For cited: *Ünver Erbaş, C., Sökmen, A. G. & Yılmaz, S. (2019). The Impact of Interest Rate and Inflation on Real Exchange Rate across Emerging Countries 1993-2015: A Panel Data Analysis. Journal of Strategic Research in Social Science, 5 (2), 1-14.*

Crossref *doi: 10.26579/josress-5.2.1*

Research Article/Araştırma Makalesi

Journal of Strategic Research in Social Science (JoSReSS)
www.josrss.com
ISSN: 2459-0029

Year: 2019
Volume: 5
Issue: 2

The Impact of Interest Rate and Inflation on Real Exchange Rate across Emerging Countries 1993-2015: A Panel Data Analysis

Cansu ÜNVER ERBAŞ[1], Ahmet Gökhan SÖKMEN[2] & Süreyya YILMAZ[3]

Keywords
Real interest rate, Exchange rate, Inflation, Panel data, Pooled mean group.

Article History
Received
31 Aug, 2018
Accepted
17 May, 2019

Abstract
One of the problems economically experienced by developing countries is the uncertainty in exchange rates. This uncertainty in exchange rates puts pressure on the country's economy and is particularly hampered by the long-term plans of sectors that are importing ultimate products or importing raw materials. Looking at the central banks of developing countries, it is observed that in cases where the exchange rates are extremely volatile, they tend to increase or decrease the interest rates in general and thus prefer the way to keep the exchange rates in balance. In this paper, we focus on whether the change in the interest rates has any effect on the exchange rate. For this aim of motivation, we have investigated; the interest rates, exchange rates and inflation data of Turkey, South Africa, Brazil, China, Malaysia, Nigeria, Romania, Russia and Indonesia for the time period 1993-2015 are analysed by panel data analysis method.

1. Introduction

The market foreign exchange is the largest financial market in the world. It is open somewhere else in the world 365 days a year, 24 hours a day. The 2016 Triennial central bank survey compiled by the Bank for International Settlements (BIS) places worldwide daily trading of spot and forward foreign exchange at $ 5.1 trillion per day on April 2016. It is important for companies and investors to understand factors that affect exchange rate changes. Because these changes would affect investment and financing decisions. Currency's exchange rate with other currencies is determined by interrelated variables that reflect the overall financial conditions of countries. These variables; interest rate, inflation rate, current-account deficit, public debt, foreign trade deficit and political stability may drive the currency value volatility. Among the variables listed above interest rate and inflation rate are the major factors that affect the country's currency value.

In recent years, many researchers have extensively studied the link between interest rates, inflation rate and exchange rate in both developed and developing countries. Inflation, interest rate and exchange rate are highly correlated. Central banks change interest rates and this impacts inflation and currency values.

[1] Corresponding Author. ORCID: 0000-0002-8905-5037 Assist. Prof. Dr, Çağ University, cansu.u.e@cag.edu.tr
[2] ORCID: 0000-0002-1836-8378. Assist. Prof. Dr, Çağ University, gokhansokmen@cag.edu.tr
[3] ORCID: 0000-0003-4150-4101. Res. Assist, Çağ University, sureyyayılmaz@cag.edu.tr

Generally higher interest rate in a country increases the value of that country's currency relative to nations offering lower interest rate without an accompanying increase in inflation.

In order to deal with some sources of endogeneity and to provide long-run panel estimations, we applied pooled mean group (PMG), mean group (MG) and dynamic fixed effect (DFE). The results confirm the existing theory and the empirical findings as such both inflation and interest rate have a significant adverse impact on real exchange rate among developing countries. The paper proceed as follows: Section 2 reviews the literature, Section 3 presents the source of data and the descriptive statistics, Section 4 provides insights on the econometric model applied, Section 5 delivers results and finally Section 6 concludes the paper. Hausman test to distinguish amongst dynamic panel estimators are presented in Appendix 1, and some robustness checks are reported in Appendix 2.

