FOREIGN EXCHANGE RISK MANAGEMENT

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This dissertation is submitted in partial fulfilment of the requirements for the degree of Master of Science in Financial Studies.

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Dedicated to my wife, Wivina

My son, Aidan

My daughter, Kim

and My mum, Rosella.

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ABSTRACT

This dissertation is concerned with the problems of foreign exchange risk management in international business. The problem became more significant to businessmen when the major currencies were "floated" in the early 1970s. Since then the foreign exchange market has experienced erratic and unpredictable exchange rate fluctuations affecting the foreign income streams of companies with international operations and/or transactions.

The key issues on foreign exchange risk management that will be discussed in this study are the nature of the foreign exchange market, the relevance of foreign exchange risk management, measuring exposure to foreign exchange risk and managing foreign exchange exposure in the international business. These issues are considered from a conceptual and empirical approach, emphasising the usefulness of the findings to the practical world in which a firm operates.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

The variety of exchange rate arrangements adopted by a large number of countries since 1973 have brought into focus an area of financial management which did not receive much attention previously. This area is foreign exchange risk management. Most corporations, including those who do not possess foreign operations, are exposed to foreign exchange risk. Not surprisingly, therefore, a considerable amount of investigations have been undertaken, aimed at providing more explicit explanations of the foreign exchange phenomenon.

This study is intended to explore the impact of foreign exchange rate changes in international business based on the premise that foreign investments and foreign tradings are continually exposed to sudden changes in the relative value of currencies in which the business is transacted. The pertinent observation is that changes in the value of many currencies has occurred in a relatively short period of time and this has caused loss of expected earnings. Hence, the corporate management needs to have an understanding and appreciation of the foreign exchange problem and how the firm can develop strategies to protect itself from the vicissitudes of random currency fluctuations.

In this dissertation, international business refers to the occasional importer/exporter, the significant importer/exporter and

the multinational company (MNC). The occasional importer/exporter operates more or less domestically but may occasionally become involved in a transaction (export or import) which entails foreign currency. The significant importer/exporter is regarded as a business which has committed a sizeable proportion of its resources into receiving foreign goods and services for local markets and providing goods and services for foreign markets. The multinational company is a business which exists across international frontiers by owning operations in other countries.

The conceptual framework for this study is based on the argument that foreign exchange risk does exist and therefore corporations need to consider it. From this viewpoint, relationships from which some general or special theory may be explored, extended, qualified, modified or corrected will be exploited.

The analysis will examine the nature of the foreign exchange market, in particular, the historical development of the currency market and the determination of the spot and forward exchange rate in Chapter Two. This will be followed by examining the case for corporate management of foreign exchange risk as projected by the Purchasing Power Parity theory, Interest Rate Parity theory, the Modigliani-Miller (MM) theory and the Capital Asset Pricing Model in Chapter Three. In Chapter Four, measuring exposure to foreign exchange risk will be considered in regards to economic, translation and transaction exposure. Chapter Five will deal with managing foreign exchange exposure, highlighting economic exposure management

and transaction and translation hedging.

The method of research is primarily a literature review highlighting the investigations and opinions of scholars and practitioners on the subject. Wherever possible, empirical evidence will be included in order to substantiate the various theories discussed.

It is hoped that this research will provide the reader with some sound insights into the problems which exchange rate fluctuations can cause for international business.

CHAPTER TWO

THE NATURE OF THE FOREIGN EXCHANGE MARKET

This chapter attempts to explain the nature of the foreign exchange market. The intention is to provide an understanding of the mechanics of foreign exchange trading. This is significant in terms of explaining currency fluctuations, the root of foreign exchange risk. The main points of discussion will be the historical development of the international money system and the mechanics of the foreign exchange market from an economic point of view.

2.1 Development of the International Monetary System

Eiteman and Stonehill[1] identified five periods of development in the international monetary system as follows:

2.1.1 International Monetary System Before 1971;
2.1.2 International Monetary Crisis of 1971-1973;
2.1.3 Floating Exchange Rates, 1973-1977;
2.1.4 Dollar Crisis, 1977-1978;
2.1.5 Floating Currency Blocs, 1979 to the present.

2.1.1 International Monetary System Before 1971

The gold standard or a variation of it dominated the international monetary system before 1971. During that period gold was denominated as a medium of exchange and as a store of value and

thus goods and service were exchanged for an equivalent value. What was crucial was the seller's confidence in the purity of the gold instruments. As international trade expanded, the need for a more formalised international system of payment became more apparent. According to McRae and Walker[2], the essential conditions for maintaining the gold standard were:

(1) the value of the fiat currency is fixed by reference to a certain weight of gold;

(2) the currency is freely convertible in gold;

(3) the international community have complete confidence in the integrity of the institution issuing the fiat currency;

(4) gold can be freely exported and imported.

It should be noted that the gold standard operated adequately until World War I when trading was interrupted, resulting in the suspension of the gold standard.

It can be said that during the operation of the gold standard, fluctuation in currency exchange rates was minimal as these were more or less fixed according to a fixed weight in gold value.

When currencies were allowed to fluctuate during World War I and the early 1920s in terms of gold and each other, the result was chaos. Eiteman and Stonehill[3] describe the situation as

such:

> "Theoretically, it was expected that supply and demand for a country's exports and imports would cause moderate changes in its exchange rate about a central equilibrium value. This was the same junction that the gold flow performed under the previous gold standard. Unfortunately, flexible exchange rate did not work in an equilibriting manner. On the contrary, international speculation sold the weak currencies short, causing them to fall further in value than warranted by the real economic factors. The reverse happened with strong currencies."

Under these circumstances, clearly there will be little confidence in the value of foreign currencies and this, in turn, must affect international trade as traders will be reluctant to accept currencies whose worth are doubtful.

At the end of World War II, leading trading nations felt that the chaotic nature of the international monetary system was not acceptable. In 1944, they held a conference in Bretton Woods where their leading monetary experts emerged with a gold standard exchange. The Bretton Woods agreement was essentially that gold would be replaced with the US dollar, as a common measure of value. The value of the US dollar, in turn, was measured in terms of a fixed weight of gold. Therefore, the countries participating in the Bretton Woods agreement would decide their exchange rate vis-a-vis the US dollar.

