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Testing Portfolio Balance Approach to Exchange Rate during Managed Float: An Empirical Evidence from India

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Abstract

Any global economic and financial disturbance affects trade and capital flows of our economy through exchange rate movements. The portfolio balance (PB) approach considers the capital flows as an additional variable explaining the exchange rate movements. This approach assumes domestic and foreign bonds to be imperfect substitutes. The bonds bearing high risk carry comparatively higher return in the form of risk premium. This study attempts to re-examine the empirical soundness of the PB model in respect of Indian rupee/ US dollar (INR/US $) exchange rate. It covers the period from 2000: 1 to 2023:1. Augmented Dickey Fuller test and Phillip Perron tests are used to test stationarity property of the variables. The Ordinary Least Square (OLS) methodology of regression is used for the purpose of estimation. Autocorrelation problem is dealt with by using the Cochrane Orcutt procedure. The PB model is estimated in naïve form as well as in partial adjustment form. The empirical finding shows that the PB model works well in partial adjustment framework rather than in its naïve form with speed of adjustment being three to four quarters. The money supply differential and relative real Gross Domestic Product (GDP) are identified as significant variables whereas the bond holding variable remained insignificant. However, in the long run, the model did not work. It is suggested that the fiscal and monetary policies that enhance capital spending in productive sectors should be implemented to achieve a gradually appreciating exchange rate.

Keywords: Exchange Rate, Capital Flows, Unit Root Test, Portfolio Balance Model, Autocorrelation

JEL Classification Code: F31, E43, E52.

Introduction

The portfolio balance (PB) theory is an extension of the monetary theory of exchange rate. The two approaches are different in their underlying assumption; the monetary model assumes the foreign bonds and domestic bonds to be perfect substitutes whereas the PB approach considers these two bonds to be imperfect substitutes of each other. The PB approach assumes that the domestic bonds and foreign bonds have different expected rates of returns. The bonus expected return on comparatively more risky domestic bonds is called 'risk premium'. To justify the risk premium, the following conditions must be satisfied:

- The risk element of the foreign and domestic bonds must be different for being imperfect substitutes of each other. This difference in the degree of risk will lead to different expected rates of return.
- The market participants must be risk adverse persons. Therefore, they expect different returns for different degrees of risk.

The uncovered interest rate parity clause does not work because of the risk premium and therefore we have:

$$r - r^* = E(\dot{s}) + RP$$

wherein, 'r' signifies the domestic interest rate, 'r*' represents foreign interest rate, RP is the risk premium component for domestic bonds and $E(\dot{s})$ is the expected rate of decrease in the value of domestic currency.

The origin of PB approach lies in the work of Pennti Kouri (1976) and William Branson (1976, 1977). Later the PB model was transformed by Girton and Henderson (1977) and Maurice Obstfeld (1980). The PB theory focuses on

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changes in current account balances due to changes in exchange rate caused by policy operations.

Theoretical Framework of the PB Model

The PB model can be derived as an expansion of monetary model. The flexi-price reduced form wherein the prices are fully flexible and the only change in assumption is that the bonds of the two economies are imperfect substitutes so that the neo-classical demand function for real money when both the physical and financial wealth is included, is:

$$\frac{M}{P} = aAy^{l}e^{-dr}w^{g}b^{h}$$

where w = wealth, b = bond holding by foreign economies, that is, domestic bond supply.

In logarithmic form, it is given as:

$$m = \alpha + p + \lambda y - \delta r + \gamma w - \eta b$$

Similar equation will exist for the foreign economy as:

$$m^* = \alpha^* + p^* + \lambda y^* - \delta r^* + \gamma w^* - \eta b^*$$

Subtracting above two equations, rearranging, and putting $(p - p^*) = s$, we have

$$s_t = (\alpha - \alpha^*) + (m - m^*) - \lambda(y - y^*) + \delta(r - r^*) - \gamma(w - w^*) + \eta(b - b^*)$$

If the physical wealth of the two countries is substitutable then the above equation can be written as:

$$s_t = \alpha^{**} + (m - m^*) - \lambda(y - y^*) + \delta(r - r^*) + \eta(b - b^*)$$

The above equation is the naïve static form of PB model wherein $(m - m^*)$ is the money supply difference of the two economies, $(y - y^*)$ is the real income difference, $(b - b^*)$ is the current account balance (CAB) difference, and $(r - r^*)$ is the interest rate difference of the two economies.