2. Literature Review

As well-known exchange rate plays a vital role in country's economy, also has a critical impact on interest rate of the country both in the short run and long run. The relationship between interest rate and exchange rate has been on a debate amongst economists both theoretically and empirically. Amoateng (1995) investigated relationship between real long–short interest spread differentials and real exchange rates for the integrated financial markets in the industrialized world from the 1980s and the early 1990s. The consistent evidence is that there is a long-run relationship between real exchange rates and real long–short interest spread differentials and vice versa for the UK/US markets. Chortareas & Driver (2001) investigated a relationship between real exchange rates and real interest rate differentials. The tests are conducted on a panel of 18 OECD economies using the United States as a numeraire for the post-Bretton Woods era. The results showing a long-run relationship between real exchange rates and real interest rate differentials appear to be more positive. Such studies concentrated on G7 economies. To investigate this further the panel was split into two groups: the G7 and eleven small open economies. For the panel of small open economies strong evidence in favour of co integration is found. In contrast, there is no evidence of co integration in a panel that consists purely of the G7 economies. Reinhart & Reinhart (2001) investigated for G3 and developing countries and Pattanoik & Mitra (2001) studied India and they found the same results. On the other hand, Goldfajn & Baig (1998) analyzed the relationship between nominal interest rates and nominal exchange rates in the aftermath of currency crises, (the Asian crisis) found no evidence for the weakening impact of higher interest rates on exchange rates. Kraay (1999) examined the usefulness of higher interest rates across speculative attacks. He failed to find very strong positive or negative association between raising interest rates and the outcome of the speculative attack. Dekle, Hsiao, & Wang (2002) determined whether high interest rates have had the effect of appreciating nominal exchange rates in three Asian countries. The authors use high-frequency data for Korea, Malaysia, and Thailand during the recent crisis and its aftermath to examine the relationship between the increase in interest rates and the behaviour of exchange rates. It is found that raising interest rates has had a small impact on nominal exchange rates during the crisis period. Gümüş (2002) evaluated the relationship between interest rates and exchange rates during the 1994 currency crisis in Turkey in order to explain whether high interest rates had the effect of appreciating the nominal exchange rates. Finding show that that raising interest rates had the significant long-run effect of depreciating the nominal exchange rates in contrast with the conventional wisdom. Gül, Ekinci & Özer (2007) evaluated relationship between the exchange rate and the interest rate in the Turkey and data spanning period 1984-2006. Their analyzing result, exchange rate is Granger causality interest rate. Uysal, Mucuk & Alptekin (2008) analyzed to investigate causality between the exchange rate and the nominal interest rate in Turkey. The findings revealed that there is a relationship between the foregoing variables; however the direction of the causality is from exchange rate to interest. Saraç & Karagöz (2016) determined the efficient level of short-term interest rates on dollar rate. Evaluating the results, has no evidence that higher interest rates cause to a weakening of exchange rate, by the frequency domain Granger causality test. On the other hand, Karaca (2005) analyzed the relationship between the exchange rate and the interest rate for Turkey. Finding show that, there is no significant co integration between variables. And findings supporting the view of the Turkish Central Bank have been reached.

Sollis & Wohar (2006) investigated the existence of threshold co integration between real exchange rates and real interest rate differentials. For six of the countries in their sample our analysis reveals some evidence of a nonlinear long-run relationship between real exchange rates and real interest rate differentials. When threshold co integration is found to exist, they find stronger mean reversion when the equilibrium error is negative relative to when it is positive. MacDonald & Nagayasu (2000) investigated the long-run relationship between real exchange rate and interest rate differentials across 14 industrialized countries by applying Johansen technique and co integration tests and found mixed results. Yet, they claimed the variation on the mixed results is caused by the estimation method used, otherwise, there is definite long-run relationship confirmed by Johansen technique as well. Hoffman & McDonalds (2009) investigated the RERI relationship using bilateral US real exchange rate data spanning the period 1978–2007. Evaluating their empirical results provide robust evidence that the RERI link is economically significant and that the real interest rate differential is a reasonable approximation of the expected rate of depreciation over longer horizons. Byrne & Nagayasu (2010) examined the relationship between the real exchange rate and the real interest rate differential using recent econometric methods robust to potential structural breaks. Their samples of countries include Austria, Belgium, Canada, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden and Switzerland data spanning the period 1978-1998. Their analyzing result that the real interest rate differential is an important determinant of the real exchange rate. However, Kayhan, Bayat & Uğur (2013) examined the dynamic relationships between the real exchange rate and the real interest rate in the BRIC-T (Brazil, Russia, India, China and Turkey) countries by employing monthly data from the beginning of flexible exchange rate regime to July 2011. Finding show that, interest rate affects exchange rate in only China and this effect exist only in the long run. On the other hand, exchange rate shocks induce changes in interest rate in the shorter period. Hacker, Karlsson & Mansson (2014) analyzed to investigate causality between the spot exchange rate and the nominal interest rate differential for seven country pairs, which includes Sweden. Impulse response functions are also utilized to examine the signs of how one of these variables affects the other over time. One key empirical finding from the causality tests is that there is strengthening evidence of the nominal interest rate differential Granger causing the exchange rate as the wavelet time scale increases. When considering impulse responses on how the interest rate differential affects the exchange rate, there appears to be some evidence of more negative relationships at the shorter time scales and more positive relationships at the longer time scales.