The Bretton Woods conference created the International Monetary Fund (IMF) and the World Bank which would administer the new agreement. Also the participants agreed to control the fluctuation in value of their currency unit and the dollar within 1% of the

agreed rate. If a weak currency could not maintain its value within the ±1% band, then it could negotiate an adjustment with the IMF. Prior agreement with the other countries would be sought on the devaluation to avoid retaliatory actions. In some cases, devaluation up to 10% was allowed without the approval of the IMF.

The responsibility of making the system operative was left to the monetary authorities of the non-USA members who were required to ensure that their respective currency rate was within the specified limit allowed for fluctuation. To achieve this, each authority maintained an amount of gold and foreign currency with which it could control demand and supply, driving the value of the currency up or down depending on the objective desired. In instances where stock of foreign exchange and gold were not sufficient to equilibrate the local currency, then other economic tools such as raising or lowering interest rate, reducing government expenditure were used. The IMF would be a last resort where government could negotiate a fixed exchange rate.

2.1.2 International Monetary Crisis of 1971-1973.

Not all the countries kept to the limits set by the Bretton Woods agreement. This brought about a decision by the United States to severe the links between the dollar and gold. This resulted in international money losing their basic unit of value and the consequence was that international trade suffered. It is generally regarded that the end of the Bretton Woods agreement was the end of the most stable period in international money since the gold standard was suspended in 1915.

With the conveniences of international trade at threat, the major trading countries met again in December 1971 in Washington to iron out their difficulties. The result was a further agreement referred to as the Smithsonian agreement which in essence was[4]:

"(1) Currency values were realigned in terms of the US dollar. The dollar was devalued by approximately 7% against other major currencies.

(2) The margins within which a currency was allowed to fluctuate in value were widened to 2¼% either way from the central rate.

(3) Gold was upvalued from an official rate of US $35 to US $38 an ounce."

2.1.3 Floating Exchange Rates - 1973-1977.

The Smithsonian agreement was short-lived with limited success. As Eiteman and Stonehill[5] described:

"The Smithsonian Agreement was less than a year old before market pressures forced changes in the new rates. The UK pound was floated in June 1972 and the Swiss franc in January 1973. In early 1973, the US dollar came under attack once again thereby forcing a second devaluation on February 12, 1973, this time by 10% to $42.22 per ounce. By late February, 1973, a fixed-rate system appeared no longer feasible given the extreme surges of speculative flows of currencies. The major foreign exchange markets were actually closed for several weeks in March, 1973, and when they reopened,most currencies were allowed to float temporarily to levels determined by market forces. Par values were left unchanged."

The result of the free floating system was that currencies of countries with strong balance of payments appreciated significantly in relation to countries with large balance of payment deficit.

The oil crisis did little but to cause further severe fluctuation in foreign exchange rates during the period 1974-1977. This was caused mainly by increased inflation,high-interest rates, balance of payment problems and speculation.

2.1.4 Dollar Crisis of 1977-1978

The dollar crisis of 1977-1978 was due mainly to expansionary policies of the US government. While growth in G.N.P. was achieved and unemployment reduced, the rate of inflation increased simultaneously thus causing a deterioration in the balance of payment position. The consequence was that the value of the dollar depreciated and a worldwide loss of confidence in the dollar ensued. This situation did not change until the US government changed course in terms of economic policies which signalled its willingness to save the falling dollar from depreciating further.

2.1.5 Floating Currency Bloc - 1979 to the present

Up to the present, foreign exchange rates have shown little stability vis-a-vis each other. Most major international currencies, such as the US dollar, UK pound sterling, Japanese yen, the German mark, float freely on the world's money markets where significant devaluation and revaluation are frequently experienced. Lots of ideas have been explored in the quest for more stable foreign exchange rates but so far a workable solution has not been devised.

The best known partial solution was provided by an EEC agreement usually referred to as the "snake". This was followed by what is described as the ambitious European Monetary System. Until then, major international currencies will continue to float on the money market to find their own value against each other. It is this fluctuation which is the cause for concern in international business. Figure 2.1 shows the major development of the international monetary systems.

