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Abstract

This paper presents for the first time an empirical investigation of the equilibrium real effective exchange rate of Vietnam. We employ the BEER approach which has not been previously applied to Vietnam. We use monthly data for the period 1995-2005 to construct a unique data base of effective exchange rates, effective terms of trade and effective productivity against Vietnam's main trade partners. A detailed review of Vietnam's exchange rate policy is also provided. The empirical results indicate that productivity and terms of trade are the most significant determinants of Vietnam's equilibrium real effective exchange rate. They also confirm the existence of significant misalignments in the Vietnamese Dong.

Key words: Equilibrium exchange rates; Effective; Misalignments; Vietnam.

JEL Classification: F31, C22

1. Introduction

For Vietnam, an economy gradually transformed from a centrally planned economy to a market oriented one, exchange rate policy has become very important. Vietnam's strongly developing economy since the early 1990s has been underpinned by its strategy of export-led investment and growth, so its competitiveness is very crucial. In addition, Vietnam has joined the ASEAN Free Trade Area (AFTA) and signed a bilateral trade agreement with the United States. It has also gained a membership in the World Trade Organization (WTO). With its increasing integration into the global economy, Vietnam is now in need of a more effective exchange rate policy than ever before. Therefore, understanding the determinants of the equilibrium real exchange rate and the misalignments of the Vietnamese Dong (VND) is essential for the Vietnamese economy.

Research on the real exchange rate of Vietnam has been rather limited. Before 2000, a few studies merely described the exchange rate regime in Vietnam with some commentary (see, for example, annual reports by the State Bank of Vietnam (1995-2005), World Bank (1997), Dodsworth *et al* (1996), Le (1999), Nguyen (1997)). General and qualitative reports as such could not address specific issues or provide for any rigorous analytical framework. Recently, some studies have appeared that are based on quantitative and econometric assessments. Vo *et al* (2000) focus on the predictive content of the exchange rate and of monetary aggregates for the movement of output and prices, using monthly data from 1992M1 to 1999M6. They conclude that real depreciation rates have had a positive and rather significant impact on output growth, though the magnitude was very unstable. Vuong (2003) uses different base currencies (USD, pound sterling, euro and Japanese yen) to test the weak form of PPP for the Vietnamese Dong, and found evince of long-run equilibrium. Moreover, using both observed and bootstrapped half-lives measures, Vuong found that speeds of convergence to PPP are faster, compared to results from other researches for developed economies.

To our knowledge, only two papers have attempted to investigate the determinants of Vietnam's real exchange rate. Nguyen (2004) has chosen government consumption, capital inflow, real GDP, technological progress and the investment/GDP ratio as key underlying economic fundamentals. The period of study is from 1992 to 2002. He concludes that all fundamentals are positively related to the real exchange rate, except government consumption which has a negative impact. Ahmed (2006) employed different

economic fundamentals (i.e. net foreign assets, terms of trade, openness, fiscal balance and productivity) over the short sample period 2000Q1- 2005Q4. Based on the result of unit root tests, he found that the real VND/USD exchange rate is broadly consistent with the PPP hypothesis. The fully-modified OLS estimates of the equilibrium relationship show that movements in net foreign assets of the banking system and in the terms of trade are likely to have played a significant role in influencing recent movements of the real exchange rate. On the other hand, estimates suggests that the exchange rate is unlikely to have been significantly affected by Balassa-Samuelson-type effects during this period[1].

In this paper we make three important contributions. First, we apply for the first time the behavioral equilibrium exchange rate (BEER) approach of Clark and MacDonald (1999, 2000), in order to investigate the determinants of the equilibrium real exchange rate of Vietnam and to calculate the misalignments of the Vietnamese currency. The BEER approach is easier to implement than the FER approach and has been applied to a number of developed and developing countries[2], but not to Vietnam. Second, while all previous studies focused on the bilateral VND/USD exchange rate, we examine the real effective exchange rate of the Vietnamese currency against the currencies of Vietnam's main trade partners, which is a better measure of international competitiveness. We construct a unique data base of real effective exchange rate, effective terms of trade and effective productivity, using the trade weights of Vietnam against its eight main trading partners (i.e. Japan, Euro Area, the United States, Singapore, Korea, Australia and Thailand). Third, we use a longer sample period of monthly data (1995M1-2005M12), thus avoiding the problems associated with the short samples employed by previous studies.

The paper is organized as follows. Section 2 provides an overview of Vietnam's exchange rate policies since 1991. Section 3 outlines the BEER model employed for the study of the real effective exchange rate. Section 4 explains the construction of the effective exchange rate and of the economic fundamentals used in the estimation. Sections 5 and 6

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[1] Given the extremely short sample (only 24 observations) employed by the author, unit root and cointegration tests have very low power and, hence, the reported results do not have much validity. The same criticism applies to the study by Nguyen (2004) which used only 11 years of annual data.

[2] For applications of the BEER approach to developed and developing countries, see, for example, Clark and MacDonald (1998, 1999, 2000), McDonald (2002), Maeso-Fernandez *et al* (2001, 2003, 2004), Zhang (2001), Rahn (2003), Chobanov and Sorsa (2004), Funke and Rahn (2004), Dufrenot and Yehoue (2005), Iimi (2006), Paiva (2006), Wang *et al* (2007).

discuss the determinants of the equilibrium real effective exchange rate and the misalignments of the Vietnamese Dong, respectively. The final section concludes.

2. Developments in the Vietnamese Exchange Rate Regime

Period prior to 1991

Vietnam was essentially a centrally planned economy prior to 1991. All aspects of the economy were controlled by the government while macro and micro policies were centrally planned for the whole country regardless of the roles of demand and supply in the market. All prices were set by the authority, and the exchange rate could not be an exception.

The exchange rate system of Vietnam during that period was a fixed and a multi-rate one. The official rate or the trade rate was estimated based on the purchasing power of currencies among nations in the socialist bloc[3] and was decided in payment conventions within these countries. In addition to the official rate (rate for the foreign trade purposes, export receipts), the other two were the non-trade rate (rate for the inward remittances and all other invisible transactions like tourism) and the internal account rate. According to the classification of exchange rate arrangements of the International Monetary Fund (IMF) the exchange rate regime of Vietnam before 1991 was a combination between pegged exchange rate regime and limited flexibility exchange rate regime. The State Bank of Vietnam (SBV) announced a monthly fix rate between the US dollar (USD) and the Vietnamese Dong (VND) or pegged the rate allowing a flexible trading band of plus or minus 5%.

1991-1993

A new foreign exchange centre was established in Ho Chi Minh City in August 1991and another one in Hanoi in November of the same year. Foreign exchange (only USD) was to be auctioned to banks, trade organizations and to economic entities needing foreign exchange. The final (closing) rate at each trade session was the Auction Fixing Rate being applicable to all transactions. All commercial banks were required to buy foreign

[3] The socialist bloc include: Cuba, USSR, Bulgaria, Czechoslovakia, German DR, Hungary, Poland, Romania.

currencies at this rate and sell at a rate within a maximum margin of 0.5% of the fixing rate.

The establishment of new foreign exchange centers laid the foundation for an official exchange market in Vietnam. This was the first time banks and main import-export companies had an organized market to auction foreign currency. The official exchange rate changed from announced fix rate to auction fixed rate. Before 1991, the rate used to be set monthly by the SBV, but from 1991 to 1993 the rate was determined at each trade session by members of centre - financial institutions, economic entities and the SBV.

To stabilize the exchange rate, the SBV directly observed and participated in each trade session of the foreign exchange centre, intervening in the market by buying or selling. Besides, the SBV also had policies to stimulate public confidence in the local currency and to remove the trend of speculation. The SBV first announced a policy of unlimited sale of gold in the market. Then a positive real interest rate policy to increase deposit was applied allowing deposit and credit with value tag with price of gold. Moreover, the SBV introduced measures for managing foreign currencies and for centralizing all sources to the banking system in order to raise the supply of foreign currencies, stabilize the exchange rate, curb inflation and expand the stock of foreign reserves.

