Journal of Business and Social Science Review
Issue: Vol. 2; No.10; October 2021 (pp.42-53)
ISSN 2690-0866(Print) 2690-0874 (Online)
Website: www.jbssrnet.com
E-mail: editor@jbssrnet.com
Doi: 10.48150/jbssr.v2no10.2021.a4

The Monetary Approach To Exchange Rate Determination In Sri Lanka

Suresh Ranasinghe
Institute of Policy Studies of Sri Lanka (IPS)
Sri Lanka
E-mail: sureshr@ips.lk

Abstract

This paper attempts to investigate the major determinants of the exchange rate using the monetary approach in the context of Sri Lanka, giving emphasis to the period 1994-2018. Consequently, the traditional flexible-price monetary model extended by adding relative foreign exchange reserve and dollarization ratio to traditional monetary fundamentals and Johansen multivariate cointegration test and the 'Vector Error Correction Model' employed as the key data analysing techniques. The findings of the study provide evidence about the validity of the flexible-price monetary model on explaining the long-run behaviour of the nominal exchange rate. Since estimated coefficients of relative money supply, relative real income, interest rate differentials, relative foreign exchange reserves and dollarization ratio are theoretically consistent as well as statistically significant, these variables can be identified as major determinants of the nominal exchange rate in Sri Lanka under the monetary approach. Additionally, this study revealed that monetary policy is significant in determining the nominal exchange rate behaviour in the long-run. Hence it is essential that the exchange rate policy, as well as monetary policy, should be conducted in a parallel way to achieve the foreign exchange rate stability in the economy.

Keywords*:* Flexible-Price Monetary Model; Monetary Policy; Exchange Rate: Cointegration;Vector Error Correction Model

Introduction

The exchange rate is the price of one currency in terms of another currency or it is simply the rate at which currencies are exchanged and it plays a crucial role in international trade. Hence, as a key price variable in the economy, an exchange rate act as a nominal anchor for domestic prices and it is potentially effects on all transactions with the rest of the world while maintaining international competitiveness. Under the era of globalization, the importance of exchange rate continuously increasing parallel to the development of international financial flows. Consequently, in both developed and developing countries, exchange rate stability is one of the main macroeconomic objective and governments have adopted different exchange rate management policies to maintain a realistic and stable exchange rate. Under a flexible exchange rate system, the volatility of the exchange rate is an unavoidable situation. Therefore in recent decades, many countries in the world experienced adverse effects of massive exchange rate volatility. Generally, factors affecting exchange rate also causes the high volatility in exchange rate and these factors include output level, inflation, trade openness, interest rates, domestic and foreign money supply, exchange rate regime, central bank independence, changes in the balance of payments, international capital movements, developments in information and communication technologies and monetary and fiscal policies. Due to this inherent volatile nature of exchange rate associated with flexible exchange rate system, policymakers and economists more concerned about the determinants of the exchange rate.

Therefore many economists and policymakers used several approaches to detect the major determinants of exchange rate relating to particular economies and the results of their studies differ among the countries as well as the sample period that they considered. Nevertheless, some studies relating to major determinants of rates of exchange suggest that monetary factors are most often responsible for influencing movements of the exchange rate (Cauiabano & Divino, 2010). Therefore several studies have carried out to identify the determinants of exchange rate using the monetary approach in international level but it can be identified that there is lack of studies relating to monetary approach to detect determinants of the exchange rate in the context of Sri Lanka.

In this scenario, this paper aimed to bridge this research gap through detecting the major determinants of the nominal exchange rate in the context of Sri Lanka using the monetary approach.

Literature Review

In the last five decades, several studies have conducted to detect the ability of the monetary approach to explaining the movements of the nominal exchange rate. Under the Bretton Wood era of the exchange rate, traditional regression analysis often used to detect the validity of the monetary approach and the majority of the studies found supportive results. In contrast under the floating exchange rate regime, many studies revealed mixed evidence relating to the same subject area. Especially Frankel (1976), Bilson (1978) and Dornbusch (1979) found favourable results but the results obtained by Meese and Rogoff (1983), Frankel (1984) Boughton (1988) did not provide evidence for the validity of monetary model.

The development of the cointegration and related econometric techniques provide the base for many empirical investigations to detect the validity of the monetary approach through identifying the long-run relationship among variables. Most of the early studies used Engle and Granger (1987) two-step cointegration methodology and they were unable to find a piece of evidence relating to the long-run relationship among the variables (Meese & Rogoff, 1986; Baillies & Selover, 1987; Kearney & MacDonald, 1990) and concluded that monetary model has low practical relevance. However few studies in the post-Bretton Wood era, emphasizes that disability of monetary model to explain the movements of the exchange rate is basically due to the low power of Engle-Granger cointegration test, short time span and small sample sizes during this period (Islam & Hasan , 2006).

In recent decades many studies used of Johanson and Juselius (1990) cointegration test as an alternative techniques, and found mixed results but the majority of the studies proved the validity of the monetary model but there were several criticisms on use of monetary approach to examine the determinants of the nominal exchange rate. Flood and Rose (1995) criticise the use of the monetary model to explain the behaviour of the exchange rate in short-run while arguing when the exchange rate shows substantial volatility, the economic fundamentals do not show volatility in short-run. Sarno and Valente (2008) indicate that poor performance of the monetary model caused by the weakness of model selection criteria rather than lack of information contents in monetary fundamentals. Moreover, this study emphasized that the strength of the link between the nominal exchange rate and monetary fundamentals is different across currencies.

