DETERMINATION OF AN EQUILIBRIUM RS/US$ RATE ACCORDING TO PURCHASING POWER PARITY AND UNCOVERED INTEREST RATE PARITY

By

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1.0 INTRODUCTION

The exchange rate of the rupee carries tremendous importance in a small open economy like Mauritius where there likely exist significant pass-through of changes in the value of the rupee onto domestic macroeconomic variables such as inflation and output. Since the suspension of the Exchange Control Act in July 1994, the rupee has been on a managed exchange rate float and has undergone large cycles, from about Rs17.50 per US$ at around this period to more than Rs30.00 per US$ currently.

According to the Bank of Mauritius Act 2004, it is the responsibility of the Bank of Mauritius to manage the exchange rate taking into account the orderly and balanced economic development of the country. In so doing, the Bank has to tread a fine line in seeking to reconcile the often-divergent interests of the different sectors of the economy and steer the exchange rate of the rupee towards an appropriate level. Of particular interest, therefore, is whether the exchange rate is consistent with some kind of fundamental equilibrium or not. Although short-term foreign exchange movements can often appear erratic, it is often believed that there are basic forces that push a currency towards an equilibrium exchange rate.

The aim of this paper is to determine such an equilibrium exchange rate for the rupee. This would allow an assessment of how under- or over-valued the exchange rate is, in order to evaluate any potential future effects on the economy. It focuses on the short term where equilibrium exchange rate can be defined as the exchange rate that would pertain when its fundamental determinants are at their current settings after abstracting from the influence of random effects. In general, monetary models such as the “Behavioural Equilibrium Exchange Rate (BEER)”, “Intermediate Term Model Based Equilibrium Exchange Rate (ITMEER)” and “Capital Enhanced Equilibrium Exchange Rates (CHEER)” are most closely related to short-run equilibrium concepts.

For the purposes of this paper, we follow Stephens (2004) and rely on a CHEER, which combines the Purchasing Power Parity (PPP) theory and the Uncovered Interest Parity (UIP) condition into a single relationship and yields a nominal equilibrium exchange rate that is consistent with current price levels and interest rates. The idea underlying this approach is that while PPP may explain long-run movements in real exchange rates, the real exchange rate may be away from equilibrium as a result of non-zero interest rate differentials.

The remainder of this paper is organised as follows. Section 2 briefly describes the CHEER framework by reviewing the theories of PPP and UIP and explaining how they can be combined. Section 3 verifies the existence of a relationship between the nominal Rs/US$ exchange rate, domestic and US prices, and domestic and US interest rates through the Johansen’s cointegration method. Using the estimated relationship, it then determines whether prices, interest rates and the exchange rate are consistent with PPP and UIP over the sample period. Section 4 calculates the exchange rate that would have been consistent with PPP and UIP and compares it with the actual Rs/US$ exchange rate while Section 5 concludes.

** The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Mauritius. Any errors are the authors’ responsibility.*

2.0 THEORIES OF PURCHASING POWER PARITY AND UNCOVERED INTEREST RATE PARITY

2.1 Purchasing Power Parity (PPP)

The most restrictive definition of the purchasing power parity (PPP) stems from the Law of One Price (LOOP) whereby international arbitrage causes the price of every good to be equalised, when expressed in a common currency. In practice, however, there are a variety of reasons, such as productivity differentials and the existence of non-traded goods and services, why PPP may not hold. Relative PPP therefore allows for a permanent wedge caused by those factors between the price levels of two countries and is expressed as follows:

$$s_t + c = p^*_t - p_t \qquad (1)$$

where s_t = Log nominal exchange rate

p_t = Log domestic price level

p^*_t = Log foreign price level

c = Constant representing permanent deviation from absolute PPP

Since goods arbitrage may be slow, it is expected that, whenever there is deviation from PPP, the exchange rate will drift in the direction of restoring relative PPP such that:

$$\Delta s_{t+1} = \alpha (p^*_t - p_t - s_t - c) \qquad (2)$$

where α = some constant between 0 and 1.