3. Data and Descriptive Statistics

Since the impact of inflation and interest rate are to be discovered on country's exchange rate , our dependent variable is real exchange rate (RER), and independent variables are inflation (based on consumer price: INF_CP and based on GDP deflator : INF_GDP) and interest rate (INT). We obtained inflation variable INF_CP from International Monetary Fund which is measured as the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals. Additionally we used inflation INF_GDP as GDP deflator (annual %) measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole, obtained from World Bank. Our interest rate variable (INT) is the real interest rate as percentage, that is, the lending interest rate adjusted for inflation as measured by the GDP deflator. This variable is obtained from World Bank, for Turkey however, it is obtained from IMF. Finally, our depended variable, real exchange rate is obtained from World Bank, for Turkey, it is obtained from Federal Reserve Bank of St. Louis. It is the real effective exchange rate index (2010 = 100), measured by the nominal effective exchange rate over a price deflator or index of costs. We applied normality test (i.e. Skewwnes/kurtosis) for RER which suggests that it deviates from normality so we take the natural logarithm of RER in our model. As both inflation variables include negative values, and interest rate is a ratio, we include them in the model without taking logarithms. Descriptive statistics of these variables are presented in Table.1:

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RER	182	91.44367	26.29216	47.16392	272.34
INF_CP	184	45.94827	218.6853	-1.407892	2075.887
INF_GDP	184	48.55927	233.8078	-5.991948	2302.841
INT	177	12.36502	20.79118	-43.57266	77.61726

Both inflation variables, those are INF_CP and INF_GDP , perform similar descriptive statistics ranging around mean of 46 and 49, respectively. This is also confirmed by the high percentage of correlation 0.92 between these two variables (output is available upon request). We will run separate regressions to check the robustness of the results and present them in Section 5.

3.1. Stationary Test

All application with real exchange rate naturally has unit roots. To ensure, we applied Im-Pesaran Shin unit root test and presented it in Table 2. As can be seen from Table 1, *RER* has a unit root, since the p-val is 0.4018 so we cannot reject the null hypothesis of "all panels contain unit-root test". Taking the natural logarithm has not solved the stationary issue as can be seen from the p-val of 0.2152. Taking the first difference both for *RER* and log_ *RER* however, appears to deal with the non-stationary. Applying dynamic panel estimator- PMG which will be covered in section 4 in more detail- will tackle this issue when estimating our model.

Table 2: Im-Pesaran-Shin Unit-Root Tests

Variables	Statistics (z-t-tilda-bar)	p-val	Number of panels	Number of periods
INF_CP	-4.6654	0.0000	8	23
INT	-3.7531	0.0001	8	22.13
INF_GDP	-6.1216	0.0000	8	23
RER	-0.2486	0.4018	8	22.75
log_RER	-0.7884	0.2152	8	22.75
d.RER	-6.0336	0.0000	8	21.75
d_log_RER	-6.3023	0.0000	8	21.75

H_0: All panels contain unit-root test for the specified variable; H_a: Some panels are stationary

4. Econometric Model

We are looking whether inflation and interest rate have any impact on real exchange rate for eight developing countries namely; Brazil, China, Malaysia, Nigeria, Romania, Russia, South Africa and Turkey from 1993 to 2015. Due to data limitation most scholars such as; Meese & Rogoff (1988), Edison & Pauls (1993), Uysal et. al. (2008), Gül et. al. (2007) Gümüş (2002), Keminsky & Schumulkler (1998), Goldfajn & Baig (1998) have looked at this relationship for a specific country and so applied time series analysis. Such relationship however, could have been portrayed well by the use of panel data since it involves multi-dimensional data with measurements over time. Also, as discussed earlier the impact of both inflation and interest rate on real exchange rate might vary depending upon Torun & Karanfil (2016) country's well-being based on GDP and/or a country's economic and political stability.