However, there is no rational foundation to neglect the monetary approach based on these criticisms since validity of a fundamental economic model could differ due to adopted econometric technique, time span, economy etc. Furthermore Engel, Mark and West (2007) emphasize that fundamental economic models cannot be judged by comparing them with the random walk model. The author further explained that good models do not need necessarily outperform the random walk model because outperforming a random walk model is just a strong criterion in accepting the model (Jegajeevani , 2012).

Civcir (2003) conducted a study on 'The Monetary Model of the Exchange Rate under High Inflation' and the author tried examined the validity of the monetary approach for determination of Turkish Lira/USD exchange rate using monthly data of the traditional monetary fundamentals including relative money supply, real income and interest rate. Johanson cointegration approach and VECM method were adopted for detecting the long-run relationship and the findings of the study revealed that long-run relationship between nominal exchange rate and monetary fundamentals and identified a clear short-run tendency of the exchange rate to revert to the equilibrium value defined by the estimated long-run flexible price monetary model.

Islam and Hasan (2006) reappraised the validity of the monetary model in the determination of the Dollar-Yen exchange rate using Johansen cointegration and VECM modelling techniques. The author used quarterly data of the traditional monetary fundamentals for the period of 1974 to 2003 and the results were indicated that a long-run relationship between monetary variables and the VEC model indicate a long-run causality running from the relative money supplies, incomes, and interest rates to the nominal exchange rate. In addition, the results indicate a short-term causality which is running from the exchange rate and the Japanese interest rate to the exchange rate variable.

Adawo and Effiong (2013) examined the validity of a flexible monetary model in the context of Nigeria over a long time span covering both fixed and floating exchange rate regimes from 1987 to 2008 using quarterly data. The study adopted the Johanson cointegration technique as the standard approach to detect the long-run relationship and result emphasizes that a long-run relationship between the nominal exchange rate the traditional monetary fundamentals.

However. Estimated cointegrating coefficients were the theoretically significant exception of the output differential. Moreover, the estimated coefficient of the money supply differential is close to unity which indicates that the monetary policy is significant in determining nominal exchange rate behaviour in the long-run in the context of Nigeria. One of the important facts of the result is theoretically consistent but statistically insignificant coefficient of the real output differentials. However, the author justified this situation emphasizing that relative domestic income has no impact on exchange rate movement in the long-run for Nigeria due to the low production and income as well as non-diversified production structure. Furthermore, Meredith (2003), Bitzenis and Marangos (2007), Liew, Baharumshah and Puah (2009), Ekong and Onye (2013) have found the same result which indicates that the long-run association between monetary variables and the nominal exchange rate.

In recent years many studies examined the determinants of exchange rate using monetary approach though modifying the traditional flexible-price monetary model or inclusion of non-traditional monetary fundamentals into the traditional flexible-price monetary model. Saeed, Awan, Sial and Sher (2012) investigated the determinants of exchange rate using the monetary approach for Pakistan Rupee-USD exchange rate and this study is aimed to identify the long-run relationship between the monetary variables and exchange rate rather than test the validity a traditional monetary model. Therefore the authors used relative money supply, relative foreign exchange, relative total debt and political instability as major variables.

Boyko (2002) carried out a comprehensive analysis to detect the validity of the flexible-price monetary model in the context of Ukraine. The author modified the traditional flexible-price monetary model by adding the dollarization ratio into the model and compared the performance of both models through constructing an ECM. The findings proclaimed that the coefficient of domestic interest rate and equilibrating are the only significant terms in the traditional flexible-price model. In contrast, results of the modified model indicate that the inclusion of the dollarization variable dramatically improved the performance of the model since parameters of the modified model is jointly statistically significant as well as explain 74 per cent of the variation in the nominal exchange rate.

Methodology

This empirical study entirely based on time series analysis and to examine the major determinants of nominal exchange rate using the monetary approach, the basic flexible price monetary model is augmented with the relative foreign exchange reserves and dollarization ratio. Therefore empirical model can be written as:

$$\mathbf{NER_t = \beta_0+\beta_1(m_t-m_t^*) + \beta_2(y_t-y_t^*) + \beta_3(i_t - i_t^*) + \beta_4(f_t - f_t^*) + \beta_5 dr_t + \mu_t} \quad (1)$$

Where NER is the dependent variable which is defined as the nominal exchange rate expressed as a ratio of Sri Lankan Rupee per unit of US Dollar. $(m_t-m_t^*)$ denotes the relative money supply which is defined as the difference of the money supply between Sri Lanka (m) and the USA (m*). $(y_t-y_t^*)$ stands for relative real income which is defined as the difference of real income between Sri Lanka (y) and the USA (y*), $(i_t - i_t^*)$ is the relative interest rate which is defined as interest rate difference between Sri Lanka (i) and the USA (i*). $(f_t - f_t^*)$ denotes the relative foreign exchange reserves defined as the difference of foreign exchange reserves between Sri Lanka (f) and the USA (f*) while dr stands for dollarization ratio of Sri Lanka. The notation t indicates the current period and μ denotes the error term. Equation 1 as the initial model, β_0 represents the constant term while $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ are the coefficients relating to the explanatory variables such as relative money supply, relative real income, relative interest rate differential, relative foreign exchange reserves and dollarization respectively. According to the literature, the expected signs for β_1, β_3 and β_5 are positive while expected signs for β_2 and β_4 are negative. All the data are applied in logarithmic form.