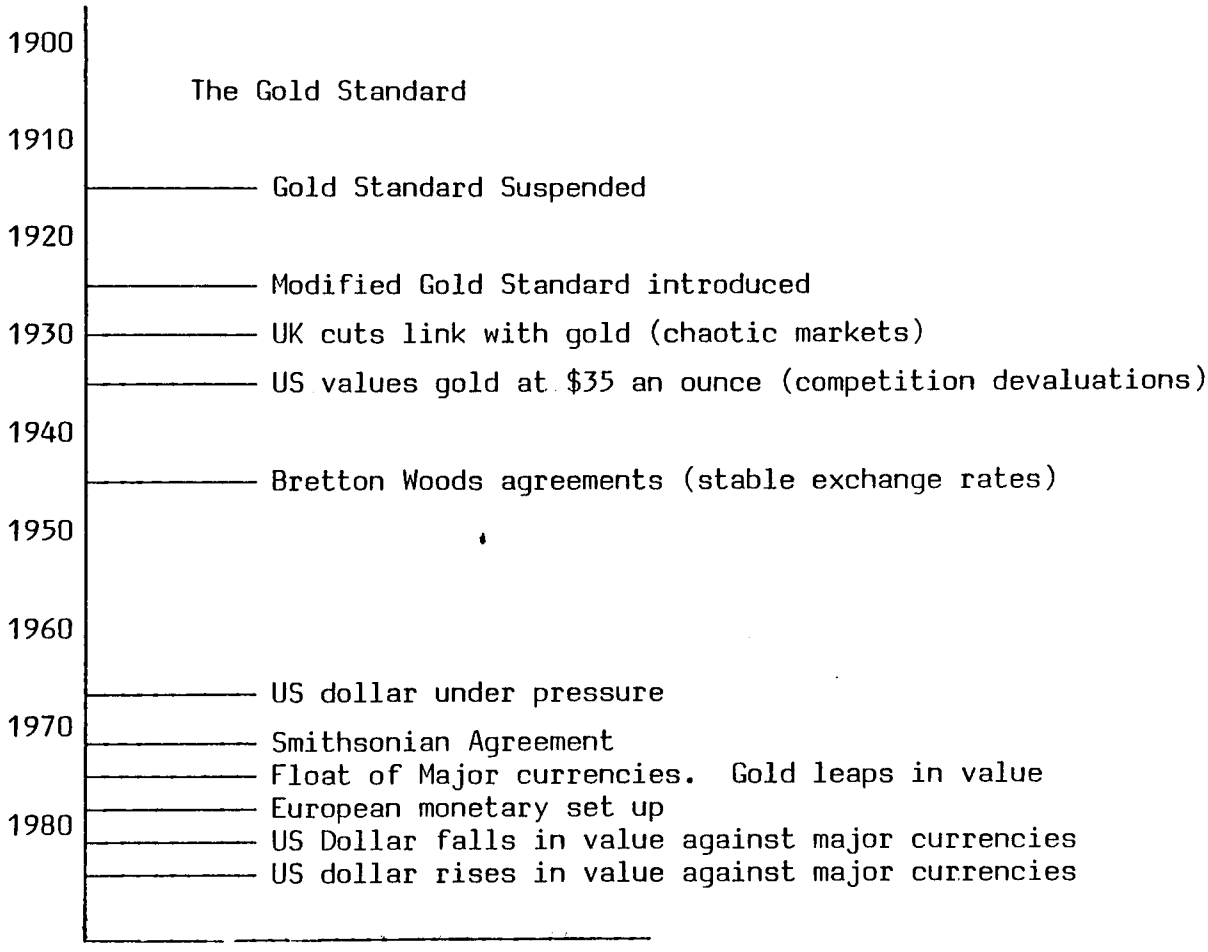


FIGURE 2.1: Major Events affecting Exchange Rate Systems 1900-1985:

(Adapted from McRae and Walker - Foreign Exchange Management, Prentice-Hall International Inc. USA, 1980).

The upsurge in value of the US dollar against major currencies in recent itmes has not been unnoticed. While this phenomenon could be explained by the growth of the US economy in real terms in the early eighties, the continued strength of the dollar in 1984 and early 1985 has been a source of bafflement to financial economists, given the slow rate of growth in the US economy and the size of US government budget deficit. In this regard, the Economist[6] noted:

> "Finance ministers in Europe and the poor countries of the world have been pinning their hopes of a weaker dollar or lower American interest rates. They trusted that slower economic growth (by reducing domestic demand for credit) or some sign that Washington would tackle the budget deficit would do the trick. This week, they got lower Amiercan interest rates and new evidence of slower economic growth. The perfidious dollar surged on."

Table 2.2 demonstrates the strength of the dollar during period March 7, 1984 to October 17, 1984.

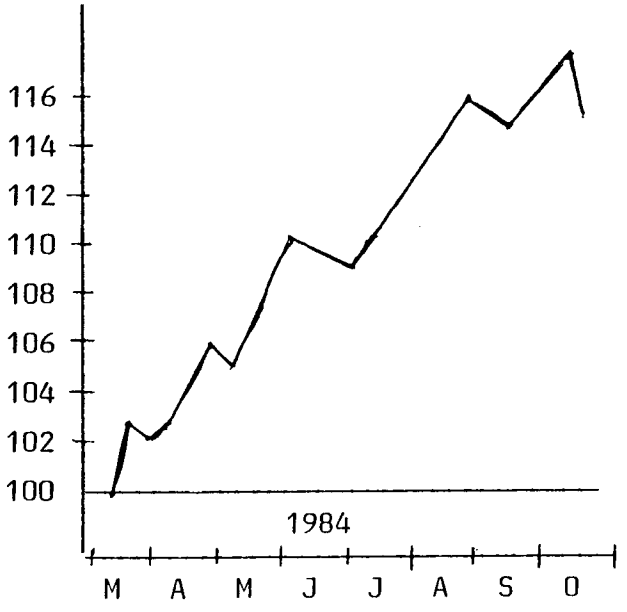


FIGURE 2.2: US $ trade-weighted exchange rate (March 7, 1984 = 100)

Source: The Economist, October 20, 1984.

2.2 The Mechanics of Foreign Exchange Market

The structure by which the international monetary system operates is usually referred to as the foreign exchange market. It can be described as the mechanism by which

> "one is able to transfer purchasing power between countries, obtain and provide credit for international trade transactions, and minimize exposure to the risks of exchange rate fluctuations."(7)

The basic function of the foreign exchange market is to transfer purchasing power from one currency to another. International transactions must involve dealings with a foreign currency. A transaction between a British importer and Japanese exporter will eventually involve one part engaging in a foreign exchange transaction. If the importer pays in pounds sterling the export will have to convert pounds to yens. On the other hand, if the exporter demands payment in yen, then the importer will convert pounds to yens.

According to Abraham M George[8], there are three levels on which the foreign exchange market operates:

(1) commercial banks engaging in foreign exchange transactions on behalf of their customers;
(2) commercial banks dealing with each other in the interbank market;
(3) central banks intervening in the market to maintain the value of currencies within desired levels.

The degree of access any party can have in the market would depend on the types of controls instituted. The controls could vary from country to country.

Three types of foreign exchange transaction can be identified. They are referred to as (i) spot trade; (ii) forward trade and (iii) the swap. The spot trade entailed the purchase of one currency for another at current exchange rate. When a transaction involves the purchase of one currency or the sale of another at a fixed exchange rate to be delivered at some future date, it is reffered to as forward trade. The swap involves a simultaneous purchase and sale of an amount of currency for two different dates. The difference between the swop and the forward trade is that in the swap, there is not prior fixing of exchange rate and the dates of delivery may not be simultaneous.

