# MODELLING THE WORLD EXCHANGE RATES:DYNAMICS, VOLATILITY AND FORECASTING

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# ABSTRACT

**Indeed, the specification of equilibrium in the world economy depends on the exchange rate regime and thus, the early contributions to the postwar literature on exchange rate economics are to a large extent concerned with the role of speculation in foreign exchange markets. However, the world has known several exchange rate systems beginning with the (pre-worldwarI) fixed-gold standard. During the war, this standard collapsed and in 1944(after Second World War) IMF was formed and with it a new exchange rate regime variously known as the "Bretton-Woods System", the adjustable-peg" system and the "adjustable-parity" system. When a new monetary unit known as the standard drawing right was evolved in the late 1960's, nations also had to redefine the exchange parity of their currencies in terms of gold SDR and dollars. By 1971, the stress of inflationary pressures being transmitted from countries with huge deficits to surplus countries, along with huge balance of payments deficits gave the first major crack to the entire peg system. Consequently, by mid-1973, most countries decided to float their currencies.**

**Meade laid the foundations for simultaneous analysis of internal and external balance in an open economy, by working through the stock equilibrium implications of a movement in international interest rate differentials. Mundell and flemming followed Meade's mathematical representation and thus abstracted from the stock-flow implications of interest rate differential changes. Although, the integration of asset markets and capital mobility into open economy macroeconomics was an important contribution of the Mundell-fleming model, it was judged to contain a fundamental flaw. In particular, the model allows current account imbalances to be offset by flows across the capital account, without any requirement of eventual stock equilibrium in the holding of net foreign assets. Subsequently, other scholars stressed the distinction between stock and flow equilibria in the open economy context and this was to become a hallmark of the monetary approach to balance of payment analysis and the monetary approach to exchange rate. Other scholars also began to integrate analyses of open economy macroeconomics and financial portfolio balance by imposing stock equilibrium constraints, and much later by incorporating more general features of financial portfolio choice.**

**In 1997, when foreign exchange was deregulated, independent traders finally had access to the biggest trading market of the world; and these forex traders attempt to make money from the simultaneous buying and selling of foreign currencies. In fact, this forex market is the largest dynamic market in the world and approaches a dollar volume of nearly 1.9trillion dollars per day. Within the forex market, many types of instruments can be used: Futures market, Spot market and forward market. However, the degree of volatility tends to increase with the frequency with which observations are sampled and this can be seen**

**clearly as one moves from monthly to daily observations on exchange rate. The thrust of this paper, is to analyze the forecasting accuracy of the full vector autoregressive (FVAR), mixed vector autoregressive (MVAR}, and Bayesian vector autoregressive (BVAR) models of the selected currency pairs (based on the monetary/asset model of exchange rate determination).**

**KEY WORDS: Exchange rates, foreign exchange, forex, forecasting, vector auto regression, regimes, volatility, world, markets, spot market, futures, options, assets, portfolio balance, brettonwood, IMF, fixed rate, floating rate, adjustable peg, purchasing power parity(PPP), Uncovered interest rate parity(UIP), Internal balance, external balance, devaluation, overvaluation, PIPS, currency pairs, trading platform, forex allocation, parallel (black) market, banks, brokers, misalignment.**

**JEL NO: F30, F41, E44, E42, F47, G15, F37, C53**

## INTRODUCTION

Given the importance attached to the exchange rate in the success or failure of an open economy, it is not surprising that exchange rate economics is one of the most heavily researched areas of the discipline. Indeed, exchange rate has been variously defined in the literature and very critically, it influence directly trade flows and indirectly capital flows between nations. Thus, the factors determining the level of exchange rates, degree of variability, medium and long-run behavior, are of crucial importance to economists, policymakers, government and investors.

Essentially, the world has known several exchange rate system or regimes beginning with the (pre-world war 1) fixed-gold standard. Although, exchange rates were fixed under the gold standard, there were margins of variation known as 'gold-points'. Unfortunately, this standard broke down during the first world war and in fact collapsed irrecoverably until after the second world war, when nations came together to evolve a new international payment mechanisms. In 1944, at bretten wood, the IMF war formed and new exchange rate regimes emerged. Brettonwoods system, adjustable peg system, adjustable parity systems, crawling peg-system, and Gliding parties system. Unfortunately the stress of inflationary pressures being transmitted from countries with huge deficits to surplus countries, along with huge balance of payments deficits gave the first major crack to the entire peg-system. In 1973, therefore, most countries decided to float their currencies.

Foreign exchange markets (FOREX) have no physical form. Rather, the market exist through a sophisticated network of communications involving telephone, telex and computer links. Essentially, participants in the foreign exchange markets can be

classified into four categories: Customers, banks, brokers and official monetary authorities. In 1997, however, when foreign exchange was deregulated, independent traders finally had access to the biggest trading market of the world. These forex trades attempts to make money from the simultaneous buying and selling of foreign currencies. This forex market is the largest market in the world and approaches a dollar volume of nearly 1.9 trillion dollars per day.

Parallel foreign exchange markets are those in which a market determined exchange rate co-exists with one or more pegged exchange rates. At the heart of any parallel foreign exchange market is a set of government restrictions assigning certain transactions to the pegged or managed exchange rate and others to the parallel rate. Here the most fundamental distinction is with respect to coverage. Virtually, all systems assign capital outflows as well as inflows to the parallel rate and where systems differ is in the assignment of current transactions. Thus, foreign exchange management is central to the process of trade liberalization and structural adjustment. Unlike commercial policy measures, exchange rate policy and allocation mechanisms affecting the availability of foreign currency to economic agents play a role in shaping the structure of incentives Administrative exchange allocation and transitional exchange allocation mechanisms are generally used in forex management.

It is now well accepted at the theoretical level that excess volatility in real exchange rates (RER) and in particular situations of real exchange rate misalignment, will be translated into important welfare costs. Maintaining the RER at the “wrong” level generates incorrect signals and greatly hurts the degree of competitiveness of the

tradeables sectors (Willet, 1986). Determining whether a country's RER is at a particular time out of line with its long-run equilibrium is (both theoretically and practically) one of the most difficult challenges faced by macroeconomic analysts and policymakers under both predetermined and floating nominal exchange rates. Indeed, if it is established that the RER is misaligned, policy packages aimed at correcting the disequilibrium should be devised. Consequently, devaluation is one of the most important traditional policy measures to face exchange rate misalignment and external sector disequilibria. However, it is very common to find out that even when facing major external disequilibria, most countries authorities vehemently resist devaluing their currencies. Thus, analyzing this problem, will allow us to understand better one of the most controversial policy issues in the world.

The forecasting performance of exchange rate models has received considerable attention. Forecasting models involving the use of both univariate and multivariate time series techniques have been constructed and analysed. However, performance results have been mixed and multivariate vector autoregressive (VAR) models have exhibited some forecasting power (Liu Gerlow and Irwin, 1994). However, the major problem associated with VAR models, even in small systems, is the number of insignificant parameters (over-parameterization), which can lead to poor rut-off sample forecasting performance. Consequently, two methods of restricting lag length in a VAR system have been proposed to overcome the problem of an over-parameterized model. One method is termed a mixed VAR model, where zero coefficients are allowed in the equations. An alternative approach is the Bayesian VAR model (Litter man, 1986a, 19866), which assumes that each coefficient has an independent and normal distribution and imposes prior information

regarding the mean and standard deviation of this distribution into the VAR model. Here, the evaluation criteria used can be grouped into three broad categories: bias tests, informational content tests, and profitability tests. Different evaluation criteria focus on different targets of forecasting accuracy. Given the apparent sensitivity of results to the particular test employed, it is important to evaluate forecasting accuracy across all three types of tests. This will basically allow a fuller understanding of the forecasting performance of alternative exchange rate models.

Therefore, the thrust of this paper is to analyze the forecasting accuracy of full vector autoregressive (FVAR) mixed vector autoregressive (MVAR), and BAYESIAN vector autoregressive (BVAR) models of the selected currency pairs. The rest of this paper is well organized and focused. In particular, we discuss Exchange rate Typology (section one), Exchange rate regimes (section two) Exchange rate determination (section three), Exchange rate models (section four), Devaluation process (section five), Parallel/black market (section six), Foreign Exchange Market (section seven), and FOREX Allocation Mechanisms (section eight). Section nine presents the methodological framework and concludes the paper (with an appendix of World Exchange rates).

## 1.0 EXCHANGE RATE TYPOLOGY

An exchange rate is the current market price for which one currency can be exchanged for another. In other words, the exchange rate expresses the national currency's quotation in respect to foreign ones. If the United States

exchange rate for the Canadian Dollar is $1.60, it therefore implies that one American dollar can be exchanged for 1.6 Canadian dollars. Again, if one United States dollar is worth 10, 000 Japanese Yen, then the exchange rate of dollar is 10, 000 Yen. Then the exchange rate is a conversion factor, a multiplier or a ratio depending on the direction of the conversion. It is also a price and if it can freely move, the exchange rate may turn out to be the fastest moving price in the economy, bringing together all the foreign goods with it. A classification of exchange rate is based on the number of currencies taken into account. Bilateral exchange rate clearly relate to two countries' currencies and are usually the results of matching of demand and supply on financial markets or in banking transaction. Other Bilateral exchange rate may be simply computed from triangular relationships. On the other hand, multilateral exchange rates are computed in order to judge the general dynamics of a country's currency towards the rest of the world. Here, one takes a basket of different currencies, select a (more or less) meaningful set of relative weights, and then computes the "effective" exchange rate of that country's currency.

Recently, the distinction between the nominal and real exchange rates has become increasingly important. The nominal exchange rate is a monetary concept that measures the relative price of two monies. That is, the nominal variable is by definition a monetary variable. The Real Exchange Rate (E) or (RER) is defined as the domestic relative price of tradeable goods ($P_T$) to non-

tradeable goods ($P_N$). That is, the relative price of tradeable with respect to non-tradeable goods.

Symbolically,

$$RER = e = P_T = \frac{\text{Price of tradeable goods}}{P_N \quad \text{Price of non-tradeable goods}} \qquad (5.1)$$

(5.1) Summarizes the incentives that guide resource allocation across the tradeables and non-tradeables sectors:

(a) As increase in e or real depreciation will make the production of tradeables relatively more profitable, inducing resources to move out of the non-tradeables sector and into the tradeables sector (representing an improvement in the degree of international competitiveness).

(b) A decline (decrease) in e or real appreciation reflects the fact that there has been an increase in the domestic cost of producing tradeable goods and if there are no changes in relative prices in the rest of the world, the decline represents a determination of the country's degree of international competitiveness.

An alternate definition of the real exchange rate relies on the Purchasing Power Parity (PPP) approach. Here, the PPP real exchange rate ($e_{ppp}$) is equal to the nominal exchange rate (E) corrected (or multiplied) by the ratio of foreign price level (p*) to the domestic price level (p). Symbolically,

$$e_{ppp} = \frac{EP^*}{P} \quad (5.2)$$

Depending on whether P and P* are consumer price index or producers price indexes, $e_{ppp}$ will be the relative price of foreign to domestic consumption or production baskets. Yet, an operational definition of the real exchange rate is given as:

$$RER = \frac{EP^*_T}{P_N} \quad (5.3)$$

Where E is the nominal exchange rate defined as units of domestic currency per unit of foreign currency.

$P^*_T$ is the world price of tradeables,

$P_N$ is the domestic price of non-tradeables

In measuring (5.3), economists have defined proxies for $P^*_T$ and $P_N$ as some foreign price level and the domestic consumer price index.

The Equilibrium Real Exchange Rate (ERER) is that relative price of tradeables to non-tradeables that, for given sustainable (equilibrium) values of other relevant variables (such as taxes, international prices and technology) results in the simultaneous attainment of internal and external equilibrium.

Internal Equilibrium means that the non-tradeable goods market clears in the current period and is expected to be in equilibrium in

- future periods. Here, it is implicit that this equilibrium takes place with unemployment at the "natural" level.
- External equilibrium is attained when the inter-temporal budget constraint that states that the discounted sum of a country's current account has to be equal to zero is satisfied. Here, it means that the current account balances (current and future) are compatible with long-run sustainable capital flows.

However, this definition of ERER implies the following:

(a) When there are changes in any of the other variables that affect the country's internal and external equilibrium, there will also be changes in the ERER. That is, the ERER itself is a function of a number of variables, includes importing tariffs, export taxes, real interest rates and capital controls. <u>These immediate determinants of the ERER are the real exchange rate "fundamentals".</u>

(b) The ERER will not only be affected by current "fundamentals" but also by the expected future evolution of these variables. To the extent that there are possibilities for inter-temporal substitution of consumption via foreign borrowing and lending, and of inter-temporal substitution in production via investment, expected future events (such as expected future change in the international terms of trade) will have an effect on the current value of ERER.

(a) In particular, the behaviour of the equilibrium real exchange rate will depend on whether changes in fundamentals are perceived as being permanent or temporary.

(b) If there is perfect international borrowing (such as a temporary disturbance) the terms of trade will affect the complete future path of equilibrium $RER_S$.

(c) If there is rationing in the international credit market, inter-temporal substitution through consumption will be cut and temporary disturbances will tend to affect the ERER in the short run only.

(d) Thus, the distinction between short-run and long-run equilibrium real exchange rates becomes relevant.

Indeed, the existence of an equilibrium value of the real exchange rate does not mean that the actual real rate has to be permanently equal to this equilibrium value. In the short-run, the actual real exchange rate will often depart from its equilibrium value. Here, short-run and medium-run deviations that are typically not very large and that stem from temporary changes in real variables or from short-term frictions and adjustments costs can be quite common. However, other types of deviations can generate large and persistent difference between actual and equilibrium real exchange rates, or a misalignment of the real exchange rate. Yet at any given moment, the actual or observed real exchange rate will depend on the values of these

fundamentals (tariffs, international prices real interest rates, etc) as well as aggregate macroeconomic pressures (generated by an excess supply of money or fiscal deficit or both). Therefore, we can distinguish between two types of misalignment of the real exchange rate: macroeconomics induced misalignment and structural misalignment. The macroeconomic induced misalignment occurs when the actual RER departs from its equilibrium value because of inconsistencies between macroeconomic policies and the official nominal exchange rate system. On the other hand, the structural misalignment takes place when changes in the long-run sustainable values of the real determinants or fundamentals of the equilibrium RER are not translated in the short-run into changes of the actual RER.

As an illustration and given that a country's international terms of trade worsen, there will be a change in the ERER, because a higher relative price of tradeables will be required to maintain equilibrium in the economy. Unless the actual RER is adjusted to reflect this change in the equilibrium RER, the real exchange rate will become (as a consequence of the terms of trade shock) structurally misaligned.

## 1.0 EXCHANGE RATE REGIMES

Essentially, the world has known several exchange rate system or regimes beginning with the (pre-word war 1) fixed-gold standard. This was a system in

whish national currencies were tied to specific weights of gold and convertible into gold and hence exchanged with each other depending on the gold content of each currency. Although, exchange rates were fixed under the gold standard, there were margins of variation known as "gold-points". Consequently:

(a) When a given country's exchange rate depreciates to such a level that it pays arbitrageurs to buy gold in domestic money and export it to foreign country to earn foreign exchange, the exchange rate is said to have reached the 'gold-export' point.