The monthly data relating to the sample period (1994-2018) was obtained from International Financial Statistics (IFS) provided by IMF, Databank of CBSL and databank of Federal Reserve Bank of St. Louis. To examine this empirical model, econometric techniques including Unit root rest, Lag selection criteria, Johanson integration test, Vector Error Correction Model (VECM), Variance decomposition test are deployed.

Results and Discussion

Unit-Root Test

According to the Augmented Dickey-Fuller test (See Appendix Table-1), all six variables are unable to reject the null hypothesis of the unit root in level because test statistic of each variable is smaller than the critical value at 5 per cent significance level in absolute terms. Thus it can be concluded that all six variables are non-stationary at levels. The test statistics in first difference of nominal exchange rate, relative money supply, interest rate differentials, relative foreign exchange reserves and dollarization are higher than the critical value of each variable at 5 per cent significant level in absolute terms. In the case of relative real income in first difference is failed to reject the null hypothesis of unit root at 5 per cent significance level but it is rejected under the 10 per cent significance level. Consequently, all six variable including nominal exchange rate, relative money supply, relative real income, interest rate differentials, relative foreign exchange reserves and dollarization are integrated at order one (I(1)).

Cointegration Test

In order to conduct cointegration test, selection of optimal lag order must be perform according to a valid criteria. Thereforethe VAR system, AIC and SIC have been employed (See Appendix Table-2) and the lag order of 2 selected as optimal lag length based on SIC and HQ criteria. At this lag length, the autocorrelation LM test (See Appendix Table-4) was unable to reject the null hypothesis of no serial correlation in the model.

With an optimal lag order of 2, the Johansson multivariate cointegration test is employed (See Table-1). According to the results, unrestricted cointegration rank test (trace) provide evidence for one cointegrating vector because the trace statistic is greater than its critical value at 5 per cent level while rejecting the null hypothesis of no cointegrating vector. In contrast, unrestricted cointegration rank test (Maximum Eigenvalue) indicate that there is no cointegration equation at 5 per cent significance level. Therefore the unrestricted cointegration rank test (trace) and unrestricted cointegration rank test (Maximum Eigenvalue) provide contradictory evidence about the existence of a cointegration relationship.

Table 1. Johanson Cointegration Test

Null Hypothesis	Eigenvalue	Trace Statistic	Critical Value (5%)	Max-Eigen Statistic	Critical Value (5%)
r = 0	0.110	**98.515**	95.754	31.844	40.078
r ≤ 1	0.084	66.671	69.819	24.053	33.877
r ≤ 2	0.073	42.618	47.856	20.559	27.584
r ≤ 3	0.054	22.059	29.797	15.046	21.132
r ≤ 4	0.024	7.013	15.495	6.543	14.265
r ≤ 5	0.002	0.470	3.841	0.470	3.841

Notes. r indicates the number of cointegrating vector. Critical values are from MacKinnon-Haug-Michelis (1999) p-values. Bold value indicate significance of the test statistic at 5% level. Estimates are derived by the author.

However, Kasa (1992), Serletis and King (1997), Johanson and Juselium (1990) emphasizes that one should give more priority to trace statistic when the results of the trace statistic and the maximum eigenvalue statistic produce conflicting results. The authors justified it because the trace statistic holds more power than the maximum eigenvalue statistic since trace statistic considers all the smallest eigenvalues. Therefore study further continued based on the results provided by the traces statistic that the evidence of existing cointegrating relationship among variables. It supports the fact that the monetary approach provides a reasonable explanation of the nominal exchange rate behaviour during the sample period.

Vector Error Correction Estimates

According to the results of the VECM, the long-term cointegrating equation can be summarized as follows.

$$\mathbf{lnner_t = 0.260 + 1.083lnrm_t - 1.415lnry_t + 0.039lnri_t - 0.138lnrf_t + 0.300lndr_t} \quad (2)$$
$$\mathbf{(7.081)\quad (-2.726)\quad (2.867)\quad (-4.653)\quad (3.995)}$$

Where $lnrm_t = \log(m_t - m_t^*)$, $lnry_t = \log(y_t - y_t^*)$, $lnri_t = \log(i_t - i_t^*)$, $lnrf_t = \log(f - f^*)$ and $lndr_t$ indicate the dollarization ratio in log terms. The t-statistics are indicated in ( ).

The results obtained from the long-term cointegrating equation are theoretically consistent because each and every explanatory variable in the model is statistically significant at 5 per cent significance level and each variable provide the correct sign as explained in the literature.

The sign of relative money supply (See Appendix Table-3) is positive as expected and it implies that an increase in relative money supply lead to depreciation of the nominal exchange rate because an increase in domestic money supply induces the domestic price level which ultimately causes the unfavourable effect on international competitiveness in export goods and it results in deterioration of the trade balance. Moreover, the estimated coefficient of the relative money supply is approximately equal to unity and it confirms that proportional change in the nominal exchange rate to changes in the money supply. Also, it means that monetary policy is significant in determining the nominal exchange rate behaviour in the long-run within the context of Sri Lanka.