In this paper we specifically focused on developing countries for the reasons 1) the availability of data and 2) the limited number of panel studies in this regard. Similar approaches have been used elsewhere. Goldfajn & Gupta (1999), Kraay (1998), Furman & Stiglitz (1998), Gould & Kamin (2000), Chortareas & Driver (2001), Reinhart & Reinhart (2001). However, our sample size captures more time dimensions, and we include many more countries in the data and also we adopt the Pooled Mean Group estimator of model by Pesaran et al. (1999, 2012) as it lends itself well to panel datasets where neither the cross-section dimension N nor the time-series dimension T are particularly small. Not to mention, it provides both short run and long run estimations. PMG is characterised as an estimator where long-run parameters are homogenous across individuals (i.e. countries) but short-run parameters are heterogeneous thus allowing dynamics to differ.

In order to investigate the long-run dynamics of the impact of interest rate and inflation on real exchange rate across developing countries, we apply the Pooled Mean Group (PMG) variant for the autoregressive distributed-lag (ARDL) estimator. The PMG estimator has been shown to deliver consistent results if the lag order is specified correctly (Pesaran *et al.*, 2012). We use both Akaike's information criterion (AIC) to determine the number of lag, but due to the number of observation we currently have, we could not go any further than 1 lag. With the general econometric specification below:

$$Y = f(X_i) \qquad \textbf{(1)}$$

where Y is dependent and X_i's are independent variables (inflation rate, INF and interest rate INT) for each i subscript, we write down the following model:

$$\log Y = \beta_1 INF + \beta_2 INT + \alpha_t T + \sum_{i=1}^{N} \alpha_i C_i + \varepsilon \qquad \textbf{(2)}$$

where T is a linear time-trend, and the C_i are country fixed effect dummies for each Ncountry.

In order to specify model (2) into PMG model, it is re-specified into ARDL parameterization to give us equation (3) as follows:

$$\log Y_t = \sum_{k=1}^{q} \beta_{0k} \log Y_{t-k} + \sum_{k=0}^{q} \beta_{1k} X_{1k-t} + \sum_{k=0}^{q} \beta_{2k} X_{2t-k} + \alpha_t T + \sum_{j=1}^{N} \alpha_j C_j + \varepsilon \qquad \textbf{(3)}$$

with q lags which accommodates the possible dynamics as well as mitigating any error autocorrelation in the error term, ε . Equation (3) is then re-parameterised as an Error Correction Model (ECM) as specified by Johansen (1988) and others that allows us to separate out the short-run and long-run effects by stacking the time series observations for each country:

$$\log \Delta Y_t = \Omega(Y_{t-1} - \Pi X_{t-1}) + \sum_{j=1}^{p} \lambda_j \Delta Y_{t-j} + \sum_{j=0}^{p} \delta_k \Delta X_{t-k} + \mu + \varepsilon_t \qquad \textbf{(4)}$$

This is a standard form of ARDL. This is to make the notation more compact X_{t-1} which is a vector containing the one-lag of dependent variables INT and INF , as well as fixed effects. The vector Π contains the long-run parameters and Ω is the error term that is the average speed of adjustment toward the long-run equilibrium each year. ΔX_{t-k} is the vector of independent variables dependent variables INT and INF , with m number of *lags* that has been first differenced. By differencing, the model specification allow us to insert dynamic variables with sufficient *lags* (i.e. p) to ensure there is no autocorrelation in error term, ε . To make equation (4) in an error-correction equation in panel-data form we included i subscripts in the equation and re-write it as follows:

$$\log \Delta Y_{it} = \Omega_i (Y_{i,t-1} - \Pi_i X_{i,t-1}) + \sum_{j=1}^{p} \lambda_{ij} \Delta Y_{i,t-j} + \sum_{j=0}^{p} \delta_{ik} \Delta X_{i,t-k} + \mu_i + \varepsilon_{it} \quad \textbf{(5)}$$