(b) When the exchange rate has appreciated so much that it pays to convert domestic currency into foreign exchange and then use the proceed to purchase gold from foreign country for the purpose of importing into the domestic economic, then, the exchange rate is said to have reached the "gold-import point".

Unfortunately, this standard broke down during the first world war and infact collapsed irrecoverably until after the second world war, when nations came together to evolve a new International payments mechanism. At bretton wood (in 1944) the international monetary fund (IMF) was formed and with it a new exchange rate regime.

(Bretton-woods system or adjustable-peg system or adjustable-parity system). Here, nations fixed their exchange in terms or gold or dollar (as the case may be). In this system, each nation could adjust the parity of its

currency provided there was "fundamental disequilibrium" in its balance of payments. Also, the fixed parity was allowed to move with a one percent margin; half of one percentage point either way of the parity. However, there were problems that plagued the adjustable-peg system and that led to its rejection by countries.

Subsequently, some economist advocated an alternative regime known as **"CRAWLING-PEG SYSTEM".** This system is essentially an adjustable peg with a difference: instead of waiting for two years to make a two percent change in exchange parity, the country needing to adjust would be adjusting every three months by one-quarter of one percentage point; and in two years an adjustment of two percentage point in parity would have been achieved. This system considerably reduced the adjustment cost. Again, another regime that was advocated and practiced was the **"GLIDING-PARITIES SYSTEM".** This system involved changing the parity of an exchange rate every week by 0.05 percentage point throughout the year. The system reduced speculation against a currency as uncertainties regarding exchange rate movement were reduced.

Unfortunately (by 1971) the stress of inflationary pressures being transmitted from countries with huge deficits to surplus countries, along with huge balance of payments deficits gave the first major crack to the

entire- peg system. Thus (by mid 1973) most countries decided to float their currencies.

A. **FLOATING CURRENCY:** Currency essentially implies that the exchange rate of a currency is determined in the market by forces of demand for, and supply of, that currency. Three main reasons were advanced in favor of floating rates:

(I) Exchange rates are prices and as such should be determined by demand and supply forces and not administrative fiat.

(II) The par-value or adjustable peg system necessarily exposed any given economy to the real and monetary disturbances of other economics. Hence, the floating rates would supposedly insulate the economy from such external shocks.

(III) The insulation property of floating rates meant that countries could enjoy autonomy in their design and pursuit of monetary and fiscal policies. Thus, the authorities of any country can pursue the maximization of its people's welfare independent of the unwanted shackles imposed by other economics. At the beginning of the 1980's the developing countries of the world joined the floating exchange-rate-regime nations. The following reasons were identified:

(a) In the most part of 1970s/1980s, most developing countries ran serious balance of payments deficits. Attempts to finance the deficits through external borrowing yielded no solution. The huge deficits led to all kinds of exchange rate restrictions in these economies which encouraged the birth of parallel (Black) markets for foreign exchange. Gives inadequate foreign exchange, a floating regime became a viable alternative.

(b) Given the existence of large illegal parallel markets in which the domestic currency has become substantially depreciated along with huge capital flight, it was though that bringing such markets to the open by merging the official rate and parallel rate under a floating regime would be of greater benefit.

(c ) That the initial substantial depreciation in exchange rates that accompany floating would encourage repatriation of earrings by economic agents that have substantial foreign exchange earnings abroad.

More concisely, we shall collapse all the known regimes into two broad categories: Fixed and floating. The basic characteristic of adjustable-peg, crawling-peg, gliding-parities, gold-standard are the same. On the other hand, the characteristics of managed float and free float are the same. Table 5.1 below reveals this point.

| CHARACTERISTICS | EXCHANGE RATE SYSTEM | | | | | |
|---|---|---|---|---|---|---|
| | FREE FLOAT (1) | MANAGED FLAOT (2) | GOLD STANDARD (3) | ADJUSTABLE PEGS (4) | CRAWLING PEG (5) | GUNDING PARITIES (6) |
| FORMAL PARITY | None | None | Formal | Formal | Formal | Formal |
| CONDITIONS FOR CHANGE IN PARITY | None | None | Last Resort | Fundamental Disequilibrium | Any Disequilibrium | Any Disequilibrium |
| EXCHANGE VALUES IN THE SHORT RUN | Flexible | Flexible | Fixed | Fixed | Less Fixed | Less Fixed |
| DESIRED EXCHANGE VALUES IN THE LONG RUN | Flexible | Flexible | Fixed | Internationally Agreed Flexibility | Slightly Flexible | Slightly Flexible |

**TABLE 5.1: RATE FLEXIBILITY UNDER SIX ALTERNATIVE EXCHANGE RATE ARRANGEMENTS**

## 3.0 EXCHANGE RATE DETERMINATION

The several theories of exchange rate determination include purchasing power parity theory, interest-Rates-parity theory, monetary approach theory and the port folio balance theory or asset markets approach theory. Here, the monetary approach is a special case of the port folio balance approach because of the fact that both approaches perceive foreign exchange as an asset whose price is determined in the stock market.

1. **PURCHASING POWER PARITY THEORY (PPP):** Here, the assertion is that the change in the exchange rate between any two currencies over any period of time is determined by the change in the two countries relative price levels. Thus, some economist singled out the price level changes as being the major determinant of exchange rate movement. The two versions of purchasing power parity theory are the strong (absolute) version and the weak (relative) version. The strong version is based on the Law of one price and thus maintains that abstracting from all controls, restrictions and costs, the price of a gives commodity would be the same in all locations when quested in the same currency. The weak version tries to take cognizance of the several obstacles that may hinder the equalization of prices across national boundaries.

2. **THE INTEREST-RATE-PARITY THEORY**: This theory maintains that, in an uncertain world, the spot rate of exchange is not determined solely by the relationship between imports and exports of goods and services. A significant force on both the spot and forward exchange rates as well as speculation is the movement of short term capital for the purpose of interest arbitrage. Keynes therefore maintained that funds available for short term investment would be placed in the money market which yields the greatest returns. Thus, in

the process of transferring funds from one money market to the other, equilibrium exchange rates are determined. For example, continuous borrowing from the country with lower rates of interest for onward lending in the country with the higher rates means that demands for the currency of the lower interest country rises, thus gradually appreciating its exchange rate. Similarly, increased supply of funds in the currency with the higher rates of interest gradually depreciates its exchange rate, until a point is reached, when the interest rates in the two countries would have equalized and the exchange rates would have ceased to appreciate or depreciate.

However, a major limitation of this theory is that it abstracts from the capital controls, which is not realistic and it assumes that supply of arbitrage funds is fairly elastic.

**3. BALANCE-OF-PAYMENT THEORY:** This theory of exchange rate determination maintains that the exchange rate between two currencies is determined by the demand for any supply of each country's currency brought about by the need to make payments to each other for goods and services exchanged. Thus in the process of settling this

payments for and receipts for imports and exports, the foreign exchange rate is determined. Here, there are three variants:

a. That emphasizes the changes in the terms of trade due to depreciation of domestic exchange rate as being responsible for the final shift in the balance of payments adjustment and hence for the equilibrium level of exchange rate. It also analysis the importance of elasticities of demand both for imports and exports and also of their supplies for the change in the terms of trade to have desirable effects.

b. That claims that switching of expenditures from imports to exports and home goods is not sufficient to ensure internal and external balance. That in order to avoid inflationary pressure, there must be reduction in expenditure to maintain domestic absorption at the level of domestic output.

c. The reconciliation of the above variants showed that for both internal and external balance, the process of adjusting the balance of payments and hence of determining equilibrium exchange rates must necessarily involve both switch of expenditures in the deficit country as well as reduction in its expenditures. However the analysis assumes that there is no capital amount.

4. **MONETARY APPROACH**: This maintains that exchange rates are determined principally by shifts in the demand for and supply of money. Unlike the BOP approach, it maintains that the demand for foreign exchange arises as a result of attempts to equilibrate the net stock demands for monies of different countries. It assumes that a country's price level is pegged to the world price level and must move rigidly with it. That is, the law of one price holds. Here, it assumes that output and employment tend to full employment level and that prices and wages adjust to changes in the level of output and employment. However, there are weaknesses inherent in this approach (as in previous approach).

a. The existence of exchange controls, tariffs and duties make equalizations of prices across countries almost unattainable if not impossible.
b. Its dependence on uncovered interest parity is not realistic. This parity states that expected returns on interest –bearing securities will be equal regardless of the currency of denomination except for as additive constant determined by differences in the characteristics of the securities. In real life, however there are capital controls that inhibit free flow of capital in spite of returns.

5. **PORT FOLIO BALANCE THEORY:** It assumes that exchange rate is determined along with interest rate in the short-run equilibration process of financial markets- given supplies of domestic and foreign

assets. Here, money is regarded as one of several financial assets in as economy. The exchange rate though determined in the process of the demand for and supply of financial assets, is a principal determinant of the current account in the balance of payments. The current account under floating exchange rate regime is the net rate of accumulation of foreign assets whose accumulation moves the exchange rate. Thus, it gives a dynamic system of exchange rate adjustment which includes asset markets, the current account and Foreign asset accumulation. This theory is also known as the Asset – Market approach and has a long and wide list of advocates. The approach maintains that if there are J income earning assets in an economy plus one money stock, then in all there are (J+1) financial assets, and for two economics, there are (2J +2) assets. The Demand and supply for all these assets determine their rates of return and hence their prices as well as one exchange rate between the two economics. Thus, for any given economy, we can assume that there are four assets: home money, foreign money, home securities and foreign securities. In the way of specification, it is assumed that residents of both countries hold all four assets (and currency substitution exists). Here, Home new wealth (W) and foreign net wealth (EW), measured in units of domestic currency are given by

$$W = M + B + E(N + F)$$

$$EW = M + B + E(N+F)$$

Where M = home net private holdings of home money

B = home net private holdings of home securities

N = home net private holdings of Foreign money

F = home net private holdings of Foreign securities

$\overline{M}$ = Foreign net private holdings of home money

$\overline{B}$ = Foreign net private holdings of home securities

$\overline{N}$ = Foreign net private holdings of Foreign money

$\overline{F}$ = Foreign net private holdings of Foreign securities

E = exchange rate

W = Home net private holdings

$\overline{W}$ = Foreign net private holdings

Here, Home net wealth is allocated among the four financial assets:

$$W = M(.) + n(.) + b(.) + f(.)$$

and foreign net wealth allocated thus

$$E(\overline{W}) = \overline{M}(.) + \overline{n}(.) + \overline{b}(.) + \overline{f}(.) \quad (5.7)$$

Where m,n,b, and f, ($\overline{m}$, $\overline{n}$, $\overline{b}$ and $\overline{f}$,) represent home (foreign) residents demands fore home money, foreign money, home securities, and foreign securities (all measured in units of home currency).

Thus, solving the above system gives the equilibrium exchange rate E, and the rate of growth of that rate dE/E.

**6. INTEGRATED APPROACH:** Indeed, the above theories of exchange rate determination provide a partial explanation of exchange rate determination. However, as amalgamation of the theories will provide a better explanation. The approach provide as amalgamation of the purchasing power parities, the monetarist approach as well as the balance of payments approach ceteris pariblis, it showed that the country with higher nominal money supply will have a depreciating exchange rate while the country with a higher real money demand will have an appreciating exchange rate.

## 4.0 EXCHANGE RATE MODELS:

Prior to the 1980s, the policy question asked was whether monetary or fiscal policy can assist to stabilize the economy under a given exchange rate regime. Today, the policy question has changed. It is now asked in terms of whether a given exchange rate regimes ensures the achievement of the goals of stabilization under any kind of policy (whether monetary or fiscal).
The most popular model in this area is the Musdell- Fleming – Model (MFM) and

has been termed the "Workhorse of traditional open economy macroeconomics". However prior to the MFM, these was as approach termed the Insular- Economy-model. This model is a balance of-payments approach to the workings of the macroeconomic under different exchange rate regimes. It denies essentially from the Keynesian income determination model which was basically a closed economy model (that was eventually opened up). After MFM, was as eclectic model of the various modification of the mundell-fleming-model, this was known as the Modified-Mundell-Fleming-Model (MMFM).

The MFM model assumes that the level of national income is controlled by government policy while maintenance of full employment is the paramount objective of macroeconomic policy. The balance of payments is a problem because its maintenance at as equilibrium level constrains the use of macroeconomic policy for purposes of maintaining full employment. In this model, the problem can be satisfactorily resolved provided the government has as adequate number of independent and effective instruments that can be assigned to the two problem areas (internal balance area and external balance area). Here, the major assumption is that capital movement responds to changes in the domestics rate of interest (which equally assumed to be the world interest rate.). However, mundell assumed that this capital response is perfectly elastic, while fleming assumed that this response could be imperfect varying from very low response (or inelasticity of capital to interest rate

changes) to very high response. The exposition of MFM model is presented as follows:

| | | | |
|---|---|---|---|
| | Y | = | X + S + B (I) |
| | Z | = | X + S (II) |
| | V | = | y/M (III) |
| | N | = | Y – T (IV) |
| | T | = | T(Y) $1 > T_y > O$ (V) |
| | X | = | X(N,R),Xr $< O$ |
| | | | $1 < Xn (1 - Ty) > O$ (VI) |
| | R | = | R(V) $RV > O$ |
| | B | = | (? ,F), $1 > -B_Z > 0$ (VII) |
| | | | $Bf > O$ |
| | C | = | C ( r ) |
| Where | y | = | National Income |
| | T | = | Taxation |
| | N | = | Private disposable income |
| | X | = | Private expenditure |
| | S | = | Government expenditure |
| | ? | = | Total Expenditure |
| | B | = | Exports Less imports |

M = Money stock

V = Income Velocity

R = Rate of interest

C = Net capital import

F = Exchange rate in terms of domestic currency price of foreign currency

Given the above model, the effects of different policies under the different regimes can be simulated. Such policy, shock includes the effect of increase in government expenditures with monetary policy fixed and exchange rate fixed. This will lead to increased income, it should also lead to increased tax revenue but the tax revenue yield must be les than the original government expenditure that brought it about. For income to rise when government expenditure rises and for money supply to remain constant, requires economy in the use of money, which drives up the rate of interest. The rise in interest checks the increase in expenditure and in income. Given these two opposing forces on private expenditure it is uncertain whether it will increase or decrease. Then the change in the balance of payments is the sum of the change in the trade balance and in the capital account. Increase interest generates increased capital flow while increased income leaks into imports and deteriorates the trade account. The overall effect of government expenditure could therefore be positive or negative. If the overall effect of government

expenditure increase is improvement in the balance of payments, then to maintain constant money stock there must be a decline in the expansion of bank credit. The reverse is the case if the balance of payments deteriorated and the extent to which the monetary authorities can go is limited by the available level of reserves. If government were to hold constant while varying monetary policy, fiscal policy, under a regime of fixed exchange rates, we have a different result. Here, the rise in income generated by an expansionary policy will moderate the decline in interest rates generated by the same policy, but will not completely eliminate it so that investment can rise. The rise in money stock, even after the rise in expenditure and income, still lowers the rate of interest thus some deterioration in the capital account would still occur. Thus, under fixed rates the overall balance of the economy can only be sustained using monetary policy if there is an infinite supply of reserve. Given that reserve of any economy is limited, then the effectiveness of monetary policy is limited under fixed exchange rate regime.

