Does Interest Rate Still Matter in Determining Exchange Rate?

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Abstract: The interest rate plays an important role in determining the exchange rate in various economic theories. However, this has been challenged both conceptually and practically. The rapid development of global financial linkages makes many attractive non-interest-bearing investments available, which dwarf the profit opportunity from interest-bearing assets. The sensitivity of the exchange rate fluctuations and institutional factors also cast doubt on the role of the interest rate in determining the exchange rate. This research used nine Asian countries, five of which are ASEAN members (Thailand, Indonesia, Malaysia, Singapore, and the Philippines), the others being South Korea, Japan, India, and China. The sample period varied between 1994 and 2015. The results from the Pool Mean Group method show that the real effective real interest rate has a significant long-run negative association with the exchange rate. This implies that the interest rate does matter in determining the exchange rate.

Keywords: Interest rate, exchange rate, pool mean group, Asia.
JEL classification: E43, F31, N15

1. Introduction

The interest rate has long been associated with exchange rate determination, either directly or indirectly. Interest rate parity directly links exchange rate changes with expected interest-based returns through active arbitrage activities. Conventional economic theories preach that an increase in the interest rate supports the currency through inducing an inflow of capital. Hence, any change in the economic policy and its fundamental may affect the exchange rate, especially monetary policy. Theoretically, an increase in the money supply (expansionary policy) reduces the interest rate, which, in return, causes capital outflow. However, these theories are challenged practically and conceptually. Practically, during the Asian Crisis 1997/98, countries that subscribed to an increase in the interest rate to halt currency depreciation failed. Perhaps, this was what prompted Malaysia, as the only country to succeed in a quick recovery, to decrease the interest rate to stimulate consumption while imposing an exchange rate control. Conceptually, Ohmae (1996) claimed that there are many attractive non-interest-bearing opportunities, such as the forex market, stocks, and real estate investment. The profit-making opportunities for these could reach 50%, which dwarfs any interest-bearing instrument; hence, reducing its impact on the exchange rate. This thought is also consistent with the asset market theory, where the inflow of in-demand currency is not only limited to interest-bearing bond instruments but also equities. Ohmae (1996) also claimed that the exchange rate is more sensitive to announcements (sentiment) rather than an

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economic fundamental. A recent example is Donald Trump's threat to recall American overseas investment back to the United States through imposing a punitive tax. The announcement itself resulted in an immediate appreciation of the dollar. Institutional factors may also play a more impactful role. The Reaganomics policy of a "strong dollar, strong America", and China's and Japan's intention to keep suppressing their currency value are stronger determinants than the interest rate or other economic fundamentals like trade and debt. These anomalies concerning the role of the interest rate in determining the exchange rate motivated this research.

The objective of this research is to determine the significance of the interest rate in determining the exchange rate. This research used nine Asian countries, of which five are ASEAN members (Thailand, Indonesia, Malaysia, Singapore, and the Philippines), the others being South Korea, Japan, India, and China. The sample period varied between 1994 and 2015 using unbalanced panel data. The Pool Mean Group (PMG) with error correction method is applied to capture the dynamic effect between the interest rate and the exchange rate with trade balance and government debt as the control variable.

2. Literature Review

The real exchange rate and interest rate relationship is often studied using a combination of various economic variables like the gross domestic product, money supply (Ibrahim, 2016), trade balance, government expenditure and debt (Yu, 2010), and commodity prices (Kandil and Bahmani-Oskooee, 2007). An insignificant long-run relationship between the interest rate and the exchange rate is found in Kia (2013), and Bouraoui and Phisuthtiwatcharavong (2015). Kia (2013) found that the interest rate only has a negative short-run relationship with the exchange rate using the Canadian quarterly data from 1972 to 2010. In fact, real factors, such as productivity shocks, had a higher impact than monetary shocks, such as the interest rate, on the volatility of the exchange rate (Meese and Rogofp, 1988). The interest rate has a different impact on different exchange rate regimes. Be nsaid and Jeanne (1997) claimed that using an interest rate hike to defend a fixed exchange rate is ineffective, because it is costly and makes it prone to speculation attack. Interest rate changes may be due to actual or perceived political risk (Dooley and Isard 1980) that may not simultaneously affect the exchange rate movement. Edwards (1988) claimed that macroeconomic shocks only have a short-term effect on the real exchange rate, the long-run equilibrium of which depends on fundamentals like terms of trade, government consumption, technology progress, capital inflow and investment. Other significant factors affecting the exchange rate movement, either in the long- or short-run, include economic linkage and co-integration (Truchis et al., 2007), structural adjustment, economy openness (Ibrahim 2016), productivity shocks (Meese and Rogofp, 1988), quality of institution and financial development (Nouira and Sekkat 2015), and the inflow of bank loans (Comunale, 2017).

