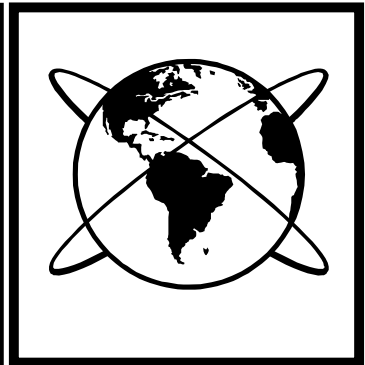


Notes in International Macroeconomics and Finance

**Introductory Concepts in International
Finance**



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I. Balance of Payments and international Transactions

The Balance of Payments (BOP) is a record of all transactions of an economy with the foreign sector, it includes the Trade Balance (Exports – Imports), and then adding Receipts of foreign transfers (transactions of national labour working abroad) we have the current account, the BOP also include the capital account balance (capital inflows and outflows), additional to the transfers of non-monetary gold, all components of the BOP and its macroeconomic links are explained below.

Transactions Types

Spot transaction: purchase or sale of a foreign exchange immediately.

Swap transaction: sale of a certain amount to be repurchased (sold) at a future date.

Forward transaction: current agreement on price, quantity and maturity (date of exercise) at a future delivery date.

Future Contract: Has standardised maturity periods throughout the year and its available to individuals unlike the forward contract.

Forwards, Futures are used in international exchange market for speculation, risk hedging and arbitrage.

Income and BOP (Absorbtion)

Keynesian Income determination implies:

$$Y = C + I + G + (X - M) \dots\dots (1)$$

All variables are defined as usually, C for Consumption, I for Investment, G for Government expenditure, Y is measured in GDP and (X-M) is the Trade Balance TB, the absorbtion is equal to

$$A = C + I + G \dots\dots\dots (1.1)$$

with the TB, Income could be given by:

$$Y = A + TB \dots\dots\dots(1.2)$$

Gross National Income GNI, given in by Z is equal to GDP (Y) additional to Receipts of transactions from abroad (R).

$$Z = Y + R \dots\dots\dots (2)$$

using (1.2)

$$Z = A + TB + R \dots\dots\dots (2.1)$$

It's worth noting that the Current Account: $(TB + R)$ which is solved as $(X - M) + R$, is also known as the Net Foreign Assets NFA.

Using (2.1)

$$Z - A = TB + R = NFA$$

$$Z - A = (X - M) + R$$

$$Z - (C + I + G) = (X - M) + R \dots\dots\dots(3)$$

The expression in (3) shows that if income rises above the level of domestic absorbtion then there is a capital outflow, alternatively if the domestic absorbtion -induced by consumption or government expenditure- is higher than domestic production then there is a deficit in the current account.

The rule is that as long as the NFA is positive there is a capital surplus due to insufficient investment opportunities at home and this is why domestic savers accumulate foreign assets.

Utilise The Leakage-Injections Terminology

To introduce Taxation T and Savings S , the leakages-injections are:

$$S + M + T = I + X + G \quad \dots\dots(4)$$

the LHS represents the injection side and the RHS is the leakages, re-arrange (4) as:

$$(S - I) + (T - G) = X - M \quad (5)$$

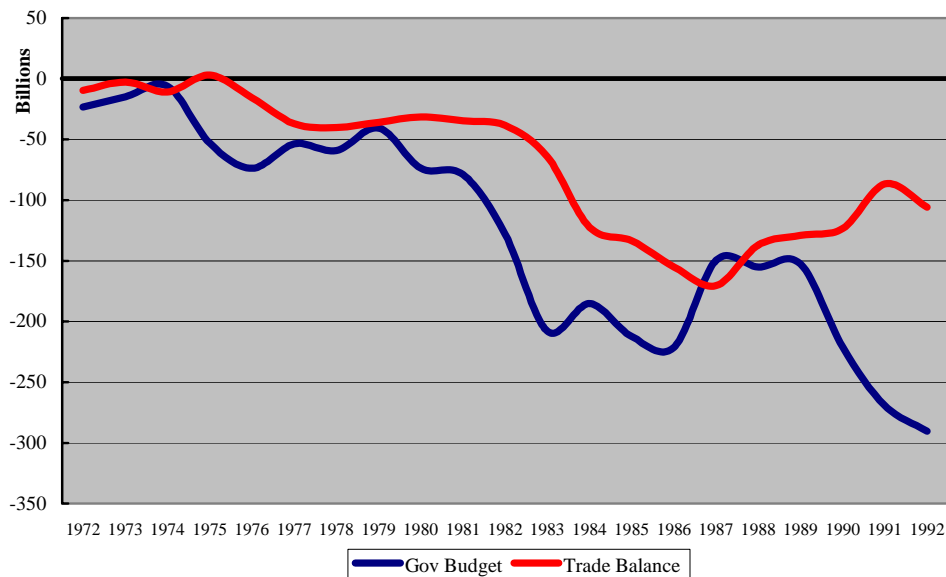
The RHS is the Trade Balance, in the LHS $(S-I)$ shows the balance of savings and investments domestically, a negative sign means more investment opportunities than what is saved, while $(T-G)$ shows the status of surplus of deficit in the Gov. budget by comparing Taxation raised with expenditure, Expression (5) provide useful interpretations, the relationship between Gov budget, domestic savings and trade balance is clearly given; when there is insufficient investment opportunities at home and $(S-I)$ positive, domestic savers accumulate foreign assets, also a Gov. budget surplus also yields TB surplus.