Again, when government expenditure increases given that exchange rate also varies, and capital is not very mobile, then the results obtains differ. The results obtain differ because increased expenditure results in a depreciation of the exchange rate. This results in a reduction of the level of imports and enhances the level of exports. If capital were highly mobile increased government expenditure leads to rising rates of interest which

generates capital inflow. This inflow of capital makes the exchange rate appreciate, thus discouraging exports and encouraging imports. Consequently, the trade balance deteriorates. The net stimulus to income would be less than in an economy with fixed rates if capital mobility were perfect the deterioration would be large enough to make the fiscal policy completely of ineffective. Thus, expansionary monetary policy under floating rates means that if capital were highly mobile the expansive effect of a given increase in the stock of money will be greater under a floating regime than under a fixed one.

However, the modifications (MMFM) of the mumdell-fleming-model (MFM) are in three respects:

(I) MMFM assumes continuous full employment

(II) Complete price flexibility

(III) Government policies are subject to budget constraint that is explicitly recognized.

The MMFM also introduces a portfolio balance relation as well as a wealth – saving relationship. The major components of the model include:

$Y = Y^0 + V$ (M1)

Production of output Y gives rise to income from labour $Y^0$ and income from capital V.

$? = Y^0 + a\text{-}T$ (MZ)

Where ? is disposable income and it is a function of labour income, $Y^0$, permanent real income streams 'a' and lump sum tax T

$$L = f(r)W, fr < 0 \qquad (M3)$$

Asset preferences between money and equities are characterized by the demand for real balances L. Here, the demand for real balances is a fraction of the real wealth, and this fraction is itself a function of rate of interest.

$$W = M + {}^{a}/_{r} \qquad (M4)$$

Where real wealth (W) is the sum of real money balances (M) and real equity holdings (${}^{a}/_{r}$).

In sum, whether an economy adopts a floating or a fixed rate regime, there can be no autonomy in its use of monetary and fiscal policies. Because capital mobility implies that all policies have repercurssions throughout the world and floating rates notwithstanding, inflation rates are interdependent.

## 5.0 DEVALUATION PROCESS

Normal devaluations try to restore equilibrium in the real exchange rate by adjusting the domestic price of tradable recalling the definition of the real exchange rate as RER = $P^T/P^N$

These policies are intended to generate a higher RER through an increase in $P^T$ (= $EP^*_T$)

By directing affecting the RER and avoiding the necessary reduction in $P_N$, devaluations can help sidestep the adjustment costs associated with the automatic adjustment policies.

Indeed, for a country with a pegged exchange rate, nominal devaluation usually means an abrupt change in the nominal exchange rate. In principle, the policy objectives of these devaluations are:

a. To generate a real devaluation or improvement in the international competitiveness of the country.

b. To provoke an improvement in its external position.

Whether a devaluation will actually be successful will depend on a number of factors, which essentially include the initial conditions and the accompanying micro economics policies.

Since RER = $EP^*_T/P_N$

A nominal devaluation that increases E will only be effective in moving the RER towards its higher equilibrium value if $P_N$ does not go up in the same

proportion as E. Ceteris paribus, nominal devaluations will affect an economy in three main ways:

1. A devaluation will usually have an expenditure-reduction effect. To the extent that the devaluation raises domestic prices, it will reduce the real value of assets denominated in domestic currency, including domestic money. The result is a negative wealth effect and to the extent that there are assets denominated in foreign currency. These may also be a positive wealth effect. If the negative wealth effect dominates, expenditure on all goods including tradeables, will decline, and the trade deficit will also decline.

2. A nominal devaluation will tend to have as expenditure switching effect. To the extent that the nominal devaluation succeeds in altering the relative price of tradeables to nontradeables, there will be a substitution in expenditure away from tradeables and a substitution in expenditure away from tradeables and a substitution in production toward tradeables. The combined effect of expenditure reducing and expenditure switching will improve the external situation of the country. However, the effects on nontradeables goods are less certain.

3. A devaluation will increase the domestic price of imported intermediate inputs. As a result, the supply schedules for the final goods, including nontradeables, will shift upward.

Essentially, the immediate objective of a nominal devaluation is to reduce or eliminate the misalignment of the real exchange rate by generating a real devaluation, which would improve the international; competitiveness of the country, with the ultimate goal of improving the external position. Whether a nominal devaluation will be successful in accomplishing these objectives will depend on the prevailing conditions before the devaluation and the accompanying policies implemented with the devaluation.

## A. INITIAL CONDITIONS

i. if the country implements a devaluation at a time when the real exchange rate is greatly misaligned (overvalued), the nominal devaluation will generally help to restore equilibrium in the external sector. Such a devaluation (if accomplished by the appropriate macro economic policies) will generally have a medium to long-run positive effect on the real exchange rate by helping the country follow a smoother transition path towards reestablishing equilibrium in the external sector.

ii. If the initial condition of real exchange rate misalignment has been generated by unsustainable macro economic policies, a discrete once-and-for-all devaluation will have a lasting effect on the real rate only if the unsustainable policies are corrected at the same time.

iii. However, if the initial condition is one of equilibrium (the actual real exchange rate does not diverge from its long-run equilibrium level) a nominal devaluation will have no medium or long-run effect.

iv. Very quickly, after the normal devaluation has been implemented, the price of non-tradables, $P_N$, will increase, and the real exchange rate will not be affected.

**B. *ACCOMPANYING POLICIES***

i. Because a nominal devaluation tries to eliminate misalignment by causing a real depreciation and consequent increase in competitiveness, the nominal devaluation (which increases E in our real exchange rate formula, RER = $EP^*_T/P_N$) must not be accompanied by an equiproportional increase in PN. Obviously, if E and $P_N$ increase in the same proportion, the real exchange rate will remain unaffected.

ii. However, a number of policies can work toward generating an increase in PN. Those include expansive credit or monetary policies, expansive fiscal policies, and wage indexation policies. If a nominal depreciation is

accompanied by such policies, the domestic price of non-tradeables is likely to increase, and the objective of the nominal devaluation is not likely to be achieved.

iii. On the contrary, if the nominal devaluation is implemented along with demand management policies (restrained domestic credit and fiscal policies) and in the absence of wage indexation, the nominal devaluation will probably succeed in equilibrium in the real exchange rate.

iv. Even if the accompanying macroeconomic policies are restrictive, nominal devaluations will never result in equiproportional real devaluations in the medium to longer run. This is because several forces generate offsetting increases in the price of non-tradeables ($P_N$). The nominal devaluation will result in higher domestic prices of imported inputs and consequently the cost of producing domestic goods will rise. This effect, which partially offsets the effect of the nominal devaluation, will become more important as time passes. In other words, the effect of the nominal devaluation on the real exchange rate will be partially eroded through time.

Indeed, policy makers are often confronted with the question of whether there are alternatives to outright nominal devaluations yes; there are other policies or policy packages that have some effects on relative prices similar to those of a devaluation. However, it is not easy to

replicate the full effects of devaluations. These policies include import tariffs and export subsidies, multiple nominal exchange rates and disinflation. Thus, the integration of the World economy in the past decides was generated important changes in the way economic policy is conducted in both industrial and developing countries. In this regard, we identify the implications of fire models of devaluation: the elasticities approach, the Keynesian approach, the absorption approach, the monetary approach and the synthesis approach.

1. In the elasticities approach devaluation will be effective (by improving the balance of trade) as long as the Marshall-Lerner condition holds. This condition states that for a devaluation to be successful in a small country, the price elasticities of the demands for imports and exports should be "large", specifically, if trade us initially in equilibrium, the sum of the demand elasticities for domestic exports and demand elasticities for the country's imports should exceed unity. Here, domestic prices are assumed to be fixed and completely independent of the exchange rate. Consequently, a nominal devaluation will always result in an equiproportional real devaluation. That is, nominal devaluation will be "super effective".

The simple Keynesian models of the open economy can be integrated with the elasticities approach to investigate the effectiveness of devaluation

1. as policy tools. Here, as long as the Marshall –Lerner condition holds, a nominal devaluation will be effective: the balance of trade will improve, output will go up, and a real devaluation will take place as a result of a nominal adjustment to the exchange rate. Here, with demand determined output, a devaluation will be expansionary; by increasing net exports, aggregate output and employment.

2. The absorption approach establishes the fact that the current account surplus is equal to the excess of income over expenditure. Thus, for a devaluation to have an effect on the current account, it has to affect real income, real, expenditure or both. This approach distinguishes two basic ways in which domestic policies can affect the current account:

a. The expenditure reducing requires the composition to fall in relation to real income.

b. The expenditure switching requires the composition of expenditure to more from foreign to domestic goods. Here, if there are utilizes resources, the switching of expenditure will generate an increase in real income (increase output) and thus current account improvement.

Whether a devaluation is actually effective then depends on its ability to generate expenditure switching and expenditure reducing. If a devaluation works through the switching of expenditures, it will have to

affect relative prices and thus the real exchange rate. However a devaluation that has a positive effect on relative prices and generates expenditure switching will have a positive impact on the economy's aggregate level of activity.

4. The monetary approach to the balance of payments (or open economy version of the quantity theory of money) is characterized by neutrality and dichotomy it focuses on the interaction between the external sector and monetary side of the economy. A version of MABP assumes that the absolute variant of the purchasing power parity (PPP) theory holds, and that uncovered interest arbitrage holds permanently. Under these assumptions, a nominal devaluation will have no effect on relative prices or on the real exchange rate.

   This is because under PPP

   $$P = EP^*$$

   Where P = domestic price level

   E = nominal exchange rate

   P* = foreign price level

Consequently, nominal devaluation has a one-to-one effect on domestic prices. Here, a devaluation will generate a real balance effect and if domestic credit is kept constant, it will result in a temporary improvement in the balance of payments. However, in the simplest

version of the MABP, a devaluation will have no effect on real output or employment in either the short or long run.

5 The synthesis approach combines characteristics of both the MABP and the Keynesian model with some features from other models, in order to derive a framework that is able to track closely more closely the developments observed in the real world. This synthesis model assumes the existence of imported intermediate inputs, sticky prices and wages in the short run, imperfect substitution between domestic and foreign assets, no purchasing power parity relation in the short run, upward – sloping aggregate supply curve, and an equilibrium real exchange rate that responds to a series of real fundamental determinants. Here, the effects of a devaluation depend to a large extent on the initial state of the economy and on the accompanying macroeconomic policies.

## 6.0 PARALLEL (BLACK) MARKET.

Parallel foreign exchange markets are those in which a market determined exchange rate coexists with one or more pegged exchange rates. At the heart of any parallel foreign exchange market is a set of government restrictions assigning certain transactions to the pegged or managed exchange rate and others to the parallel rate. Here, the details of exchange restrictions vary widely from country to country and the most fundamental distinction is

with respect to coverage. Virtually all systems assign capital outflows and usually inflows as well, to the parallel rate. But where systems differs is in the assignment of current transactions. Again, a secondary distinction is with respect to the legality of transaction at the parallel rate. At the formal level, such transactions are either legal or illegal. However, given the high cost of enforcement, governments typically tolerate a substantial amount of illegal parallel market activity. Yet, it is not unusual to observe attempts to suppress parallel markets, but success in such efforts (and the commitment to continue them) is typically short-lived.

Essentially, there are two ways in which parallel foreign exchange markets develop and become important in the economy (given their large premium and volume of transactions).

1. The authorities split the foreign exchange a market in order to phase in a devaluation when capital outflows prompt a balance of payments crisis.
2. The parallel market emerges gradually in response to effort to maintain an overvalued exchange rate. |Here, the authorities are forced to restrict access to the official foreign exchange market for both capital and current account transactions. Eventually, Controls are tightened and the illegal market begins to acquire macroeconomic importance.

Indeed, dual exchange rate systems were generally adopted on a transitional basis at times of balance of payment crisis to limit the inflationary impact of devaluations. Here, the main objective was to phases in the required devaluation when problems of macroeconomic management were compounded by capital outflows. Relative to unified peg, a dual system insulates international reserves from capital outflows and this leads to a depreciation of the parallel rate rather than to a loss of reserves. On the other hand, relative to the unified float, a dual system helps to limit the impart of capital outflows on domestic prices, since current account transactions are effected at the official (pegged or managed) exchange rate. Specifically, in most developing countries, unofficial (black) parallel foreign exchange markets exist in response to the restrictions on capital account transactions in the official foreign exchange market. Like official dual systems, these markets become important at times of balance of payments crisis. Unlike the official case, where adoption is often temporary and part of an overall policy adjustment, a growing black market typically reflects a systematic bias against devaluation.

The typical pattern is one where the economy faces a gradual worsening in the balance of payment as a result of expansive monetary and fiscal policies that raise inflation and lead to overvaluation of the official exchange rate. As the government fails to correct this imbalance through a tightening of macroeconomic policies or devaluations of the official rate, it is forced to

increase restrictions on the private sectors access to foreign exchange at the official exchange rate. Expectations of a possible maxi-devaluation of the official rate, or of a further tightening of foreign exchange controls, add to the excess demand for foreign exchange in the short run by encouraging inventory away from domestic assets toward foreign exchange. These forces support the demand for foreign exchange in an illegal market and the supply is provided by exporters of goods tourists, and domestic workers abroad (whom may find it profitable to divert forex from official to illegal market).