The conceptual underpinnings which underly the foreign exchange market can be best explained from an economic point of view. The analysis will continue by examining (a) what determines the spot exchange rate under the following conditions:-

(1) systems of floating exchange rates in which the price of currencies is largely the result of interacting supply and demand forces with little or no stabilising interference;

(2) systems of stabilised exchange rates whereby the market determined price of currencies is constrained through

central bank intervention to remain within pre-scheduled band of fluctuations;

(3) systems of controlled exchange rates in which currency prices are set by bureaucratic decisions.

(b) What determines the forward exchange rate.

Jacque[9] produced an indepth analysis of the determination of the spot exchange rate and the forward exchange rate. The continuation of this section will be based primarily on his work in that area.

2.2.1 The Determination of Spot Exchange Rates

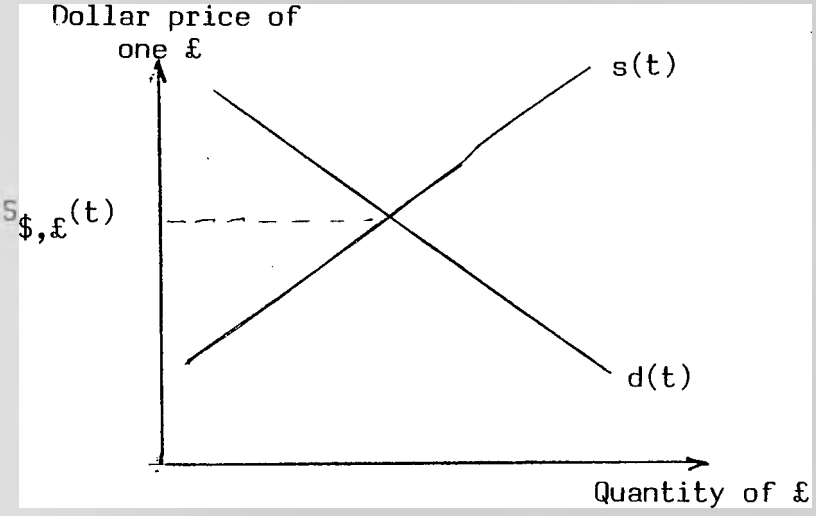
Consider a two trading country situation, say, the UK and the USA where the currency of the UK is pound sterling and the USA is the dollar. If the USA imports British goods and services and also invest in and extend loans to the UK, then a demand for pounds will be created. Likewise, if the USA exports goods and services to the UK and the UK invest in and extends loans to the USA, then a supply of pounds will be created. The exchange rate for pounds in relation to dollars will be determined by the interaction of the supply of and demand for pounds sterling. This is called the spot exchange rate.

The demand for pounds will be influenced by the laws of demand which purports that the amount of a commodity demanded will vary inversely to the price of the commodity. In other words, when

the price of the commodity is high, less will be demanded and as the price of the commodity falls, more will be demanded.

The forces of supply operate in the opposite direction with demand. That is, the lower the price of the commodity, the less of that commodity supplied and the higher the price, the more of that commodity supplied. In the two country example, an expensive pound sterling will result in more goods and services being obtained by the UK from the USA as they appear cheap. From the USA's point of view the expensive pound could curtail the demand for UK goods and services, investments and extensions of loans, thus reducing the supply of foreign exchange.

When the forces of demand and supply of pound sterling interact freely, an equilibrium rate of exchange in relation to the dollar emerges. It is at this rate that the market is cleared. This interaction between demand and supply of foreign exchange is illustrated in Figure 2.3:



$S_{\$,£}(t)$ denotes the spot dollar price of one pound sterling for immediate delivery as prevailing at time t.

s(t) = supply of pound sterling at time (t)

d(t) = demand of pound sterling at time t

FIGURE 2.3: Equilibrium Exchange Rate.

The equilibrium situation described by Figure 2.3 can be applied to any two country situation. The fact that any one country would be trading with a multiple of other countries suggests that a foreign exchange market exists. It is this market which allows the purchasing power of the dollar to be translated into another currency and vice versa, based on the simple concept of demand and supply.

An important question is whether the price of any one currency will be quoted differently in different locations. For example, would the dollar price of one pound be $1.30 in London but $1.31 in Singapore? The general view is that it does not matter because arbitragers will correct this discrepancy in prices by buying pounds in London and selling them in Singapore. An increased demand for pounds will be created which will raise the price of the pound in London and at the same time, the increased supply of pounds in Singapore will push down the price until a single price exists in both locations. As Jacque[10] explains it:

> "As a result, exchange arbitragers provide the mechanism whereby geographically distinct exchange markets are integrated in an economic sense."

The formal expression for this equilibrium condition for a two country situation is as follows:

$$[S_{\$,£}(t)]_{\text{market 1}} = [S_{\$,£}(t)]_{\text{market 2}} = \ldots\ldots [S_{\$,£}(t)]_{\text{market i}}$$

where $S_{\$,£}(t)$ denotes the spot dollar price of one pound sterling for immediate delivery is prevailing at time t.

Naturally, concern should be expressed as to what will happen if the two-currency world is relaxed? Assume a three currency situation, that is, US dollar, pound sterling and French franc. As arbitragers try to capitalised on market imperfections to abstract abnormal returns, they will operate in such a way so as to ensure that purchasing pound sterling directly with dollars at the unit pirce of $S_{\$,£}(t)$ or through the intermediary of a third currency, French franc, will be equivalent. Expressed mathematically, the situation is:

$$S_{\$,£}(t) = S_{\$,FF}(t) \cdot S_{FF,£}(t)$$

where $S_{\$,FF}(t)$ denotes the dollar price of one French franc for spot delivery as prevailing at time t.

$S_{FF,£}(t)$ denotes the French franc price of one pound sterling for spot delivery also as prevailing at time t.