2.2 Uncovered Interest Rate Parity (UIP)

Taking into account international capital flows, UIP states that the rates of return on domestic and foreign assets expressed in the same currency are equal, that is, exchange rates adjust to interest rate differentials. It is expressed as follows:

$$E_t (s_{t+1}) - s_t = i^*_t - i_t + u \qquad (3)$$

where i_t = Domestic nominal interest rate

i^*_t = Equivalent foreign nominal interest rate

u = Risk premium associated with holding Mauritian rupee assets, and

E_t denotes an expectation at time t

2.3 Combining PPP and UIP

In the literature, equilibrium exchange rates are often defined either in terms of PPP or UIP, but seldom both. However, empirical tests of these hypotheses separately have often yielded conflicting conclusions. It has been seen that generally, failure of PPP was caused by factors such as imperfect competition, pricing to market, the composition of price indices, information costs, transport costs and trade barriers while failure of UIP has arisen because of the existence of time varying risk premium and limited capital mobility, for example.

The rejection of PPP and UIP, individually, may be due to a systematic relationship between the two conditions. Indeed, for a financially open economy, PPP is based on the arbitrage in goods market, hence postulated as an adjusting mechanism for the current account equilibrium. Equilibrium in capital account, on the other hand, may need adjustments in the variables determining the UIP. By definition, balance of payments consists of the sum of the current account and capital account. As a disequilibrium in one market may have repercussions on the other, the two international parity conditions may therefore not be independent of each other in the long run evolution of the balance of payments equilibrium.

It is therefore proposed to combine both international parities to allow for interactions among prices, interest rates and exchange rates. This approach is referred to as Capital Enhanced Equilibrium Exchange Rates (CHEER). The main idea of the CHEER approach is that non-stationary deviations from the PPP and UIP form a stationary relationship consistent with the interdependence of adjustments in the assets and goods markets towards equilibrium. Assuming rational expectations, equation (2) can thus be rewritten as:

$$E_t(s_{t+1}) - s_t = \Delta s_{t+1} = \alpha\ (p^*_t - p_t - s_t - c) \qquad (4)$$

Since PPP is a long-run condition, it is assumed that PPP forms the basis of expectations in the UIP condition. Algebraically, this amounts to substituting equation (4) for expectations in equation (3):

$$\alpha\ (p^*_t - p_t - s_t - c) = i^*_t - i_t + u$$

Rearranging:

$$s_t + p_t - p^*_t + 1/\alpha\ (i^*_t - i_t) + k = 0 \qquad (5)$$

where $k = c + u/\alpha$

Equation (5) can be postulated to represent the equilibrium condition toward which prices, interest rates and the exchange rate tend to move in the long run. In the real world, however, nominal exchange rates could be expected to deviate from this equilibrium condition, such that:

$$s_t + p_t - p^*_t + 1/\alpha\ (i^*_t - i_t) + k = q_t \qquad (6)$$

where q_t represents the deviation from the equilibrium PPP-UIP condition and is stationary. It is therefore posited in equation (6) that interest rates, prices and the exchange rate are cointegrated, that is, there exists a long-run relationship among them. This would imply that there exists one or more vectors of coefficients such that:

$$\beta_1 s_t + \beta_2 p_t + \beta_3 p^*_t + \beta_4 i_t + \beta_5 i^*_t + \beta_6 \sim I(0) \qquad (7)$$

β_1	β_2	β_3	β_4	β_5	β_6
1	1	-1	$-1/\alpha$	$1/\alpha$	k

where the values of $\beta_1,\ldots, \beta_6$ implied by equation (6) are displayed underneath.

3.0 EMPIRICAL ESTIMATION

3.1 Model Specification

Against this background, the model to be estimated is a Vector Error Correction (VEC) model, which can be represented by:

$$s_t = f\ (p_t,\ p^*_t,\ i_t,\ i^*_t) \qquad (8)$$

where s_t, p_t, p^*_t, i_t, and i^*_t are as described above.

3.2 The Data

Monthly data from July 1994 to June 2005 are used throughout this study. This period covers financial liberalisation in the Mauritian economy. Reforms, which were accelerated since July 1991 through interest rate liberalisation, abolition of direct control on bank credit and a general move away from direct to indirect instruments of monetary policy, culminated with the complete abolition of exchange control and the floating of the rupee as from July 1994. The economy was thereafter characterised as open, with managed floating exchange rates and liberalised international capital flows, thus making it a reasonably good candidate for investigating the validity of the PPP and UIP hypotheses.