This estimation is known as dynamic panel estimators- these are- pooled mean group (PMG), mean group (MG), and dynamic fixed effects (DFE). We used Stata 14's implementation under the xtpmg…, pmg command. PMG estimator allow for heterogeneous short-run dynamics, homogeneous long-run dynamics; with the MG estimator the long-run parameters (i.e. Π_i) are not restricted across countries; finally with DFE estimator allow for homogeneous short-run and long-run dynamics and restricts the speed of adjustment coefficients (i.e. Ω_i)(Blackburne & Frank, 2007). Amongst all dynamic panel estimators, we will apply DFE as suggested by Hausman test in our model. (Hausman test results are presented in Table 5 and 6 of Appendix1)

5. Results

Before applying Pooled mean group estimator, let us see few results for ordinary least square (OLS), random effect (RE) and fixed effect (FE) for the consistency of these results, and to be able to compare these results with PMG, MG and DFE results. Table 3, represents the first group of estimation results where INF_CP is used as an inflation variable as multiple number of scholars did so. Inflation has been found to have an adverse impact on real exchange rate. As well known, the higher the prices of goods or services the higher the inflation rate which result in a decrease in the value of local currency against other currencies resulting exchange rate to rise. In fact, inflation appears to be quite significant in all cases. Interest rate operates the demand for money, thus in the long run a decrease in the demand for money will result in an increase in inflation which eventually will end up increasing the real exchange rate.

When it comes to interest rate (INT), it is known to soar the finance charge for the investors that ends up for the investors to search for countries with lower finance charge. Ultimately, this causes capital outflows from the country which eventually results in the decrease in the value of local currency. The negative sign in the output table confirms the theory.

Similarly, Table 7 in Appendix 2 shows the second group of estimation results where INF_GDP is taken as inflation variable as robustness checks. In comparison to Table 3, both the signs and the magnitudes of the coefficients in Table 7 show almost alike patterns. The very high significance in inflation verifies the importance of it over real exchange rate comparing to interest rate, which brings new inspection to the literature because interest rate have been of much central factor on real exchange rate. As discussed in Section 4, to be able to investigate the dynamics of the impact of interest rate and inflation on real exchange rate across developing countries, we apply the Pooled Mean Group (PMG) variant for the autoregressive distributed-lag (ARDL) estimator and presented the results in Table 4.

Table 3: Results for OLS, RE and FE (Inflation Variable is: INF_CP)

Variables	(1)	(2)	(3)
INF_CP	-0.00325***	-0.00329***	-0.00337***
	(0.000741)	(0.000397)	(0.000416)
INT	-0.00263***	-0.00143	-0.000429
	(0.000999)	(0.00135)	(0.00122)
Constant	4.575***	4.558***	4.550***
	(0.0189)	(0.0371)	(0.0172)
Observations	176	176	176
R-squared	0.225		0.154
Number of Country		8	8

Model (1), (2) and (3) presents OLS, RE and FE respectively. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Column 1 and 2 of Table4.represents the short and long- run results for PMG. Changes in the interest rate or/and inflation might not play an instant role on the real exchange rate, yet it is helpful to investigate for any possible dynamics for the comparison. Column 3 and 4 of Table 4 show the short and long- run results for MG, and finally column 5 and 6 of Table 4 show the short and long- run results for DFE estimators. To start with, error correction term is found to be negative in all cases consistent with error correcting behaviour, and the significance of it proves the long run relationship between dependent and independent variables. As discussed earlier, PMG estimator allows for homogeneity across all panels (i.e. countries sampled) in the long run, and heterogeneous short-run estimations; MG, is similar to PMG estimator and only is preferred if the true model is not heterogeneous by its nature. DFE, however, similar to PMG estimator, which additionally restricts the coefficients of the co integrating vector to be equal across countries sampled, and restricts the speed of adjustment coefficient (i.e. Ω) and provide homogenous short-run estimations.(Blackburne & Frank, 2007). Stata's Hausman test offers a sigma more option that enables us to specify which dynamic estimator to use based on the estimation model. Table 5 and 6 of Appendix 1 presents the Hausman test results; suggestion DFE is the preferred estimator. Starting with PMG results, both inflation and interest rate found to be positive and significant in the short run. This could be explained by the followings: (1) both inflation and interest rate may not have an instant impact on real exchange rate, so long-run results should be taken into consideration, (2) high interest rate allow for cash flows within the country in the short run but it becomes burden on the finance charge for the investors that ends up for the investors to search for countries with lower finance charge. Thus the sudden cash flows will change a direction, which ultimately decreases the value of local currency. This is more or less similar in all short-run results. Looking at the long-run results, however, tell the real story about the relationship between inflation-interest rate and real exchange rate arise. In view of the fact that it might take several years to play out the inflation and interest rate impact on the real exchange rate, interpretations should be carried out as precise as possible. Starting with long-run PMG results, both inflation and interest rate appear to have an adverse impact on the real exchange rate, where only the former is significant at one per cent, and no significance is observed in the error correction coefficient. Moving to the long-run