Objectives of the Study

Several studies have been done on testing the empirical soundness of the PB model of exchange rate but only a very few studies have been done in context of the developing countries particularly India. In this study, the main objectives are:

- Too test the empirical soundness of the PB approach for determining INR/US dollar exchange rate during the managed float period and
- To give policy recommendations for the appropriate authorities.

Review of Literature

Dooley and Isard (1980) proved that there is no premium for bearing political risk or country risk. Only the exchange risk is priced and changes in the risk premium depend on current account imbalances, budget deficits and foreign exchange intervention by the authorities. They used decomposition methodology and regression analysis on the data for the period 1973–1978 in respect of $/DM exchange rate. Their findings suggest that CAB variable does not have a considerable consequence on exchange rates movements.

Dooley and Isard (1982) modelled exchange rate ($/DM) for the period 1973:1 to 1977:12 using the PB approach which assumes that domestic and foreign bonds are complete alternatives of one another, and the expectations are also assumed to be rational. The model adopted was a reduced from solution of PB framework. The authors specified an association amongst the expected rate of variation in exchange rate, the relative interest rate and a set of assets variable.

Nicholas Sarantis (1994) conducted a study with the objective of investigating the impact of both domestic and foreign assets along with an important factor Sea Oil price, on the value of British currency. For this purpose, the author employed an expanded form of the asset market model for determining currency rates, which had been previously established by Branson et al. (1977). The study focused on five specific bilateral exchange rates of the developed nations including US $/Pound, Yen/Pound, Deutsche Mark/Pound, Italian Lira/Pound and French Franc/Pound. The findings of the model indicated a significant influence of sea oil prices on the long-term equilibrium currency rate of the British Pound. The estimation was based on data for the period spanning from 1972:1 to 1981:4. Were and Kisinguh (2013) conducted a study in Kenya to examine the factors influencing exchange rate determination. They utilised the econometric technique of Vector Error Correction

Model (VECM) and asserted that the CAB is an important variable in determining exchange rate. They observed that a rise in the CAB will result in a relatively high interest rate as compared to foreign interest rate, and an upward shift in foreign price level will raise the value (appreciation) of the national currency. On the contrary, an upward shift in the domestic price levels will cause decrease in value of the domestic currency. Khan and Abbas (2015) examined the application of PB approach in determining the currency rate of Pakistani rupee against US dollar. To analyse the data, they utilised quarterly times series for the period 2001 to 2010 and employed the ADF and PP tests to assess the stationarity property of the data. Their results highlighted a long-term relationship amongst the variables. Furthermore, the researchers observed that US bonds had an impact on movements of exchange rate.

Sakanko and David (2017) investigated the factors determining exchange rate for Nigeria with the help of VECM and used data from 1980 to 2016. They identified several factors as major long-run determinants, including the interest rate, domestic price levels, trade openness, capital inflows and buying of tradable and non-tradable merchandise by the government. In the short run, they found that interest rates and inflation rate are important contributing factors.