In the short run, the parallel exchange rate is determined by portfolio equilibrium (as shown in figure 6.1). The demand for Dollars is the downward-sloping function DD. Since capital account transactions take place at the parallel exchange rate, a key determinant of the domestic currency return on foreign assets is the expected rate of depreciation in the parallel market. Here, the expected rate of depreciation is defined as

$$(U_{t+1}/U_t) - 1 = (E_{t+1}/E_t) \,.\, (Z_{t+1}/Z_t) - 1$$

Where U = parallel rate

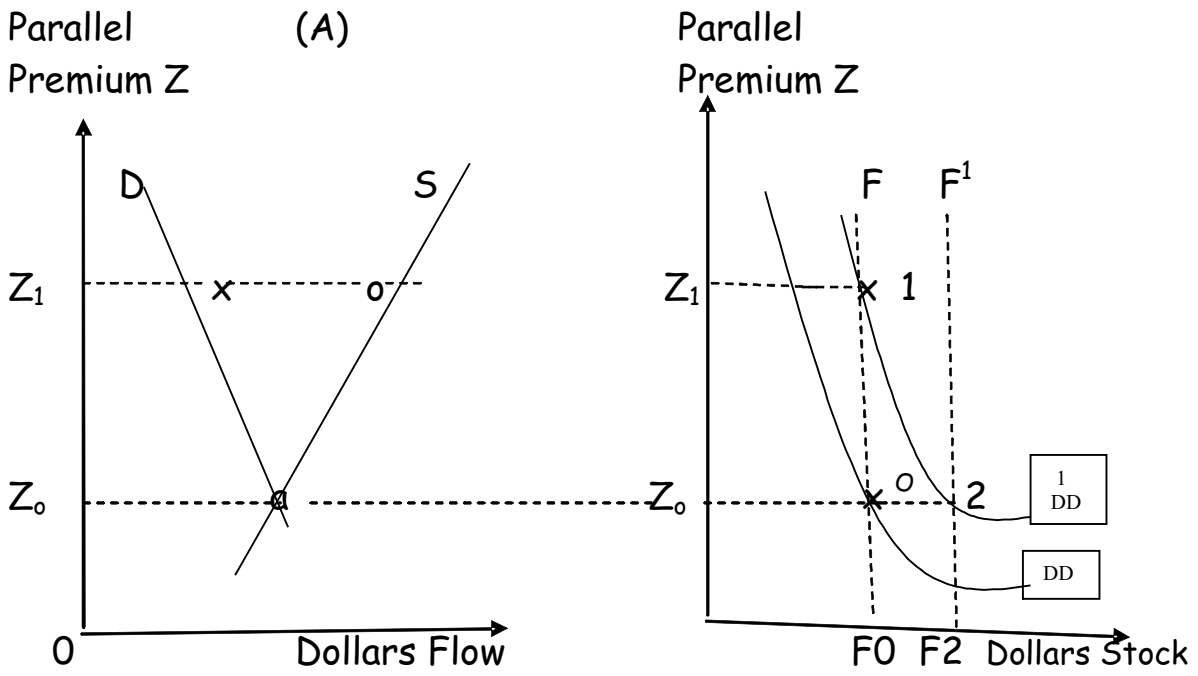


Figure 6.1 Parallel Exchange Rate Determination: Portfolio Equilibrium

E = Official exchange rate

Z = parallel premium

Z = U/E is one plus the parallel premium

Variables dated t + 1 are expected values.

Therefore, given the current premium, the demand for dollars increases (shifting DD to the right) with increases in either the expected future premium, since these raise the yield differential in favour of dollars. Similarly, the DD curve shifts to the left with a rise in the interest rate on domestic assets. Thus, a rise in the dollar value of domestic assets shifts DD to the right, as wealth holders seek to re-balance their portfolios. The existing stock

of net foreign assets ("dollar") held privately is F. Thus, portfolio equilibrium prevails when this stock is willingly held; and this occurs at point O, where DD and F interest. Therefore, the premium is as increasing function in the short run of the expected future premium, the real stock of domestic financial assets, and the official interest parity differential, since these all increase the portfolio demand for dollars. Definitely, this is a decreasing function of net foreign assets. And yet, a second set of influences on the parallel premium comes from the parallel trade balance as shown on the left side of figure 6.1

Indeed, adjustment to the brig run is governed by the evolution of asset stocks and expectations of depreciation over time. Since net capital flows at the pegged official rate are typically prohibited, the primary source of changes in the stock of foreign assets is the parallel trade balance. This implies that the "flow" or 'trade balance' determinants that matter in the long run can also influences the premium in the short run. Similarly, domestic asset stocks change primarily through monetary financing of the fiscal deficit, and this gives fiscal variables a potential role in both the short and long run …….. Figure 6.1 shows adjustment over time to an increase in the domestic money stock measured in dollars, under the assumption that the official exchange rate remains fixed. Starting at point O, the monetary expansion shifts the DD curve to the right and increases the premium to Z, in the short run; the premium subsequently

falls as the parallel current account surplus leads to an increase in private holdings of foreign exchange. Under static expectations regarding the parallel rate, adjustment occurs along DD, from point 1 to point 2. under rational expectations, market participants foresee the appreciation that occurs in the parallel market during the adjustment paths this reduces the demand for dollars, implying a smaller initial increase in the premium and adjustment to point 2 takes place along a downward sloping path below DD.

## 7.0 FOREX MARKET

Foreign exchange markets (FOREX) have no physical form, in the sense of there being an actual market place where dealers in currencies meet. Rather, the market exists through a sophisticated network of communications, involving telephone, telex and computer links. London is the world's largest foreign exchange market. This is largely due to the business generated from other financial activities relating to products such as insurance and Eurobonds and to shipping, commodities and banking. Also, London benefits from its geographical location and time zone which enables trade to take place with Europe throughout the day with Japan, Hong Kong and Singapore in the morning and with the USA after 1pm. The markets in different countries are closely associated, and exchange market activity is a truly international occupation. Essentially,

participants in the foreign exchange markets can be classified into four categories: customers, banks, brokers and official monetary authorities.

(1) Customers are companies that use the market because they require foreign currency in connection with their cross border business.

(2) Some banks act as market makers who undertake at all times to quote buy and sell rates for foreign exchange transactions. Market makers profit from the spread between their buy and sell rates (bid/offer rates) but they must be ready to adjust prices very quickly to avoid being short of a rapidly appreciating currency or being over stocked with a rapidly depreciating one.

(3) Brokers act as intermediaries and make their profit from commissions. They have dedicated communication links with banks (telephone, telex, and computer-based links) and they should be aware at any given time of the trends in the market makers' prices and which market makers currently offer the best deal for their client needs.

(4) The official monetary authorities are important participants in the markets, buying and selling currencies with the objective of either stabilizing or altering currency exchange rates for economics policy purposes.

Basically, dealings in the market may be 'spot' (where transactions take place at current market prices with settlement being within two business days of the

deal being contracted) or 'forward' (where a price is agreed for currency to be delivered at a future date, with settlement being more than two businesses days after dealing).

To execute a spot deal, a broker would contact a market maker and ask for the rate. For example, "dollar mark" (that is, Deutschemarks to the US dollar).

Here, the market maker normally quotes a two-way price (that is, he stands ready to bid for or offer up to some standard amount. The spread is the difference between these two prices and favors the market maker against the price taker to whom the quote has been made.

During inter-bank trading where participants know the 'big figures' the dealer might quote only the points (last two figures of the price).

For example, if the rate of dollars against deutschemark was

US $1- DM 1.5050 – 1.5060

Then the market maker would quote 'fifty-sixty'; he bids for dollars at DM 1.5050 and offers then at DM 1.5060.

If the caller wishes to deal, he will hit, that is accept one side of the price. Confirmation of this oral contract will be exchanged and instructions concerning payment given, and passed on to the settlements staff who ensure that the respective currency amounts are transferred into the designated accounts on the value date.

Bank dealers normally quotes two rates of exchange, one the buying rate and the other the selling rate. Since the bank wishes to make a profit on the 'turn' (that is, the difference between the two rates), it will use the higher rate for buying and the lower one for selling.

Thus, if the rate quoted for the US $ is 1.8525 – 1.8535, the bank will buy it at 1.8535 and sell it at 1.8525.

The reason is that the bank wants to receive as many dollars for each pound as possible when it buys them and the bank wants to give out as few dollars as possible in exchange for every pound when it sells them.

When dealing with exchange rates, always work from the point of view of the bank.

Hence the rule is:

Buy high : Sell low.

However, when foreign exchange was deregulated in 1997, independent traders finally had access to the biggest trading market of the world. These Forex traders attempt to make money from the simultaneous buying and selling of foreign currencies. One of the unique characteristics of this Forex market is that there is no centralized exchange as there is for the New York Stock exchange (NYSE) or for the numerous future firms such as the Chicago Board of Trade (CBOT) or Chicago Mercantile Exchange (CME). Rather the Forex market is more along the lines of the NASDAQ market (market made up of

computer terminals and telephone lines among thousand of institutions that trade currencies). Today Forex has been brought to the individual trader (and as such includes home-based trading).

Indeed, the Forex market is the largest market in the world and approaches a dollar volume of nearly 1.9 trillion dollars per day. Within the Forex markets, there are many types of instruments that can be used.

1. Within the futures markets, traders are buying and selling currencies in the 'future' and these instruments are primarily used for hedging activities among large corporations.
2. The 'spot' market is where traders deal in buying and selling currencies at the going market rate or the price where they can buy in on the 'spot'.
3. In the forward market, forwards are customized contracts usually between banks or other large institutions. Thus, future contracts are just standardized forward contracts.

In Forex trading, there are no brokerage fees nor government cleaning fees. However, the cost of trading currencies is the bid ask spread (that is buying currency at a price that is little higher than it's worth and sell it for a little bit less than it is worth at that time). Because of the Forex market shear volume, traders can enter and exit the market. The high liquidity creates

another for immediate execution and the second you click "by", you are in. In order to buy or sell currencies, you post a small amount of money, called margin, as collateral. By depositing a small amount of money, you can control a very large amount. Most firms allow 100:1 leverage, which means that you can control $100,000 worth of United States currency by only depositing $1,000. unlike stock trading, there are only seven major currencies to choose from and its cross currencies are inclusive, there are fifteen different pairs that are commonly chosen.

To understand currency quotes, each currency has a three letter code. The first two letters generally represent the name of the country while the third latter represents the currency unit. For instance, the symbol for the US dollar is USD, the Japanese Yen is JPY, and Swiss franc is CHF (Confederation Helvetica Franc). The most currently quoted currencies are:

| S/N | SYMBOL | CURRENCY |
|---|---|---|
| 1 | USD | US Dollar |
| 2 | EUR | Euro |
| 3 | JPN | Japanese Yen |
| 4 | GBP | Great Britain Pound |
| 5 | CHF | Swiss franc |
| 6 | CAD | Canadian Dollar |
| 7 | AUD | Australian Dollar |

Currency quotes we always given in pairs and most currency quotes are given to four or five decimal place with the exception of the USD/JPY quotes, which is always given to two decimal places. Here, the left side shows the base currency, and is always quoted as one unit of currency. This base currency is usually the bigger and theoretically more stable economy such as the U.S. Dollar, Euro and British Pound. However, the currency on the right side is called the quote currency or counter currency. For example, a quote like USD / JPY = 1.17 implies that one U.D. Dollar equals 1.17 Japanese Yen. That is, 1 USD = 1.17JPY.

The quote is also called the exchange rate because it tells us how much of the foreign currency are can get in exchange for one dollar.

* As the quote rises, it is the base currency that is getting stronger.
* If the quote USD/JPY = 1.17 ⟶ USD/JPY = 1.18, it is the USD that is getting stronger.
* So when the number for the quoted currency rises, it is the base currency that is getting stronger since it is able to buy more units of the quote currency.
* For any currency quote, we can always find the inverse quote by simply taking the reciprocal of both sides. E.g.

  JPY/USD 1/1.17 = 0.8547

* If CHF/AUD = 1.0726 ⇒ 2,500 CHF ⇒ 2,500 x 1.0726

⇒ 2,618.50 AUD

* If EUR/CAD 1.4086 ⇒ 6,000 CAD ⇒ 6,000/1.4086

⇒ 4,256.55 EUR

The table I below shows that a typical format for currency quotes that may be listed on any electro trading platform:

| QUOTE CURRENCIES | BASE CURRENCIES: USD | EUR | JPY | GBP | CHF | CAD | AUD |
|---|---|---|---|---|---|---|---|
| AUD | 1.3956 | 1.6880 | 1.1900 | 2.4392 | 1.0726 | 1.1984 | ……. |
| CAD | 1.1646 | 1.4086 | 0.99297 | 2.0354 | 0.89502 | …… | 0.83446 |
| CHF | 1.3012 | 1.5738 | 1.1094 | 2.2741 | ……. | 1.1173 | 0.93234 |
| GBP | 0.57215 | 0.69204 | 0.48785 | …… | 0.43972 | 0.49130 | 0.40997 |
| JPY | 117.28 | 141.86 | ……. | 204.98 | 90.136 | 100.71 | 84.037 |
| EUR | 0.82675 | ……. | 0.70494 | 1.4450 | 0.6354 | 0.70993 | 0.59241 |
| USD | …… | 1.2096 | 0.85266 | 1.7478 | 0.76855 | 0.85070 | 0.71655 |

**TABLE 1: CURRENCY QUOTES / CROSS RATES**

| | USD | EUR | JPY | GBP | CHF | CAD | AUD |
|---|---|---|---|---|---|---|---|
| **AUD** | 1.3956 | 1.6880 | 1.1900 | 2.4392 | 1.0726 | 1.1984 | …… |
| **CAD** | 1.1646 | 1.4086 | 0.99297 | 2.0354 | 0.89502 | …… | |
| **CHF** | 1.3012 | 1.5738 | 1.1094 | 2.2741 | …… | | |
| **GBP** | 0.57215 | 0.69204 | 0.48785 | …….. | | | |
| **JPY** | 117.28 | 141.86 | …….. | | | | |
| **EUR** | 0.82675 | …….. | | | | | |
| **USD** | …… | | | | | | |

**TABLE 2 UPPER DIAGONAL QUOTES**

In Table I, all quotes below the diagonal are simply inverse (reciprocals) of the quotes above the diagonal and therefore many tables will only show the quotes along the upper diagonal as shown in table 2 above.

Indeed, currencies are always traded in pairs. These pairs are very numerous and the most common pairs are called the **majors** (given their dominance in the Forex market). In the order of performance, these pairs are:

1. EUR/USD ⇒ Euro
2. USD/JPY ⇒ Dollar Yen
3. GBP/USD ⇒ Cable Best Three Pairs
4. USD/CHF ⇒ Swissy Best four pairs

5. USD/CAD ⇒ Dollar Canada

6. EURO/JPY ⇒ Euro Yen

7. AUD/USD ⇒ Aussie Dollar Best seven pair

* Whenever USD is the quote currency, it is a quote in American terms (/ USD)
* Whenever USD is the base currency, it is a quote in European terms (USD /)
* Whenever the home currency is the quote currency, it is a direct quote.
* Whenever the home currency is the base currency, it is an indirect quote.
* Any currency quote that does not involve USD is called a cross rate.
* When trading currency cross rates, it is pertinent to note that they tend to be more volatile (greater price fluctuations). Thus, currencies quoted against the USD since you are indirectly trading two pairs of currencies.
* WHY DO WE NEED TO TRADE CURRENCIES IN PAIRS?
* The reason is that profits (and losses) result from the relative charge between the two currencies in the pair.

A. If you buy a currency, you are really buying the first currency and shorting the second one.

B. If you sell a currency pair, you are really selling (shorting) the first currency and buying the second one.

C. Just as with stock trading, if you short a currency, you must deliver the same number of units back to the bank at a later time.

D. If you buy a currency pair, you are effectively borrowing the second currency (shorting one) in order to pay for base currency.

E. This is the only way you can make money if the base currency rises against the quote currency.

F. Assume the quote for the currency pair

USD/JPY = 117.28

If you 'buy' this pair, you are really buying USD and selling JPY

If you 'sell' this pair, you are really selling USD and buying JPY

G. Thus, you will always want to buy the currency on which you think will rise and by default, must short (sell) the other currency in the pair.

H. EXAMPLES: Assume that the quote USD/JPY = 117. Assume you give the bank $1, 000 and now holding 117, 000 Japanese Yen. Without realizing it, you have entered a simultaneous transaction to sell dollars and buy Yen (as well as selling Yen and Buying Dollars).