MG results, again both independent variables oppose with real exchange rate, and based on the significant value of error correction coefficient that they have a long run relationship. With the confirmation of Hausman test (please see Appendix 1) or main estimator is DFE. One per cent increase in inflation will decrease real exchange rate by 0.1 percentage point, and one per cent increase in the interest rate will decrease real exchange rate by 0.2 percentage point.

Table 4: Dynamic Panel Estimators (inflation variable is: INF_CP)

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ec		-0.0128		-0.256***		-0.303***
		(0.0605)		(0.0784)		(0.0555)
D.INF_CP		-0.0113***		-0.00888**		-0.00108*
		(0.00337)		(0.00410)		(0.000603)
D.INT		-0.00104		-4.23e-08		-0.00175*
		(0.00160)		(0.00213)		(0.00104)
INF_GDP	0.0606**		-0.0104		0.000132	
	(0.0242)		(0.0132)		(0.00208)	
INT	0.0932***		0.00596		-0.00761**	
	(0.0361)		(0.0166)		(0.00344)	
Constant		0.0127		1.203***		1.391***
		(0.202)		(0.343)		(0.254)
Observations	168	168	168	168	.	.

Model (1) and (2) presents short run and long run PMG estimator; (3) and (4) short run and long run MG estimator and (5) and (6) represents short run and long run DFE estimator. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Few robustness checks are provided in Table 7 and 8 of Appendix 2 confirming the almost alike coefficients only insignificant in DFE results.

6. Conclusion Remarks

This paper investigates the – mainly long-run impact of interest rate and inflation on the real exchange rate by applying dynamic panel estimators namely; PMG, MG and DFE. In the view of the fact that increasing prices of goods or services increases the inflation rate which eventually result in a decrease in the value of local currency against other currencies resulting exchange rate to rise. Also it is known that the increase in the interest rate surges the finance charge for the investors that ends up for the investors to seek for countries with lower finance charge which causes capital outflows from the country resulting in a decrease in the value of local currency. Interest rate and inflation is directly and highly correlated in the sense that, if inflation increases interest rate rises. Interest rate operates the demand for money, thus in the long run a decrease in the demand for money will result in an increase in inflation which eventually will end up increasing the real exchange rate. This is one source of endogeneity in our model, tough it expresses the importance of how related all these variables are.

Our panel data estimations confirm the existing theory and empirical finding as such, both interest rate and inflation have an adverse and significant impact on the real exchange rate amongst developing countries for the period from 1993 to 2015- by far the latest data sampled in an empirical model- in the long run. Although short-run results vary, it especially confirms the crucial impact of inflation rather. Unlike most of the studies, inflation has been of more central key on the variation of exchange rate, this is either by the use of data sample, or methodology used for the first time in this regard.The significance in the error correction term confirms the long-run relationship that dependent and independent variables have.

References

Amoateng, Kofi. A. (1995), "The relationship between real long-short interest spread differentials and real exchange rates", *Applied Economics Letters*, 2:11, pp. 432-436

Blackburne E.F., and Frank M.W. (2007), "Estimation of nonstationary heterogeneous panels", *The Stata Journal*, 7(2): 197-208

Byrne, J.P. and Nagayasu, J. (2010), "Structural Breaks in the Real Exchange Rate and Real Interest Rate Relationship", *Global Finance Journal*, 21(2): 138-151

Chortareas, G. E., and R. L. Driver. (2001), "PPP And The Real Exchange Rate–Real Interest Rate Differential Puzzle Revisited: Evidence From Non-Stationary Panel Data", London: Bank Of England.

