment in the remittance-dependent economy of Tajikistan, an increase in the number of labour migrants and remittances, as well as changes in the macroeconomic fundamentals of the remittance-sending economy (Russia).

References

1. Acosta, P., Lartey, E. and F. Mandelman. (2009). Remittances and the Dutch disease. Journal of International Economics 79(1): 102-116.
2. Amuedo-Dorantes, C. and S. Pozo. (2004). Workers' remittances and the real exchange rate: A paradox of gifts. World Development 32(8): 1407-1417.
3. Ball, C., Cruz-Zuniga. M., Lopez, C. and J. Reyes. (2008). Remittances, inflation and exchange rate regimes in small open economies. University of Cincinnati, Economics Working Papers Series 2008-03, University of Cincinnati, Department of Economics.
4. Barajas, A., Chami, R., Hakura, D. and P. Montiel. (2010). Workers' remittances and the equilibrium real exchange rate: Theory and evidence. Department of Economics Working Papers 2010-14, Department of Economics, Williams College.
5. Kamar, B., Bakardzhieva, D. and S. Naceur. (2010). The impact of capital and foreign

exchange flows on the competitiveness of developing countries. IMF Working Papers 10/154, International Monetary Fund.

6. Lopez, H., Bussolo, M. and L. Molina. (2007). Remittances and the real exchange rate. World Bank Policy Research Working Paper No. 4213. Available at SSRN: http://ssrn.com/abstract=981304.