The nominal exchange rate (s_t) used is the indicative Rs/US$ exchange rate because banks in Mauritius first adjust the rupee against the US dollar, taking into account daily movements in the US dollar on the international market and the liquidity situation of the domestic foreign exchange market, before crossing the rate thus obtained against other currencies according to their movements on the international market. It should be noted that over 50 per cent of total trade is denominated in US dollars and that the Bank of Mauritius uses this currency as its intervention currency. Since 2004, the rupee has been continuously depreciating against the US dollar more as a result of local demand pressures, which have tended to take precedence over the evolution of the US dollar on the international markets. To counteract the effects of rupee depreciation, the Bank has intervened on the domestic foreign exchange market by selling US dollars to the tune of US$193.2 million from May 2004 to June 2005.

Consumer price indices are used as the price measures for both Mauritius (p_t) and the USA (p^*_t). It is generally found that the price level has been higher in Mauritius compared to the USA. The interest rates chosen were the yields on three-months Treasury Bills for both Mauritius (i_t) and the USA (i^*_t). Adjusted for the appreciation/depreciation of the US dollar, the rate of return on Mauritian assets has by and large been higher than on US assets with a maturity of three months. The evolution of the inflation rate and of three-months interest rates in both countries is given in Chart 1 of the Appendix.

A precondition for cointegration is that all series are integrated of the same order. Results of the Augmented Dickey-Fuller unit root tests conducted on all series for the period under study suggest that all series are I(1), as reported in Table 1 of the Appendix.

3.3 Testing the Model

3.3.1 Lag Determination

Before proceeding to test the VEC model *per se,* a corresponding Vector Autoregressive (VAR) model is specified to determine the number of lags, which would then be applied to the VEC model. To decide on the number of lags to be included, the sequential modified likelihood ratio (LR) test with Sims' (1980) small sample modification is used. The modified LR statistics thus obtained is compared to the 5% critical values starting from the maximum lag, and decreasing the lag one at a time until the reduction of the lag order by 1 at the 5 per cent significance level cannot be rejected.

The VAR model is first estimated with 12 lags. However, from the LR test conducted, nine lags were suggested. Lag exclusion test was then applied, with the χ^2 (Wald) statistic strongly rejecting the first lag at the 5 per cent significance level. These results were applied to the corresponding VEC model, which was therefore estimated with 1 to 8 lags in first-differences.

3.3.2 Cointegration and VEC Results

The basis for a VEC specification is the presence of a cointegrating relation. If such a relation exists, then it can be posited that at least one linear combination of the non-stationary series is stationary and that there is therefore a long-run equilibrium relationship among the variables. The Johansen cointegration technique is applied to Equation (6) above to test for the presence of one or more cointegrating vectors.

Table 2 of the Appendix reports the eigenvalues (λ_i), the maximal eigenvalue (λ_m) and the trace eigenvalue (λ_t) statistics obtained using the Johansen cointegration technique, assuming an intercept but no trend in the cointegrating vector. The maximal eigenvalue test indicates the presence of one cointegrating equation at the 5% and 1% levels while the trace tests statistics indicate two cointegrating equations at the 5% level and one cointegrating equation at the 1% level. Given that both tests indicate at least one cointegrating equation at the 5% level, the first one, which is normalised on the Rs/US$ nominal exchange rate, is used for the purposes of this paper and is shown below in Table 1:

Table 1: Unrestricted Cointegrating Vector

Rs/US$ (s_t)	Mtius CPI (p_t)	US CPI (p^*_t)	Mtius Interest Rate (i_t)	US Interest Rate (i^*_t)	Constant
1.000	6.715	-18.221	-22.062	23.846	50.812

Confirmation of cointegration supports the hypothesis that the exchange rate, prices and interest rates are related in the long run. It can be seen that the cointegrating vector, normalised by the exchange rate variable, has signs that match the theory of combined PPP and UIP, as depicted in Equation (7)[1].
The next step is to test whether the cointegrating vector matches the theoretical restrictions postulated by strict PPP and/or UIP.