Hence, the exchange rate regime in this period was considered as a continuation of the combined regime between pegged and limited flexibility regime as the classification of IMF (1975). The main difference from the previous period was the determination of the official rate. This new rate contained more market element as it reflected the demand and supply in foreign exchange centre. If the IMF new classification (1999) was applied, the exchange rate regime during that period could be described as a soft peg; the regime was a combination of peg with horizontal band and crawling peg.

1994-1996

In September 1994, the government established the interbank foreign exchange market in order to assist the development of the economy. Members of this market were commercial banks, other financial institutions, and the SBV. Economic entities were not allowed to participate in this market. Instead, they would deal with commercial banks. The interbank foreign exchange market reflected the ability to reconcile and trade foreign currencies of the commercial banks. It became an effective channel for the SBV to intervene in the market as the SBV acted as the final dealer.

The exchange market entered a new stage of development. The traded currency was not only USD but also other five currencies and both spot and forward transactions were permitted. While the average volume traded in the old foreign exchange centre was approximately $1 million per trade session, the average volume traded in the interbank market during 1995-1996 was around $3.8 million per day. Moreover, the difference between buying and selling volume decreased, showing the improvement of commercial banks' reconciliation ability. Any shortage between the sell and buy volume was provided timely by the SBV.

Thus, the SBV could actively estimate and announce the official rate. Then the commercial banks set their rate for customer within the fluctuation-trading band. In this period, the SBV loosened the trading band twice, from 0.1% in July 1994 to 0.5% in October 1994 and to 1% in November 1996. With this system, the SBV tried to maintain the exchange rate stable (see Table 1).

In brief, the replacement of the foreign exchange centre with the interbank foreign exchange market made the exchange rate regime during this period relatively more effective. As the de jure classification of IMF (1975), this regime was the Limited Flexibility regime. As the de factor classification (1999), the SBV was pursuing a crawling band exchange rate regime.

1997-1998

Given Vietnam's close link with the Asia-Pacific countries through trade (about 60% of Vietnam's exports and nearly 75% of its imports) and FDI (about 2/3 came from East Asian countries), the contagion effects of the 1997 Asian financial crisis on Vietnam's economy were unavoidable. Worries of overvaluation of the Dong and thus worsening of the competitiveness of Vietnamese exports had become more acute, following the sharp devaluation of the currencies in other South East Asian countries,

Given this background, the SBV corrected the exchange rate policy several times. It continued to announce the official rate and trading band, but in the two years of 1997-1998, it adjusted the exchange rate four times through changing the trading band and increasing the official rate. (see Table 2).

The result was a rise of the VND/USD rate by 10.21% in 1997 and 13.02% in 1998. The free market exchange rate also increased significantly, 15% in 1997 and 6.7% in 1998. The gap between the free and official exchange rates was considerable, peaking at 1079

VND per USD in 1997M12, though by the late 1998 the gap had narrowed substantially and the two rates became once again quite close.

Besides, the SBV issued a series of Decrees and Decisions for controlling foreign currency. To reduce the negative impacts of Asian crisis, the government tried to attract and gather foreign currency into the banking system, and limit the usage of foreign currency in Vietnam. To conclude, the exchange rate regime during this period could be classified as the crawling band regime by the new classification system of IMF (1999).

1999 until now

In February 1999, the SBV introduced a new exchange rate mechanism. The official rate (the rate between VND and USD) was now set daily at the average of interbank exchange rates on the previous transaction day and the daily trading band within which the rate is allowed to fluctuate was a very narrow band of ±0.1 percent. This trading band was gradually widened to ±0.25 percent in July 2002 and to ±0.5 percent in January 2007. This widening gave more freedom for the commercial banks to set their rates. The SBV has monitored the daily rate and intervened in the foreign exchange market through purchases and sales of foreign currency or foreign exchange swaps to achieve the exchange rate target.

In addition, since 2003 the SBV has gradually changed the peg of the Dong with the US dollar to a peg with a "currency basket" which includes not only the USD but also the currencies of its other major trade partners, with the weights reflecting the geographical distribution of trade, services, and capital flows. The real effective exchange rate (REER) began to be used in the exchange rate operation of SBV. The SBV has updated the nominal exchange rate of currencies in the basket as well as the price indices and the trade weights daily to estimate the REER and use it as an important indicator to orient the nominal exchange rate. These policy changes show that the SBV has been pursuing a roadmap toward a more flexible exchange rate regime to make the VND fully convertible by 2010.

The authorities also introduced measures for the development of the foreign exchange derivatives market. For the forward rate, the SBV has moved the upper limits of forward rate in all terms in May 2004 after changing these limits three times. Since allowing forward transaction in January 1998, the SBV had applied the upper limits, which prescribed the forward rate for terms from one week to six months not to exceed the max

spot rate plus a certain percentage. In 2004, the SBV announced a new regulation for the forward contract. The maturity of forward contract was from 3 days to 360 days instead of 7 days to 180 days. The forward rate was set through swap points instead of fixing percentage margin of the SBV, and the upper limit was removed. Therefore, unlike a spot rate, no trading band bound a 3 days forward rate.

Moreover, other currency derivative instruments like swaps and options were also allowed. From November 2004, forward, swap and option transactions could be carried out between financial institutions, economic entities and individual investors. The term, rate and price were set by negotiation between purchaser and seller and were not restricted by any limit. Furthermore, transactions without documents to improve the purpose of foreign currency were allowed, except for transactions in which economy entities or individuals buy foreign currency from commercial banks through spot and forward contracts. In fact, the convertibility of main foreign currencies was conceded. Thus, in an indirect way, the USD could be bough and sold between commercial banks at a rate exceeding the trading band limit (through converting to another foreign currency which does not have trading band as euro, pound sterling or Japanese yen).

The government has introduced additional foreign currency policies in order to absorb foreign currency into Vietnam and the banking system, and to use it effectively as the economy opens itself to global competition and private capital.

The first is the foreign exchange surrender requirement policy. In the previous period, the surrender requirement was 80 percent. Nevertheless, in the following years, as the exchange rate was stable, the SBV continually reduced the surrender requirement to 50 percent in 1999, 40 percent in 2001, 30 percent in 2002 and to 0 percent in April 2003.

The second is the foreign currency control policy for foreign direct investment. In May 2001, the government abolished the foreign currency self-balancing mechanism. Companies with foreign investment capital could purchase foreign currency directly from commercial banks. The SBV also guaranteed to sell foreign currency for important projects.

The third is the inward remittance policy. Combining with the new branches to receive and pay remittance, the government has ensured the right to receive and use the foreign currency of receiver and no income tax for the remittance has been applied. Thus, the

remittance volume rose from 0.95 billion USD in 1998 to 3 billion USD in 2004 and to 4 billion USD in 2005.

Vietnam's progressive liberalization of its exchange system has been an important element of its strategy of integration into the global trading system. The relative success of the exchange rate policy measures is reflected in the dramatic reduction of the "black" market premium (the difference between the "black" or free exchange rate and the official exchange rate) since 1999 (see Figure 1 and Table 3). The premium peaked at 17.89% in June 1991 when the official market was formed but fell quickly since 1992. It remained at low level (below 1%) for most of the time between 1993-2005. During the 1997-1998 Asian financial crisis it rose again, with a highest level of 8.77% in 1997M12. Since 1999, the black premium has remained below 1% for almost the entire period, with the average rate being 0.22% compared to 1.36% during 1997-1998 and 1.83% during 1991-1996. What this implies is that the official and black market exchange rates have converged almost completely since 1999.