The coefficient of the relative real income (See Appendix Table-3) is negative and it depicts that an increase in relative real income leads to an appreciation of nominal exchange rate and improvement of the international competitiveness and trade balance following a reduction in the domestic price level. The significant and positive coefficient of the interest rate differentials indicates that an increase in relative interest rates lead to depreciation in the nominal exchange rate since the increase in the domestic interest rate leads to a decrease in demand for real money and this causes to exchange rate depreciation through an increase in the domestic price level. In addition to that this kind of situation can be occur when nominal interest rate is a combination of real interest rate and expected inflation level and the real interest rate is identical to two countries, increase in nominal interest rate causes to increase expected inflation which ultimately increases expenditure on goods and reduction in demand for money and causes exchange rate depreciation through increase in the domestic price level. Also, Levich (1985) explained that the coefficient of interest rate differential should be positive and close to 0.04 for monthly data. Therefore obtained coefficient of 0.039 is satisfying the empirical condition.

The coefficient of foreign exchange reserve differentials (See Appendix Table-3) is significant as well as it provides a negative sign since an increase in foreign exchange reserves causes exchange rate appreciation since the increase in foreign exchange causes to reduce the balance of trade deficit and current account deficit. The dollarization ratio is also significantly related with the behaviour of the nominal exchange rate and imply a positive sign which explained that increase in dollarization causes to depreciation in the nominal exchange rate because increase of deposits in foreign currency relative to the domestic money supply indirectly induce the demand for the foreign currency (Boyko, 2002).

In addition to the long-term relationship, short-term dynamics of the empirical model can be explain based on the results obtained from VECM estimates which are shown in Appendix Table-5. The result shows that the error correction term is negative and significant and it signifies that there is a long-run causality running from all variables in the empirical model towards the nominal exchange rate. The coefficient -0.394 indicates that a previous period disequilibrium from long-run equilibrium is corrected in the current period as an adjustment speed of 39.4 per cent. In other words, it indicates that around 39.4 per cent of disequilibrium in the nominal exchange rate in the short-term is corrected monthly.

Furthermore, VEC residual serial correlation LM test (See Appendix Table-4) indicate that the VECM is free from serial correlation at the lag order of 1(P-1) lag level selected as optimal lag order to VECM) since the P-value at lag order 1 is greater than the 0.050. According to the Cusum test (See Appendix Figure 1), the VECM model is dynamically stable because in the Appendix Figure 1, the blue trend line allies within the red boundaries.

Causality analysis relating to the VECM provide more insights into the dynamic relationship interactions and the strength of the causal relationship among the variable in the model. Also, it confirms the existence of a cointegrating relation among the variables. The long-run causal effects can be examined through the statistical significance of the error correction term. Therefore -0.394 error correction term is statistically significant, it indicates a long-run causal relationship among the variables. The short-run causal relationship can be detected through the F-statistic and the statistical significance of the short-run coefficients of VECM. According to the P values obtained from the main model (See Appendix Table-3) indicate that coefficient of relative foreign exchange reserves with lag 1 is statistically significant at the 5 per cent significant level, dollarization ratio with lag 1 is statistically significant at the 10 per cent significance level and the t-statistic of each short-run coefficients confirm this results.

In contrast, short-run coefficient of relative money supply, relative real income and interest rate differential are statistically insignificant at 5 per cent significance level indicating that no short-run causal relationship running from these traditional monetary fundamentals towards nominal exchange rate.

This kind of situation can be justified because there might be variables with no short-run relationship but a causal long-run relationship. One of the major examples for this kind of situation is the relationship between money supply and price level. Changes in money supply don't lead to immediate changes in the price level or inflation but there is a well-known positive long-run relationship. Since the flexible price model based on the assumption of PPP condition, initial effects of changes in the traditional monetary fundamentals on the nominal exchange rate are transmitted through the changes in the price level. Generally, an increase in domestic money supply induces the domestic price level to increase which in turn reduces the international competitiveness of domestic good and ultimately causes to depreciation in the nominal exchange rate. An increase in relative domestic output causes appreciation in the nominal exchange rate following a reduction of the domestic price level. Likewise, an increase in the domestic interest rate leads to a decrease in demand for real money and this induce the exchange rate to depreciate through an increase in the domestic price level. Hence there is no rational foundation to expect the short-run causal relationship from traditional monetary fundamentals to the nominal exchange rate since all of their effects are transmitted through the changes in price level after a time lag.

Variance Decomposition

Variance decomposition of the forecast error gives the percentage of unexpected variation in each variable that is produced by shocks form itself and other variables. It indicates the relative impact that a variable has on another. According to the results (See Appendix Table 7) in the first period, 100 per cent forecast error variance in nominal exchange rate explained by nominal exchange rate itself and contribution from main explanatory variables are strongly exogenous. However, percentage variance explained by own shock for nominal exchange rate declines 86 per cent in the fifth period and continues falling until it ends with 43 per cent in the 12^{th} period indicating a weak endogenous in this period. In contrast, the influence on the nominal exchange rate from the explanatory variable is increasing which exhibit that these explanatory variables are strongly endogenous in future. Therefore throughout this period, merely 35 per cent of the variance in nominal exchange rate is from relative foreign exchange reserves, about 10 per cent of the variance is from the relative real output differential while merely 1 per cent, 7 per cent and 3 per cent of the variance explained by relative money supply, relative interest rate and dollarization respectively.