Now assume that the yen does not rise against the dollar and the quote is USD/JPY = 116.

Next, you take your 117,000 yen to the bank and they will now give you 117,000/116 = $1,008.62

Thus, you have made a profit of $8.62 from fluctuations on exchange rates. To close out of the deal, you had to enter another

simultaneous set of transactions with the bank and sell your yen in exchange for dollars.

- Most currencies trade in 100,000 units of the base currency and the margin is only 1% for most trades so that one will only have to post a relatively small amount of money for margin.
- Assume the quote is USD/JPY = 117 and you sell this pair; it implies that you are shorting $100,000 dollars and putting this dollars into yen. Here, the margin requirements will only be about one percent of the base amount and this means that you must deposit $1,000 for margin.
- By selling this pair, you are taking the $1, 000 that you are short and using that to buy $100,000 (177) = 11,700,000 yen.
- Now if yen strengthened against the dollar and the quote is now USD/JPY = 116.
- If you close out the position, you will buy the currency pairs to transfer your profits back into dollars.
- If you buy the pair, you will be "long" dollars and "short" yen.
- Since we have 11,700,000 yen, we will get 11, 700, 000/116 = $100,862.07. After paying back the $100,000 that you borrowed from the bank, you are left with a profit of $826.07

**PIPS –** Regardless of the format, the last placeholder for any quote is called a PIP (Price Interest Point). It is the smallest interest that the quote currency can move (and is similar to a 'tick' for the stock market).

- In table I, the quote for the GBP/USD is 1.7478 and thus the last decimal placeholder (8 in this quote) is called a PIP since that placeholder represent the smallest increment that this quote could move.
- Thus, an increase in one PIP will make the quote 1.7479 while a decrease of one PIP makes it 1.7477.
- Because most currencies are quoted for four decimal points, a one PIP move is generally 0.0001 (but for USD/JPY = 0.01).
- Indeed, the value of the PIP depends on the size of the contract that is being traded. Assume GBP/USD = 1.7478 and the value of the PIP is 0.0001 and this quote moves up one PIP to 1.7479. This results to an increase of 0.0001 x $100,000 = $10.
- Infact, any currency that is quoted out in terms of USD to four decimals will always have a PIP value of $10. It is called a static PIP value since it never changes.
- The major currencies with static PIP values are EUR/USD, and AUD/USD.
- However, a one-PIP decrease will result in a $10 loss.

- If a currency is quoted with the dollar as the base currency then it will have a variable PIP value and the major currencies with variable PIPs are

  USD/JPY, USD/CHF, and USD/CAD

- The value of a PIP is always in relation to the quote currency and if the quote currency is USD then it has a static PIP value while if the quote currency is not USD then it will have a variable PIP value.

(Buy) - (Sell)

**BID – ASK SPREAD –** Forex market has Bid-Ask spreads due to different dealers placing bid to buy and offers to sell. Thus, a quote like

USD/JPY = 117.00/117.05

Means that the Bid is 117 and the asking price is

(buy) (sell)

117.05

Here, there is a five PIP spread between the Bid and ask

(buy) (sell)

- Because the spread are relatively small, most dealers only show the digits to the right of the decimal points for the asking price (sell price):

  USD/JPY = 117.00/05

- This implies that the **dealer** is willing to buy the USD in exchange for the 117 JPY and is also willing to sell the USD in exchange for 117.05 JPY.
- As a **Retail trader,** you can buy the USD in the exchange for 117.05 JPY and sell the USD in exchange for 117 JPY.

  (buy) (sell)
- It is the bid-ask spread that allows dealers not to charge commissions for currency trading.
- With retail traders buying at the asking price and selling at the Bid price, a nice profit is created for their services.
- It is the dealer who gets to buy low and sell high thus ensuring profit.
- The retail trader must buy and sell at unfavourable prices, which is what creates profit to the dealer.
- The bid-ask spread affects all traders equally and is not affected by which currency you start with.
- The spread percent is used to show how the bid-ask spread creates a hidden transaction cost for traders: it is given as $\left[\text{Prices}\right]$

  $$\text{Spread percent} = \frac{\text{Ask (sell)} - \text{Bid (buy)}}{\text{Ask (sell)}}$$
- The bid-ask spread depends on the volume in a particular market, the volatility and the size of the transaction.

**TRIANGULAR ARBITRAGE** – Since there is a connection between currency pairs and cross rates, there are known procedures set in place to ensure that the cross rate quotes do not get out of line from the rest. The people in charge of making sure the prices do not get out of line are called arbitrageurs. Arbitrageurs are speculators in the market who make "free" money by judging the relative values between assets. And free money is a powerful incentive for someone to keep a watchful eye on prices. By placing simultaneous trades, arbitrageurs can capture money for no risk (arbitrage profit) in the market place. For the arbitrageurs, the profit is not so easy because they must gain the profit by not spending any money. The classic form of arbitrage involves the simultaneous buying and selling of the same security on two different exchanges.

The arbitrageur says the relatively cheap asset and at the same time, sells the relatively expensive one. In the currency market, they do a similar process called triangular arbitrage. This denotes the fact that the arbitrageur must convert one currency into another on one exchange, then into another at another exchange and then convert the currency back to the base currency at yet another exchange.

However as the buying and selling pressures start to move their respective markets, the arbitrage opportunity quickly disappears.

# CURRENCY FUTURES AND FORWARD CONTRACTS

A future contract is one of many classes of derivative instruments, which means that its value is tied to or derived from another aspect. It is an agreement today to buy or sell something in the future at a predetermined price. Here, one person agrees to buy the commodity while the other agrees to sell it. Basically, each party is agreeing to settle the deal in the future thus creating a futures contract.

- If you buy a futures contract, you are "long" the contract and are agreeing to buy some types of commodity.
- On the other hand, the seller is "short" the contract and is agreeing to sell the commodity.
- The buyer deposits a small amount of money as a good faith deposit and agrees to take delivery at the expiration date in the future.
- The roots of the modern day contract started in the Midwest in the 1800s and it was there that grain traders faced volatile market conditions (which led to the creation of a futures exchange).
- In 1848, merchants formed the Chicago Board of Trade (CBOT), which is the first and largest futures exchange in the world.
- Entering into a futures contract with the dealer accomplishes two things:

1. For the dealer, the futures contract locked in profits.
2. For buyer, the futures contract controlled cost.

- Futures contracts were designed to remove unwanted risks associated with unforeseen future events.
- Future contracts are exchange traded and are standardized as to the size and quality of the underlying asset.
- With forward contracts, you are at risk of default by the other party and you must make sure, you are also at risk of default by the other party and be sure of dealing with someone reputable.
- With futures contracts, you are cleaned through well-capitalized cleaning firms, so there is no risk of default by the other party. The cleaning firm becomes the buyer to every seller and the seller to every buyer. Futures contracts are standardized as to size, equality, delivery dates and all other contract specifications with one exception (price) which is left to the market to decide.
- Standardization is good in that it provides a lot of liquidity but not so good in that it creates inflexible terms.
- Future contracts are just standardized forward contracts.

When one guards against risk with financial assets, it is called a hedge. A hedge is an asset whose value will move in opposite direction as that

- of the asset, you are trying to protect. If the price of the asset to protect falls, the price of the hedge will rise.
- An asset used as a hedge is usually not intended to make money but only offset losses.
- Insurance on your home is a hedge.

- An arrangement that operates where one person gains exactly another person's loss is called a zero-sum game. This game means that one person cannot be made better off without making another equally worse off. Thus, futures contracts are a zero-sum game. The markets do not create disastrous "holes" in the financial system but rather allow for hedgers and speculators to hedge risk by simply passing money from one to another. These holes are filled by gains of equal size.
- If you own an asset (stock, bond, futures, contract etc) you are long the position. With a long position, you are hoping to profit from an increase in the assets price (that is, to "buy low, sell high"). Therefore,

a. You buy a futures contract (<u>long position</u>). If you wish to hedge against <u>rising</u> prices in the future.

a. You sell a future contract (short position). If you wish to hedge against falling prices in the future.

b. You buy a future contract if you are willing to buy the underlying asset in the future.

c. You sell a futures contract if you are willing to sell the underlying asset in the future.

- The ability to swap contracts and allow buyers and sellers a way out at their discretion is perhaps the biggest advantage of standardized contracts. For every futures contract, there must be one buyer (long position) and one seller (short position), which is why futures are a zero-sum game. Any gain in the long position is cancelled out by equal losses in the short positions.

Whether locking in low or high prices, hedgers are trying to avoid price uncertainty or volatility. Speculators are not trying to avoid price volatility but, instead, are seeking it. They wish to speculate on price movement and either buy or sell futures contracts accordingly to profit from the outlook. Speculators wish to profit from the same price swings that hedgers are trying to avoid. Hedgers seek to minimize risk while speculators seek to increase risk in search of profits. It is this interplay between hedgers and speculators that

- makes the futures market work. A speculator attempting to buy low and sell high is probably buying that contract from a hedger selling a contract high to protect him from declining prices. The table below outlines the respective roles of the hedger and speculator:

| Trader | Short | Long |
|---|---|---|
| Hedger | Secure a price now to protect against falling prices | Secure a price now to protect against rising prices |
| Speculator | Secure a price now to profit from falling price | Secure a price now to profit from rising profits |

## FUTURES TRADING OPERATIONS - E-MINI JAPANESE

- Futures provide accessibility for all types of market participants. The Chicago Mercantile Exchange (CME) was first to launch financial futures. Subsequently, several commodity traders established the international monetary market (IMM). Thus, individual investors, small businesses and professional money managers can buy or sell currencies.

- 1st step to trade a futures contract is to open an account through your broker (offering currency futures contracts as well as other futures contract.)
- After currency opening, you are free to trade currency futures contract. If you buy a future contract in search of profit, then you are acting as a speculator.
- On the other hand, the hedger has risk prior to the trade but removes it through the use of futures contracts. Thus, the hedger does not profit from a futures position when the underlying asset rises or falls. The contract cuts a hedge and offset gains and losses.
- However, the speculator will profit on a long futures contract from a rise in the underlying (and will lose if it falls). Rather than buy the Yen and sell the Dollar in the spot market, you could just buy the Japanese Yen contract, which is trade through the CME. If you buy the Japanese Yen contract, you are buying the JPY/USD currency pair, that is, you are Long Japanese Yen and short US Dollars.
- For the E-mini Japanese Yen futures contract, there are six months to choose from at any given time on the "march" quarterly circle.
- The "March" circle means that the third month of each quarter (March, June, September, December) will be trading.

- Each futures contract has a unique identifying symbol just as for stocks. For futures contracts, the letters H, M, U, Z are used to represent the months of March, June, September and December respectively.
- The symbol for the E-mini Japanese Yen contract is "J7" with two more identifiers attached. Thus,

  J7H6 = March 2006 E-mini Japanese Yen Contract

  J7 is the E-mini Japanese Yen contract

  H = Month of March

  "6" = 2006
- Buying or selling a futures contract, you must deposit a relatively small amount of money usually ranging from 2 – 20 percent of the value of the contract. It is called the performance bond, Dr. "Good Faith" deposit to show that provides the exchange with some security that you can sustain some of the market swings.
- For the E-mini Japanese Yen contract, the exchange requirement is $1,875 to enter the position.
- The contract trades through GLOBEX (Automated trading) around the clock with the exception of 4:00 pm to 5:00 pm CT.

The June 06 contract had 60 days remaining until expiration and was trading for 8514 = $.008514 per Yen. Assuming, this is the price

- where you buy one contract, since there are 6,250,000 Yen in the contract thus the total value is 6,250,000.

  $0.008514 = $53,212,50.

- If you deposit the performance bond of $1,875, you are controlling $53,212.50 worth of goods (currency) for $1,875 which represents a deposit requirement of $1, 875/$53,212.50 = 35%.
- Assume that you bought one contract for 8514 (up to 10 PIPs) at the end of the day. Because it closed higher, it is therefore a gain to you of 0.008524 – 0.008514 = 0.00010. On a contract of this size (6,250,000 X 0.00010) = $62,50, your account would be credited with $62,50.
- You can withdraw this credit immediately or buy other assets through your broker. Even though this credit is available for withdrawal, most traders leave the money in their account until the position is closed in case they get debited on another day and these credits provides a cushion to your account.
- Consequently, the brokerage firms require you to keep sufficient funds in the account to guard against losses. That level is called maintenance level and is usually 20% to 25% below the initial margin levels.

- Forward agreements are independent agreements between two people to buy and sell an asset for a fixed price in the future. Here, profits and losses are not realized until that future date. The only thing that matters for a forward contract is where it ends up at expiration.
- Futures contracts realize profits and looses daily through the process of marking-to-market. Here, futures contracts are closed and rewritten at a new price each day.
- To lessen the chances of traders getting into large losses, many futures contracts have daily price limits. This means that the underlying assets are allowed to only move up or down a certain amount per day before trading must be suspended and no trading must take place outside these limits on that day. Daily price limits are normally set by the exchanges and can, under certain circumstances, be modified.
- Futures contracts are important tools for currency traders. The Chicago Mercantile Exchange (CME) offers numerous futures products to be hedge or speculate in currencies.
- Many times these instruments will be a better choice than the spot market due to the size and bid-ask spreads.

# CURRENCY OPTIONS

- Options is the most popular and powerful trading tool. This is because options give you a limited risk but unlimited reward profile. Like spot and futures market, it offers unlimited reward. But unlike them, it offers unlimited risk.
- Options are legally binding agreements (contracts) between two people to buy or sell some specified asset as a fixed price over a given time period.
- Basically, there are two types of options: calls and puts

1. A call option gives the owner the right, not the obligation, to buy a futures contract at a specific price over a given period of time. It gives you the right to "call" that contract away from another person.
2. A put option gives the owner the right, not the obligation, to sell a futures contract at a specific price through an expiration date. It gives you the right to "put" the contract back to the owner.

- Option buyers have rights to either buy (with a call) or sell (with a put). That means, it is the owners choice, or option to do so (hence the name).
- A call option represents:

1. Right to buy a futures contract.

1. At a fixed price.
2. Over a given time period.

- A put option represents:

1. Right to sell a futures contract
2. At a fixed price.
3. Over a given time period.

- If you buy a call, you have the right to buy a futures contract. And if you buy a put, you have the right to sell a futures contract.
- Buyers of options have rights to either buy or sell. Option sellers have obligations, buyers have rights, sellers have obligations. Sellers have obligation to fulfill the contract if the buyer decides to use their option.

| | **Calls** | **Puts** |
|---|---|---|
| **Long** | Right to buy future contracts | Right to sell futures contracts |
| **Short** | Obligation to sell futures contracts | Obligation to buy futures contracts |

- This arrangement is required to make the options market work. Both parties (buyers and sellers) cannot have rights. Both cannot buy nor can they both sell. One side has the right to buy (or the right to sell) while the opposite has the obligation to complete the transaction. In other words, it was only the long position that has the rights while the short position has the obligation.
- Just as with a futures contract, all you have to do to get out of a contract, is to enter a closing transaction. In other words, you can always "escape" your obligations by simply doing the reverse set of actions that got you into the contract.
- Options on currency futures have an expiration date, which is generally the Friday preceding the third Wednesday of the expiration month. If you are required to buy or sell futures contracts due to shot options, it is called an assignment.
- Once, you submit exercise instructions to your broker and the contracts and cash have exchanged hands, it is an irrevocable transaction.