Oriavwote and Oyovwi (2012) reinvestigated the macroeconomic variables affecting real exchange rates. They used the ECM methodology, and the data was taken for the period 1970–2010. They identified nominal effective exchange rate, price level and capital flows as important variables influencing real exchange rates. However, they did not find technological progress, government spending, and terms of trade to be important determinants. Oke and Adetan (2018) investigated factors determining currency rate in Nigeria by applying the ECM and the annual data was used for the period 1986–2016. They established that GDP, inflation, and interest rate are important factors determining exchange rate. Ajao (2015) focused on volatility in exchange rate movements in Nigeria and utilised the GARCH (1, 1) and ECM. The study covered time span from 1981 to 2008 and found that government expenditure, trade openness, lagged values of exchange rate and interest rate movements are significant determinants explaining volatility in exchange rate in Nigeria. Srivastava (2015) conducted a study on the utilisation of currency derivatives. His research is based on 83 non-banking Indian firms that are more inclined to employ currency derivatives. The findings suggested that these firms might employ derivatives to mitigate cash flow fluctuations, thereby enabling them to invest in valuable growth opportunities. The micro-economic variables, such as debt ratios and income ratios, are noticed to have a significant role in the adoption of currency derivatives. Hassan, Abubarkar, and Dantama (2017) also explored the causes of the same issue of volatility in exchange rate movements for Nigeria making use of quarterly time series for the period 1989:1 to 2019:4. They applied ARCH models and found that interest rates and net foreign assets have a considerable influence on exchange rate volatility. Also, it was noticed that the economic openness, oil prices and fiscal imbalance, had insignificant positive effect volatility in exchange rate movements. Bristy (2017) conducted a study to recognise the factors influencing the exchange rate in Bangladesh. The research covered the time span 1999–2013 and used correlation and Ordinary Least Square (OLS) regression methods. The study identified government expenditure to be the most crucial factor in determining the exchange rate. The other significant factors included money supply, GDP, gross national income, gross capital formation, and primary income payments. It was also observed that an increase in lending rate resulted in expected appreciation of the Bangladeshi Taka. Cavusoglu, Goldberg and Stillwagon (2019) re-examined the empirical soundness of the PB theory to currency returns. The study is based on data collected through survey to estimate models of ex-ante returns. They used co-integrated VAR framework and found weak support for the model based on expected utility approach. Basanna and Vittala, (2019) tried to examine different foreign exchange risk management AU: Please provide expansion of strategies adopted in the Indian FMCG sector and their influence on exchange gain or losses. The research spanned from 2010 to 2017 considering data from seven FMCG companies. The findings revealed that the US dollar and EUR dominated the forex market. His study highlighted the forward contract as an effective hedging tool, known for its simplicity and ease of comprehension.

Otapo (2020) tried to find the major factors of exchange rates determination in case of Nigeria and how these determinants affect the exchange rate jointly as well as individually. His study covers the period from 1982 to

2018. Domestic credit, reserves and foreign bonds were found to disagree with theoretical expectation while real GDP, foreign prices, and local bonds were as per expectations. The real GDP had the highest effect on exchange rate. Adekoya (2020) tested the PB theory for Nigeria during the period Sep 1997 to Sep 2018 and examined the impact of worldwide financial crisis of 2008, on the PB theory. His results showed that the PB theory holds valid for Nigeria and structural breaks were also indicated in the exchange rate. Kallianiotis (2021) tested the PB model of exchange rate for bilateral US dollar and Australian dollar, for monthly data ranging from 1988:04 until 2019:06 using OLS multiple regression technique. He concluded that exchange rate is influenced by foreign bonds, and domestic and foreign interest rates. Khan, Ahmad and Murtaza (2022) investigated monetary models for Pakistani exchange rates and observed a weak long-term relationship for the Chinese Yuan-based rate, but strong evidence for the Euro and US dollar-based rates, both in the long and short runs. Vo and Vo (2023) analysed exchange rate movements considering cross country panel data for 50 years after the collapse of Bretton Woods. They found that trade restrictions and arbitrage process were quite effective in smoothing out the distortions in exchange rate behaviour over a long-time window. Ayushman et al. (2023) investigated the impact of macroeconomic variables namely foreign direct investment, foreign institutional investors, exchange rate, and foreign exchange reserve on the Indian stock market returns, applying the ARIMA model on monthly data for the period 2017–2018 to 2021–2022. They found that foreign direct investment and exchange rate are negatively related to the Indian stock market, whereas foreign institutional investors and foreign exchange reserve are positively related.

The above literature review shows that overall, the findings and observations are mixed regarding the empirical soundness of PB theory of exchange rate depending upon the frequency and duration of the data used and the econometric tools applied.

Research Methods and Data Sources

The time series data on relevant variables is extracted from International Financial Statistics, a publication of IMF. For data on money supply, M1 definition of money is used, and discount rate is taken as interest rate. The Consumer Price Index is used to compute the inflation rate. Before starting estimation of the model, first the stationarity of all the variables used in the study is tested by using ADF (1979) and PP (1988) tests. OLS regression method is used to estimate the model. Seasonal dummies are used to take care of any seasonality in the data series. Whenever the model suffers from autocorrelation problem, the AR1 (Cochrane Orcutt method) procedure is used to remove that.