3. The Behavioral Equilibrium Exchange Rate (BEER) Model

In the BEER approach, the relevant notion of equilibrium is not derived from macroeconomic balance; rather it is determined by an appropriate set of economic fundamentals. Hence the concept of equilibrium embedded in the BEER is mostly of a statistical nature. According to Clark and MacDonald (1999, 2000), the starting component of the BEER model is the uncovered interest parity (UIP) condition,

$$E_t \Delta S_{t+k} = - (i_t - i^*_t) + \pi_t \qquad (1)$$

where s_t is the nominal exchange rate defined as foreign currency per unit of domestic currency, i_t is the domestic nominal interest rate, i^* is the foreign nominal interest rate, $\pi_t = \lambda_t + k$ is the risk premium that has a time-varying component λ_t, E_t is the conditional expectations operator, and $t + k$ is the maturity horizon of the bonds.

By subtracting the expected inflation differential, $E_t (\Delta p_{t+k} - \Delta p^*_{t+k})$, from the exchange rate and interest differential, we could converted equation (1) into a real relationship. After rearranging, we have:

$$q_t = E_t[q_{t+k}] + (r_t - r^*_t) - \pi_t \qquad (2)$$

where $r_t = i_t - E_t(\Delta p_{t+k})$ is the ex ante real interest rate.

This equation describes the current equilibrium exchange rate as being determined by the expectation of the real exchange rate in period $t + k$, $E_t[q_{t+k}]$, the real interest differential, $(r_t - r^*_t)$ (*RID*), and the risk premium, π_t (*RIPRE*).

To implement the UIP relationship as an empirical model, beside the addition of the risk premium, *RIPRE*, Clark and MacDonald (1999 and 2000) has made the assumption that the expected future of the exchange rate, $E_t[q_{t+k}]$, would be determined by the long-run economic fundamentals.

The choice of economic fundamentals varies among studies. We refer here to the popular theoretical model advanced by Faruqee (1995), extended by Alberola *et al* (1999), and applied by Clark and MacDonald (1999 and 2000) and Funke and Rahn (2004). In this model, the systematic component of the exchange rate is driven by the effective terms of trade (*TOT*), effective productivity (*PROD*) and the net foreign asset position (*NFA*):

$$q'_t = f(TOT_t, PROD_t, NFA_t) \tag{3}$$

Thus, we get the variable space, which will motivate the empirical work:

$$BEER = f\left(\overset{+}{TOT}, \overset{+}{PROD}, \overset{+}{NFA}, \overset{+}{RID}, \overset{-}{RIPRE}\right) \tag{4}$$

The terms of trade are expected to have a direct impact on the equilibrium exchange rate. An improvement in the terms of trade gives rise to an increase in domestic income and a stronger balance of payments, which put upward pressure on the real exchange rate.

Productivity levels have been commonly reviewed in the literature on exchange rate fundamentals as a proxy for the Balassa-Samuelson effect. This effect is based on the divergence of productivity levels in a country's non-tradable and tradable goods. Higher productivity growth in the tradable sector would tend to raise wages in that sector, and would gradually exert upward pressure on wages in the non-tradable sector, as labor from the non-tradable sector moves to the tradable one. This, in turn, would tend to increase domestic demand and the price of non-tradable, giving rise to an appreciated real exchange rate.

The NFA position is also expected to have a direct impact on a country's real exchange rate. Higher foreign borrowing and/or inflows of foreign direct investment worsens a country's NFA position and thus require a weaker currency to generate an improvement in the primary current account that will help recover the higher debt service and profit remittances associated with these inflows. On the other hand, higher NFA allow a country to sustain a stronger real exchange rate because of higher income from its foreign assets. In addition, the higher level of national wealth tends to increase domestic consumption, thus exerting upward pressure on non-tradable prices and the real exchange rate.

4. Construction of the Effective Variables and Data Sources

Monthly data are used for all time series[4]. The length of the sample is limited by data availability for Vietnam and covers the period from 1995 M1 to 2005 M12 for all countries. Data are obtained from the *International Monetary Fund (IMF)'s International Financial Statistic (IFS)* online system, the *IMF's Direction of Trade (DOT)* online system, *State Bank of Vietnam (SBV) Annual Reports*, *General Statistic Office (GSO) Statistical Yearbook*, *European Central Bank (ECB)* online data source and *Reuters 3000 Xtra* system.

a. Real Effective Exchange Rate (REER)

This is a multilateral CPI-based real effective exchange rate of the currency of the domestic economy relating to its partner countries. For the effective rate, the weighted average here is taken over the bilateral trade volumes of Vietnam against its eight main trading partners, Japan, Euro Area, the United States, Singapore, Korea, Australia and Thailand. Trade with these economies amounted to 79 percent of Vietnam total trade in

[4] The risk premium is commonly proxied by using the ratio of outstanding domestic government debt to foreign government debt (Clark and MacDonald 1999) or other fiscal position (Maeso-Fernandez *et al* 2001, Iimi 2006, Paiva 2006). However, Vietnam's data for these variables are available only on an annual basis while our empirical model uses monthly data. Moreover, in previous empirical work, the risk premium was proved to be insignificant (Clark and MacDonald 2000, Maeso-Fernandez *et al* 2001, Ahmed 2006). Thus, this variable is not included in our model.

2005. These trade weights are based on cumulated export and import volume given by the following formula:

$$W_j = \frac{IM}{IM + EX} \times im_j + \frac{EX}{IM + EX} \times ex_j \quad (5)$$

Where j is an index that runs over Vietnam's trade partners, IM and EX are Vietnam's total import and export volume to eight trading partners and im_j is the share of Vietnam's imports originating from country j, ex_j is the share of Vietnam's exports sold in country j. All data for calculating Wj are obtained from the Direction of Trade (DOT) online system of IMF, including monthly volume of Vietnam's total import from the world and export to the world, monthly volume of Vietnam's import and export with main eight trading partners.

Applying the methodology developed by Zanello and Desruelle (1997) for the IMF, the CPI-based REER index of Vietnam is given by:

$$reer = Log(REER) = Log\{\frac{ER_{VN} CPI_{VN}}{\Pi_j \left(ER_j CPI_j\right)^{W_j}}\} \quad (6)$$

where CPI_{VN} and CPI_j are consumer price indices in Vietnam and country j, and ER_{VN} and ER_j represent the nominal exchange rates of Vietnam and country j's currencies in USD in index form. All the price indices and the nominal exchange rate indices have been converted to the same base month (2000M1 = 100).

Exchange rates and consumer price indices for calculating REER are obtained from IFS. For the Euro Area, data on the euro do not exist before its introduction in 1999. However, the European Central Bank (ECB) has published a "synthetic" value for the consumer price indices preceding its introduction in ECB website. The "synthetic" value for the nominal euro/dollar exchange rate before 1999 is not available in ECB website, thus we obtained this variable from Reuters 3000 Xtra.

Checking the results, we have compared the calculated REER against the annual REER available in IMF Country Report for Vietnam. These figures match to more than 90%.

As we can see from Figure 2, movements in the REER reflect primarily trends in Vietnam's nominal effective exchange rate (NEER). From 1995 to 1998, the REER appreciated by about 30%. During the period of the Asian crisis, the NEER and REER depreciated somewhat in 1998 and 1999, and leveled off during 2000 – 2002, before

recording a significant depreciation during 2003 – 2004. Thereafter, the reemergence of persistently higher inflation compared to that of Vietnam's main trading partners led to a renewed divergence between trends in the REER and NEER. As we can see, while the NEER was kept to fluctuate within a narrow range from 2004 until now, Vietnam's high rate of inflation has resulted in a significant appreciation of the REER.

b. Effective Terms of Trade (TOT)

The terms of trade are measured by the ratio of the domestic export price index (EPI) to the import price index (IPI) to the equivalent foreign ratio, where the same trade weights described above are used to calculate the weighted average of the terms of trade for Vietnam's trade partners. This variable is given by

$$tot = Log(TOT) = Log\left(\frac{EPI_{VN} / IPI_{VN}}{\Pi_j \left(EPI_j / IPI_j\right)^{W_j}}\right) \quad (7)$$

Vietnam's export and import price indices are taken from the GSO Statistical Yearbook. For other partner countries, the data source is the IFS. The export and import price indices of Euro are available in IFS from 1998M1. For values before 1998, we used the indices of the twelve European countries weighted by their total trade shares. *TOT* is displayed in Figure 3.

c. Effective Productivity (PROD)

The productivity level, which proxies the Balassa-Sumelson effect, is defined as the ratio of the domestic consumer price index (CPI) to the domestic wholesale or producer price index (PPI) relative to the corresponding foreign ratio using the same trade weights for Vietnam's trade partners as above[5]. This variable is given by the equation below:

$$prod = Log(PROD) = Log\left(\frac{CPI_{VN} / PPI_{VN}}{\Pi_j \left(CPI_j / PPI_j\right)^{W_j}}\right) \quad (8)$$

The data sources to calculate the productivity levels are the IFS (for the CPI and PPI of Vietnam's main trade partner), the GSO (for the CPI and PPI of Vietnam), and the ECB

[5] Given the lack of data on productivity in the traded and non-traded sectors in developing countries, many studies have used this measure of relative productivity to capture the Balassa-Samuelson effect. See, for example, Clark and MacDonald (1998, 1999, 2000), Alberola *et al* (1999), Chinn (1999), Rahn (2003), Funke and Rahn (2005).