Basically, there are two styles of options: American and European. American style option can be exercised at any time through the Friday preceding the third Wednesday of the preceding month. European

- style options can only be exercised on Friday prior to the third Wednesday. Most currency futures options are European style. However, the Japanese yen contract does off both American and European style options.
- Indeed, the two assets (calls and put) are the building blocks for every option strategy you will ever encounter. Because options are binding contracts, they are traded in units called contracts. While stocks are traded in contracts. An option contract will always be designated by the underlying futures contract it controls along with the expiration month and strike price.

- **EXAMPLE/OPTIONS CONTRACT**

(JAPANESE YEN JUNE 06 8400 CALL)

The buyer of this call has the right (not the obligation) to purchase one Japanese yen future contract for 8400 ($.0.008400) per yen.

(a) If this were an American style option, the answer would purchase the yen at any time through expiration.

(b) If it is an European style then the owner must wait until expiration before exercising the call.

- Here, the buyer of the coupon is "locked in" to the 8400 price no matter how high the Japanese yen may be trading against the dollar. The higher the yen trader the more valuable the call option becomes.
- Most of the time, traders have no intention of taking delivery of the futures contract even through they have the right to do so. They are more interested in profiting from price changes in the option contracts.
- Here, you are locked into the purchase price of 8400. in order to take delivery of the 12,500,00 yen you must pay 0.008400 x $2,500,00 = $105,000 (called total contract value or exercise value)
- In exchange for this payment, you will receive one Japanese yen futures contract that is about to expire (since option expiration date coincides with the futures contract expiration date).
- In call option, you pay a fixed amount of cash and receive some types of underlying asset and most brokers charge a standard futures commission to exercise your options.
- If you exercised this call, your broker would probably charge you their regular commission for buying the futures contract.

- **JAPANESE YEN JUNE 06 8400 CALL PUT**

- If you buy this put option, you have the right, not the obligation, to sell one Japanese yen futures contract for 88400 per yen. Because you are locking in a selling price, put options become more valuable as the futures contract falls.
- if you exercise this put option, you are selling one Japanese yen futures contract (that is about to expire)
- You will sell 12,500,000 yen and receive 12,500,000 x $0.008400 = $105,000 cash.
- In options on currency futures, a call option on the JPY/USD currency pair really represents a call option on JPY and a put option on USD.
- When you buy this pair, you are really purchasing yen and selling dollars.
- When you buy a call option on JPY/USD, you want JPY to rise against USD/call option, which is the same thing as wanting USD to fall against JPY (put option).
- Here the option covered a futures contract on JPY/USD and the strike was 8400, which represents the dollar price of the yen.
- Thus, if you buy a call on JPY, you are therefore betting that its dollar price will rise to something higher than 8400.

- If its dollar price is rising then the yen is getting more expensive (in terms of dollars).

- Like futures, options are standardized contracts, which mean that there is a uniform process that determines the terms, which are designed to meet the needs of most traders and investors.
- Standardized options solve the performance risk problem. When you buy or sell an option, you are really trading through the CMES cleaning firm just as when trading futures contracts.

- Any option's price can be broken down into the two components of intrinsic values and time values and thus:

Total values (premium) = Intrinsic Value + Time Value

(1) Intrinsic Value formula for calls:

Futures Price – Exercise Price = Intrinsic Value

(2) Intrinsic Value formula for puts:

Exercise Price – Futures Price = Intrinsic Value

Options are often classified by traders as in-the-money.

Out-of-the-money.

At-the-money.

(a) An option with intrinsic value is in the money.

(b) An option with intrinsic value is out-of the money.

(c) An option that is neither in nor out of the money is at-the-money.

## MONEYNESS FOR CALLS AND PUTS

### CALL OPTIONS

| Moneyness | Relationship to futures |
|---|---|
| the-money | futures price > strike price |
| At-the-money | futures price = strike price |
| Out-of-the-money | futures price < strike price |

### _ PUT OPTIONS

| Moneyness | relationship to futures |
|---|---|
| In-the-money | futures price < strike price |
| At-the-money | futures price = strike price |
| Out-out-the-money | futures price > strike price |

The biggest advantage of options is the limited risk they offer. The amount you pay for the option is the most you could ever lose.

- However, they come at a price in that you must pay a time premium over and above the current price of the underlying asset.
- And that means that the underlying asset must make some size of a move just for you to break even. Depending on your outlook and risk tolerance, option may be the perfect solution for many of your currency trades.
- The Chicago mercantile exchange offers a wonderful array of forex futures and options products that you might find beneficial depending on what you are buying to do. Currently, the exchange offers foreign exchange future on:

- Australian - dollar
- Brazilian - real
- British - pound
- Canadian - dollar
- Czech - koruna
- Euro FX (plus E-mini euro FX)
- Japanese - yen (plus E-mini Japanese yen)
- Hungarian - forint
- Israeli - shekel

Mexican - Reso

- New Zealand - Dollar
- Norwegian - krone
- Polish - Zloty
- Russian - Ruble
- South African - Rand
- Swedish - Krona
- Swiss – Frane

- CME also offer futures contracts for 17 popular cross rates (as well as CME $INDEX (CME Dollar Index).
- This was developed as the index of seven foreign currencies weighted to reflect the relative competitiveness of U.S goods in foreign markets.
- It also provides investors with a new interment for foreign exchange market participation and risk management.

**The following table shows the currencies and weights for 2006.**

| Region/currency | weight (%) |
|---|---|
| European union/euro | 43.9503 |
| Japan/yen | 23.3876 |
| United Kingdom/pound | 16.0302 |

| | |
|---|---|
| Switzerland/Franc | 5.5542 |
| Australia/dollar | 3.6348 |
| Canada/dollar | 2.8985 |
| Sweden/krona | 4.5384 |

- In 2003, CME began trading CME $INDEX futures and options on futures.
- The contract's size is $1,000 times the CME $INDEX, which is approximately $93,340.
- Trading occurs in points where $0.01 index points equal $10.00 per contract.
- CME $INDEX futures contracts trade six months in the march Quarterly cycle (March, June, September, December)
- Option on futures contracts trade four months in the march quarterly cycle,
- Two months not in the march cycle (serial months), plus four weekly expiration options.
- The index is a wonderful way to hedge your sets and profit from the rise or fall of the dollar.

## 8.0 FOREX ALLOCATION MECHANISMS

In general, foreign exchange management is central to the process of trade liberalization and structural adjustment. Administrative exchange allocation has been very popular because it is the most direct and quickest means of dealing with balance of payments crisis of indirectly taxing disfavored sectors and of channeling crucial imports toward uses the government considers high priority. Transitional foreign exchange allocation mechanisms are present in adjustment programs as cells of a complex matrix rather than “self- contained” schemes. The order in which the various schemes are presented reflects the phases of the transition, with a shift in emphasis from mechanisms which only deal with allocating foreign exchange (where the price is set outside the mechanism itself) to schemes in which the allocation and the price-setting are endogenous. While the introduction of own-funds, open general licensing and export retention schemes do not require any departure from a fixed or multiple foreign exchange system, the establishment of auctions, legalized foreign exchange bureaus and inter-bank markets do.

An own funds schemes allows a certain set of goods to be imported without constraints as long as the importer does not require access to official foreign exchange resources . Most own funds schemes do not require any documentation from the importer about the source of his currency and this can translate into an implicit incentive to use black market foreign exchange, although legal remittances and retained funds from exports could in principle serve to finance such imports. Such schemes can cover both intermediate inputs whose shortage may reduce the utilization of productive capacity and consumer goods which play a major role in providing incentives for production. By increasing the availability of these “incentive

goods", the introduction of this scheme removed a bottleneck not only on the consumption but also on the production side.

Besides increasing the supply of goods in the country, the scheme also have the advantage of legalizing imports that are already smuggled as well as encouraging the repatriation of remittances and other capital goods (Ferrara, et al 1994).

An open general licensing (OGL) regime is designed to allocate foreign exchange for importation of goods or services specified on a list, according to some automatic criteria and at an official exchange rate. For items specified on the list, import licenses and foreign exchange are automatically provided at a "subsidized rate. Indeed, the main rationale for the introduction of an OGL scheme is to allocate foreign exchange in a non-discretionary manner according to some well defined rules. Besides alleviating production and consumption bottlenecks related to insufficient import capacity such as a scheme eliminates the distortions brought about by discretionary allocation of import and exchange licenses. However, OGL schemes do not address the issue of exchange rate determination and this do not totally eliminate multiple rates, rationing or rents.

Under an export retention Scheme (ERS), exporters are allowed to retain a certain percentage of their earnings in special foreign currency deposit accounts at home or (rarely) abroad. When required to surrender all their proceeds, exporters must sell exchange to the authorities at the official (over valued) exchange rate and then resort to the parallel market to finance their imports, thus paying an implicit export tax equal to the black market premium. Thus, the beneficial effect of ERS is to insulate exporters from problems in the exchange allocation system so as to rea

import for their own needs. Again, ERS gives an implicit subsidy to exporters as well as reducing the implicit tax from the overvalued rate. It also provide a source of supply for a legal private exchange market.

Under the auction regime, the available amount of foreign exchange is allocated by the Central Bank through a bidding process. The central bank decides the amount of foreign exchange to be auctioned, and in some cases sets minimum reserve price. Here, the participants submit bids indicating the amount requested and the price they are willing to pay. The Central Bank then ranks the bids by price and beginning with the highest, awards the amount bid to each bidder until the available supply is exhausted. The market clearing price becomes the official market exchange rate and applies to all transactions until the next auction. In the wholesale auction, the participants are commercial banks and authorized dealers who then sell onward to importers. In the retail auction however, foreign exchange is sold directly to importers.

Foreign exchange bureaus are institutions that purchase and sell foreign exchange at rates established by themselves. The sources of the foreign exchange sold by business are mostly private remittances (when allowed) and retained export proceeds (when salable). In principle bureaus can be allowed to bid at the auctions, so that even auction funds can be channel through foreign exchange bureaus. Indeed, the rationale for the official recognition of foreign exchange bureaus is to legalize at least a portion of the parallel market thus bringing under control part of the informal sector and laying the foundation for exchange rate unification. Again, the entrance of bureaus into the market brings competition and efficiency and potentiality

creates a thick and non-volatile market of a sufficient amount of foreign exchange is channel through this system.

In an inter bank market wholesale participants are the commercial banks and the authorized foreign exchange dealers who trade foreign exchange among themselves and with the general public. Here, the exchange rate is determined in transactions between the bans and their clients, and is therefore free to vary periodic fixing sessions are held with the Central bank participating, during which the “official” rate is established based on the previous transactions among the private buyers and sellers. Here, foreign exchange is alleviated through the price mechanism in a efficient manner, its availability for import necessities is increased and the degree of anti-export bias implicit in fixed overvalued exchange rate regimes is significantly reduced or eliminated. Since the interbank system is actually a floating regime. Besides providing more uniform incentives, such a system virtually eliminates the spread between the official and the parallel rate and hence reduced the scope for black market activities.

As step toward establishing a time market allocation mechanism, a well-functioning auction has significant advantages over these other mechanisms. Perhaps the most important is that, in addition to: its allocation function, it incorporates a pricing mechanism as well. However, the most important lesson of experience is that the pricing mechanism must be allowed to work without interference; otherwise, the auction may degenerate into another mechanism foe non-transparent, administrative allocation of exchange.

## 9.0 METHODOLOGICAL FRAMEWORK

A vector autoregressive (VAR) model is a general dynamic model with several endogenous variables in the system. In the VAR model, each variable is a linear function of lagged values of all variables in the system. A full VAR model is the standard form of a VAR model. In this approach, lag lengths for each variable are identical and every variable in the system is included in each equation. The full VAR model with a lag length of P [FVAR(P)] can be represented as:

$$Z_t = \sum_{S=1}^{P} \Phi(s) Z_{t-s} + E_t \qquad (9.1)$$

Where $Z_t$ is an (m x 1) vector of variables measured at time period t,

$\Phi$ (s) is an (m x m) matrix of the coefficients.

P is the lag length of the variable

$E_t$ is an (m x 1) vector of random disturbances with the properties,

$E[E_t] = 0$; $E[E_t E^1_t]$ = o t ? s

= ?t =s

And E is the expected operator

In a mixed VAR model, different Lag lengths are specified for each variable in each equation. However, the Bayesian procedure is used to circumvent the problem of over fitting. The prior information imposed on the VAR model is the means and standard deviation of the coefficients, $\Phi_{ij}$ (s), in Eq (9.1). Here, the coefficients apply to variable Zj with Lag length of S in the ith equation. A random walk prior suggested by Litterman (1986a,b) may be consistent with an efficient market hypothesis and

may be useful for exchange rate series. Assuming the $\Phi^1$'s are jointly normally and independently distributed, the mean of

$$\Phi_{ij}(s) \text{ is } \Phi_{ij}(s) = \begin{cases} o \text{ if } I \text{ ?} j \quad i=j, \quad s?1 \\ 1 \text{ if } i=j \; s=1 \end{cases} \qquad (9.3)$$

where $\Phi_{ij}(s)$ is the mean of $\Phi_{ij}(s)$ and s is the Lag length

The assumption shows that the mean of the coefficient of an own lagged dependent variable is 1 and that other coefficients are zero (o). The mean of the coefficient can also be expressed as a random walk process

$$Z_t = Z_{t-1} + €_t \qquad (9.4)$$

Empirically, a significant decision in the construction of VAR models involves specifying the variables in the vector $Z_t$. Therefore, this paper uses the monetary / asset model (Driskill et al, 1992) to specify the vector of variables. They derived a reduced form model of exchange rate determination from a structural model which includes money and foreign exchange markets. There, the exchange rate is a function of all exogenous variables. However, in order to incorporate all information in the money and foreign exchange markets, both exogenous variables and endogenous will be included in the VAR System. Thus, the vector of variables, $Z_t$ can be represented as:

$$Z = [e_t, M_t, P_t, Y_t, I_t, T_t,] \qquad (9.5)$$

Where e = Logarithm of the exchange rate

M= Logarithm of relative money supply between domestic and foreign countries.

P = Logarithm of relative price level between two countries.

Y = Logarithm of relative real income between two countries.

I = Interest rate differential between two countries.

T = Trade balances between two countries.