Twin Deficits

Using the expression of (5) above, when $(T-G)$ the Gov. budget is negative clearly it would induce a deficit in the TB, this phenomenon is called 'Twin Deficits' occur, TB deficit occur in accordance with the Gov deficit if national saving is insufficient for purchasing the bills or bonds that the Central Bank issues to finance the Government's deficit.

One of the best examples of the 'Twin Deficits' is the case of the US economy

Figure 1: Twin Deficits of the US 1972-1992



Data Sources: Gov Budget data from GPO Budget of the United States: Table 1.1.

Trade Balance (exports-Imports) from the IMF International Financial Statistics

Central Bank Intervention

Lowering the exchange rate makes domestic goods more affordable for foreigners and boosts exports, the Central Bank CB intervention could be crucial, CB balance sheet takes the form:

$$B = D + NFA$$

$$= D + [(X - M) + R]$$

where D is the deposits of domestic money supply, now to lower the exchange rate against the foreign currency, the CB would buy foreign currency in the banking system accumulating deposits and increasing the CB balance, this process is called **un-sterilized** intervention.

In reducing the money supply in order to keep B constant, the effects a foreign exchange rates are questionable, this is called **sterilised** intervention.

If the CB increased money supply by raising deposits through purchasing domestic bonds from the banking sector, the effects of such intervention would lead to an increase in domestic prices and a loss in international competitiveness, foreign goods and services becomes relatively cheaper and this expenditure switching effect would increase imports leading to a deficit in the trade balance, and to an increase demand for foreign currency, this force the CB to sell foreign exchange to economic agents leading eventually to a reduction in the NFA bringing the money supply to its initial level.

II. Exchange Rate and Prices

The concept of Purchasing Power Parity

The theory of the PPP is that the same bundle of goods and services should have the same price across countries when measured in a common currency, PPP is a theory of used either to explain the exchange rate or the domestic price, in a fixed exchange rate regime for a small economy then foreign price would determine the domestic price level, PPP is given by:

$$P = S P^* \dots\dots\dots (6)$$

In the alternative view PPP explains the exchange rate as given by re-arranging (1) as: $S = P / P^*$ this is the basis of the monetary approach to the exchange rate and BOP, the PPP is viewed as a Long Run relationship, as deviations are obviously expected, however models like the flexible price monetary approach FPMA assumes that PPP holds at all times, while according to the sticky price exchange rate overshooting model of Dornbusch (1976) PPP holds only in the long run.

In log transformation equation (1) become:

$$p = s + p^* \dots\dots\dots (7)$$

The empirical validity of the PPP and its treatment as a LR relation is discussed in a separate paper.

The real exchange Rate Q

The nominal exchange rate S would be an implicit reflection of prices and competitiveness, the international competitiveness defined as SP^* / P could be declining while exchange rate is depreciating (S increasing), clearly this could occur if the rate of depreciation is less than the price level.

The real exchange rate Q is simply the nominal exchange rate weighted by the relative price levels of home and abroad, Q is given by:

$$Q = S \left(P^* / P \right) \dots\dots\dots(8)$$

During high domestic inflation periods the nominal exchange rate should rise (depreciate) to stabilise Q, a fall in Q means SP^* / P is getting lower, a loss in international competitiveness.