3.3.3 Imposing Restrictions

This is performed by imposing, and testing, three types of restrictions on the cointegration coefficients as given by the cointegrating vector:

(i) Strict form PPP and UIP, that is, price differentials affect the exchange rate proportionately and interest rates in the two countries affect the exchange rate symmetrically:

$$\beta_1 = \beta_2 = -\beta_3 = 1; \text{ and } \beta_4 = -\beta_5$$

(ii) Strict PPP and Weak form UIP, that is, price differentials affect the exchange rate proportionately while interest rates are allowed to affect the exchange rate non-symmetrically:

$$\beta_1 = \beta_2 = -\beta_3 = 1$$

(iii) PPP Symmetry and Weak form UIP, that is, price differentials affect the exchange rate but they do not necessarily affect the exchange rate proportionately:

$$\beta_2 = -\beta_3$$

The validity of the restrictions is tested using the likelihood ratio (LR) test. The LR statistics are reported in Table 2 below together with their probability values:

Table 2: Restrictions Tests for PPP and UIP

	Strict PPP & UIP	Strict PPP & Weak UIP	PPP Symmetry & Weak UIP
LR Statistics	20.82	3.29	3.07
P-Values	0.0001	0.19	0.08

Strict form PPP and UIP as well as PPP symmetry and weak form UIP were both rejected at the 5 per cent significance level. Evidence, however, supports strict PPP and weak form UIP.

The equilibrium exchange rate is therefore estimated with PPP imposed but with the UIP proposition relaxed. The restricted cointegrating vector is displayed in Table 3 below:

Table 3: Restricted Cointegrating Vector

Rs/US$ (s_t)	Mtius CPI (p_t)	US CPI (p^*_t)	Mtius Interest Rate (i_t)	US Interest Rate (i^*_t)	Constant
1.000	1.000	-1.000	-28.499	61.548	-3.060

Taking into account only the relative signs and magnitude, it can be seen that the US interest rate has more effect on the Rs/US$ rate than the domestic interest rate.

4.0 EQUILIBRIUM ESTIMATES OF THE RUPEE

From the restricted cointegrating vector estimated above, it is possible to derive the Rs/US$ exchange rate that would have restored the Rs/US$ exchange rate, prices and interest rates to their long run relationship according to PPP and UIP. Figure 1 below plots the actual Rs/US$ exchange rate against its estimated equilibrium while Figure 2 shows the percentage misalignment of the rupee vis-à-vis the US dollar.

1 *Since the model is being tested in first differences, the absolute magnitudes of the coefficients no longer represent elasticities, as given by levels. Only relative signs and magnitudes matter in this case.*

Figure1: Actual and Estimated Equilibrium Rs/US$ Exchange Rate

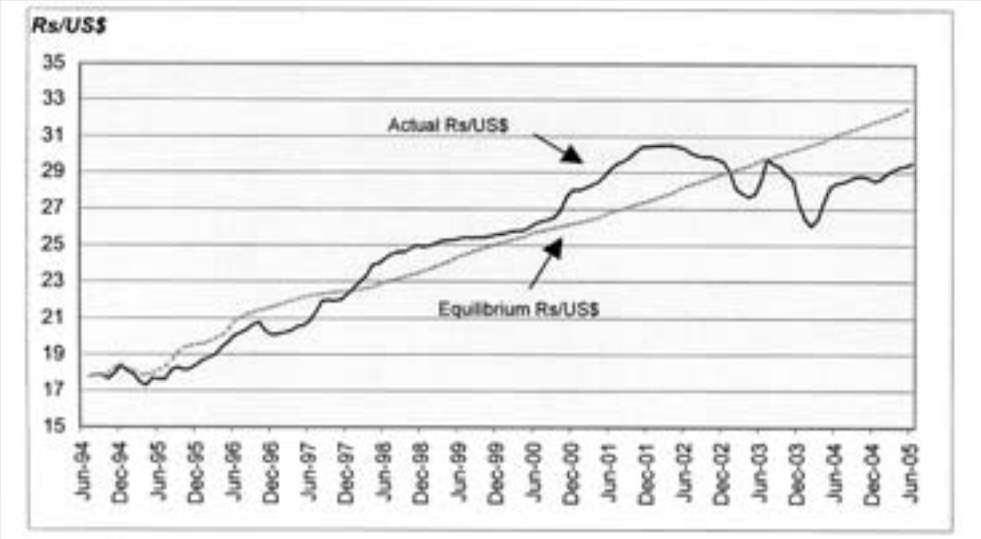
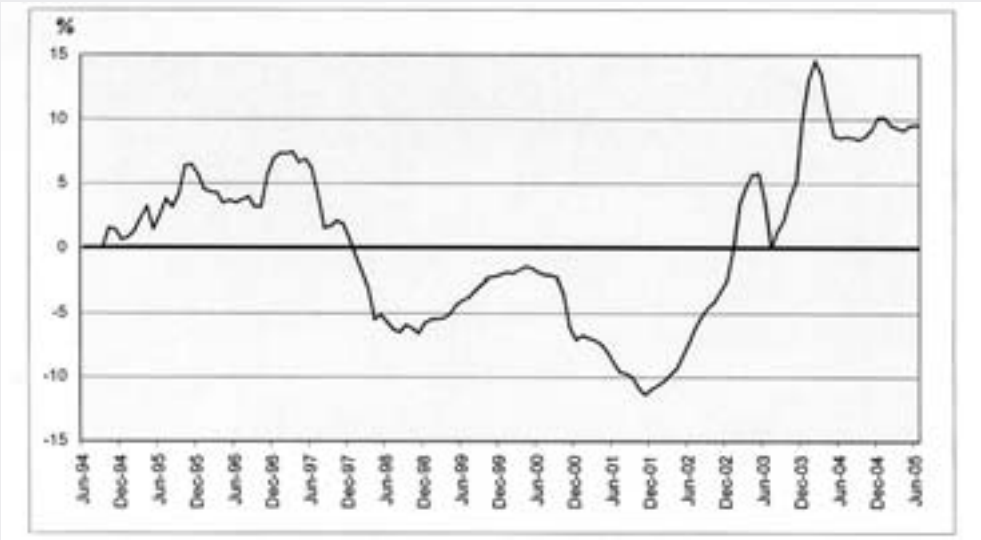