This trilateral equilibrium emphasises that given arbitrage operations, the costs incurred in whether acquiring pound sterling or to purchase the amount of French franc to acquire pound sterling will be the same in terms of dollars. To illustrate, assume the following arbitrage opportunity situation:

$$S_{\$,£}(t) = 1.32$$

$$S_{\$,FF}(t) = 1.083$$

$$S_{FF,£}(t) = 12.11$$

Applying the equilibrium convention, indirect purchase of pound sterling through French franc would allow arbitragers to obtain an abnormal return of .01 cent per unit because of lower cost (.1083 x 12.11 = 1.31). In trying to capitalise on the situation, the actions of the arbitragers drive up the dollar price of French france and French franc price of sterling as a result of increased demand. Likewise, the dollar price of pound will be reduced arising from increase supply of pound on the market.

Jacque[10] contends that the equilibrium condition is perfectly general and can be applied to n-currency situation. Accordingly, for any pair of currencies i and j, and n-currency foreign exchange market will be equilibrium at time (t) if the following condition exists:

$$S_{i,j}(t) = \prod_{k=i}^{k=j-i} S_{k,k+1}(t) \qquad \text{where } i \leq j$$

where $S_{i,j}(t)$ denotes the currency i price of one unit of currency j for spot delivery at time t;

$S_{k,k+1}(t)$ denotes the currency k price of one unit of currency k+1 for spot delivery at time t.

2.2.2 The Role of Central Banks

The model of foreign exchange rate presented above assumed a perfect market condition; i.e. homogeneous product, market participants have perfect knowledge, a large number of buyers and sellers

who singularly cannot influence price. In reality, the market condition may not be so straightforward. Depending on the economic circumstances, countries may take actions which control the effect on the fluctuation of exchange rates. The most likely institution to intervene in the foreign exchange market is the central bank. In this section, the role of the central bank in the foreign market will be examined. In particular, central bank strategies in regards to floating, stabilised and controlled exchange rates will be discussed.

2.2.2.1 Freely Floating Exchange Rates.

The dynamic nature of international trade suggests that an equilibrium exchange rate will be stable only in the short-term. It is expected that there will be continuous fluctuation around a longer-term trend in a manner similar to the prices of securities on a stock market or the quotations of commodities traded on a commodity exchange. As random information is made available to the market changes in demand and supply of foreign currency will ensue causing new equilibrium positions to emerge.

It is a general fact that most countries do not allow thier currency to float freely in accordance with market forces. This is because of the devastating effects such a policy could have on their economic development. Victor Argy[11] identifies three reasons why controls are used to manage exchange rates as follows:

"(1) On a continuing basis, to shelter the economy from potential destabilizing inflows or outflows of capital.

(2) To offset longer-term weaknesses or strengths in the current account, by biasing the controls against outflows in the case of a weak currency (as in the UK until 1979) or by biasing the controls against inflows in the case of a strong currency (as in Germany).

(3) To offset short-term exchange-market pressures in either direction (as in Germany)."

2.2.2.2 Managed Floating Exchange Rates

In the process of managing floating exchange rates system, a country is attempting to achieve a short-run exchange rate stability without affecting long-term flexibility. It does so by intervening through its central bank which uses certain monetary policy to smooth out daily exchange rate fluctuations. The actions of the central bank is not likely to be known to the market participants.

Three major classes of central banks' intervention strategies in a managed float system are identified and described below.

One strategy deals with smoothing out short-term fluctuations to enhance an orderly pattern in currency exchange rate changes. Not much attention is paid to the long-term trends subjected to market forces.

The second strategy concerns with preventing or reducing the full effects of adverse short- and medium-term fluctuations caused

by external factors deemed to be temporary. Examples of such factors are natural disasters, prolonged strike, etc. The reason why the central bank intervene into the market under such situations is to reduce the serious effects that such abnormal events could have on the exchange rate level.

The third strategy is described as "tantamount to a system of stabilized exchange rates that would not define an official par value". Countries pursuing such actions are normally trying to avoid fundamental rise or fall in their exchange rate. One example that can be cited is the action of the Bank of England in the first quarter of 1976 to prevent the pound sterling from depreciating below the psychological level of two dollars because it was feared that a cheaper pound sterling would mean a higher sterling cost of imports which would raise inflation.

The central banks intervene in the market by spot purchasing or selling their own currency in exchange for a foreign currency with the objective of influencing its price. This type of action can be best explained through an illustration.

Assume that it is known that in a free floating situation, the pound sterling will depreciate from

$$S_{\$,£}(t) = \$1.32 \text{ to } S_{\$,£}(t+1) - \$1.26$$

over the period (t,t+1). However, the desired level at which the central bank wants to maintain the exchange rate is $S_{\$,£}(t+1)^{*}=\$1.30$.