III. Marshall Lerner Condition

So far the terms used are for total values of Exports X and Imports M , both values are a multiplication of exchange rate, prices and foreign prices. Exports are given by $X_t = P_t X_t^V$ while imports equal the price of the good imported in the foreign country multiplied by the volume and then converted into domestic currency by the exchange rate as follows $M_t = S_t P_t^* M_t^V$.

Hence the trade balance (exports – imports) could be given by:

$$P \times TB = P_t \times X_t - S_t P_t^* M_t^V \dots\dots\dots(9)$$

Equation (9) provides that a fall in the domestic price level relative to the foreign price level would generate exports to the foreign country, but exports also relies positively on the foreigners' income and relative price differences, exports as a function is given by:

$$X\left(\frac{P}{SP^*}, Y^*\right)$$

A fall in relative prices is due to a reduction in domestic prices, a rise in foreign prices or because of a depreciation of exchange rate, since exactly the same applies for the foreigners' exports, equivalently domestic imports, then the relative price of foreign goods is given by SP^* / P .

Dividing (9) by P yields:

$$TB = X_t - (S_t P_t^* / P_t) M_t^V \dots\dots\dots(10)$$

The expression in (10) shows how the trade balance is worsened by an increase in SP^* / P , the overall effect would depend on the representing the responsiveness of exports and imports to changes in competitiveness or 'price elasticity' of exports and imports a high elasticity means the volumes of exports or imports could rise or fall substantially, here the Marshall-Lerner condition states that '*the overall effect of a rise in competitiveness SP^* / P would improve the trade balance as long as the sum of the price elasticities of demand exceeds one*'.

Illustration

Use equation (9) assuming $p = p^* = 1$ yields:

$$P \times TB = P_t \times X_t - S_t P_t^* M_t^V$$

$$TB = X_t - S_t M_t^V$$

Taking the First Order Condition with respect to S :

$$\frac{\partial TB}{\partial S} = \frac{\partial X}{\partial S} - M^V - \frac{\partial M}{\partial S} S \dots\dots\dots(12)$$

we define the demand elasticity for both exports and imports as:

$$\epsilon_x = \frac{\partial X}{\partial S} \times \frac{S}{X} \quad \text{Demand elasticity for exports}$$

$$\epsilon_M = \frac{\partial M}{\partial S} \times \frac{S}{M} \quad \text{Demand elasticity for imports}$$

In order to ensure the overall effect of competitiveness on trade balance is positive, clearly the RHS of (12) should be positive, the Marshall-Lerner condition is obtained by setting $\frac{\partial TB}{\partial S} = 0$

$$\frac{\partial X}{\partial S} - M^v - \frac{\partial M}{\partial S} S = 0$$

Multiplying the above expression by $1/M$ and multiplying the first term of the RHS of (12) by SX/SX would yield the following:

$$M \left[\frac{1}{M} \frac{\partial X}{\partial S} \frac{S}{S} \frac{X}{X} - \frac{S}{M} \frac{\partial M}{\partial S} - 1 \right] = 0 \quad \dots\dots\dots (13)$$

Note that the expressions inside the brackets include both the exports and imports demand elasticity; the first term is the demand elasticity of exports as defined earlier but multiplied by X/SM and the second term is identically the same as the demand elasticity of imports as shown by the red surroundings inserted on expression (13) that could be then written as:

$$M \left[\frac{X}{SM} \varepsilon_x - \varepsilon_M - 1 \right] = 0$$

The expression above should be positive for the Marshall Lerner condition to hold, and then it's easily derived as,

$$\varepsilon_x - \varepsilon_M - 1 > 0$$

$$\varepsilon_x + \varepsilon_M > 1$$

the Marshall-Lerner condition of the sum of both price elasticities to be equal to or exceeds 1.

In applied research it is very often that the Marshall-Lerner condition holds and is empirically, the Marshall-Lerner condition is strongly supported.