(for Euro Area). As we can see from Figure 4, the broad cyclical patterns of the effective real exchange rate and productivity are quite similar.

d. Net Foreign Assets (NFA)

This variable is simply defined as total foreign assets (less official gold holding) minus total liabilities to foreigners, expressed as a ratio to GNP. The data source for net foreign assets and GNP of Vietnam is the IFS. NFA is displayed in Figure 5.

e. Real Interest Differentials (RID)

The real interest differential is defined as the difference between the domestic real interest rate and the foreign interest rate.

$$RID = r - r^* \tag{9}$$

The domestic real interest rate (r) is the nominal long-term government bond yield minus the CPI percentage change of the same month of the previous year. The foreign interest rate (r^*) is a weighted average of partner countries' real interest rates. Government bond yields are available for Vietnam, US, Euro Area, Japan, and Thailand. But for Korea we used the yield on national housing bonds, and for Australia the 15 years Treasury bond. Data were obtained from the IFS (change in the CPI and the long-term interest rate of partner countries) and the SBV (Vietnamese ten-year government bond yield). The real interest differential is shown in Figure 6.

5. Empirical Results

We employ the Johansen cointegration method to identify the long-run relationships among the variables. We also use the Dynamic Ordinary Least Squares method (DOLS) to estimate the parameters of the long-run equilibrium relationship.

Before applying the cointegration analysis to equation (4), it is necessary to test for the presence of unit roots in the time series to avoid spurious regression. The ADF unit root test is performed on all the series[6]. We employ a model with intercept and without trend. The lag length is chosen by the general-to-specific method (Ng and Perron, 1995).

[6] Note that all variables in the econometric estimation are measured in natural logarithms (except *rid*), which is indicated by the use of lower case letters.

Results are summarized in Table 4. The ADF statistics cannot reject the null of a unit root in the levels of the variables, but reject it for the first differences. In other words, all variables are *I(1)* processes and can be entered into a cointegrating relationship. It is interesting to note that the presence of a unit root in the real effective exchange rate implies rejection of the long-run PPP hypothesis.

After testing for the stationary of the variables, the next step is to test whether they have a cointegrating relationship. We use the statistics system version of SIC and select the lag order of the VAR that minimizes the SIC information criterion. The SIC criterion indicates 1 lag in the VAR. The specification of the VAR is supported by the multivariate LM-type statistics for autocorrelation (*p*-values in parenthesis) which are LM(4)=0.30.95(0.191) and LM(8)=28.21(0.298). The Johansen's Trace test and Max Eigenvalue test are then applied with the assumption that there is an intercept in the VECM but no trend. The main results are summarized in Table 5.

The Trace test suggests one cointegration equation ($r = 1$) while the Maximum Eigenvalue test indicates zero cointegrating equations ($r = 0$). However, the Trace test is often preferred to the Maximum Eigenvalue because it is more robust to departures from normally distributed residuals of the systems' equation. Hence, we favour the result from the Trace test that there is one cointegrating vector ($r = 1$).

The equilibrium equation (*t*-values in parenthesis) is given below:

$$\underset{\quad}{reer} = \underset{(5.792)}{0.864805tot} + \underset{(3.203)}{1.313168prod} - \underset{(3.701)}{0.063006nfa} + \underset{(0.414)}{0.001403rid} - 5.281795 \qquad (10)$$

All coefficients, except that on *nfa,* are correctly signed. The t-ratios suggests that *tot*, *prod* and *nfa* are significant, while *rid* is insignificant. The adjustment coefficient in the exchange rate equation, shown in Table 6, is negative and significant at the 5% level, while the other adjustment coefficients are mostly insignificant and wrongly signed. This implies that the real exchange rate adjusts negatively to disequilibrium in the cointegrating vector (at 8% per month) and this adjustment dominates adjustment in the other equations. This evidence further supports the validity of equation (10) as a long-run equilibrium exchange rate relationship.

A number of studies (see Maddala and Kim, 1998) have shown that the Johansen method is very sensitive to departures from the underlying assumptions about the distributions of the error terms. In their review of Monte Carlo studies comparing the properties of alternative cointegration methods, Maddala and Kim (1998, pp. 183-184) conclude that the Johansen estimator exhibits large variation and has the tendency to produce outliers while, among single equation methods, where estimation of a single cointegrating vector is of concern, a linear model with leads and lags provides the best choice. This implies that the dynamic ordinary least squares (DOLS) method, which corrects for the endogeneity of regressors, includes leads and lags and is shown to perform well in finite samples relative to other asymptotically efficient estimators, is to be preferred for the estimation of the equilibrium parameters, especially when a single cointegrating vector has been established. Therefore we employ the DOLS method, together with the Newey-West (1987) heteroscedasticity and autocorrelation consistent covariance estimator (HAC), to estimate the parameters of the long-run equilibrium relationship.

The DOLS equation is given below:

$$reer_t = \alpha + \beta tot_t + \gamma prod_t + \delta nfa_t + \theta rid_t + \sum_{j=-k}^{k} \phi_j \Delta tot_{t-j} + \sum_{j=-k}^{k} \chi_j \Delta prpod_{t-j} + \sum_{j=-k}^{k} \psi_j \Delta nfa_t + \sum_{j=-k}^{k} \omega_j \Delta rid_t + t \quad (11)$$

where k = leads and lags of the economic fundamentals.

The number of leads and lags in equation (11) was chosen with the Akaike criterion and was equal to four. The DOLS estimates of the long-run equilibrium exchange rate equation (HAC t-values in parenthesis) are[7]:

$$reer = 0.722603tot + 1.412577prod - 0.044892nfa + 0.007440rid - 5.162064 \quad (12)$$
$$(5.548) \qquad (4.130) \qquad (3.556) \qquad (3.147) \qquad (3.018)$$

We note that now all coefficients are highly significant even at the 1% level of significance. Furthermore all economic fundamentals, with the exception of net foreign

[7] Note that the Jarque-Bera statistic (p-value in parenthesis), which is equal to 3.578(0.167), implies normally distributed errors. In addition, the CUSUM of squares based on recursive residuals indicates stability of estimated coefficients at the 5% level of significance. Combined with the autocorrelation and heteroscedasticity consistent standard errors of the coefficients, these statistics confirm that the DOLS equation is well specified.

assets, have the anticipated positive effects. It is interesting to note that productivity and terms of trade exert the strongest influence on the long-run equilibrium effective exchange rate. This result was also obtained with the Johansen method, so it remains robust to the estimation method employed..

The results on productivity suggest that Balassa-Samuelson-type effects are likely to have played a major role in influencing the real exchange rate in Vietnam during the sample period. An increase in productivity leads to a strong appreciation of the real exchange rate. A 1% rise in the productivity differential causes a 1.4% appreciation in the equilibrium real effective exchange rate.

Any terms of trade improvement results in a significant appreciation of the real exchange rate. This result is consistent with the earlier equilibrium exchange rate literature. A 1% rise in the terms of term differential causes a 0.7% appreciation of the equilibrium real exchange rate.