The diagrams below show the two positions

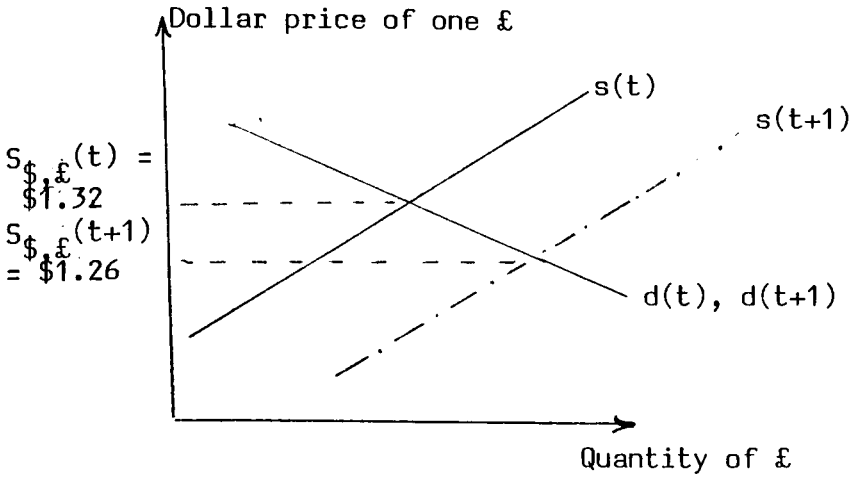


FIGURE 2.4: Pound Sterling Depreciates

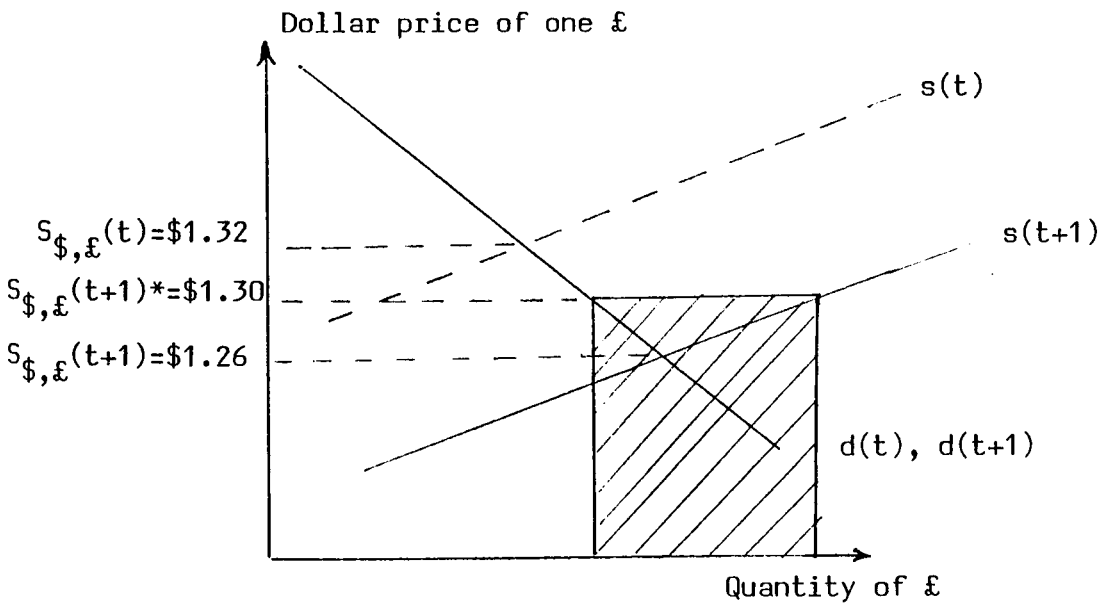


FIGURE 2.5: Modus Operandi of Central Bank Intervention.

Figure 2.5 shows that at the target rate of \$1.30, there is an excess supply of $\Delta_{£}$, or equivalently, an excess demand of

$$\left\{\Delta_{£} \cdot S_{\$,£}^{(t+1)*}\right\}_{\$}$$

The central bank will effectively reduce this instability by purchasing $\Delta_{£}$ in exchange for the equivalent dollar amount which is tantamount to supplying the market with $\left\{\Delta_{£} \cdot S_{\$,£}^{(t+1)}\right\}_{\$}$.

2.2.2.3 Stabilised Exchange Rates

A system of stabilised exchange rate can be described as one in which central banks are overtly committed to prevent foreign exchange fluctuation beyond a specified limit in regards to a par value. Under this system the forces of demand and supply are still operating just as in the system of floating exchange rates. The limits allowed for fluctuation may differ from country to country. The operation of this system is illustrated below.

Assume an exchange market for two currencies, the pound sterling (£) and the Deutsche Mark (DM), where the official par value of the DM in regards to the £ is defined at DM4 to the £ at time t. Using general notation

$$[S_{£,DM}^{(0)}]_{par} = .25$$

Assume further that the allowance for fluctuation is defined at

$\pm\frac{1}{2}$ per cent around the par value. Accordingly, the ceiling and floor pound sterling prices of one DM is defined as follows:

Ceiling £ price of one DM is solved by determining :

$$\frac{[S_{£,DM}(t)]_{MAX}-[S_{£,DM}(0)]_{PAR}}{[S_{£,DM}(0)]_{PAR}} = +.005$$

Floor £ price of one DM is determined by solving :

$$\frac{[S_{£,DM}(t)]_{MIN}-[S_{£,DM}(0)]_{PAR}}{[S_{£,DM}(0)]_{PAR}} = -.005$$

where $[S_{£,DM}(0)]_{PAR}$ = par value of the DM vis-a-vis the £.

$[S_{£,DM}(t)]_{MAX}$, $[S_{£,DM}(t)]_{MIN}$ = the ceiling and floor £ prices of one DM respectively.

Solving for the two equations respectively, the ceiling and floor exchange rate are obtained as follows:

$$[S_{£,DM}(t)]_{MAX} = [S_{£,DM}(0)]_{PAR} \cdot (1+.005)$$

$$= (.25)\cdot(1.005) = 0.25125$$

$$[S_{£,DM}(t)]_{MAX} = [S_{£,DM}(0)]_{PAR} \cdot (1-.005)$$

$$= (.25)\cdot(0.995) = 0.24875$$

The responsibility of overseeing that the exchange rates do not escape the band allowed for fluctation belongs to the central bank. Figure 2.6 illustrates the concept of upper and lower limit fluctuations in the stabilised exchange rate system.