Conclusion and Recommendations

This study mainly aimed to explain the major determinants of the nominal exchange rate (USD/LKR) in the context of Sri Lanka using the monetary approach for the period of 1994-2018. In order to pave the way to achieve the objective, the traditional flexible-price monetary model extended by adding relative foreign exchange reserves and dollarization ratio to traditional monetary fundamentals based on empirical literature. The obtained results were able to identify a long-run relationship running from all the variables in the model to the nominal exchange rate. Furthermore, the estimated cointegration coefficients were theoretically consistent with the flexible-price monetary model as explained by the literature as well as coefficients are statistically significant. Consequently, the empirical results of the present study provide evidence for the validity of the flexible-price monetary model in explaining the behaviour of the nominal exchange rate in the context of Sri Lanka.Hence the monetary approach can still be used as a valid empirical framework to explain the long-run behaviour of the nominal exchange rate and the monetary policy can be used as a major instrument to influence the nominal exchange rate. Additionally, there is a rational foundation to accept the fact that the changes in the nominal exchange rate is a monetary phenomenon.

Since flexible-price monetary policy based on the PPP condition, effects of every monetary variable are transmitted through the changes in the price level. It implies that the importance of maintaining the price level stability in order to prevent the adverse effects of exchange rate fluctuations. In recent years (2019-2020) many developing countries including Sri Lanka experienced exchange rate depreciation situation mainly due to the strengthening the US economy and with that the USD, US-China trade war. In this kind of situation, easy monetary policy and high inflation massively cause to multiply the effect of currency depreciation. Therefore it is necessary to use contractionary monetary policy in order to mitigate the expansionary effect brought by high inflation.

Moreover, exchange rate policy, as well as monetary policy, should be conducted in a parallel way to achieve the foreign exchange rate stability because both policies affect each other, as well as great caution, should be exercised with regard to interest rate because reflects inflationary expectations and its effect on the economy in various ways.

Moreover, the decline of foreign reserves from 2010 is also caused the currency depreciation in Sri Lanka which emphasize the importance of maintaining stable foreign exchange reserve situation within Sri Lanka. Diversification and development of the production structure including export sector is important for managing the exchange rate stability. Increase the stability of the financial system, ensure the soundness of the financial system, reduce high potential risks associated with the banking industry are also required to facilitate to mitigate exchange rate fluctuations.

References

Adawo, M. A., & Effiong, E. L. (2013). Monetary exchange rate model as a long-run phenomenon: evidence from Nigeria. Munich Personal RePEc Archive, 1-18. Retrieved November 25, 2019, from https://mpra.ub.uni-muenchen.de/46407/1/MPRA_paper_46407.pdf

Baillies, R. T., & Selover, D. D. (1987). Cointegration and Models of Exchnage Rate Determination. International Journal of Forecasting, 3(1), 43-51. Retrieved December 25, 2019, from https://doi.org/10.1016/0169-2070(87)90077-X

Bilson, J. F. (1978). The Current Experience with Floating Exchange Rates: An Appraisal of the Monetary Approach. The American Economic Review, 68(2), 392-397. Retrieved December 3, 2019, from https://www.jstor.org/stable/1816727?seq=1

Bitzenis, A. P., & Marangos, J. (2007). See discussions, stats, and author profiles for this publication at: https://ww The monetary model of exchange rate determination: the case of Greece (1974?1994). International Journal of Monetary Economics and Finance, 1(1), 57-88. Retrieved November 25, 2019, from http://www.johnmarangos.eu/wp-content/uploads/2014/10/45-2007-Int.%20J.%20Monetary%20Economics%20and%20Finance.pdf

Boughton, J. M. (1988). The monetary approach to exchange rates: What now remains?. 4-25. Retrieved December 15, 2019, from https://ies.princeton.edu/pdf/E171.pdf

Boyko, N. (2002). The Monetary Model of Exchange Rate Determination. Master's thesis, Kyiv School of Economics, 1-52. Retrieved December 15, 2009, from https://kse.ua/wp-content/uploads/2019/02/Boyko.pdf

Cauiabano, S. M., & Divino, J. A. (2010, November). Exchnage Rate Determination: An Application of a Monetary Model for Brazil. International Advances in Economic Research, 16, 345–357. Retrieved December 2019, 20, from https://doi.org/10.1007/s11294-010-9276-x

Cevik, S., Harris , R., & Yilmaz , F. (2015, March). Soft Power and Exchange Rate Volatility. IMF Working Papers, 3-8. Retrieved December 22, 2019, from https://www.imf.org/external/pubs/ft/wp/2015/wp1563.pdf

Dornbusch, R. (1979). Monetary policy under exchange rate flexibility. National Bureau of Economic Research(No. w0311). Retrieved December 03, 2019, from https://www.nber.org/papers/w0311.pdf

Ekong, C. N., & Onye, K. U. (2013). The failure of the monetary exchange rate model for the naira-dollar. Munich Personal RePEc Archive, 8-19. Retrieved December 02, 2019, from https://mpra.ub.uni-muenchen.de/88238/1/MPRA_paper_88238.pdf

Engel, C., Mark, N. C., & West, K. D. (2007). Exchange rate models are not as bad as you think [with comments and discussion]. NBER macroeconomics annual, 22, 381-473. Retrieved November 26, 2019, from http://faculty.econ.ucdavis.edu/faculty/bergin/ECON260D/EngelMarkWest8-2-07.pdf