As expected, an increase in the real interest rate differential leads to appreciation of the real exchange rate. One unexpected result is the negative coefficient on net foreign assets[8], though the economic impact on the real exchange rate is very low.

6. The Equilibrium Real Effective Exchange Rate and Misalignments

Using the parameters from the equilibrium exchange rate equation (12) and the actual values of the fundamental variables (*tot, prod, nfa, rid*), we can estimate the current equilibrium real effective exchange rate of the Vietnamese Dong (BEER). Figure 7 shows the relationship between the actual (REER) and the equilibrium (BEER) real effective exchange rates. It is interesting to note that the real exchange rate converges to its equilibrium level, thus confirming the validity of equation (12) as being a long-run equilibrium relationship.

Given the value of BEER, we calculate the current misalignments of the Vietnamese

[8] It is difficult to explain the negative sign of the coefficient on net foreign assets, except for measurement errors. It may also be the case that capital flows were not a large part of the Vietnamese economy during the sample period.

Dong[9]. These are exhibited in Figure 8. It appears that the Dong was overvalued for most of the period 1998M1-2002M8, with the highest rates during 1999M3-1999M6 (8%-10%) and 2002M1-2002M3 (around 11%). On the other hand, it was undervalued during the South East Asian financial crisis (7%-8%) and since the end of 2002, with the highest rate at the end of 2003 (7%).

In constructing the equilibrium real exchange rate, it is normally assumed that the economic fundamentals are also at their sustainable or long-run levels. To abstract from the short, random disturbances in the BEER, we use the Hodrick-Prescott (HP) filter technique (as in Clark and MacDonald, 1999) with an integer value for the smoothing parameter, $\lambda = 14400$ for monthly data, to obtain the smoothed or long-run values of the economic fundamentals. These are entered into equation (12) to obtain the long-term equilibrium real effective exchange rate, which is labeled as HPBEER.

Figure 9 shows the relationship between the REER and HPBEER effective exchange rates for Vietnam during 1995-2005. The equilibrium real exchange rate appreciated during the 1990s, followed by depreciation from 1998 to 2002, and another appreciation for the last three years. The early appreciation was due to a rise in the long-run values of both the terms of trade and productivity. The subsequent depreciation resulted from a downwards movement in the long-run state values of the above variables and of relative interest rates. However, the recent appreciation of the equilibrium exchange rate seems to be due primarily to a steady improvement in productivity. As Figure 11 shows, the long-run equilibrium real effective exchange rate mirrors quite closely the pattern of long-run relative productivity, thus providing strong support for the Balassa-Samuelson effect.

Figure 11 displays the total misalignment rates based on HPBEER[10]. The Vietnamese Dong seems to have experienced significant misalignments. We observe three patterns. During 1995-1997, the actual exchange rate fluctuated around its equilibrium rate. The second phase was from 1998 (the aftermath of the Asian financial crisis) to 2002 when the actual exchange rate was mostly above its equilibrium level (except for a few months

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[9] The misalignment rates are calculated by employing the following formula:

[REER-BEER)/REER]*100.

[10] In contrast to current misalignments which reflect transitory factors and/or random error terms, total misalignments also reflect deviations of the economic fundamentals from their sustainable or long-run levels.

at the end of 1998 and 1999). The highest degree of overvaluation of VND over that period was during 1997M12-1998M1 (8.7%-10.3%) and in 2002M2 (8.4%). This pattern changed dramatically towards the end of 2002. Since the beginning of 2003 the real exchange rate has been considerably lower than the equilibrium rate (except for the last 3 months of 2005). This implies undervaluation of the VND against the currencies of Vietnam's main trade partners for the last three years, with the highest undervaluation rate observed at the end of 2003 (8%) and at the end of 2004 (6.5%). Such significant misalignments of the Dong have important implications for Vietnam's international competitiveness.

7. Conclusions and Policy Implications

This paper investigates Vietnam's equilibrium real effective exchange rate and misalignments of the Dong by employing the behavioral equilibrium exchange rate approach that has not been hitherto applied to Vietnam. Our research is based on a comprehensive data set for Vietnam and its main trading partners, which has been compiled for the period from 1995 to present on a monthly basis. We have constructed for the first time a monthly time series for the Dong's real effective exchange rate against the main trade partners of Vietnam (Japan, Euro Area, United State, Singapore, Korea, Australia and Thailand) by using the trade volumes of Vietnam against its trade partners as weights. Effective economic fundamental variables have also been constructed. In addition, we provide an overview of developments in the Vietnamese foreign exchange market and of the foreign exchange policies pursued by the government.

The ADF tests indicate that these variable are all variables are I(1). Applying Johansen's procedure, we found one significant cointegrating vector among the variables. In addition we have used the DOLS method, which is shown to perform well in finite samples relatively to other asymptotically efficient estimators, to obtain estimates of the long-run equilibrium exchange rate relationship. The latter suggest that productivity and terms of trade are the most significant determinants of the equilibrium real effective exchange rate followed by net foreign assets and interest rate differentials.

The estimates of the long-run exchange rate equation, together with the long-run values of the economic fundamentals, obtained with the Hodrick-Prescot filter, are used to calculate the Dong's equilibrium real effective exchange rate (HPBEER). This appreciated in the

middle of the 1990s, followed by depreciation during 1998-2002, and then by another appreciation. What is remarkable is that the overall pattern of the equilibrium real effective exchange rate mirrors quite closely the pattern of long-run relative productivity, thus providing strong support for the Balassa-Samuelson effect.

We have found that the Vietnamese Dong was persistently overvalued during the 1998-2002 period and overvalued over the last three years. These significant misalignments imply that continuation of Vietnam's de facto fixed exchange rate policy over a longer period of time would carry significant risks. Beside their welfare implications, such misalignments would affect Vietnam's competitiveness, with eventual adverse implications for export and growth performance. Moreover, Vietnam's exposure to international competition is bound to increase in the period ahead, as it progressively dismantles its remaining trade barriers and levels the playing field for domestic and foreign based economic entities, in line with its commitments under the WTO. A more flexible exchange rate would facilitate the economy's adjustment to structural changes and exogenous shocks, reduce external vulnerability, and create incentives for economic agents to improve their management of exchange rate risks as the economy opens itself to global competition and private foreign capital. To these ends, the State Bank of Vietnam will need to make full use of the flexibility built into the current regime while limiting intervention to addressing disorderly conditions. In addition, the control regime on foreign currencies needs to be liberalized in accordance with international regulations. That's what Vietnam did in 2005 when solving limitations on foreign currencies for foreign trade and step by step for capital transaction. Continuation of the liberalization process both in the foreign exchange market and in other domestic financial markets, combined with improvements in the contact of monetary policy, would enable Vietnam to achieve its developing targets and make the Vietnamese Dong fully convertible.