Figure 2: Percentage Misalignment



It can be observed that equilibrium according to PPP and UIP dictates a constant depreciation of the rupee against the US dollar over this period. From this perspective, the actual Rs/US$ exchange rate has been largely in line with equilibrium as the overall trend of the rupee is one of depreciation against the US dollar.

Even though the actual and estimated equilibrium Rs/US$ rate trend in the same directions, Figure 2 shows that varying degrees of misalignments have occurred at different periods of time. Furthermore, these misalignments seem to have grown more significant with time. From July 1994 to end-1997, except for a small blip at around end-1995 and for a somewhat more pronounced over-valuation from October 1996 to mid-1997, the actual Rs/US$ was fairly well aligned to its estimated equlibrium level. This was reversed starting 1998, with a prolonged stretch of under-valuation until end of 2002. The ensuing period, from 2003 onwards, marks mostly over-valuation of the Rs/US$ exchange rate vis-à-vis its estimated short-term equilibrium value. In the section below, an attempt is made to explain the behaviour of the Rs/US$ exchange rate relative to its equilibrium.

From July 1994 to October 1996, except for a small blip at around end-1995, it may be observed that the actual Rs/US$ was fairly well aligned to its short-term equlibrium level, as given by PPP and UIP. During that period, even if US interest rates rose from 4.25 per cent in July 1994 to 6.00 per cent in February 1995 before coming down to 5.25 per cent in January 1996, rupee denominated assets remained

attractive, as yields on 91-day Treasury Bills were still relatively higher. On the domestic front, improving fundamentals, with inflation rate declining from high levels of above nine per cent in July 1994 to around six per cent in October 1996 and the current account posting a surplus of Rs610 million in 1996 as against a deficit of Rs4,168 million in 1994, exerted no unnecessary pressure on the Rs/US$ exchange rate to depart from its equilibrium.

During the last months of 1996, a small deviation from equilibrium occurred as the rupee appreciated slightly against the US dollar. The only possible reason that could explain this behaviour of the rupee exchange rate was intervention by the Bank of Mauritius by way of important sales of US dollar amounting to more than US$100 million on the inter-bank foreign exchange market from October to December 1996. However, continued intervention of this nature during 1997 and 1998, where the Bank sold some further US$337 million and US$166 million, respectively, to banks did not prevent the rupee from depreciating as from beginning 1997. The depreciation, which was slow at first, accelerated during the second half of 1997 till end-1998. Whilst initially bringing the rupee back towards its estimated equilibrium value, depreciation eventually contributed to a fairly prolonged period of under-valuation of the rupee compared to its short-term estimated equilibrium exchange rate.