Engle, R. F., & Granger, C. W. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. Econometrica, 55(2), 251-276. Retrieved December 30, 2019, from https://www.jstor.org/stable/1913236?seq=1

Flood, R. P., & Rose, A. K. (1995). Fixing exchange rates a virtual quest for fundamentals. Journal of monetary economics, 36(1), 3-37. Retrieved December 04, 2019, from https://www.nber.org/papers/w4503.pdf

Frankel, J. A. (1984). Tests of monetary and portfolio balance models of exchange rate determination. Exchange rate theory and practice, 239-260. Retrieved December 12, 2019 , from https://www.nber.org/chapters/c6837.pdf

Frenkel, J. A. (1976). A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence. The Scandinavian Journal of Economics, 78(2), 200-224. Retrieved December 07, 2019, from https://www.jstor.org/stable/3439924?seq=1

Islam, M. F., & Hasan , M. S. (2006). The monetary model of the Dollar-Yen exchange rate determination: A cointegration approach. International Journal of Business and Economics, 5(2), 129-145. Retrieved November 29, 2009, from http://www.ijbe.org/table%20of%20content/pdf/vol5-2/vol5-2-03.pdf

Jegajeevani , S. (2012). Validity of the Monetary Model of Exchange Rate: Empirical Evidence from Sri Lanka. Staff Studies, 42(1), 47-74. Retrieved December 10, 2019, from https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/statistics/otherpub/StaffStudies_Vol_42_2012-min.pdf

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. Oxford Bulletin of Economics and statistics, 52(2), 169-210. Retrieved December 27, 2019, from https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x

Kasa, K. (1992). Adjustment costs and pricing-to-market theory and evidence. Journal of International Economics, 32(1-2), 1-30. Retrieved December 25, 2019, from https://doi.org/10.1016/0022-1996(92)90034-H

Kearney, C., & MacDonald, R. (1990). Rational expectations, bubbles and monetary models of the exchange rate: the Australian/US dollar rate during the recent float. Australian Economic Papers, 29(54), 1-20. Retrieved December 18, 2019, from https://doi.org/10.1111/j.1467-8454.1990.tb00467.x

Levich, R. M. (1985). Empirical studies of exchange rates: price behavior, rate determination and market efficiency. Handbook of international economics, 2, 979-1040. Retrieved December 25, 2019, from https://doi.org/10.1016/S1573-4404(85)02010-X

Liew, V. K., Baharumshah, A. Z., & Puah, C. H. (2009). Monetary Model of Exchange Rate for Thailand: Long-run Relationship and Monetary Restrictions. Global Economic Review, 38(4), 385-395. Retrieved December 02, 2009, from https://doi.org/10.1080/12265080903391784

Liew, V. K.-S. (2009). Linear and nonlinear monetary approaches to the exchange rate of the Philippines peso-Japanese yen. Economics Bulletin, 29(2), 1331-1340. Retrieved November 27, 2019, from https://mpra.ub.uni-muenchen.de/15550/

Meese, R. A. (1986). Testing for bubbles in exchange markets: A case of sparkling rates? Journal of political economy, 94(2), 345-373. Retrieved December 01, 2019, from https://www.jstor.org/stable/1837408

Meese, R. A., & Rogoff, K. (1983). Empirical exchange rate models of the seventies: Do they fit out of sample? Journal of international economics, 14(1-2), 3-24. Retrieved December 9, 2019, from https://doi.org/10.1016/0022-1996(83)90017-X

Meese, R., & Rogoff, K. (1986). The out-of-sample failure of empirical exchange rate models: sampling error or misspecification? Exchange rates and international macroeconomics, 67-112. Retrieved December 9, 2019, from https://www.nber.org/chapters/c11377.pdf

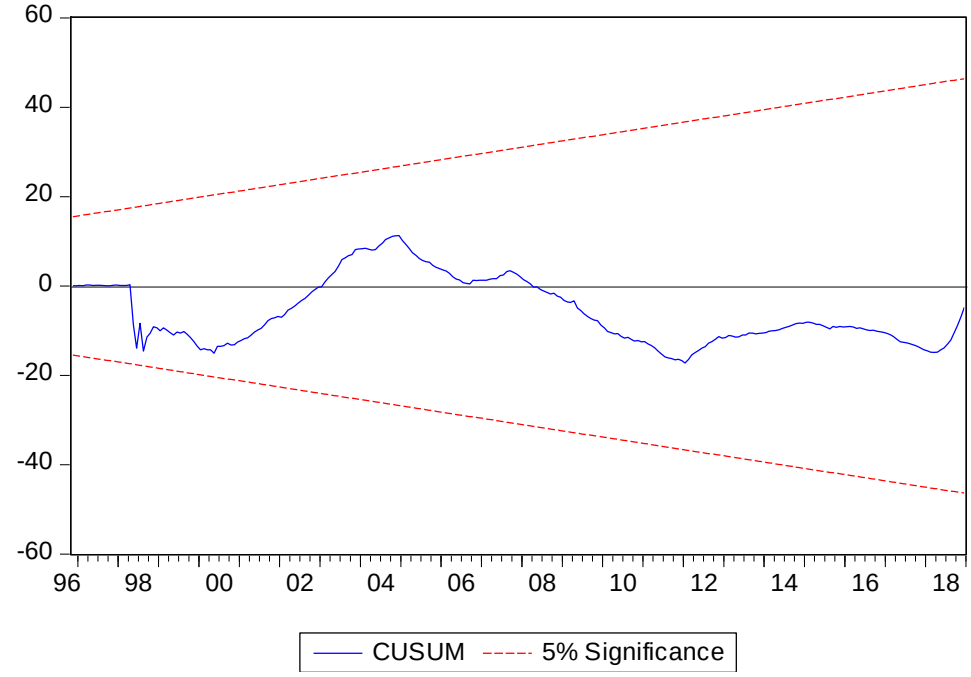
Meredith, G. (2003). Mediurn-Term Exchange Rate Forecasting: What Can We Expect? IMF Working Papers, No. 3-21. Retrieved December 19, 2019, from https://www.elibrary.imf.org/doc/IMF001/04594-9781451843934/04594-9781451843934/Other_formats/Source_PDF/04594-9781451891768.pdf?redirect=true