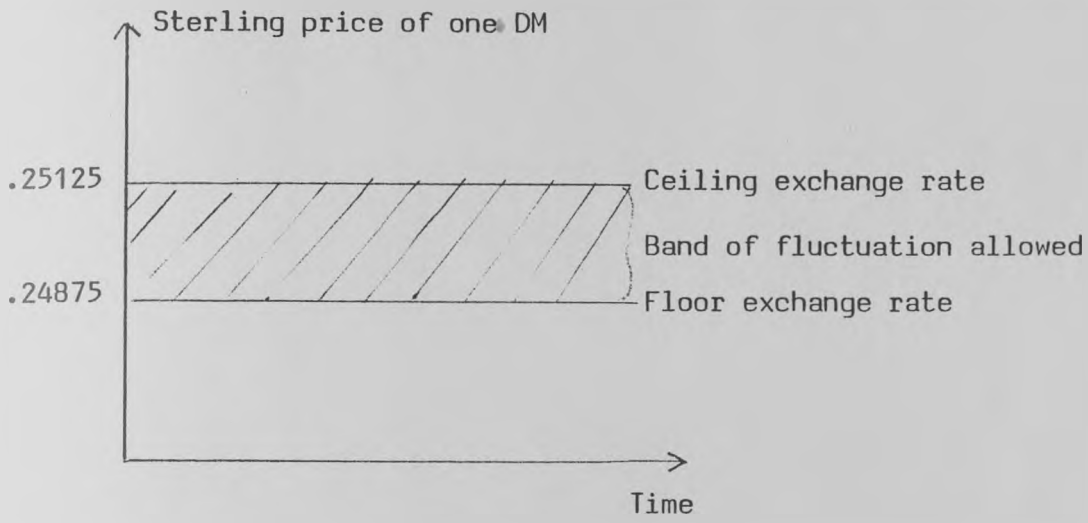


FIGURE 2.6: Permissible Fluctuation allowed in a stabilised exchange rate system.

In Figure 2.7, the permissible fluctuation band is superimposed on a demand and supply schedule in regards to the £ and DM.

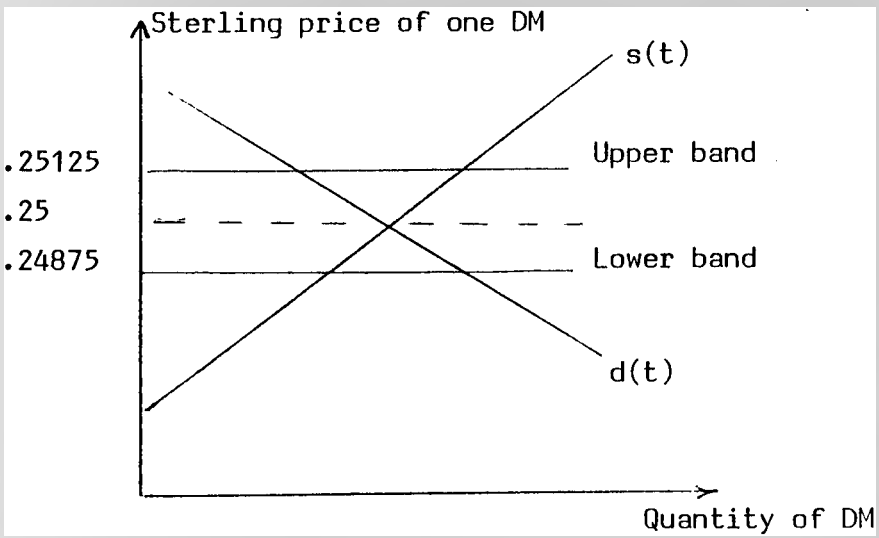


FIGURE 2.7: Tunnel of permissible fluctuations.

If at time t+1, the demand for DM were to increase, a shift in the demand schedule in Figure 2.7 will follow (see Figure 2.8A). If the shift causes a new equilibrium in excess of the upper band, the central bank will supply the excess DM demanded at the ceiling exchange rate in order to keep the exchange rate at the desired level. The effect of the bank intervention is shown in Figure 2.8B. In other words, the central bank will sell the excess quantity demanded, F_{DM}, or purchase

$$\left\{F_{DM}\left[S_{£,DM}(t)\right]_{MAX}\right\}_{\$}$$

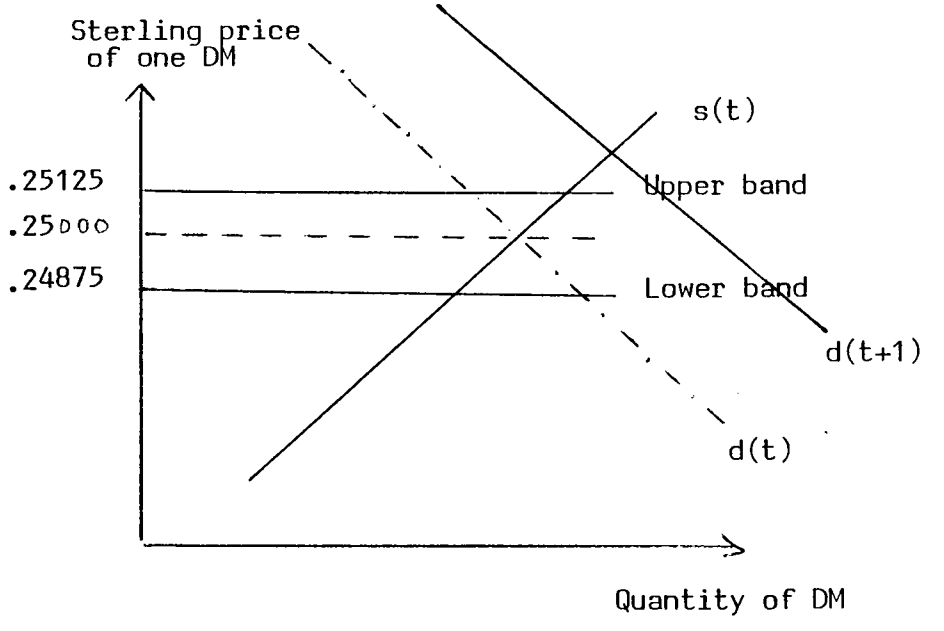


FIGURE 2.8A: Central Bank Intervention at the ceiling exchange rate.