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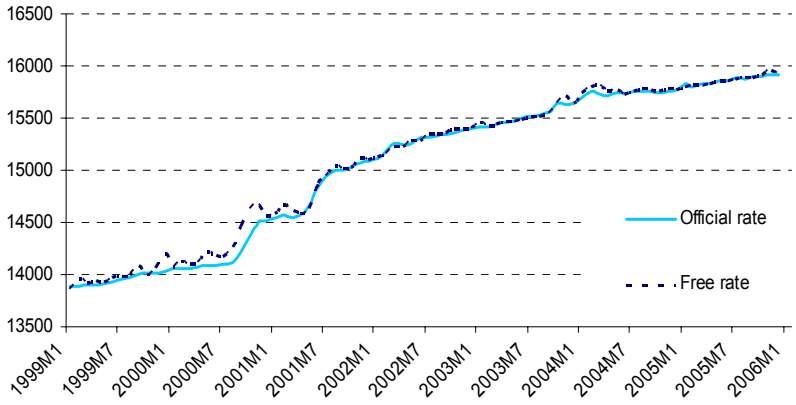
Figure 1: **The VND/USD Rate in Official and Free Markets**



Source: SBV

Figure 2: Nominal and Real Effective Exchange Rate Indices (2000M1 = 100)

In Official Market

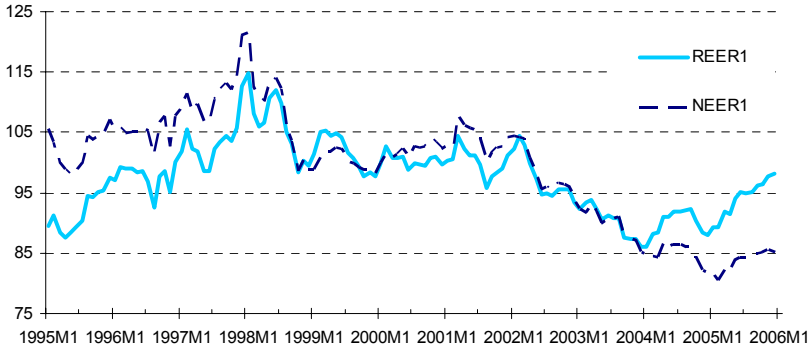


Figure 3: Real Effective Exchange Rate and Terms of Trade Indices (2000M1 = 100)

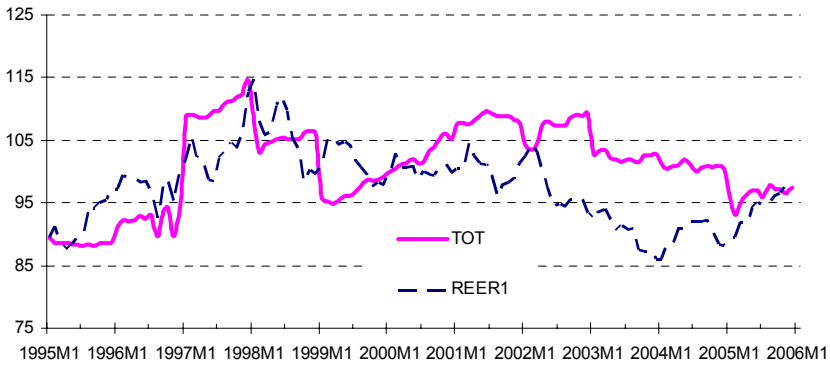


Figure 4: Real Effective Exchange Rate and Productivity Indices (2000M1 = 100)

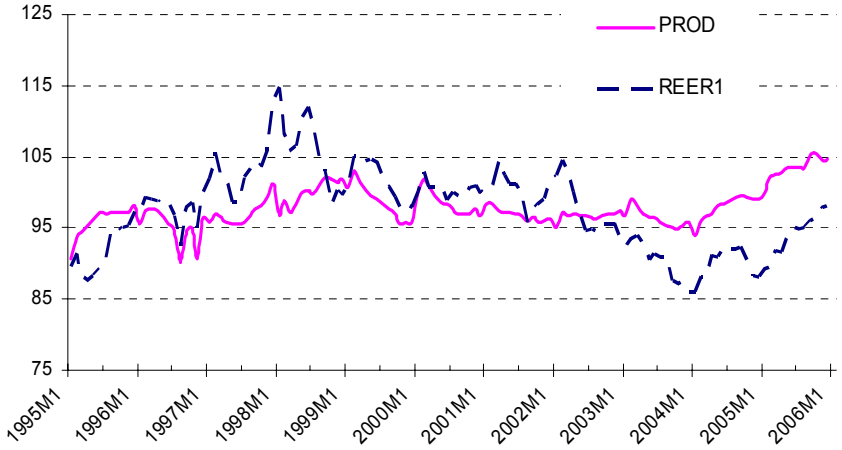


Figure 5: Real Effective Exchange Rate Index (2000M1 = 100) and Net Foreign Assets (% of GNP)

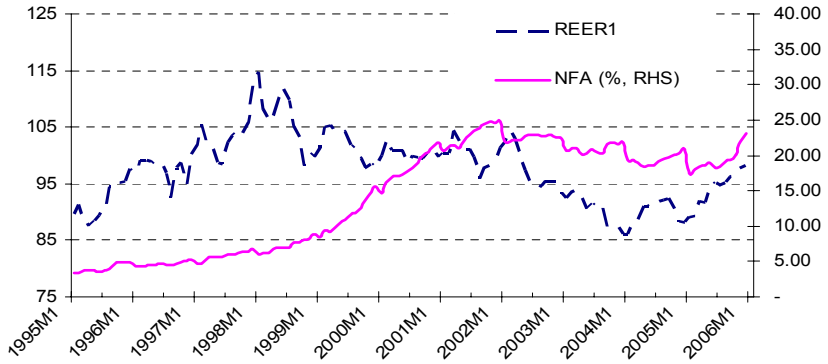


Figure 6: Real Effective Exchange Rate Index (2000M1 = 100) and Real Interest Differential (%)

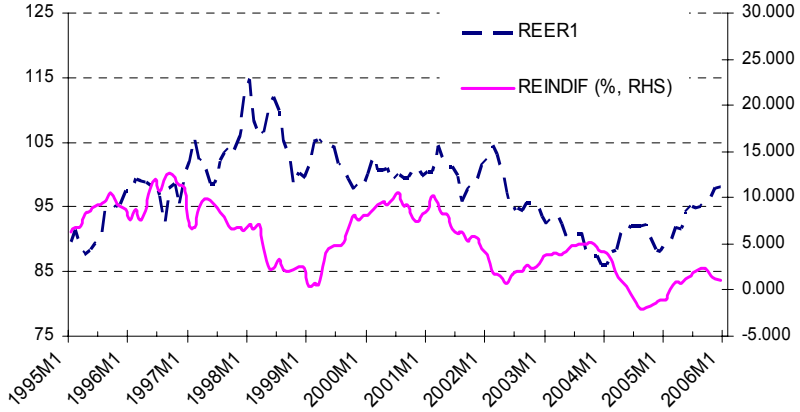


Figure 7: Actual (REER) and Equilibrium (BEER) Real Effective Exchange Rates

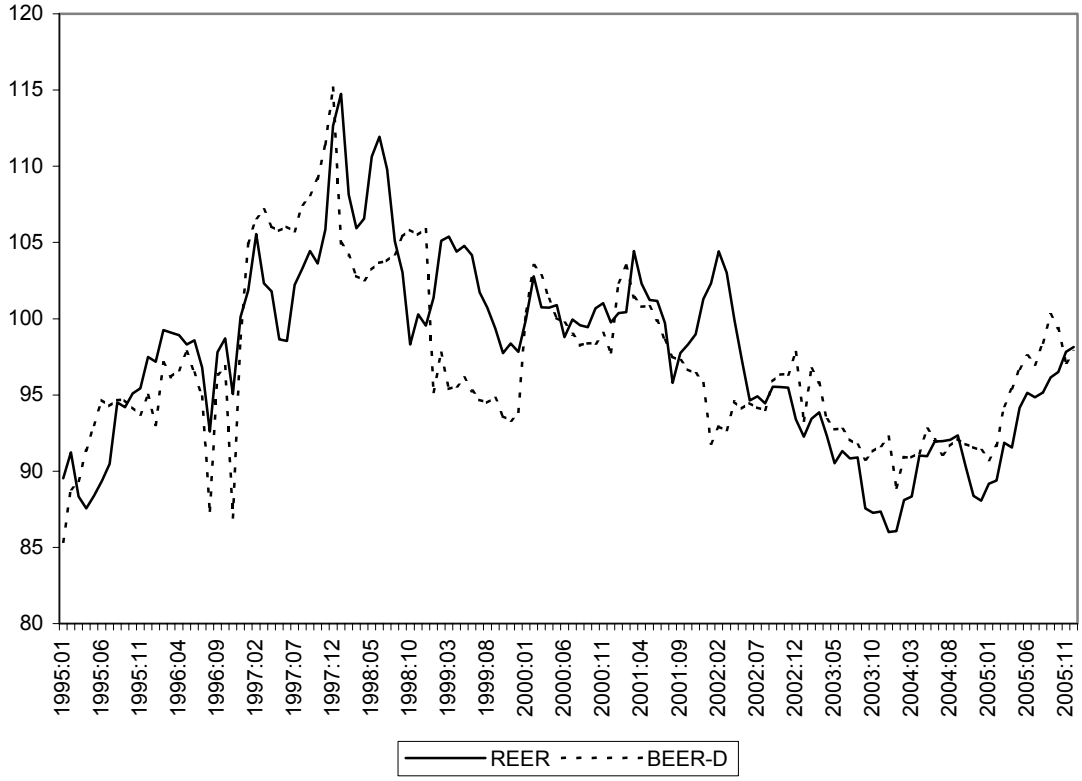


Figure 8: Current Misalignment (%)