Additionally, the exchange rate has been studied with trade balance, especially under the Marshall Learner hypothesis and J-curve (Ng et al., 2008; Sek and Har, 2014; Bahmani-Oskooee, 1991; Arize 1994). Interest Rate Parity (IRP) also has a major theoretical link between the expected exchange rate and the interest rate. Over decades of debate, there is literature to support this; thus, implying a long-run relationship between the exchange rate and the interest rate (Bahmani-Oskooee et al., 2016). Those who found no significant evidence are also numerous, such as Baharumshah et al. (2005), and Rio and Sentana (2011). The liquidity risk also plays a role in determining the exchange rate. Fukuda and Tanaka (2017) found that money market risk and policy rates have a significant effect on the covered interest parity condition for the currencies of the European Union, the United Kingdom, Canada, Japan, Australia, and New Zealand using the United States dollar as the benchmark.

Regression specifications do matter in determining the significance of the relationship between the interest rate differential and the exchange rate. Through the uncovered interest parity theory, Herger (2016) favoured time-specific fixed effect panel data testing. Sarantis (1999) claimed non-linearity in the exchange rate in eight of the G-10 developed countries tested using the Smooth Transition Autoregressive (STAR) model. Other models applied include the structural vector autoregressive (SVAR) approach, generalized autoregressive conditional heteroscedasticity (GARCH) (Fukuda and Tanaka, 2017), exponential GARCH (EGARCH) (Meng and Huang, 2016) and Autoregressive Distributed Lag (Bahmani-Oskooee et al., 2016). Nonetheless, although dynamic panel analysis is rarely used to test the determinants of the exchange rate it offers better analysis methods, especially when a dynamic heterogeneous problem exists (Pesaran et al., 1999).

3. Research Methodology

3.1 Model Specification and Estimation Approach

In exploring the effect of the interest rate on the exchange rate, the model is specified as follows:

$$REER_{it} = \delta_i + \theta_{1it} INTRATE_{it} + \theta_{2it} TOT_{it} + \theta_{3it} GOVDEBT_{it} + \upsilon_{it} \quad (1)$$

where *REER* is the real exchange rate (domestic currency relative to foreign currency), and *INTRATE* is the real interest rate. In this study, control variables consist of *TOT* and *GOVDEBT*, which refer to the terms of trade and government debt, respectively; while δit is the country-specific effect, θ*'s* are long-run parameters, and υ refers to residual terms. In economic theory, a higher interest rate induces an appreciation of currency due to the higher expected return on the investment and vice-versa. Therefore, the expected sign of the interest rate coefficient is to be negative on the real exchange rate.

This study investigates the factor of the interest rate on the exchange rate by applying panel econometric estimation. For estimation, there are several prevalent techniques that are utilized in the panel model. Firstly, the conventional pooled method (OLS), which restricts the homogeneity of the intercepts and all slope coefficients across units. At one extreme, the Fixed effect (FE), Random effect (RE), and Generalized Method of Moments (GMM) impose homogeneity on all long-run parameters but allow the intercepts to be freely independent. Nevertheless, Pesaran and Smith (1995) stress that under slope heterogeneity, GMM will be potentially affected by heterogeneity bias and lead to inconsistency in the slope coefficients. At the other extreme, Pesaran and Smith (1995) introduce the Mean Group (MG) estimate to produce more consistent average parameters since it averages the coefficients in ARDL regressions and has no constraints on the intercepts or long-run parameters. Nonetheless, this method has been criticized by Pesaran *et al.* (1999) in that MG does not consider some parameters and can be homogenous across units in the long run. Hence, as an alternative, the author proposes the Pooled Mean Group (PMG) estimate, which allows intercepts, speeds of adjustments, and short-run parameters to be varied, but a common long-run coefficient. Therefore, the PMG estimate will be more efficient and consistent than the MG estimate under the hypothesis of homogeneity. In this regard, the Hausman test will be utilized to examine the homogeneity of the long-run parameters.