The ADF test of stationarity considers the following augmented Dickey Fuller regression equation:

$$\Delta y_t = \beta 0 + \beta 1 y_{t-1} + \beta 2 \Delta y_{t-1} + \beta 3 \Delta y_{t-2} + ... + \beta k \Delta y_{t-k} + \varepsilon_t$$

where, Δy_t represents the differenced series of the variable of interest (to remove any trend), and y_{t-1}, Δy_{t-1}, Δy_{t-2}, ..., Δy_{t-k} are lagged values of the dependent variable.

$\beta 0$, $\beta 1$, $\beta 2$, ..., βk are the coefficients that are to be estimated, and ε_t is the error term.

The ADF test considers the null hypothesis, which states that a unit root exists in the time series, indicating non-stationarity. On the contrary, the alternative hypothesis states the absence of a unit root, suggesting that nature of the time series is stationary. The test statistic is computed on the basis of t-statistic associated with the coefficient $\beta 1$ in the above equation.

The PP test is similar to the above explained ADF test with the only deviation that it incorporates a different method for estimating the coefficient $\beta 1$. The PP test equation is as follows:

$$\Delta y_t = \beta 0 + \beta 1 y_{t-1} + \beta 2 \Delta y_{t-1} + \beta 3 \Delta y_{t-2} + ... + \beta k \Delta y_{t-k} + \varepsilon_t$$

where the variables and coefficients have similar meanings as in the ADF test equation. The PP test modifies the ADF test by using robust standard errors to account for autocorrelation and heteroscedasticity. Both the tests involve estimating the model and then calculating the test statistic, which is compared to critical values from the appropriate distribution to determine whether the null hypothesis should be rejected confirming stationarity.

Specification of the Model to be Estimated

The estimable form of the PB model derived in section 1 is:

$s_t = \alpha + \beta(m - m^*) + \lambda(y - y^*) + \delta(r - r^*) + \eta(b - b^*) + \varepsilon_t$

Where ε_t is the error term, with following restrictions and expected signs:

$\beta = 1, \lambda < 0, \delta > 0$, and $\eta < 0$.

In partial adjustment framework, the model can be specified as:

$\mathbf{s_t} = \alpha + \beta(m - m^*) + \lambda(y - y^*) + \delta(r - r^*) + \eta(b - b^*) + \varphi s_{t-1} + \varepsilon_t$

s_{t-1} being the lagged dependent variable, with the following restrictions and expected signs:

$\beta = 1, \lambda < 0, \delta > 0, \eta < 0$, and $0 < \varphi < 1$.

Empirical Estimation of the Model

Testing Stationarity of the Variables

Prior to estimation of the models, the stationarity test was performed using ADF and PP tests. The obtained values of these two tests are given in Table 1 along with the order of integration.

Table 1: Unit Root Result of the Variables Used in the Models

Variables	*ADF Values*	*PP Values*
$\Delta \mathbf{s_t}$	-8.5293 **(1)**	-5.1790 **I(1)**
Δ (m – m*)	-9.7044 **I(1)**	-7.6823 **I(1)**
Δ (y – y*)	-9.5883 **I(1)**	-18.7216 **I(1)**
Δ (r – r*)	-4.1030 **I(1)**	-6.5739 **I(1)**
Δ (b – b*)	-6.3639 **I(1)**	-11.9852 **I(1)**

Source: Author

Critical values for unit root test: ADF test PP test

Ist difference: -3.5598 -3.5523 (1% level of significance).

Critical values given by MacKinnon are used for rejecting the null hypothesis assuming presence of unit root in the time series. The table given above indicates that all the variables are of same order of integration, that is, I (1). Therefore, OLS procedure can be applied for estimation purpose.

Correlation Matrix

Before estimation the correlation amongst all the variables is also computed which is reported in Table 2.