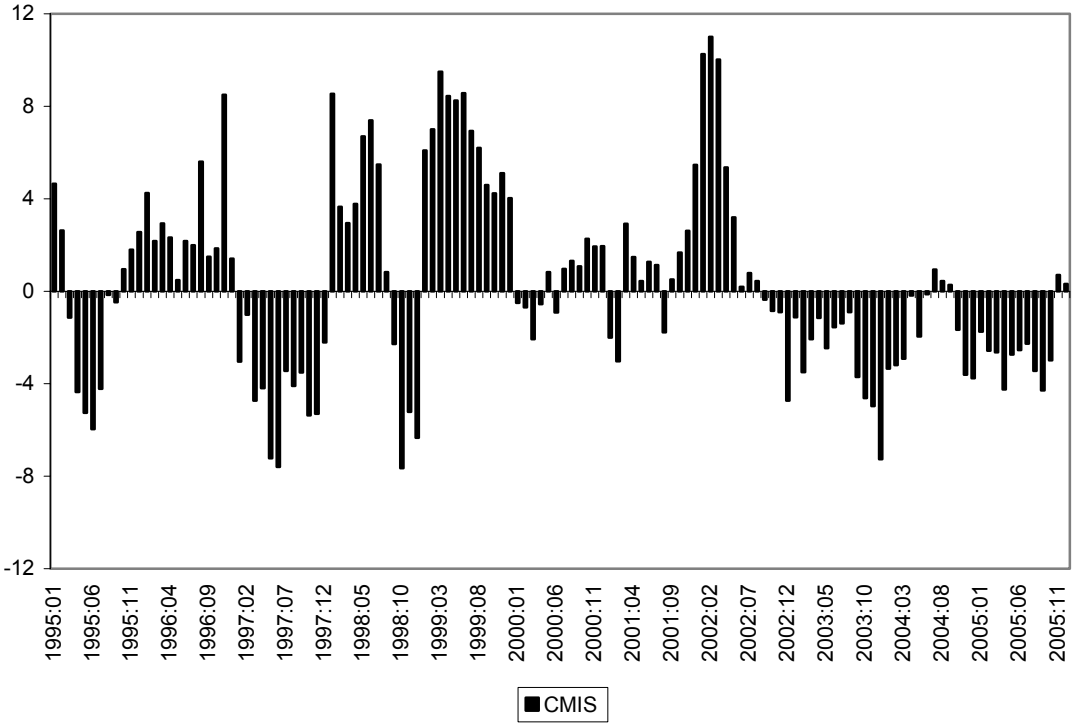


Figure 9: Actual REER) and Equilibrium (HPBEER) Real Effective Exchange Rates

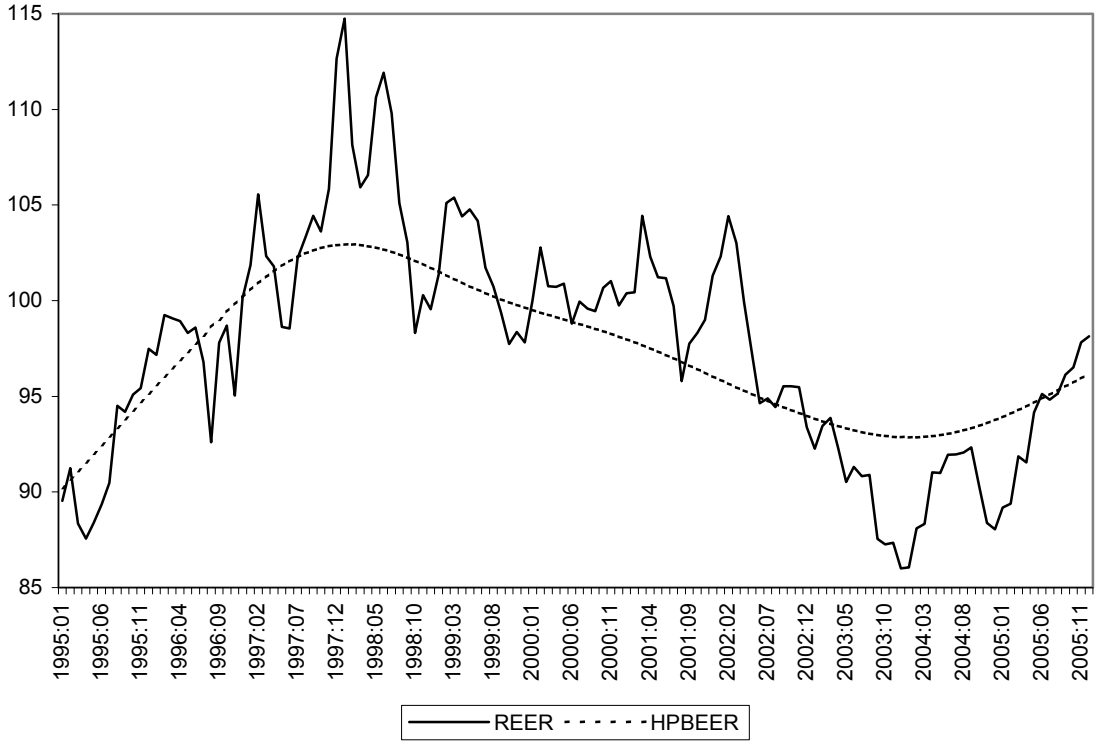


Figure 10: Total Misalignment (%)

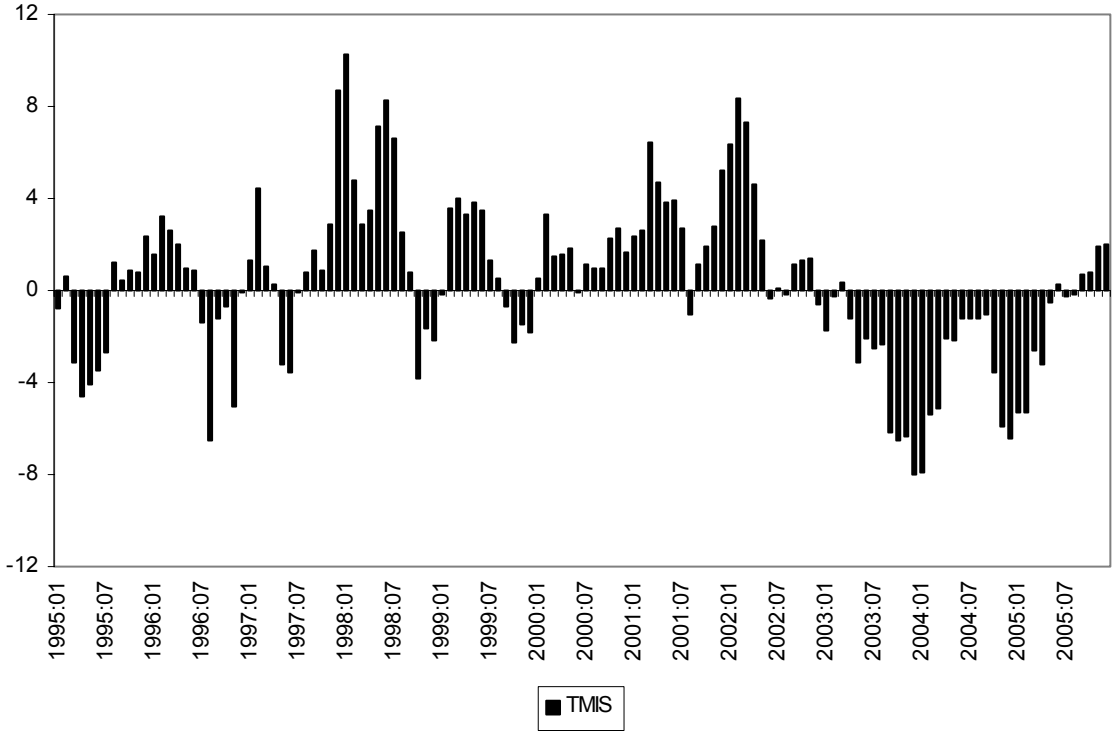


Figure 11: Equilibrium (HPBEER) Real Effective Exchange Rate and HP filtered Productivity