Based on the PMG approach, the ARDL (p,q,q,q) dynamic panel regression for Eq.(1) is specified as below:

$$REER_{it} = \delta_i + \sum_{j=1}^{p} \theta_{0i,j} REER_{i,t-j} + \sum_{j=0}^{q} \theta_{1i,j} INTRATE_{i,t-j} + \sum_{j=0}^{q} \theta_{2i,j} TOT_{i,t-j} + \sum_{j=0}^{q} \theta_{3i,j} GOVDEBT_{i,t-j} + \upsilon_{it} \quad (2)$$

where p and q refer to the lags of the dependent and explanatory variables, respectively. The re-parameterized Eq.(2) as an error correction model can be specified as follows:

$$\begin{aligned}\Delta REER_{it} &= \pi_i (REER_{i,t-1} - \delta_{1i} - \theta_{1i} INTRATE_{it} - \theta_{2i} TOT_{it} - \theta_{3i} GOVDEBT_{it}) \\ &+ \sum_{j=1}^{p-1} a^*_{0i,j} \Delta REER_{i,t-j} + \sum_{j=0}^{q-1} a^*_{1i,j} \Delta INTRATE_{i,t-j} + \sum_{j=0}^{q-1} a^*_{2i,j} \Delta TOT_{i,t-j} \\ &+ \sum_{j=0}^{q-1} a^*_{3i,j} \Delta GOVDEBT_{i,t-j} + \mu_i + \upsilon_{it}\end{aligned} \tag{3}$$

where $\pi_i = -\left(1 - \sum_{j=1}^{p} a_{0i,j}\right)$, $\delta_i = \mu_i$, $\theta_i = \sum_{j=0}^{q} a_{1i,j}$, $\theta_{2i} = \sum_{j=0}^{q} a_{2i,j}$, and $\theta_{3i} = \sum_{j=0}^{q} a_{3i,j}$

based on Eq.(3), πi refers to the parameter of the error correction terms, which measures the speed of adjustment of the exchange rate towards the long-run equilibrium. θ's are the long-run coefficients for explanatory variables while a's imply the short-run coefficients. Finally, δi defines the country-specific effect while vit signifies the residual terms.

3.2 Data Description

The data in this study consist of unbalanced panel annual data for nine Asian countries; the list of countries is shown in Table A1 (see Appendix A). The data for the real exchange rate, interest rate, terms of trade and government debt are retrieved from three sources: (a) World Economic Outlook, IMF, (b) World Development Indicator (WDI), and (c) Bank for International Settlements (BIS). The definition of the variables and data sources are summarized in Table A2 (see Appendix A).

4. Data Analysis

The results of the panel estimations are summarized in Table 1. Based on the PMG estimate, both the interest rate and the terms of trade are important in influencing the real exchange rate, while government debt is statistically insignificant in the model. In light of the results, an improvement in the terms of trade results in an increase in the quantity of exports but a decrease in the quantity of imports; hence, a depreciation in the exchange rate. In addition, a higher interest rate of a country would lead to an appreciation of a country's currency (decrease in the exchange rate) by virtue of more attractive returns from the investment.

In the long-run perspective, the PMG estimate reveals more consistent findings with the literature compared to the MG estimate, since most of the coefficients of the PMG estimate are significant in the model. Moreover, the Hausman test proposes that the null hypothesis of homogeneity in long-run coefficients cannot be rejected in the model. Hence, the PMG estimate is preferable to the MG estimation. Furthermore, for the convergence coefficient, a negative and significant parameter implies that the real exchange rate, on average, has a correction speed of 31.11% towards its equilibrium in the long run during each period.