Table 2: Correlation Matrix

Variables	s_t	*(m – m*)*	*(y – y*)*	*(r – r*)*	*(b – b*)*
$\mathbf{s_t}$	1	0.9438	0.7214	-0.6047	0.6606
(m – m*)	0.9438	1	0.8066	-0.7665	0.6471
(y – y*)	0.7214	0.8066	1	-0.5337	0.6034
(r – r*)	-0.6047	-0.7665	-0.5337	1	-0.2889
(b – b*)	0.6606	0.6471	0.6034	-0.2889	1

Source: Author.

Estimation of PB Model (Naive Form) in Short Run

When the model was estimated, the following regression was obtained. This equation suffered from autocorrelation problem as show by very low value of Durbin Watson (DW) statistic.

$$\mathbf{s_t} = \underset{(39.3172)}{2.7648} + \underset{(15.5755)}{0.9073}(m - m^*) - \underset{(-4.4014)}{0.8755}(y - y^*) + \underset{(6.3245)}{0.0399}(r - r^*) - \underset{(-1.9383)}{0.0003}(b - b^*) + \underset{(0.6202)}{0.0160}\,Dum1 - \underset{(-3.1320)}{0.0732}\,Dum2 - \underset{(-1.2456)}{0.0287}\,Dum3$$

$R^2 = 0.9515$ $\bar{R}^2 = 0.9439$ DW-statistic = 0.9057

To remove the autocorrelation problem, the equation was re-estimated using AR1 method. The following equation was obtained.

$$\mathbf{s_t} = \underset{(37.1861)}{3.2982} + \underset{(6.1719)}{0.4619}(m - m^*) - \underset{(-0.4931)}{0.0771}(y - y^*) + \underset{(0.4929)}{0.0022}(r - r^*) - \underset{(-1.4930)}{0.0002}(b - b^*)$$

$- 0.0178\ Dum1 \quad - \quad 0.0397\ Dum2 \quad - \quad 0.0061\ Dum3$

(-1.3108) (-2.2982) (-0.5721)

$R^2 = 0.9803 \quad \bar{R}^2 = 0.9767 \quad$ DW-statistic = 1.5406
Rho(r)= 0.7204 (10.3704)

The seasonal dummies; Dum1 and Dum3 were insignificant and were therefore dropped. The regression was estimated again. The obtained equation was re-estimated using AR1 Processfor removing autocorrelation problem and the following regression was obtained:

$$s_t = 3.2917 + 0.4682\,(m - m^*) - 0.1757\,(y - y^*)$$
(37.2219) (6.5795) (-1.8346)

$$+ 0.0020\,(r - r^*) - 0.0002(b - b^*) - 0.0327\ Dum2$$
(0.2704) (-1.5257) (-3.1768)

$R^2 = 0.9793 \quad \bar{R}^2 = 0.9766 \quad$ DW-statistic = 1.6648
Rho(r) =0.7338 (10.6862)

Hypothesis Testing: H_0: b = 1, H_1: b ¹ 1
F-value (1, 77) = 55.8545

In the above equation, all parameters have expected signs. Money supply difference and relative real output are significant at 5% level and CAB difference is significant at 10% level of significance. The relative interest rate variable is insignificant. The insignificance of interest rate differential may be explained by its high correlation (see correlation matrix) with the relative money supply. The model explains 97.7% variations in the dependent variable. The model shows seasonality in exchange rate data in the second quarter of the year.

Estimation of PB Model (Partial Adjustment Form)

When the model was estimated in partial adjustment framework, the following equation was obtained:

$$s_t = 0.8675 + 0.1476\,(m - m^*) - 0.1675\,(y - y^*)$$
(3.8844) (1.7095) (-1.1253)

$$- 0.0009\,(r - r^*) - 0.0001(b - b^*) + 0.0056\ Dum1$$
(-1.5564) (-0.6218) (0.3711)

$$- 0.0151\ Dum2 + 0.0033\ Dum3 + 0.7365\ s_{t-1}$$
(-1.0232) (0.2396) (9.1889)

$R^2 = 0.9818 \quad \bar{R}^2 = 0.9784 \quad$ DW-h = 1.7110

In the above estimated regression, all the seasonal dummies were insignificant and therefore dropped and the equation was estimated again.