Dekle, R., Hsiao, C. and Wang, S. (2002), "High Interest Rates and Exchange Rate Stabilization in Korea, Malaysia and Thailand: An Empirical Investigation of the Traditional and Revisionist Views", *Review of International Economics*, 10 (1), 64-78.

Edison, H. and William R., (1995), "Alternative Approaches To Real Exchange Rates And Real Interest Rates: Three Up And Three Down," *International Finance Discussion Papers*. No: 518, Board of Governors of the Federal Reserve System.

Furman, J. and Stiglitz J. E. (1998), "Economic Crises: Evidence and Insights from East Asia", *Brooking Papers on Economic Activity*, No. 2, Brooking Institution, Washington D.C

Goldfajn, I. and Gupta, P. (1999), "Does Monetary Policy Stabilize the Exchange Rate Following a Currency Crisis?" *International Monetary Fund Working Paper*, WP/99/42, Washington D. C.

Goldfajn, I. and Baig, T. (1998), "Monetary Policy in the Aftermath of Currency Crises: The Case of Asia"Mimeo, IMF

Gould, D. M. and Kamin, S. B. (2000), "The Impact of Monetary Policy on Exchange Rates During Financial Crisis", *International Finance Discussion Paper* 669, Board of Governers of the Federal Reserve System, Washington D.C.

Gül, E., Ekinci, A. and Özer, M. (2007), "Türkiye'de Faiz Oranları ve Döviz Kuru Arasındaki Nedensellik İlişkisi: 1984-2006", *İktisat, İşletme ve Finans*, Yıl: 22, Sayı: 251.

Gümüş, I. (2002), “Effects of the Interest Rate Defense on Exchange Rates during the 1994 Crisis in Turkey”*. TCMB Working Paper*, No: 14.

Hacker, R.S., Karlsson, H.K., and Mansson, K. (2014),“An Investigation Of The Causal Relations Between Exchange Rates And Interest Rate Differentials Using Wavelet”, *International Review of Economics and Finance*, 29, 321–329.

Johansen S., (1988), “Statistical Analysis of Co integration Vectors”, *Journal of Economic Dynamics and Control* 12. Pp.231-254

Karaca, O. (2005), “Türkiye’de Faiz Oranı İle Döviz Kuru Arasındaki İlişki: Faizlerin Düşürülmesi Kurları Yükseltir mi?”,*Türkiye Ekonomi Kurumu Tartışma Metni*, Ekim 2005(14):7.

Kayhan, S., Bayat, T. And Uğur, A. (2013), “Interest Rates and Exchange Rate Relationship İn BRIC-T Countries, *Ege Academic Review*, 13 (2), 227- 236.

Keminsky, G. and Schumulkler, S. (1998), “The Relationship Between Interest Rates and Exchange Rates in Six Asian Countries” World Bank, Development Economics and Office of the Chief Economist, Washington, D.C.

Kraay, A. (1999),“Do High Interest Rates Defend Currencies During The Speculative Attacks?”,*Policy Research Working Paper,* No: 2267 (Washington. World Bank)

MacDonald R. and Nagayasu J. (2000), “The Long-Run Relationship between Real Exchange Rates and Real Interest Rate Differentials: A Panel Study”, *IMF Staff Papers*, *47*(1), 116-128

Mesee, R. and Rogoff, K. (1988) “What Is Real? The Exchange Rate- Interest Differential Relation over the Modern Floating Rate Period,” *Journal of Finance* Vol. XL III, No: 4, pp. 933-948

Pattanaik, S. and Mitra A.K.(2001),“Interest Rate Defence of Exchange Rate,Tale of the Indian Rupee.”,*Economic and Political Weekly*, November 24,2001.Vol.36 no.46 and 47,pp 4418-4427

Pesaran M.H., Shin, Y. and Smith R.P. (2012), “PMG Estimation of Dynamic Heterogeneous Panels”, *Journal of American Statistical Association*, 94(446):621-634.

Pesaran, M. H, and Shin Y. (1998), “An autoregressive distributed-lag modelling approach to cointegration analysis”, *Econometric Society Monographs*, 31:371-413.