Table 1: Panel estimations

Equation	PMG	MG	DFE
Long run coefficients			
INTRATE	-0.0184***	-0.0015	-0.0216
TOT	0.4117**	0.4149	1.130*
GOVDEBT	-0.0478	-0.1983	-0.0220
Error Correction (π_i)	-0.3111***	-0.4281**	-0.1747***
Short run coefficients			
ΔINTRATE	0.0216***	0.0113*	0.0125***
ΔTOT	-0.3420**	-0.3953**	-0.2632**
ΔGOVDEBT	0.1197	0.0809	-0.2381***
Δ^2INTRATE	-0.0102**	-0.0067***	-0.0048***
Δ^2TOT	0.1335	0.1754*	-0.0265
Δ^2GOVDEBT	-0.0867	-0.0472	0.0395
Hausman p-value	0.6409		
Observation	170		

Notes: ***, ** and * indicate significant at 1%, 5%, and 10% significance levels, respectively. The appropriate lag order for ARDL (p,q,q,q) in each equation is selected based on the Akaike information criterion.

5. Discussion of Result

The results show a positive relationship between the trade balance (TOT) and the real exchange rate, which is consistent with the Marshall-Lerner theorem. Ignoring the causality aspect, the former advocates that a higher trade balance is associated with the depreciation of the currency. Practically in almost all the selected countries, and perhaps other developed and developing Asian countries, export competitiveness comes from price competitiveness, which is attained through a lower domestic currency. This is in contrast to Western developed countries where export competitiveness comes from innovation, better technology, and higher labour productivity. Hence, the pressure to sustain higher exports could cause depreciation of the domestic exchange rate, especially through a managed float system. In export-oriented Asian countries, export revenues in foreign currency (usually in US dollars) are not converted (or just partially) to domestic currency. For example, this can be seen in the fierce objection to the recent direction from Bank Negara Malaysia to force conversion of export revenue up to a certain percentage. Hence, the increase of export revenue did not actually equal the capital or foreign reserve inflow into the domestic economy. Indeed, the capital flow theory is observed in the result of the negative relationship between the interest rate and the real exchange rate. A higher interest rate induces an inflow of capital, especially to interest-bearing instruments. This also implies that, as a whole, the selected countries have not yet fallen into the liquidity trap where the interest rate is no longer instrumental or effective in affecting the exchange rate or other economic fundamentals.

6. Conclusion

Theoretically, the interest rate and trade balance play an important role in determining the real exchange rate. However, globalization, financial innovation and a variety of factors have encouraged research to re-evaluate the determinants of the exchange rate. This research aims to determine the significance of the interest rate in determining the exchange rate with the trade balance as the control variable. Nine Asian countries, of which five are ASEAN members (Thailand, Indonesia, Malaysia, Singapore and Philippine), the others being South Korea, Japan, India, and China were tested empirically using the Pool Mean Group (PMG) with the error correction method. The sample period varied between 1994 and 2015 using unbalanced panel data. The results revealed a negative relationship between the interest rate and the real exchange rate, which reaffirmed the validity of the capital flow theory. The

positive relationship between the trade balance (TOT) and real exchange rate implies the importance of price competitiveness from the lower exchange rate on export competitiveness.

References

Arize, A.C. (1994). Cointegration test of a long-run relation between the real effective exchange rate and the trade balance. *International Economic Journal, 8(3),* 1-9.

Baharumshah A.Z., Chan, T. H., & Fountas, S. (2005). A panel study on real interest rate parity in East Asian countries: Pre and post liberalization era. *Global Finance Journal, 16*(1), 69-85.

Bahmani-Oskooee, M. (1991). Is there a long-run relation between the trade balance and the real effective exchange rate of LDCs? *Economics Letters, 36*(4), 403-407.

Bahmani-Oskooee, M., Chang, T., Yang, M.-S., & Yang, H.-L. (2016). Revisiting real interest rate parity in BRICS countries using ADL test for threshold cointegration. *Economic Analysis and Policy*, *51*, 86-89.

Bensaid, B., & Jeanne, O. (1997). The instability of fixed exchange rate systems when raising the nominal interest rate is costly. *European Economic Review, 41*(8), 1461-1478.

Bouraoui, T., & Phisuthtiwatcharavong, A. (2015). On the determinants of the THB/USD exchange rate. *Procedia Economics and Finance*, *30,* 137-145.