$$s_t = 0.7754 + 0.0954(m - m^*) - 0.0945(y - y^*)$$
(3.7848) (1.3671) (-0.9365)

$$- 0.0035(r - r^*) - 0.0001(b - b^*) + 0.7757\ s_{t-1}$$
(-0.6694) (-0.2781) (10.7814)

$R^2= 0.9809 \quad \bar{R}^2 = 0.9788 \quad$ DW-h = 1.7809

In the re-estimated equation, except lagged dependent variable, all other variables were insignificant. Interest rate differential had adverse sign. Therefore, it was dropped. In the obtained equation also, the CAB difference was insignificant and therefore it was also dropped.

$$s_t = 0.8261 + 0.1344\,(m - m^*) - 0.1253\,(y - y^*)$$
(4.3662) (3.5254) (-1.4034)

$$- 0.0001\,(b - b^*) + 0.0784\ s_{t-1}$$
(-0.5484) (12.6862)

$R^2 = 0.9807 \quad \bar{R}^2 = 0.9790 \quad$ DW-h = 1.7729

The final estimated equation was:

$$s_t = 0.7567 + 0.1236\,(m - m^*) - 0.1669\,(y - y^*)$$
(4.3816) (3.4492) (-2.2382)

$$+ 0.7695\ s_{t-1}$$
(14.2511)

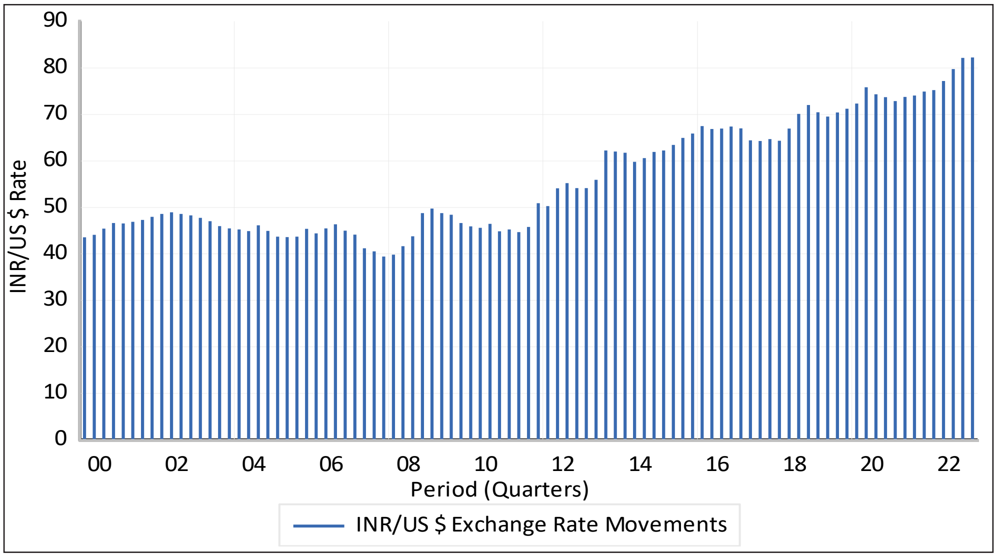
$R^2 = 0.9806 \quad \bar{R}^2 = 0.9795 \quad$ DW-h = 1.8111

Such that $0 < j < 1$ where j is the coefficient of lagged dependent variable, that is, s_{t-1}

Hypothesis Testing: H_0: β = 1, H_1: β ≠ 1
F-value (1, 81) = 597.9979

In the above equation, all variables are significant and have expected signs. The equation shows that the PB model seems to converge towards the Cambridge equation model. In this case, the speed of adjustment is 0.7695 implying that the actual levels adjust to the desired levels in just above one quarter.

The actual exchange rate movements in India against US dollar during the managed float period are depicted in Fig. 1.



Source: Generated by author in E-Views.

Fig. 1

After analysing the regression models, the data was analysed for long run analysis, that is, whether the cointegrating vectors among the variables exist during this period or not. Johansen – Juselius (1990) technique was used to identify these vectors. Using Johansen – Juselius (1990) technique given cointegrating vectors among the variables was obtained.