Yet another important decision in building the alternative VAR models involves specifying log lengths. This can be done either arbitrarily or by using a specified statistical testing procedure. A seven-lag structure is specified for the FVAR and BVAR specifications for dollar/Yen exchange rate models; a six-lag structure for dollar/Canadian dollar exchange rate models; and an eight-lag structure for dollar/deutsche mark exchange rate models. Again, in a mixed VAR model, different lag lengths are specified for each variable in each equation. Here, the estimation is carried out on lags ranging from one through eighteen for each variable in order to detect any trace of seasonality. The specific model structures are presented as follows:

DOLLAR/YEN

$$M = F\left( M(-1), \ldots, M(-13), Y(-1), \ldots, Y(-16), I(-1), T(-1), T(-2) \right) \quad (9.6)$$

$$T = F\left( T(-1), \ldots, T(-13), I(-1), P(-1), \ldots, P(-10), Y(-1), Y(-2) \right) \quad (9.7)$$

$$Y = F\left( Y(-1), \ldots, Y(-13), P(-1), \ldots, P(-3), M(-1), e(-1), \ldots, E(-2) \right) \quad (9.8)$$

$$I = F\left( I(-1), e(-1), M(-1) \right) \quad (9.9)$$

$$P = F\left( P(-1), \ldots, P(-13), E(-1), e(-2), Y(-1), \ldots, Y(-10) \right) \quad (9.10)$$

$$E = F\left( e(-1), T(-1), P(-1) \right) \quad (9.11)$$

DOLLAR / CANADIAN DOLLAR

$$M = F\left( M(-1), \ldots, M(-13), T(-1), P(-1), P(-2), I(-1) \right) \quad (9.12)$$

$$T = F\left( T(-1), T(-2), Y(-1), \ldots, Y(-4), M(-1), M(-2), P(-1), \ldots, P(-3) \right) \quad (9.13)$$

$$Y = F\left( Y(-1), \ldots, Y(-14), P(-1), \ldots, P(-3), M(-1), e(-1) \right) \quad (9.14)$$

$$I = F\left( I(-1), \ldots, P(-9), T(-1), T(-2), T(-3) \right) \quad (9.15)$$

$$P = F\left( P(-1), \ldots, P(-9), T(-1), T(-2) \right) \quad (9.16)$$

$$e = F\left( e(-1), T(-1), I(-1) \right) \quad (9.17)$$

**DOLLAR/DEUTSCHE MARK**

$$M = F\left( M(-1), \ldots, M(-13), I(-1), P(-1) \right) \quad (9.18)$$

$$T = F\left( T(-1), \ldots, T(-3), Y(-1), P(-I) \right) \quad (9.19)$$

$$Y = F\left( Y(-1), \ldots, Y(-14), P(-1), M(-1) \right) \quad (9.20)$$

$$I = F\left( I(-1), e(-1) \right) \quad (9.21)$$

$$P = F\left( P(-1), \ldots, P(-12), Y(-1), e(-1), T(-1), T(-2) \right) \quad (9.22)$$

$$e = F\left( e(-1), t(-1), T(-2) \right) \quad (9.23)$$

Where M is the logarithm of relative money supply between domestic and foreign countries; T is the trade balances between two countries; Y is the logarithm of relative real income between two countries; I is the interest rate differential between two countries; P is the logarithm of relative price level between two countries; e is the logarithm of exchange rate; and (- ? ) is the lag operator. In addition, we shall impose this monetary / asset model as a long-run equilibrium condition in a dynamic error-connection model and allow the data to determine short-run dynamics. Therefore, an interesting question is whether error-correction models provide improved forecasting performance over the VAR models. Again, the degree of volatility tends to increase with the frequency with which observations are sampled. Clearly, this can be seen as one moves from monthly to daily observations on exchange rates.

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## APPEN DIX: THE WORLD EXCHANGE RATES(MONETARY UNITS)

| S/N | COUNTRY | REGIONAL CLASSIFICATION | INCOME STATUS | MONETARY UNIT |
|---|---|---|---|---|
| 01 | AFGHANISTAN | SOUTH ASIA | LOW INCOME | AFGHANI (AF) OF 100 PULS |
| 02 | ALBANIA | EASTERN EUROPE | LOW INCOME | LEK (LK) OF 100 QINDARKA |
| 03 | ALGERIA | NORTH AFRICA | MIDDLE LOWER INCOME | ALGERIAN DINAR (DA) OF 100 CENTIMES |
| 04 | ANDORRA | REST OF EUROPE | HIGH INCOME (NON-DECD) | FRENCH AND SPANISH CURRENCIES |
| 05 | ANGOLA | SOUTH AFRICA | LOW INCOME | KWANZA (KZ) OF 100 IWEI |
| 06 | ANTIGUA AND BARBUDA | CENTRAL AMERICA AND WEST INDIES | UPPER MIDDLE INCOME | EAST CARIBBEAN DOUAR (EC$) OF 100 CENTS |
| 07 | ARGENTINA | SOUTH AMERICA | UPPER MIDDLE INCOME | PESO OF 10,000 AUSTRALES |
| 08 | ARMENIA | EASTERN EUROPE | LOWER INCOME | ROUBLE OF 100 KOPEKS |
| 09 | ARUBA | CENTRAL AMERICA AND WEST INDIES | HIGH INCOME (NON-DECD) | ARUBIAN FRORIN |
| 10 | AUSTRALIA | PACIFIC | HIGH INCOME (ASIAN) | AUSTRANLIAN DOLLAR ($A) OF 100 CENTS |
| 11 | AUSTRIA | REST OF EUROPE | HIGH INCOME (OECD) | SCHILLING OF 100 GROSCHEN |
| 12 | ALERBAIJAN | EASTERN EUROPE | LOW INCOME | ROUBLES OF 100 KOPEKS |
| 13 | BAHAMAS | CENTRAL AMERICA/ WEST INDIES | HIGH INCOME (NON-OECD) | BAHAMIAN DOLLARS (B$) OF 100 CENTS |
| 14 | BANGLADESH | SOUTH ASIA | LOW INCOME | TAKA (TK) OF 100 POISHA |
| 15 | BARBADOS | CENTRAL AMERICA / WEST INDIES | UPPER MIDDLE INCOME | BARBADOS DOLLAR (BD$) OF 100 CENTS |
| 16 | BELARUS | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 17 | BELGIUM | REST OF EUROPE | HIGH INCOME (OECD) | BELGIAN FRANK OF 100 CENTIMES |
| 18 | BELIZE | CENTRAL AMERICA AND WEST INDIES | LOWER MIDDLE INCOME | BELIZE DOLLAR (BZ$) OF 100 CENTS |
| 19 | BENIN | WEST AFRICA | LOW INCOME | FRANC CFA |
| 20 | BERMUDA | CENTRAL AMERICA AND WEST INDIES | HIGH INCOME (NON-OECD) | BERMUDA DOLLAR OF 100 CENTS |
| 21 | BHUTAN | SOUTH ASIA | LOW INCOME | NGULTRUM OF 100 CHETRUM |
| 22 | BOLIVIA | SOUTH AMERICA | LOWER MIDDLE INCOME | BOLIVIANO ($b) OF 100 CENTRAVOS |
| 23 | BOSNIA / HERZEGOVINA | EASTERN EUROPE | LOW INCOME | DINAR OF 100 PARAS |
| 24 | BOTSWANA | SOUTH AFRICA | UPPER MIDDLE INCOME | PULA (P) OF 100 THEBE |
| 25 | BRAZIL | SOUTH AMERICA | UPPER MIDDLE | CRUZEIRO (BRC) |

| | | | | |
|---|---|---|---|---|
| 26 | BRUNEI | EAST ASIA | HIGH INCOME (NON-OECD) | BRUNEI DOLLAR OF 100 SEN |
| 27 | BULGARIA | EASTERN EUROPE | LOWER MIDDLE INCOME | LEV OF 100 STOTINKI |
| 28 | BURKINA FASO | WEST AFRICA | LOW INCOME | FRANC CFA |
| 29. | BURUNDI | EAST AFRICA | LOW INCOME | BURUNDI FRANC |
| 30 | CAMBODIA | EAST ASIA | LOW INCOME | REIL OF 100 SEN |
| 31 | CAMEROON | CENTRAL AFRICA | LOW INCOME | FRANC CFA |
| 32 | CANADA | NORTH AMERICA | OECD (HIGH INCOME) | CANADIAN DOLLAR (C$) OF 100 CENTS |
| 33 | CAPE VERDE | WEST AFRICA | LOWER MIDDLE INCOME | ESCUDO CABOVERDIARO OF 100 CENT |
| 34 | CAYMAN ISLANDS | CENTRAL AMERICA / WEST INDIES | HIGH INCOME (NON-OECD) | CAYMAN ISLANDS DOLLAR (CI$) OF 100 CENTS |
| 35 | CENTRAL AFRICA REPUBLIC | CENTRAL AFRICA | LOW INCOME | FRANC CFA |
| 36 | CHAD | CENTRAL AFRICA | LOW INCOME | FRANC CFA |
| 37 | CHILE | SOUTH AMERICA | UPPER MIDDLE INCOME | CHILEAN PESO OF 100 CENTRAVOS |
| 38 | CHINA | EAST ASIA | UPPER MIDDLE INCOME | YUAN OF 10 JIAO OR 100 FEN |
| 39 | COLOMBIA | SOUTH AFRICA | LOWER MIDDLE INCOME | COLOBIAN PESO OF 100 CENTRAVOS |
| 40 | COMOROS | EAST AFRICA | LOW INCOME | FRANC CFA |
| 41 | CONGO REP | CENTRAL AFRICA | LOW INCOME | FRANC CFA |
| 42 | COSTA RICA | CENTRAL AMERICA WEST INDIES | LOWER MIDDLE INCOME | COSTA RICAN COLON (⊄) OF 100 CENTIMOS |
| 43 | COTE DIVOIRE | WEST AFRICA | LOW INCOME | FRANC CFA |
| 44 | CROATIA | WESTERN EUROPE | UPPER MIDDLE INCOME | DINAR OF 100 PARAS |
| 45 | CUBA | CENTRAL AMERICA / WEST INDIES | LOWER MIDDLE INCOME | CUBAN PESO OF 100 CENTAVOS |
| 46 | CYPRUS | REST OF EUROPE | HIGH INCOME (OECD) | CYPRUS POUND (C£) OF 100 CENTS |
| 47 | CZECHOSLOVAKIA | EUROPE | UPPER MIDDLE INCOME | KORUNA (KCS) OF 100 HALERU |
| 48 | DENMARK | REST OF EUROPE | HIGH INCOME (OECD) | DANISH KRONE OF 100 DRE |
| 49 | DJIBOUTI | SOUTH AFRICA | LOWER MIDDLE INCOME | DJIBOUTI FRANC OF 100 CENTIMES |
| 50 | DOMINICA | CENTRAL AMERICA / WEST INDIES | LOWER MIDDLE INCOME | EAST CARIBBEAN DOLLAR (EC$) OF 100 CENTS |
| 51 | DOMINICAN REPUBLIC | CENTRAL AMERICA / WEST INDIES | LOWER MIDDLE INCOME | DOMINICAN REPUBLIC PESO (RD$) OF 100 CENTAVOS |
| 52 | ECUADOR | SOUTH AMERICA | LOWER MIDDLE INCOME | SUCRE OF 100 CENTAVOS |
| 53 | EGYPT | NORTH AFRICA | LOWER MIDDLE INCOME | EGYPTIAN POUND (£E) OF 100 PIASTRES |
| 54 | EQUITORIAL GUINEA | CENTRAL AFRICA | LOWER MIDDLE INCOME | FRANC CFA |

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|---|---|---|---|---|
| 55 | ESTONIA | EASTERN EUROPE | UPPER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 56 | ETHIOPIA | EAST AFRICA | LOW INCOME | ETHIOPIA BIRR (EB) OF 100 CENTS |
| 57 | FAEROE ISLANDS | REST OF EUROPE | (NON-OECD) HIGH INCOME | DENMARK CURRENCY |
| 58 | FIJI | PACIFIC | LOWER MIDDLE INCOME | FIJI DOLLAR (F$) OF 100 CENTS |
| 59 | FINLAND | REST EUROPE | HIGH INCOME (OECD) | MARKKA (MK) OF 100 PENNIA |
| 60 | FRANCE | REST OF EUROPE | HIGH INCOME (OECD) | FRANCE OF 100 CENTIMES |
| 61 | FRENCH GUIANA | SOUTH AMERICA | HIGH INCOME (NON-OECD) | FRANCE CURRENCY |
| 62 | FRENCH POLYNESIA | PAZIFIC | HIGH INCOME (NON-OECD) | FRANCE CFP |
| 63 | GABON | CENTRAL AFRICA | UPPER MIDDLE INCOME | FRANCH CFA |
| 64 | GAMBIA | WEST AFRICA | LOW INCOME | DALASI (D) OF 100 butut |
| 65 | GEORGIA | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 66 | GERMANY | REST OF EUROPE | HIGH INCOME (OECD) | DEUBCHE MARK (DM) OF 100 PFENNING |
| 67 | GHANA | WEST AFRICA | LOW INCOME | CEDI OF 100 PESEWAS |
| 68 | GREECE | REST OF EUROPE | HIGH INCOME (OECD) | DRACHMA OF 100 LEPTAE |
| 69 | GREEN LAND | REST OF EUROPE | HIGH INCOME (NON-OECD) | DENMARK CURRENCY |
| 70 | GRENADA | CENTRAL AMERICA / WEST INDIES | LOWER MIDDLE INCOME | EAST CARIBBEAN DOLLAR (EC$) OF 100 CENTS |
| 71 | GUADELLOUPE | CENTRAL AMERICA / WEST INDIES | UPPER MIDDLE INCOME | FRANCE CURRENCY |
| 72 | GUAM | PACIFIC | HIGH INCOME (NON-OECD) | USA CURRENCY |
| 73 | GUATEMALA | CENTRAL AMERICA / WEST INDIES | LOWER MIDLE INCOME | QUETZAL (Q) OF 100 CENTAVOS |
| 74 | GUINEA | WEST AFRICA | LOW INCOME | GUINEA FRANC OF 100 CENTIMES |
| 75 | GUINEA BISSAU | WEST AFRICA | LOWER INCOME | GUINEA BISSAU PESO OF 100 CENTAVOS |
| 76 | GUYANA | SOUTH AMERICA | LOWER MIDDLE INCOME | GUYANA DOLLAR (G$) OF 100 CENTS |
| 77 | HAITI | CENTRAL AMERICA / WEST INDIES | LOW INCOME | GOURDE OF 100 CENTIMES |
| 78 | HONDURAS | CENTRAL AMERICA / WEST INDIES | LOW INCOME | LEMPIRA OF 100 CENTAWS |
| 79 | HONGKONG | EAST ASIA | HIGH INCOME (NON-OECD) | HONGKONG DOLLAR (HK$) OF 100 CENTS |
| 80 | HUNGARY | EASTERN EUROPE | UPPER MIDDLE INCOME | FORINT OF 100 FILLER |
| 81 | ICE LAND | REST OF EUROPE | HIGH INCOME (OECD) | ICELANDIC KRONA (KR) OF 100 OURAR |