There are several factors that may have caused the rupee to depreciate against the US dollar from 1997 to 1998 in spite of heavy sales intervention by the Bank. One factor relates to domestic changes regarding the release of sugar export proceeds to the market. The Mauritius Sugar Syndicate (MSS), which had the obligation to surrender all sugar export proceeds to the Bank of Mauritius, was allowed, effective August 1996, to surrender 25 per cent of the proceeds to the banking system and, effective May 1997, it was permitted to surrender 100 per cent of sugar proceeds to the banking system. This measure, while giving free rein to market forces, was hugely detrimental to the rupee exchange rate as banks started to bid quite aggressively for the foreign exchange proceeds thereby contributing to rupee depreciation. In addition, such behaviour seemed to have fed into self-fulfilling depreciating expectations on the domestic market in 1998. This was reflected in foreign currency deposits held with former Category 1 banks which, despite the somewhat widening relative interest-rate differential in favour of rupee assets, brought about by three consecutive cuts of 25 basis points by the Fed in the last quarter of 1998 and rising yields on 3-month Treasury Bills, witnessed a nearly threefold increase from Rs1,786 million at the end of December 1996 to Rs4,903 million at the end of December 1997, and to Rs5,953 million at end-December 1998.

In order to halt the aggressive bidding strategy by banks over sugar proceeds, the MSS was requested to surrender 20 per cent of its proceeds to the Bank of Mauritius in November 1998. In addition, with a view to further stabilising the exchange rate of the rupee and inducing repatriation of foreign exchange holdings abroad, the Bank of Mauritius, as from 14 December 1998, started to carry out regular sales of Treasury Bills over the counter to individuals and non-financial corporations. Taken together with Fed tightening of some 75 basis points over 1999 and Government of Mauritius Treasury Bills yields hovering at high levels, the outcome was a significant slow-down in the depreciation of the rupee and a gradual return towards equilibrium in the second half of 1999.

During the first three quarters of 2000, the rupee tracked its equilibrium level closely as the Fed tightened monetary policy by an additional 100 basis points and Treasury Bills yields in Mauritius came down by some 250 basis points. The pace of actual rupee depreciation was thus more in line with that given by equilibrium. Plagued by the shortfall in sugar export proceeds due to the drought that had severely hit sugar production in 1999, the Bank of Mauritius managed to mitigate the negative impact on the exchange rate by striking a balance between satisfying the level of demand for foreign exchange by way of intervention on the domestic interbank foreign exchange market and maintaining a reasonable level of reserves.

The situation reversed as from fourth quarter 2000 to end-2001 as the rupee embarked on a rapidly depreciating trend against the US dollar, which took it further away from its estimated equilibrium. A plausible reason for the rupee's decline against the US dollar in the last quarter of 2000 was the run to general elections whereby market perception shifted to expectations of further depreciation of the rupee associated with a probable change in government. The depreciating trend was further exacerbated by

the constant decline of the euro/US dollar exchange rate on the international market, which was reflected in the continuous appreciation of the rupee vis-à-vis the euro on the domestic market. Given that a large share of Mauritian exports are denominated in euro, recipients of foreign exchange proceeds preferred to withhold their proceeds rather than offloading them on the market creating, in the process, an imbalance in the demand and supply of foreign currencies on the domestic foreign exchange market. Viewed against equilibrium estimates, such depreciation seemed unwarranted given the widening interest rate differentials in favour of the rupee over that period. Indeed, there were successive reductions in official US interest rate rates, which went down from 6.50 per cent at the beginning of January 2001 to 1.75 per cent in December 2001. With no significant changes in the 3-month Treasury Bills yields in Mauritius over that same period, the interest rate differential was increasingly in favour of the rupee.

Beginning 2002 marked another turnaround, which saw the rupee start to appreciate against the US dollar and thus return towards equilibrium. Plagued by low interest rates, which stayed at 1.75 per cent throughout most of 2002, and concerns about the US high current account deficit, the US dollar remained under pressure on international markets. On the domestic front, the rupee drew support from positive local market conditions, amongst which a growing current account surplus coupled with positive inflows of foreign currencies into the economy. Another 50 basis points cut in US interest rates at end-2002 further boosted the repatriation of funds from abroad. With the appreciation of the rupee against the US dollar and its depreciation vis-à-vis the euro, banks could maintain their foreign exchange liquidity positions at appreciable levels and the rupee thus maintained its appreciating movement. Intervention by the Bank reflected the foreign exchange liquidity condition of the domestic market. Over the period starting June to December 2002, the Bank purchased a total amount of US$117.65 million on the interbank foreign exchange market in an effort to contain the appreciation of the rupee.