PB Model (Naïve Form) in Long Run

s_t = -2.0966 + 4.6111(m – m*) – 10.3179(y – y*) + 0.3819(r - r*) + 0.0004(b – b*)

S.E. (6.4531) (4.9444) (12.4113) (0.4605) (0.0015)

Log Likelihood Ratio: -13.6776

In the above cointegrating vector, all the variables are insignificant at 5% level in the naïve model. This indicates that the model does not work. However, the relative real income has adverse sign due to export-oriented nature of growth of the Indian economy. It is a significant variable in the determination of exchange rate. The variable representing holding of bonds, that is, (b – b*) is found to be an insignificant variable.

Discussion and Conclusion

If we look at the results and the discussion thereon, we find that the CAB difference has not been a significant determinant. Other variables are also not behaving well. When the insignificant variables were dropped, only money supply difference and relative real output remained to be significant along with the lagged dependent variable, that is, the partial adjustment framework. Both the variables have correct sign, and all the variables are significant at 5% level of significance. One essential feature that one observes is that the actual levels adjust to the equilibrium levels in about 3–4 quarters. We have also observed that in all the regression equations, the hypothesis of unit elasticity of exchange rate with respect to relative money supply is rejected at 5% level of significance. These questions are the very basic assumptions of monetary models. The insignificance of relative real GDP might also be because of forcing of the coefficient of real GDP being equal in both the economies. Similar assumptions exist in the case of other variables as well.

In the long run period, the sign of the coefficient of current account differential becomes adverse. In the cointegrating equation, relative money supply, the basic variable of monetary model becomes insignificant in both the models. The models do not work in this segment. In the case of short run analysis also, the models degenerated to reduced form monetary model in partial adjustment framework.

Thus, the variable that the PB theory introduces into regression equation remains to be insignificant or acquires adverse sign.

Note: Values in the parentheses represent t- values.

Policy Implications

The PB model of exchange rate determination has several policy implications. Here are some of the key policy implications derived from this model:

Monetary Policy: The PB model suggests that changes in interest rates and money supply can influence the demand for domestic and foreign assets. Central banks should use monetary policy tools to affect these variables and indirectly influence exchange rates.

Capital Controls: The PB model emphasises the role of capital flows in determining exchange rates. By imposing restrictions on capital movements, policymakers can manage exchange rate volatility and protect domestic industries from sudden currency fluctuations.

Fiscal Policy: Government fiscal policies can affect the exchange rate movements through its components namely interest rates, inflation rate, and the overall macroeconomic conditions. By implementing prudent fiscal policies, such as maintaining fiscal discipline and controlling budget deficits, governments can promote stability and confidence in their currencies.

Foreign Exchange Reserves Management: The PB model highlights the importance of foreign exchange reserves as a policy tool. Central banks can use their reserves to intervene in the currency market and influence exchange rates to manage excessive exchange rate volatility.

Investor Confidence and Market Sentiment: The PB model recognises the role of investor confidence and market sentiment in exchange rate determination. Policy actions that promote stability, transparency and confidence in the economy can attract foreign investors and positively impact exchange rates. Governments should enhance investor confidence by implementing sound economic policies, maintaining political stability and ensuring the rule of law.

However, the effectiveness of these policy implications may vary depending on the specific economic and financial conditions of each country. Policy decisions should consider the broader economic objectives, including inflation targeting, economic growth and employment, in addition to exchange rate stability.

References

Adekoya, O. B. (2020). Portfolio balance approach to asymmetries, structural breaks and financial crisis: Testing a model for Nigeria. *CBN Journal of Applied Statistics*, *11*(1), 87-110.

Adetan, T. T., & Oak, M. O. (2018). An empirical analysis of the determinants of exchange rate in Nigeria. *International Journal of Scientific Research and Management*, *6*(5). doi:10.18535/ijsrm/v6i5.em07

Ajao, M. G. (2015). The determinants of real exchange rate volatility in Nigeria. *Ethiopian Journal of Economics*, *24*(2).

Ayushman, K., Verma, K., & Rakesh Kumar. (2023). An analytical study of the impact of macroeconomic variables on the performance of the Indian stock market with special reference to NSE and BSE. *International Journal of Banking Risk and Insurance*, *11*(1), 29-35.

Basanna, P., & Pundareeka Vittala, K. R. (2019). A study on currency derivatives in India - An evidence from FMCG sector. *Journal of Commerce and Accounting Research*, *8*(3), 37-46.