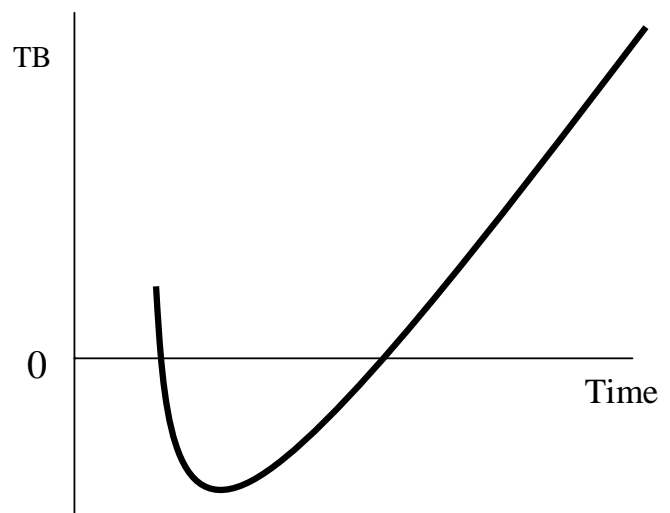
IV. The J Curve

The elasticities approach ignores incorporating time into the analysis, lessons of experience showed that while exchange rates may adjust instantaneously, price levels and real value of exports, imports and their demands change only after a lag.

If Home demand is inelastic in prices then during the deficit in the Trade Balance, devaluation domestic currency (depreciation of nominal exchange rate) would not improve the deficit, since the demand is price inelastic then there would be no switching effect towards domestic goods and services, imports would remain at the same level, this is also true depending on the nature of commodity structure of the imports.

Alongside the depreciation of the exchange rate imports would actually increase and trade balance will be worsened in the short run until the expenditure switching effect takes place and economic agents shift into domestic goods reducing the imports and improving the trade balance, another reason for increased deficit rise from the elastic foreign price demand that will make foreign consumers shift away from domestic exports as the devaluation make the exports more costly.

Figure 2: The J curve

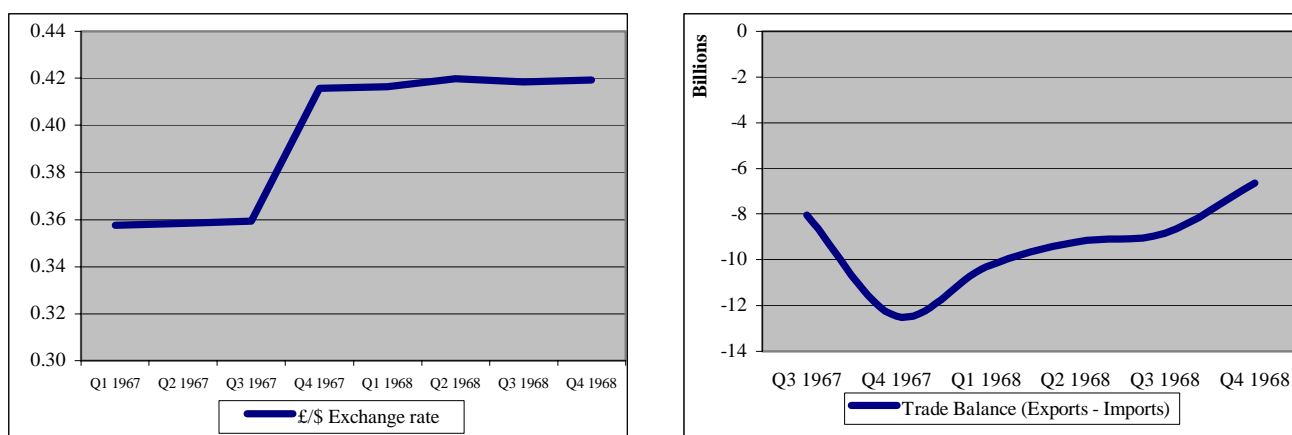


The devaluation of the sterling pound of the UK in 1967 was estimated by Artus (1975) showing no gain in exports in the first two years post to the devaluation, another interesting episode of the J-curve occurred after the dollar decline in early 1985, the US deficit grew up till 1987 the adjustment mechanism worked pretty well as the trade balance improved only after a long lag, another factors contributed to the US J-curve given by Krugman (1991) as:

- ‘Other things were NOT constant’
- Devaluation made growth of exports more than imports
- US dollar sharply appreciated
- Exporters to the US were ‘pricing to market’, which delayed the adjustment.

Another episodes of the J-curve occurred in south East Asia during the crisis of the 1997

Figure 3: UK episode of the J curve 1967 Exchange Rate Depreciation and Trade Balance



VI. Arbitrage

Triangular Arbitrage

This arbitrage occur if the gains of transferring home currency into a foreign currency then using this foreign currency to convert it into a third currency in which is converted back into home currency yielding more units of home currency than the initially ‘Invested’.