As from start 2003, the rupee had appreciated to such an extent that it fell below its estimated equilibrium value. It can be observed from Figure 1 that, up to the end of our sample period in June 2005, the rupee remained overvalued to varying degrees against its estimated short-term equilibrium value although the story is not one of continuous rupee appreciation. For instance, for a brief period, from May to mid-July 2003, the rupee depreciated quite rapidly by around 10.0 per cent against the US dollar, and moved back towards equilibrium. Two factors could weigh in trying to explain what triggered such fast rupee depreciation. First, there was a sudden large drop in banks' foreign exchange liquidity position from end-June to mid-July 2003, which quickly reverted to more normal levels, however[2]; and secondly, the US dollar was back on an appreciating trend on international markets as from mid-June 2003. But the most determining factor may have been central bank intervention, which amounted to US$26.1 million purchased from the market from 30 May to 01 July 2003 at increasingly higher rates.

As stated, this depreciation was short-lived and, as from mid-July 2003, the rupee resumed its appreciating trend, driven by particularly high levels of foreign exchange liquidity in the domestic foreign exchange market. In the same vein, it became increasingly over-valued compared to its equilibrium, as given by PPP and UIP, which was influenced by falling Treasury Bills yields on the local market while the Fed, after cutting US interest rates by an additional 25 basis points in June 2003, left them unchanged up to June 2004. The Bank continued to intervene on the interbank foreign exchange market to try to limit rupee appreciation, purchasing a total amount of US$160.9 million in 2003.

Appreciation lasted till February 2004 when several factors began to impact negatively on the economy. First, the yields on Treasury Bills, which had been on a constant but relatively slow decline, dropped sharply over the period January-May 2004 spurred by a large excessive liquidity on the money market. Faced with weak demand for private sector credit, banks adopted a fierce bidding strategy on the primary market for Bills, thereby decreasing yields by more than 500 basis points over this period. Given that the US interest rates were poised to increase, the rupee lost its interest rate differential appeal and some major local investors shifted out of rupee into foreign currency denominated assets, resulting into a significant outflow of foreign currencies and a worsening of banks' overall foreign exchange liquidity

2 *This drop in banks' foreign exchange liquidity position was related to the repayment of a foreign currency loan by one bank in advance of receiving foreign exchange proceeds for the sale of an overseas subsidiary.*

position. In addition, the current account, after posting three successive years of surpluses, turned around in 2004 to record a deficit of Rs857 million as Mauritius started to feel the effects of the phasing out of the Multi Fibre Agreement (MFA) and faced the challenge of eroding preferential access agreements stemming from the proposed reforms of the European Union sugar regime.

Rupee depreciated rapidly during the first half of 2004 but the depreciation thereafter slowed due to central bank intervention. A total amount of US$184.8 million was sold during 2004-05 in an effort to bring about more orderly conditions on the domestic foreign exchange market. Intervention contributed to leave the rupee over-valued compared to its equilibrium estimates when in fact a good number of reasons would have substantiated a greater depreciation of the rupee, notably: (i) the interest rate differential was progressively less in favour of the rupee as a result of continuous increases in the US official rate, which stood at 3.25 per cent as at end-June 2005; (ii) the current account deficit for Mauritius accentuated during 2004-05 as could have been expected; and (iii) by the end of 2004, expectations of further rupee depreciation emerged and seemed to become fairly well entrenched in the market. Exporters became increasingly unwilling to convert their foreign currency holdings and in fact, foreign currency deposits increased by approximately Rs5 billion during 2004-05. The corollary was significant demand pressure for foreign currencies on the domestic foreign exchange market and negative foreign currency position of banks continuously, as from July 2004.

5.0 COMMENTS AND CONCLUSION

This paper, by using a CHEER framework, has shown that there exists a systematic long-run relationship between exchange rates, prices and interest rates. While price differentials may affect the exchange rate proportionately, it has been found that foreign interest rates may have a larger effect on the Rs/US$ exchange rate than domestic interest rates.