Sarno, L., & Valente, G. (2008). Exchange rates and fundamentals: Footloose or evolving relationship? Journal of the European Economic Association, 7(4), 786-830. Retrieved December 10, 2019, from http://wrap.warwick.ac.uk/1711/1/WRAP_Sarno_CEPR-DP6638%5b1%5d.pdf

Serletis, A., & King, M. (1997). Common stochastic trends and convergence of European Union stock markets. The Manchester School, 65(1), 44-57. Retrieved December 26, 2019, from https://ideas.repec.org/a/bla/manch2/v65y1997i1p44-57.html

Appendix

Figure 1. Cusum test results for stability diagnostics



Source: Author developed

Table 1. Augmented Dickey-Fuller Unit Root Test Results

Variable	Test for unit root in	Include in test equation	t-Statistic	P-value	Critical values		
					1%	5%	10%
LNNER	Level	Intercept	-1.105	0.715	-3.453	-2.871	-2.572
		Intercept + Trend	-1.992	0.603	-3.990	-3.425	-3.136
	First Difference	Intercept	-8.578	0.000	-3.453	-2.871	-2.572
		Intercept + Trend	-8.585	0.000	-3.990	-3.425	-3.136
LNRM2 (m-m*)	Level	Intercept	1.475	0.999	-3.453	-2.872	-2.572
		Intercept + Trend	-2.130	0.526	-3.991	-3.426	-3.136
	First Difference	Intercept	-3.663	0.005	-3.453	-2.872	-2.572
		Intercept + Trend	-4.058	0.008	-3.991	-3.426	-3.136
LNRY (y-y*)	Level	Intercept	1.403	0.999	-3.452	-2.871	-2.572
		Intercept + Trend	-1.639	0.775	-3.990	-3.425	-3.136
	First Difference	Intercept	-2.743	0.068	-3.452	-2.871	-2.572
		Intercept + Trend	-3.311	0.066	-3.990	-3.425	-3.136
LNRI (i-i*)	Level	Intercept	-1.214	0.669	-3.452	-2.871	-2.572
		Intercept + Trend	-0.953	0.947	-3.989	-3.425	-3.136
	First Difference	Intercept	-11.369	0.000	-3.452	-2.871	-2.572
		Intercept + Trend	-11.386	0.000	-3.989	-3.425	-3.136

LNRF (f-f*)	Level	Intercept	0.584	0.989	-3.453	-2.871	-2.572
		Intercept + Trend	-1.251	0.897	-3.990	-3.425	-3.136
	First Difference	Intercept	-3.897	0.002	-3.453	-2.871	-2.572
		Intercept + Trend	-4.041	0.009	-3.990	-3.425	-3.136
LNDR	Level	Intercept	-0.079	0.949	-3.454	-2.872	-2.572
		Intercept + Trend	-1.846	0.680	-3.992	-3.426	-3.136
	First Difference	Intercept	-20.356	0.000	-3.454	-2.872	-2.572
		Intercept + Trend	-20.621	0.000	-3.992	-3.426	-3.136

Note. Estimated are derived by the author.

Table 2. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	462.2164	NA	1.34e-09	-3.4046	-3.324205	-3.37231
1	3393.528	5709.494	5.53e-19	-25.0114	-24.44863	-24.78537
2	3592.787	379.1868	1.64e-19	-26.22975	-25.18461*	-25.80997*
3	3630.506	70.09128	1.62e-19*	-26.24258*	-24.71508	-25.62906
4	3655.004	44.42497	1.77e-19	-26.15675	-24.14687	-25.34948
5	3700.891	81.15890*	1.64e-19	-26.23053	-23.73828	-25.22953
6	3723.297	38.62395	1.83e-19	-26.12908	-23.15446	-24.93433
7	3750.274	45.29823	1.97e-19	-26.06175	-22.60475	-24.67325
8	3780.891	50.03750	2.07e-19	-26.02157	-22.08221	-24.43934

Notes. * indicates lag order selected by the criterion. LR (sequential modified LR test statistic), FPE (final prediction error), AIC (Akaike information criterion), SC (Schwarz information criterion), and HQ (Hannann-Quinn information criterion). NA is not applicable. Estimates are derived by the author .