Reinhart, C. and Reinhart, V. R. (2001)."What Hurts Most: G-3 Exchange Rate or Interest Rate Volatility? In Preventing Currency Crises in Emerging Markets”, edited by M. Edwards and J. Frankel (*Chicago: University of Chicago Press* for the NBER, 2001), pp.73-99

Saraç, T. B. and Karagöz, K. (2016).“Impact of Short-Term Interest Rate On Exchange Rate: The Case of Turkey”, *Procedia Economics and Finance*, 38, 195-202.

Sollis, R. and Wohar, M., (2006), "The Real Exchange Rate–Real İnterest Rate Relation: Evidence From Tests For Symmetric And Asymmetric Threshold Co integration", *International Journal of Finance and Economics* 11, 139–153.

Torun, M. and Karafin, M. (2016), "1980-2013 Dönemi Türkiye Ekonomisinde Enflasyon ve Faiz Oranı Arasındaki İlişki" *Yönetim Bilimleri Dergisi / Journal of Administrative Sciences* Cilt / Volume: 14, Sayı / N: 27, ss. / pp.: 473-490

Uysal, D., Mucuk, M. And Volkan, A., (2008). "Finansal Serbestleşme Sürecinde Türkiye Ekonomisinde Faiz Kur İlişkisi", *KMU IIBF Dergisi*, 15(10), pp.48-64

Appendix 1

Table 5: HausmanTest Results between MG and PMG

```
. hausman mg pmg, sigmamore

                  ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      mg           pmg         Difference          S.E.
-------------+----------------------------------------------------------------
     INF_GDP |   -.0426732     .0648202       -.1074934             .
         INT |   -.0445145     .0875597       -.1320742             .
------------------------------------------------------------------------------
                          b = consistent under Ho and Ha; obtained from xtpmg
           B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       81.53
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

The calculated Hausman statistics is 81.53 and is distributed $\chi^2(2)$. Thus, the efficient estimator under the null hypothesis is MG over PMG.

Table 6: HausmanTest Results between MG and DFE

```
. hausman mg dfe, sigmamore

                  ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      mg           dfe         Difference          S.E.
-------------+----------------------------------------------------------------
     INF_GDP |   -.0426732     .0006914       -.0433646        .2202582
         INT |   -.0445145    -.0073115        -.037203        .2501129
------------------------------------------------------------------------------
                          b = consistent under Ho and Ha; obtained from xtpmg
           B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        0.05
                Prob>chi2 =      0.9765

.
```

The calculated Hausman statistics is 0.05 and is distributed $\chi^2(2)$. Thus, the efficient estimator under the null hypothesis is DFE over MG.

Appendix 2

Robustness Checks

Table 7: Results for OLS, RE and FE (inflation variable is: INF_GDP)

Variables	(1)	(2)	(3)
INF_GDP	-0.00323***	-0.00321***	-0.00320***
	(0.000843)	(0.000636)	(0.000662)
INT	-0.00315***	-0.00225*	-0.00158
	(0.00102)	(0.00131)	(0.00125)
Constant	4.584***	4.570***	4.564***
	(0.0189)	(0.0352)	(0.0120)
Observations	176	176	176
R-squared	0.225		0.145
Number of Country		8	8

Model (1), (2) and (3) presents OLS, RE and FE respectively. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Dynamic Panel Estimators (inflation variable is: INF_GDP)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
ec		-0.0198		-0.258***		-0.299***
		(0.0513)		(0.0545)		(0.0568)
D.INF_GDP		-0.0157***		-0.0106**		-0.000839
		(0.00486)		(0.00452)		(0.000720)
D.INT		-0.0102***		-0.00448		-0.00124
		(0.00360)		(0.00405)		(0.00125)
INF_GDP	0.0648**		-0.0427**		0.000691	
	(0.0315)		(0.0207)		(0.00225)	
INT	0.0876*		-0.0445*		-0.00731**	
	(0.0476)		(0.0236)		(0.00360)	
Constant		0.0381		1.231***		1.371***
		(0.171)		(0.248)		(0.260)
Observations	168	168	168	168	.	.

Model (1) and (2) presents short run and long run PMG estimator; (3) and (4) short run and long run MG estimator and (5) and (6) represents short run and long run DFE estimator. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Journal of Strategic Research in Social Science
(JoSReSS)

ISSN: 2459-0029

www.josrss.com