Branson, W. (1976). *Asset markets and relative prices in exchange rate determinations.* Paper No. 66, International Institute of Economic Studies, Stockholm.

Branson, W. H. (1977). Asset markets and real time prices in exchange rate determination. *Social Wissenschafliche Annalen*, *1,* 69-89.

Bristy, J. F. (2017). Factors affecting the determination of exchange rate in Bangladesh. *Journal of Commerce and Accounting Research*, *6*(4), 25-35.

Cavusoglu, N., Goldberg, M. D., & Stillwagon, J. (2019). New evidence on the portfolio balance approach to currency returns. Institute for New Economic Thinking Working Paper Series No. 89.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*.

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

Dooley, M., & Isard, P. (1982). A portfolio-balance rational expectations model of the dollar-mark exchange rate. *Journal of International Economics*, *12,* 257-276.

Girton, L., & Henderson, D. W. (1977). Central bank operations in foreign and domestic assets under fixed and flexible exchange rates. In P. Clark, D. Logue, & R. Sweeney (Eds.), *The Effects of Exchange Rate Adjustments* (pp. 151-179). U.S. Government Printing Office.

Hassan, A., Hassan, A., Abubakar, M., & Dantama, Y. U. (2017). *Determinants of exchange rate volatility: New estimates from Nigeria.* doi:10.20448/809.3.1.1.12

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and interference on cointegration-with application to demand for money. *Oxford Bulletin of Economics and Statistics*, *52,* 169-210.

Kallianiotis, I. N. (2021). Exchange rate determination: The portfolio-balance approach. *Journal of Applied Finance & Banking*, *11*(1), 1-2.

Khan, A., & Abbas, Z. (2015). Portfolio balance approach: An empirical testing. *Journal of Economics and International Finance, 7*(6), 137-143. doi:hhtps://doi.org/10.5897/JEIF2014.0579

Khan, A. J., Ahmad, H. R., & Murtaza, F. (2022). Do monetary models really matter to determine the exchange rate behavior: A case for Pakistan. *Forman Journal of Economic Studies*, *18*(1), 23-50. doi:https://doi.org/10.32368/FJES.20221802

Kouri, P. J. K. (1976). The exchange rate and the balance of payments in the short run and in the long run: A monetary approach. *The Scandinavian Journal of Economics*, *78,* 280-304.

Obstfeld, M. (1980). Portfolio balances, monetary policy, and the Dollar-Deutschemark exchange rate. Discussion Paper No. 52, Columbia University.

Oriavwote, V. E., & Oyovwi, D. O. (2012). The determinants of real exchange rate in Nigeria. *International Journal of Economics and Finance*, *4*(8), 150-160.

Otapo, T. W. (2020). Determinants of exchange rates in Nigeria: An empirical evidence using the portfolio balance model. *IOSR Journal of Business and Management* (IOSR-JBM), *22*(3), Ser. IV, 01-10. doi:10.9790/487X-2203040110

Phillips, P. C. B., & Perron, P. (1988). Testing a unit root in time series regression. *Biometrika*, *75,* 335-346. doi:http://dx.doi.org/10.1093/biomet/75.2.335

Sarantis, N. (1994). A dynamic asset market model for the exchange rate of the pound sterling. *Welwirtschaftliches* Archiv, Bd. CXXIII.

Sakanko, M. A., & David, J. (2017). An econometrics analysis of the determinants of exchange rate in Nigeria (1980-2016). *European Journal of Business and Management*, *9*(34), 22-29. doi:10.9790/487X-2203040110

Srivastava, A. (2015). An empirical study on factors affecting the usage of currency derivatives with reference to India. *International Journal of Banking Risk and Insurance*, *3*(2), 1-9.

Vo, L. H., & Vo, D. (2023). The purchasing power parity and exchange-rate economics half a century on. *Journal of Economic Surveys*, *37*(2), 446-479.

Were, M., Kamau, A., & Kisinguh, K. (2013). An empirical investigation of exchange rate determination in Kenya. Does current account imbalance play a role? *Advances in Management & Applied Economics*, *3*(2), 165-178.