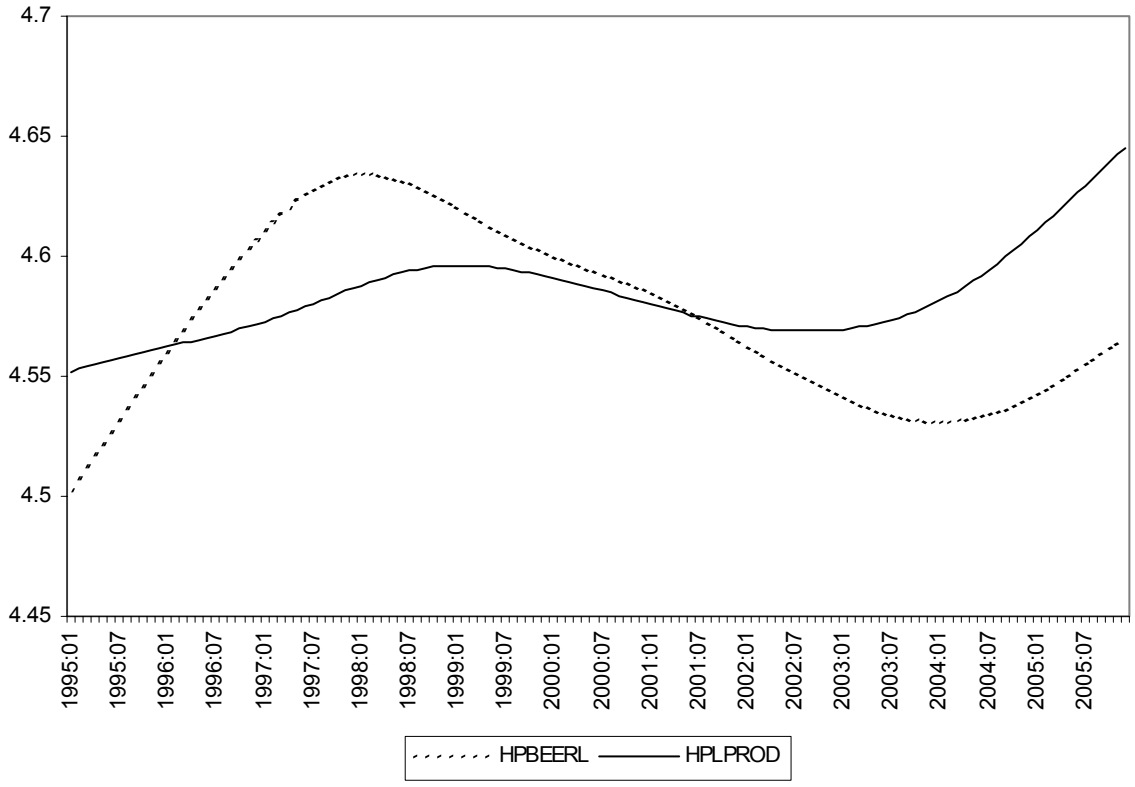


Table 1: Exchange Rate on 31 December of 1994, 1995, and 1996

Indicators	1994	1995	1996
Interbank Rate (VND/USD)	11,062	11,018	11,154
Increase/Decrease	+1.95%	-0.4%	+1.23%
Free market Rate (VND/USD)	11,060	11,005	11,260
Increase/Decrease	+1.39%	-0.5%	+2.3%

Source: SBV

Table 2: **Changes to the Vietnamese Exchange Rate Regime in 1997-1998.**

Date	Changes to the exchange rate regime
27 Feb 1997	The SBV widened the trading band for the Dong in the interbank market to 5% from 1%.
13 Oct 1997	The SBV widened the trading band for the Dong in the interbank market to 10% from 5%.
16 Feb 1998	The SBV depreciated the official rate of the VND against the USD by 5.6% from 11,175 VND/USD to 11,800 VND/USD.
07 Aug 1998	The SBV narrowed the trading band for the Dong in the interbank market to 7% from 10% but devalued the official rate of the VND against the USD by 10% from 11,815 VND/USD to 12,998 VND/USD

Source: SBV

Table 3: Summary of the Official and Free (Black Market) VND/USD Exchange Rates, 1991-2005

	Official			Free			Black Premium(%)		
	1991-1996	1997-1998	1999-2005	1991-1996	1997-1998	1999-2005	1991-1996	1997-1998	1999-2005
Mean	10642	12514	15054	10804	12685	15085	1.834	1.361	0.217
Median	11009	12292	15321	11002	12992	15312	0.173	0.382	0.117
Max	12450	13907	15916	13715	14463	15950	17.893	8.778	1.787
Min	7000	11132	13880	7585	11210	13850	-0.903	-0.103	-0.267
Std	1161	930	714	1004	994	692	3.963	2.309	0.375

Table 4: Unit Root Test: ADF Statistics

Variable	Level		1st Difference	
	t-Statistic	***Prob.****	***t-Statistic***	***Prob.****
reer	-2.20495	0.2056	-10.30573	0.0000
	Lag length: 0		*Lag length: 0*	
tot	-2.26780	0.1840	-9.17205	0.0000
	Lag length:2		*Lag length: 1*	
prod	-2.08734	0.2502	-6.35378	0.0000
	Lag length: 3		*Lag length: 2*	
nfa	-1.98166		-10.86877	0.0000
	Lag length: 0		*Lag length: 0*	
rid	-1.65734	0.4505	-9.03797	0.0000
	Lag length: 1		*Lag length: 0*	
Test critical values:	*1% level*	*-3.480818*		
	5% level	*-2.883579*		
	10% level	*-2.578601*		

Table 5: Johansen Cointegration Tests

		0.05 Critical value	**Probability****
Cointegration test: Trace statistic			
H_o: r = 0	71.58879*	69.81889	0.0359
H_o: r = 1	45.56458	47.85613	0.0808
H_o: r = 2	25.04056	29.79707	0.1600
H_o: r = 3	12.74117	15.49471	0.1247
H_o: r = 4	2.58231	3.841466	0.1081
No. of CE(s) at the 0.05 level	One cointegrating equation		
Cointegration test: Max Eigenvalue statistic			
H_o: r = 0	26.02421	33.87687	0.3193
H_o: r = 1	20.52402	27.58434	0.3060
H_o: r = 2	12.29939	21.13162	0.5184
H_o: r = 3	10.15885	14.26460	0.2017
H_o: r = 4	2.58231	3.84147	0.1081
No. of CE(s) at the 0.05 level	No cointegrating equation		

Note: * denotes rejection of the hypothesis at the 0.05 level. ** MacKinnon-Haug-Michelis (1999) *p*-values.

Table 6: Alpha Adjustment Matrix

$\Delta(reer)$	$\Delta(tot)$	$\Delta(prod)$	$\Delta(nfa)$	$\Delta(rid)$
-0.0834	0.1551	-0.0055	0.1352	-0.1094
(2.025)	(3.87)	(0.21)	(1.43)	(0.06)