The general rule for the triangular arbitrage is:

$$S_{XY} = S_{XZ} \times S_{ZY}$$

Where S_{XY} is the exchange rate defined as the amount of home currency X needed to get one unit of the foreign currency Y , Converting the domestic currency into Y investing the amount given by S_{XY} , currency Y is then transformed into Z by S_{XZ} and lastly using S_{ZY} we get back to the home currency, clearly an opportunity exists if $S_{XY} < S_{XZ} S_{ZY}$

Practically a small percentage yield would be worthwhile to perform the transactions, if the gain is 0.05 for example then transferring a million would yield a profit of 5000 in one day! However in a practical sense this arbitrage does not occur due to transaction costs.

Covered Interest Parity

The condition that an investor is indifferent between placing an extra unit of currency invested in either home or foreign treasury bills when the interest rates are equal and risk free, if the returns at home and abroad are equal -at the spot exchange rate- then this return is converted using the spot exchange rate is sold at the forward exchange rate F

$$1 + R_t = (1 + R_t^*) \frac{F_t}{S_t} \dots\dots\dots (14)$$

Defining the forward premium (P) also known as ‘The Cost of Covering’ as $P = (F_t - S_t) / S_t$ by rearranging we get:

$$P + 1 = \frac{F_t}{S_t} \dots\dots\dots (15)$$

Substituting in (14) yields the following algebraic manipulations:

$$1 + R_t = (1 + R_t^*) (P + 1)$$

$$R_t = P + R_t^* P + R_t^*$$

Given that the term $R_t^* P$ is usually very small (e.g. $0.05 * 0.07 = 0.0035$) and is then ignored, hence

$$R_t = R_t^* + \frac{F_t - S_t}{S_t} \dots\dots\dots (16)$$

then if the domestic interest rate is lower than the foreign interest rate, then the forward exchange rate F would reduce making the premium P even negative, this is likely to occur as arbitrage funds will be flowing into the spot market of the foreign country because of its higher interest rate that investors are planning to buy, this process increases the demand on the foreign currency raising the spot exchange rate S whilst the selling in the forward market -in order to get the funds back- would reduce the forward exchange rate F .

Constant Arbitrage is the force behind the fact that both covered interest parity CIP and equation (16) would hold continuously, the opportunity is in buying foreign treasury bills yielding R_t^* at the spot exchange rate S_t and selling instantly in the forward market at F_t by a contract with a specific maturity (i.e. *forward contract*).

The expression in (16) could be re-written as follows:

$$R_t - R_t^* = (F_t - S_t) / S_t$$

$$R_t - R_t^* - (F_t - S_t) / S_t = R_t - R_t^* - P$$

The term $R_t - R_t^* - P$ is known as the *Covered Interest Differential CD*, if CD is positive there would be a capital inflow and if CD is negative there would be a capital Outflow, portfolios are in equilibrium when CD is equal to zero.

Empirical Evidence on CIP: Frenkel & Levinch (1975)

Generally the CIP is empirically supported as discussed in a detailed paper by Frenkel and Levinch (1975) showing that the CIP could be violated in “turbulent” periods, their approach was in adopting a 45° line as shown in figure 4 where CD is equal to zero, also showing a combination of interest rates differentials and forward premiums where the CIP holds, the area to the left represent a negative CD the cost of covering exceeds the differential so there is a capital outflow.

A strategy for borrowing domestic currency with a round-trip arbitrage involves four transactions given by C as:

$$\bar{c} = (1 - \tau) \times (1 - \tau_S) \times (1 - \tau^*) \times (1 - \tau_F)$$

The overall arbitrage is unprofitable if $\bar{c}(1 + R^*)F/S \leq (1 + R)$

Then buying R^* in the spot exchange rate S and selling in the forward rate F is not worthwhile due to the transactions costs.

$(1 + R) \geq \bar{c}(1 + R^*)F/S$ is a modification of the CIP, now letting the following:

$$f_p = (F - S)/S \rightarrow 1 + f_p = F/S$$

substituting in the above expression:

$$(1 + R) \geq \bar{c}(1 + R^*)(1 + f_p)$$

Solving for f_p

$$f_p \leq (1 + R) - \bar{c}(1 + R^*) / \bar{c}(1 + R^*) \dots \text{Then the arbitrage is not profitable.}$$

The condition in f_p defines an interval where there is a profitable arbitrage, Frenkel and Levich then broke the samples into periods of a “Tranquil Peg”, “Turbulent Peg” and “Managed Peg”, and their findings show that the CIP is violated in the turbulent period.