Table 3.Parameter Estimates of Vector Error Correction Model

	D(LNNER)	D(LNRM2)	D(LNRY)	D(LNRI)	D(LNRF)	D(LNDR)
CointEq1	-0.394	0.008	0.000	0.084	0.357	0.036
	[-7.819]	[0.839]	[0.158]	[0.667]	[2.170]	[1.109]
D(LNNER(-1))	0.201	-0.007	-0.001	-0.076	-0.121	0.024
	[3.301]	[-0.623]	[-0.739]	[-0.504]	[-0.609]	[0.602]
D(LNRM2(-1))	-0.443	0.118	0.014	-1.483	0.561	0.271
	[-1.234]	[1.827]	[1.236]	[-1.661]	[0.479]	[1.158]
D(LNRY(-1))	1.267	0.149	0.864	5.785	9.460	-1.270
	[1.203]	[0.790]	[26.442]	[2.210]	[2.755]	[-1.852]

D(LNRI(-1))	-0.011	-0.004	-0.000	0.352	-0.115	-0.023
	[-0.470]	[-0.964]	[-0.176]	[6.139]	[-1.527]	[-1.520]
D(LNRF(-1))	0.068	-0.003	0.000	-0.044	-0.154	-0.003
	[3.323]	[-0.682]	[0.382]	[-0.865]	[-2.287]	[-0.237]
D(LNDR(-1))	-0.158	0.010	-4.85E-05	-0.111	0.503	-0.196
	[-1.670]	[0.591]	[-0.017]	[-0.472]	[1.630]	[-3.174]
C	0.003	0.006	0.000	-0.002	-0.014	-0.000
	[0.569]	[7.196]	[1.991]	[-0.197]	[-0.933]	[-0.041]

Note. t-statistics in [ ]. Estimates are derived by the author.

Table 4. VEC Residual Serial Correlation LM Test

Lags	LM statistic	Prob.
1	43.421	0.185
2	41.210	0.253

Note. Null Hypothesis: no serial correlation at lag order h.
Probs from chi-square with 36 df. Estimates are derived by the author.

Table 5. Parameter Estimates of Error Correction Model (short-run coefficients)

	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.394	0.050	-7.819	0.000
D(LNNER(-1))	0.201	0.061	3.301	0.001
D(LNRM2(-1))	-0.443	0.360	-1.234	0.218
D(LNRY(-1))	1.267	1.053	1.203	0.230
D(LNRI(-1))	-0.011	0.023	-0.470	0.639
D(LNRF(-1))	0.068	0.021	3.323	0.001
D(LNDR(-1))	-0.158	0.095	-1.670	0.096
C	0.003	0.005	0.569	0.570

R-squared	0.191
Adjusted R-squared	0.170
S.E. of regression	0.049
Sum squared resid	0.641
Log likelihood	441.234
F-statistic	8.977
Prob(F-statistic)	0.000

Note. Estimates are derived by the author.

Table 6. Outcome of VEC Granger Causality/ Block Exogenity Wald Test

Dependent Variable: D(LNNER)	
Excluded	Prob.
D(LNRM2)	0.217
D(LNRY)	0.229
D(LNRI)	0.638
D(LNRF)	0.001
D(LNDOLLAR)	0.095
All	0.010

Dependent Variable: D(LNRM2)	
Excluded	Prob.
D(LNNER)	0.534
D(LNRY)	0.429
D(LNRI)	0.335
D(LNRF)	0.495
D(LNDOLLAR)	0.555
All	0.795

Dependent Variable: D(LNRY)	
Excluded	Prob.
D(LNNER)	0.460
D(LNRM2)	0.216
D(LNRI)	0.861
D(LNRF)	0.702
D(LNDOLLAR)	0.987
All	0.731

Dependent Variable: D(LNRI)	
Excluded	Prob.
D(LNNER)	0.614
D(LNRM2)	0.097
D(LNRY)	0.027
D(LNRF)	0.387
D(LNDOLLAR)	0.637
All	0.136

Dependent Variable: D(LNRF)	
Excluded	Prob.
D(LNNER)	0.542
D(LNRM2)	0.632
D(LNRY)	0.006
D(LNRI)	0.127
D(LNDOLLAR)	0.103
All	0.037

Dependent Variable: D(LNDR)	
Excluded	Prob.
D(LNNER)	0.547
D(LNRM2)	0.247
D(LNRY)	0.064
D(LNRI)	0.128
D(LNRF)	0.813
All	0.095

Note. Statistically Significant coefficients are underlined. Estimates are derived by the author.

Table 7. Variance Decomposition of LNNER

Period	S.E.	LNNER	LNRM2	LNRY	LNRI	LNRF	LNDR
1	0.049	100.000	0.000	0.000	0.000	0.000	0.000
2	0.063	99.816	0.003	0.025	0.006	0.114	0.036
3	0.067	98.267	0.083	0.085	0.177	1.162	0.227
4	0.070	93.166	0.398	0.082	0.759	4.928	0.667
5	0.073	85.604	0.791	0.154	1.739	10.460	1.253
6	0.077	77.458	1.114	0.540	2.886	16.192	1.810
7	0.081	69.777	1.320	1.373	4.001	21.251	2.276
8	0.085	62.896	1.427	2.654	4.985	25.396	2.642
9	0.090	56.838	1.463	4.302	5.809	28.669	2.920
10	0.095	51.536	1.453	6.208	6.477	31.199	3.127
11	0.100	46.904	1.415	8.268	7.010	33.126	3.278
12	0.105	42.857	1.362	10.392	7.429	34.573	3.386

Note. Estimates are derived by the author.