An equilibrium nominal Rs/US$ exchange rate was therefore estimated with strict PPP imposed and weak UIP allowed. By and large, the analysis shows that the actual Rs/US$ exchange rate has broadly been tracking down estimated equilibrium over the sample period July 1994 to June 2005. Of course, at different points in time, there may have been varying degrees of misalignment compared to estimated equilibrium. Subject to the limitations of the model used, the evidence from this paper indicates that, during the first few years of the sample period to end 1997, the misalignment of the rupee in nominal terms against the US dollar was fairly marginal. Furthermore, the rupee may have been under valued during the period 1998-2002 and overvalued from 2003 to the end of the sample period in June 2005.

Our discussion above puts forward several factors that may explain these misalignments and it can be seen that they pertain mostly to the state of the domestic market, which was not aligned with conditions given by the combination of PPP and UIP. Taking into consideration the overvaluation found towards the end of the sample period, it can indeed be argued that several economic indicators such as the current account, balance of payments and fiscal deficits would point towards more rupee depreciation than has been the case, which would be more in line with the estimates of equilibrium.

However, with a view to managing the exchange rate taking into account the orderly and balanced economic development of the country, the Bank of Mauritius needs to balance the depreciation of the Rs/US$ exchange rate to reduce the estimated misalignment against its potential effects on inflation, financial stability and on the economy in general. Appropriate policy measures taken on the fiscal and monetary fronts would no doubt limit the required exchange rate adjustments.

This therefore raises the scope for further research incorporating the fundamental structures of the Mauritian economy on the topic of equilibrium exchange rates.

APPENDIX

Chart 1A: Adjusted 3-Mth Bill and US 3-Mth Rate

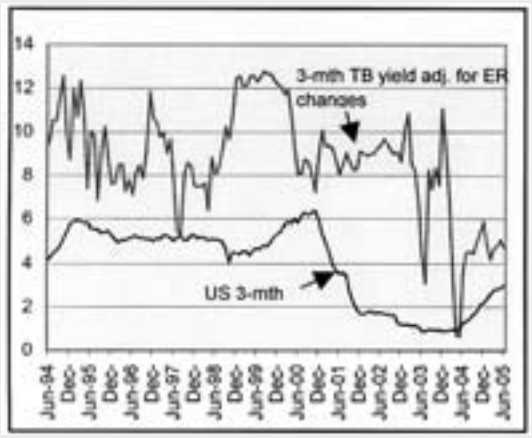


Chart 1B: Inflation rates - Mauritius and USA

Table 1: Augmented Dickey-Fuller (ADF) Test Statistics

Series	Levels		First Differences		*Mac Kinnon's Critical Values-5%*
P_t	-0.68	(9)	-4.94	(9)	***-3.44***
P^*_t	-1.87	(9)	-4.43	(9)	***-3.44***
S_t	-0.86	(6)	-4.85	(6)	***-3.44***
i_t	-1.24	(3)	-5.61	(3)	***-2.88***
i^*_t	-1.53	(3)	-3.49	(3)	***-2.88***

Notes: Except for the interest rate test regressions, which contain a constant, all other test regressions contain an intercept and a constant. Numbers in parentheses are the number of lags used in the augmentation of the regressions. MacKinnon's critical values indicate rejection of the null at the 5% level in first differences for all series, suggesting a single unit root, i.e. that all series are I(1).

Table 2: Tests of the Cointegration Rank (Using Johansen Test)

H_0:r	λ_i	λ_m	λ_m0.95	λ_m0.99	λ_t	λ_t0.95	λ_t0.99
0	0.266	40.02	**33.46**	**33.77**	91.17	**68.52**	**76.07**
1	0.187	26.77	**27.07**	**32.24**	51.15	**47.21**	**54.46**
2	0.122	16.82	**20.97**	**25.52**	24.38	**29.68**	**35.65**
3	0.042	5.53	**14.07**	**18.61**	7.57	**15.41**	**20.04**
4	0.016	2.03	**3.76**	**6.65**	2.04	**3.76**	**6.65**

Note: The max-engienvalue test (λ_m) indicates 1 cointegrating equation at both 5% and 1% levels. The trace test (λ_t) indicates 2 cointegrating equations at the 5% level and 1 cointegrating equation at the 1% level.

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