Comunale, M. (2017). Dutch disease, real effective exchange rate misalignments and their effect on GDP growth in EU, *Journal of International Money and Finance, 73*, 350-370.

De Los Rios, A.D., & Sentana, E. (2011). Testing uncovered interest parity: A continuous-time approach. *International Economic Review, 52*(4), 1215-1251.

De Truchis, G., Dell'Eva, C., & Keddad, B. (2017). On exchange rate comovements: New evidence from a Taylor rule fundamentals model with adaptive learning. *Journal of International Financial Markets, Institution and Money, 48,* 82-98.

Dooley, M.P., & Isard, P. (1980). Capital controls, political risk, and deviations from interest-rate parity. *Journal of Political Economy*, *88*(2), 370-384.

Edwards, S. (1988). Real and monetary determinants of real exchange rate behaviour: Theory and evidence from developing countries. *Journal of Development Economics*, *29*(3), 311-341.

Fukuda, S., & Tanaka, M. (2017). Monetary policy and covered interest parity in the post GFC period: Evidence from the Australian dollar and the NZ dollar. *Journal of International Money and Finance*, 74, 301-317.

Herger, N. (2016). Panel data models and the uncovered interest parity condition: The role of two-way unobserved components. *International Journal of Finance and Economics*, *21(3),* 294-310.

Ibrahim, W. (2016). Econometric analysis of determinants of real effective exchange rate in Nigeria (1960-2015). *Timisoara Journal of Economics and Business, 9*(1), 62-80.

Kandil, M. E., & Bahmani-Oskooee, M. (2007). *Exchange rate fluctuations and output in oil-producing countries: The case of Iran* (IMF Working Paper No. WP/07/113). Retrieved from International Monetary Fund website: https://www.imf.org/~/media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/wp/2007/_wp07113.ashx

Kia, A. (2013). Determinants of the real exchange rate in a small open economy: Evidence from Canada. *Journal of International Financial Markets, Institutions and Money, 23*, 163-178.

Meese, R., & Rogoff, K. (1988). Was it real? The exchange rate-interest differential relation over the modern floating-rate period. *Journal of Finance*, *43*(4), 933-948.

Meng, X., & Huang, C.H. (2016). Nonlinear models for the sources of real effective exchange rate flatuations: Evidence from the Republic of Korea. *Japan and the World Economy*, *40*, 21-30.

Ng, Y. L., Har, W. M., & Tan, G. M. (2008). Real exchange rate and trade balance relationship: An empirical study on Malaysia. *International Journal of Business and Management*, *3*(8), 130-137.

Nouira, R., & Sekkat, K. (2015). What determines the extent of real exchange rate misalignment in developing countries? *International Economics*, *141*, 135-151.

Ohmae, K. (1996). *The end of nation state: The rise of regional economies*. New York, NY: Free Press Paperbacks.

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics, 68*(1), 79-113.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association, 94*(446), 621-634.

Sarantis, N. (1999). Modeling nonlinearities in real effective exchange rates. *Journal of International Money and Finance*, *18*, 27-45.

Sek, S. K., & Har, W. M. (2014). Testing for Marshall-Lerner condition: Bilateral trades between Malaysia and trading partners. *Journal of Advanced Management Science*, *2*(1), 23-28.

Yu, H. (2010). Government debt and the long-term interest rate: Application of an extended open-economy loanable funds model to Poland. *Managing Global Transitions*, *8*(3), 227-237.

Appendix A

Table A1: List of sample countries

Country	Income Level	Sample Period
Thailand	Middle	1996-2015
Indonesia	Middle	2000-2015
Malaysia	Upper middle	1994-2015
Singapore	High	1994-2015
Korea	High	1994-2015
Japan	High	1994-2015
India	Lower middle	1994-2015
China	Middle	1994-2015
Philippine	Lower middle	1994-2015

Notes: All data were collected based on the availability of data for each country.

Table A2: Sources of data

Variables	Variable definition	Data Source
REER	Real effective exchange rate (2010=100) (Billions of dollars)	BIS
INTRATE	Real interest rate (%)	WDI
TOT	Terms of trade	WDI
Government Debt	Government Gross Debt (% of GDP)	IMF

Notes: All variables were transformed into logarithm form, except for interest rate.