Uncovered Interest Parity

Upon taking a position in the forward market then F_t agreed at time t for maturity date of $t+k$, the profit is expressed by the difference between the forward rate and spot rate at maturity given by $F_t - S_{t+k}$, but under risk neutrality the expected forward speculation profits should be driven to zero, in equilibrium: $F_t = E_t(S_{t+k})$

Recall the covered interest parity CIP, $1 + R_t = (1 + R_t^*) \times F_t / S_t$ and then the profit could be written by plugging F_t in the CIP giving the following:

$$1 + R_t = (1 + R_t^*) \frac{E_t(S_{t+k})}{S_t} \dots \dots \dots (17)$$

The expression in (17) could be re-arranged and then by taking logs, the Uncovered Interest Parity UIP is obtained:

$$R_t = R_t^* + (S_{t+k}^e - S_t) / S_t$$

By taking the logs and writing the above expression in first differences, and since the log of $S_{t+k}^e - S_t / S_t$ is actually s_{t+k} , then the expression above is written in logs as:

$$r_t = r_t^* + \Delta s_{t+k}^e \dots \dots \dots (18)$$

Foreign currency is bought today and sold by a forward contract at a maturity date, equation (17) show the condition for UIP, where an investor is indifferent to invest one unit of domestic currency whether in home or foreign treasury bills, its worth noting it is NOT possible to borrow in one currency and lend in another currency in order to gain profit.

Empirical Evidence on UIP

Assuming the expectations are formed rationally; then the term of Δs_{t+k} is given by:

$$\Delta s_{t+k} = \Delta s_{t+k}^e + \Psi_{t+k}$$

Ψ_{t+k} : The random forecast error,

Substituting in expression (18) it is straightforward to get:

$$\Delta S_{t+k} = (R_t - R_t^*) + \Psi_{t+k} \dots\dots\dots(19)$$

testing the empirical validity of the UIP is possible by providing the econometric formulation of (19) given in the double-log form:

$$s_t = \beta_0 s_{t-k} + \beta_1 (r - r^*)_{t-k} + \varepsilon_t \dots\dots\dots (20)$$

The model in (20) could then be estimated and the UIP would suggest that β_0, β_1 are -1 and 1 respectively, and the error term being a normally identically distributed “White Noise”, also a trend term and a constant could be added, the model in (20) could be estimated by traditional OLS or by other methods, the UIP is argued to hold only in the Long Run, suggesting that interest rates and spot exchange rate are co-integrated¹, in the literature empirical evidence is provided in numerous attempts, selectively by Hacche and Townend (1981), Cumby and Obstfield (1981), Davidson (1985), and Lopesko (1984) where the UIP was strongly rejected.

VII. Exchange Rate Volatility

Historically exchange rates has been volatile over time, for example the G7 economies exchange rates against the US dollars \$ compared in the periods of Bretton-Woods agreement of 1961-1970 with the ‘float’ period post the OPEC oil price shocks of 1973 and 1979.

Volatility is measured in the squared deviation of the growth in a series from its mean, in other words it is a variance of the variance, for a series of y the volatility is measured by:

$$V_x = (\Delta y - \Delta \bar{y})_t^2$$

Relative to the fundamental determinants as Output, Price Index, Monetary aggregates and current account imbalances the volatility of the exchange rate is higher, regardless of the country’s money supply and price measures, but volatility is similar in magnitude with other assets as Government debt.

Exchange rates has been volatile relative to the change predicted by the forward foreign exchange rate premium, the forward foreign exchange rate premium reflects what is expected to happening the future horizon for the exchange rate, plotting the exchange rate against the forward premium defined earlier by $P = (F - S) / S$, it is revealed that the premium moves around zero while the exchange rate is quite more volatile, therefore a large component of the exchange rate is unpredictable.

The graph below show the exchange rate volatility of a number of major currencies against the US dollar, the graphs shows the volatility in the floating era after 1961 and the increased volatility after the OPEC oil shocks of the 1973 and 1979.

¹ For more details on the Long Run and cointegration see Notes in Macroeconometrics-“Modelling The Long Run”

Figure 4: Exchange Rate Volatility of Major Currencies 1960Q1 – 2002Q4