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|---|---|---|---|---|
| 82 | INDIA | SOUTH ASIA | LOW INCOME | INDIAN RUPEE (RS) OF 100 PAISA |
| 83 | INDONESIA | EAST ASIA | LOWER MIDDLE INCOME | RUPIAN (RP) OF 100 SEN |
| 84 | IRAN | ASIA MIDDLE EAST | LOWER MIDDLE INCOME | RIAL OF 100 DINARS |
| 85 | IRAQ | ASIA MIDDLE EAST | LOWER MIDDLE INCOME | IRAQI DINAR (ID) OF 1,000 FILS |
| 86 | IRELAND, REPUBLIC OF | REST OF EUROPE | HIGH INCOME (OECD) | PUNT (IR£) OF 100 PENCE |
| 87 | ISRAEL | ASIA MIDDLE EAST | (NON-OECD) HIGH INCOME | SHEKEL OF 100 AGORA |
| 88 | ITALY | REST OF EUROPE | HIGH INCOME (OECD) | LIRA OF 100 CENTESIMI |
| 89 | JAMAICA | CENTRAL AMERICA / WEST INDIES | LOWER MIDDLE INCOME | JAMAICAN DOLLAR (J$) OF 100 CENTS |
| 90 | JAPAN | EAST ASIA | HIGH INCOME (OECD) | YEN OF 100 SEN |
| 91 | JORDAN | ASIA MIDDLE EAST | LOWER MIDDLE INCOME | JORDANIAN DINAR (JD) OF 1,000 FILS |
| 92 | KAZAKHSTAN | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 93 | KENYA | EAST AFRICA | LOW INCOME | KENYA SHILLING (KSH) OF 100 CENTS |
| 94 | KIRIBAN | PACIFIC | LOWER MIDDLE INCOME | AUSTRALIAN DOLLAR ($A) OF 100 CENTS |
| 95 | KOREA DEM. REP/NORTH | EAST ASIA | LOWER MIDDLE INCOME | WON OF 100 JUN |
| 96 | KOREA REP. (SOUTH) | EAST ASIA | HIGH INCOME (OECD) | WON OF 100 JEON |
| 97 | KUWAIT | ASIA MIDDLE EAST | HIGH INCOME (NON-OECD) | KUWAITI DINAR (KD) OF 1,000 FILS |
| 98 | KYRGYZ REP. | EASTERN EUROPE | LOW INCOME | ROUBLE OF 100 KOPEKS |
| 99 | LAOS (PDR) | EAST ASIA | LOW INCOME | KIP (K) OF 100 AT |
| 100 | LATVIA | EAST EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KPEKS |
| 101 | LEBANON | ASIA MIDDLE EAST | UPPER MIDDLE INCOME | LEBANESE POUND (L£)” OF 100 PIASTRES |
| 102 | LESOTHO | EAST AFRICA | LOW INCOME | LOTI (M) OF 100 LISENTE |
| 103 | LIBERIA | WEST AFRICA | LOW INCOME | LIBERIAN DOLLAR (L$) OF 100 CENTS |
| 104 | LIBYA | NORTH AFRICA | UPPER MIDDLE INCOME | LIBYA DINAR (LD) OF 1,000 DIRTIANS |
| 105 | LIECHTENSTEIN | REST OF EUROPE | HIGH INCOME (NON-OECD) | SWISS FRANCE OF 100 REPPEN (OR CENTIMES) |
| 106 | LITHUANIA | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 107 | LUXEMBOURG | REST OF EUROPE | HIGH INCOME (OECD) | LUXEMBOURG FRANCE (LF) OF 100 CENTIMES |
| 108 | MACAO | EAST ASIA | HIGH INCOME (NON-OECD) | PATACA OF 100 AVOS |
| 109 | MACEDONIA | EAST ASIA | HIGH INCOME | DINNER OF 100 |

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|---|---|---|---|---|
| 110 | MADAGASCAR | EAST AFRICA | LOW INCOME | FRANC MALGACHE (FMG) OF 100 CENTIMES |
| 111 | MALAWI | EAST AFRICA | UPPER MIDDLE INCOME | KWACHA (K) OF 100 TAMBICA |
| 112 | MALAYSIA | EAST ASIA | UPPER MIDDLE INCOME | MALAYSIAN DOLLAR (M$) OF 100 SEN |
| 113 | MALDIVES | SOUTH ASIA | LOWER MIDDLE INCOME | RUFIYAA OF 100 LAARIS |
| 114 | MALI | WEST AFRICA | LOW INCOME | FRANC CFA |
| 115 | MALTA | EUROPE MIDDLE EAST | UPPER MIDDLE INCOME | MALTESE LIRA (LM) OF 100 CENTS OR 1000 MILS |
| 116 | MARSHALL ISLAND | PACIFIC | LOWER MIDDLE INCOME | USA CURRENCY |
| 117 | MARTINIQUE | CENTRAL AMERICA / WEST INDIES | HIGH INCOME (NON-OECD) | FRANCE CURRENCY |
| 118 | MAURITANIA | WEST AFRICA | LOW INCOME | OUGUIYA (UM) OF 5 KHOUMS |
| 119 | MAURITIUS | SOUTH AFRICA | UPPER MIDDLE INCOME | MAURITIUS RUPEE OF 100 CENTS |
| 120 | MAYOTEE | AFRICA | UPER MIDDLE INCOME | FRANCE CURRENCY |
| 121 | MEXICO | NORTH AMERICA | UPPER MIDDLE INCOME | PESO OF 100 CENTAVOS |
| 122 | MOLDOVA | EASTERN EUROPE | LOW INCOME | ROUBLE OF 100 KOPEKS |
| 123 | MONACO | REST OF EUROPE | HIGH INCOME (NON-OECD) | FRENCH FRANC OF 100 CENTIMES |
| 124 | MONGOLIA | EAST ASIA | LOW INCOME | TUGRIK OF 100 MONGO |
| 125 | MOROCCO | NORTH AFRICA | LOW INCOME | DIRHAM (DH) OF 100 CENTIMES |
| 126 | MOZAMBIQUE | EAST AFRICA | LOW INCOME | METICAL (MT) OF 100 CENTAVOS |
| 127 | MYANMAR | EAST ASIA | LOW INCOME | KYAT (K) OF 100 PYAS |
| 128 | NAMIBIA | SOUTH AFRICA | LOWER MIDDLE INCOME | SOUKTH AFRICA RAND (R) OF 100 CENTS |
| 129 | NEPAL | SOUTH ASIA | LOW INCOME | NEPALESE DUPEE OF 100 PAISA |
| 130 | NETHERLANDS | REST OF EUROPE | HIGH INCOME (OECD) | GULDEN (GUILDER) OR FLUMN OF 100 CENTS |
| 131 | NETHERLANDS ANTILLES | CENTRAL AMERICA / WEST INDIES | HIGH INCOME (NON-OECD) | NETHERLANDS ANTILLES GUILLER OF 100 CENT |
| 132 | NEW CALEDONIA | EAST ASIA | HIGH INCOME (NON-OECD) | FRANC CFP |
| 133 | NEW ZEALAND | EAST ASIA | HIGH INCOME (OECD) | NEW ZEALAND DOLLAR (NZ$) OF 100 CENTS |
| 134 | NICARAGUA | CENTRAL AMERICA/WEST INDIES | LOW INCOME | CORDOBA (C$) OF 100 CENTAVOS |
| 135 | NIGER | WEST AFRICA | LOW INCOME | FRANC CFA |

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|---|---|---|---|---|
| 136 | NIGERIA | WEST AFRICA | LOW INCOME | NAIRA (₦) OF 100 KOBO |
| 137 | NORWAY | REST OF EUROPE | HIGH INCOME (OECD) | KRONE OF 100 ORE |
| 138 | OMAN | MIDDLE EAST | UPPER MIDDLE INCOME | RIALOMANI (OR) OF 1,000 BAIZA |
| 139 | PAKISTAN | SOUTH ASIA | LOW INCOME | PAKISTAN RUPEE OF 100 PAISA |
| 140 | PANAMA | CENTRAL AMERICA/WEST INDIES | LOWER MIDDLE INCOME | BALBOA OF 100 CENTESIMOS |
| 141 | PAPUA NEW GUINEA | PACIFIC | LOWER MIDDLE INCOME | KINA (K) OF 100 TOEA |
| 142 | PARAGUA | SOUTH AMERICA | LOWER MIDDLE INCOME | GUARANI (GS) OF 100 CENTIMOS |
| 143 | PERU | SOUTH AMERICA | LOWER MIDDLE INCOME | NEW SOL OF 100 CENTS |
| 144 | PHILIPPINES | EAST ASIA | LOWER MIDDLE INCOME | PHILIPPINE PESO (P) OF 100 CENTAVOS |
| 145 | POLAND | EASTERN EUROPE | UPPER MIDDLE INCOME | ZLOTY OF 100 GROSZY |
| 146 | PORTUGAL | REST OF EUROPE | HIGH INCOME (OECD) | ESCUDO (ESC)? OF 100 CENTAVOS |
| 147 | PUERTO RICO | CENTRAL AMERICA / WEST INDIES | UPPER MIDDLE INCOME | USA CURRENCY |
| 148 | QATAR | ASIA MIDDLE EAST | HIGH INCOME (NON-OECD) | QATAR RIYAL OF 100 DIRHAMS |
| 149 | ROMANIA | EASTERN EUROPE | LOWER MIDDLE INCOME | LEU (LET) OF 100 BANI |
| 150 | RUSSIA FED. | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 151 | RWANDA | EAST AFRICA | LOW INCOME | RWANDA FRANC OF 100 CENTIMES |
| 152 | ELSALVADOR | CENTRAL AMERICA / WEST INDIES | LOWER MIDDLE INCOME | ELSALVADOR COLON (⊄) OF 100 CENTAVOS |
| 153 | SAO TOME AND PRINCIPE | CENTRAL AFRICA | LOW INCOME | DOBRA OF 100 CENTAVOS |
| 154 | SAUDI ARABIA | MIDDLE EAST | UPPER MIDDLE INCOME | SAUDI RIYAL (SR) OF 20 QURSH OR 100 HALALA |
| 155 | SENEGAL | WEST AFRICA | LOW INCOME | FRANC CFA |
| 156 | SEYCHELLES | SOUTH AFRICA | UPPER MIDDLE INCOME | SEYCHELLES RUPEE OF 100 CENTS |
| 157 | SIERRA LEONE | WEST AFRICA | LOW INCOME | LEONE (LE) OF 100 CENTS |
| 158 | SINGARPORE | EAST ASIA | HIGH INCOME (NON-OECD) | SINGAPORE DOLLAR (S$) OF 100 CENTS |
| 159 | SLOVENIA | EASTERN EUROPE | HIGH INCOME (NON-OECD) | DINAR OF 100 PARAS |
| 160 | SOLOMON ISLANDS | PACIFIC | LOWER INCOME | SOLOMON ISLANDS DOLLAR (SI$) OF 100 CENTS |
| 161 | SOMOLIA | EAST AFRICA | LOW INCOME | SOMALI SHILLAING OF 100 CENTS |

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| 162 | SOUTH AFRICA | SOUTH AFRICA | MIDDLE UPPER INCOME | RAND (R) OF 100 CENTS |
| 163 | SPAIN | REST OF EUROPE | HIGH INCOME(OECD) | PESETA OF 100 CENTIMOS |
| 164 | SRI LANKA | SOUTH ASIA | LOWER MIDDLE INCOME | SRI LANKAN RUPEE OF 100 CENTS |
| 165 | SUDAN | EAST AFRICA | LOW INCOME | SUDANESE DINAR (SD) PF 10 POUNDS |
| 166 | SURINAME | SOUTH AFRICA | LOWER MIDDLE INCOME | SURINAME GUILDER OF 100 CENTS |
| 167 | SWAZILAND | SOUTH AFRICA | LOWER MIDDLE INCOME | LILANGENI (E) OF 100 CENTS |
| 168 | SWEDEN | REST OF EUROPE | HIGH INCOME (OECD) | SWEDISH KRONA OF 100 ORE |
| 169 | SWITZERLAND | REST OF EUROPE | HIGH INCOME(OECD) | SWISS FRANC OF 100 RAPPEN (OR CENTIMES) |
| 170 | SYRIA | MIDDLE EAST | LOWER MIDDLE INCOME | SYRIAN POUND (S$) OF 100 PIASTRES |
| 171 | TAIJIKISTAN | EASTERN EUROPE | LOW INCOME | ROUBLE OF 100 KOPEKS |
| 172 | TANZANIA | EAST AFRICA | LOW INCOME | TANZANIAN SHILLING OF 100 CENTS |
| 173 | THAILAND | EAST ASIA | LOWER MIDDLE INCOME | BAHT OF 100 SATANG |
| 174 | TOGO | WEST AFRICA | LOW INCOME | FRANC CFA |
| 175 | TONGA | PACIFIC | LOWER MIDDLE INCOME | PA'ANGA (T$) OF 100 SENITI |
| 176 | TRINIDAD AND TOBAGO | CENTRAL AMERICA / WEST INDIES | UPPER MIDDLE INCOME | TRINIDAD AND TOBAGO DOLLAR (TT$) OF 100 CENTS |
| 177 | TUNISIA | NORTH AFRICA | LOWER MIDDLE INCOME | TUNISIA DINAR OF 1,000 MILLIMES |
| 178 | TURKEY | REST EUROPE | UPPER MIDDLE INCOME | TURKISH LIRA (TL) OF 100 KURUS |
| 179 | TURKMENISTAN | EASTERN EUROPE | LOW INCOME | ROUBLE OF 100 KOPECKS |
| 180 | UGANDA | EAST AFRICA | LOW INCOME | UGANDA SHILLING OF 100 CENTS |
| 181 | UKRAINE | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |
| 182 | UNITED ARAB ENIRATES | MIDDLE EAST | HIGH INCOME (NON-OECD) | UAE DIRHAM OF 100 FILS |
| 183 | UNITED KINGDOM | REST OF EUROPE | HIGH INCOME (OECD) | POUND STERLING (£) OF 100 PENCE |
| 184 | UNITED STATES OF AMERICA | NORTH AMERICA | HIGH INCOME (OECD) | US DOLLAR (US$) OF 100 CENTS |
| 185 | URUGUAY | SOUTH AMERICA | UPPER MIDDLE INCOME | NEW URUGUAYAN PESO OF 100 CENTESIMOS |
| 186 | UZBEKISTAN | EASTERN EUROPE | LOWER MIDDLE INCOME | ROUBLE OF 100 KOPEKS |

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| 187 | VANUATU | PACIFIC | LOWER MIDDLE INCOME | VATU OF 100 CENTIMES |
| 188 | VENEZUELA | SOUTH AMERICA | UPPER MIDDLE INCOME | BOLIVAR (BS) OF 100 CENTIMOS |
| 189 | VIETNAM | EAST ASIA | LOW INCOME | DONG OF 10 HAO OR 100 XU |
| 190 | VIRGN ISLAND | CENTRAL AMERICA/ WEST INDIES | HIGH INCOME (NON OECD) | USA CURRENCY |
| 191 | YEMEN | MIDDLE EAST | LOW INCOME | YEMEN DINAR (YD) OF 1,000 FILS |
| 192 | ZAMBIA | SOUTH AFRICA | LOW INCOME | KWACHA (K) OF 100 NOWEE |
| 193 | ZAIRE | AFRICA | LOW INCOME | ZAIRE OF 100 MAKUTA |
| 194 | ZIMBABWE | SOUTH AFRICA | LOW INCOME | ZIMBABWE DOLLAR (Z$) OF 100 CENTS |