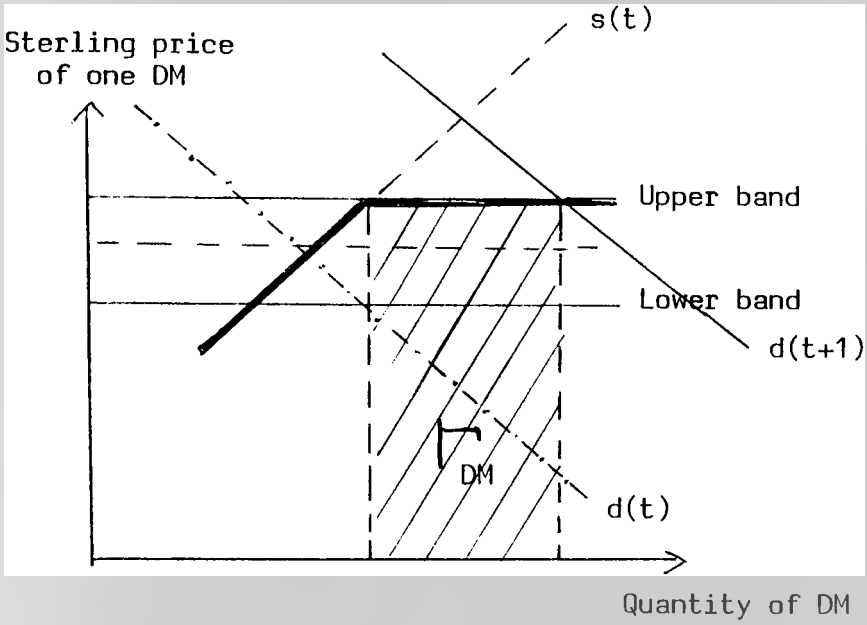


FIGURE 2.8B: Central Bank intervention at the ceiling exchange rate.

In the same manner, if the sterling price of the DM were to depreciate below the floor exchange rate the central bank will buy the excess supply of DM on the market or sell the pounds acquired, in order to keep the exchange at least at the floor rate. This is illustrated in Figure 2.9A and B.

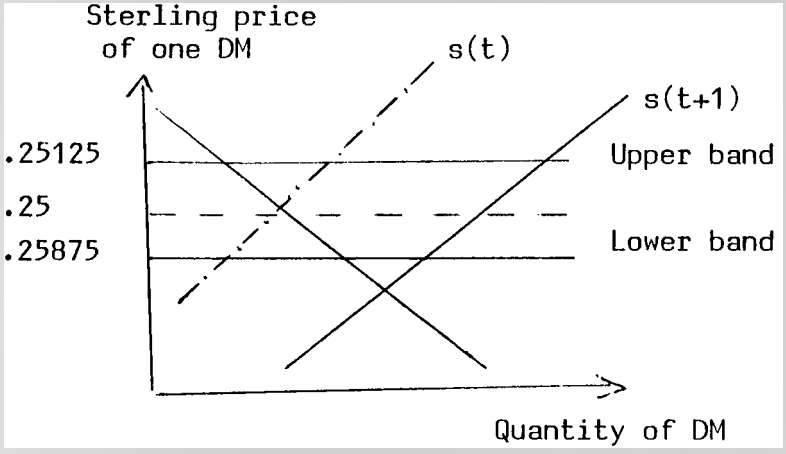


FIGURE 2.9A: Central Bank Intervention at the floor exchange rate.

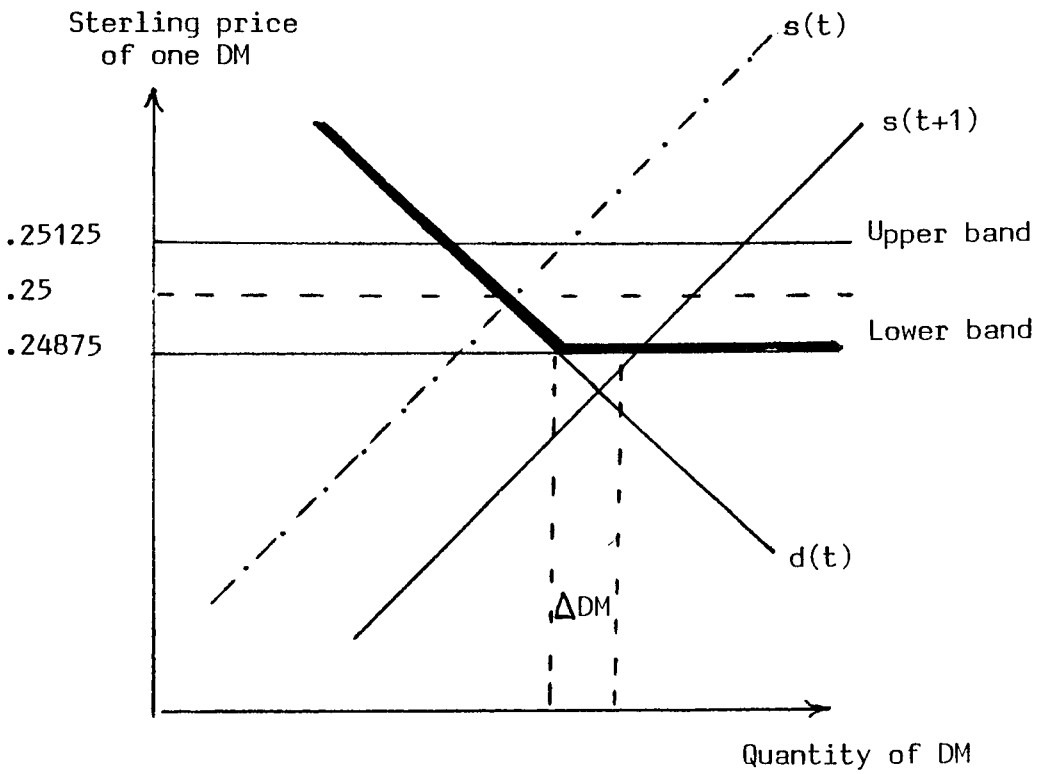


FIGURE 2.9B: Central Bank Intervention at the floor exchange Rate.

In general terms, the central bank will purchase Δ_{DM} or buy

$$\left\{ \phi_{DM} \left[S_{£,DM}(t) \right] \right\}£$$

The uncertainty attached to the stabilised exchange rate system is limited to the upper and lower band rates.

2.2.2.4 Controlled Exchange Rates

In a system of controlled exchange rates, the price of currency is not determined by the interplay of supply and demand forces. It is determined by a control authority such as the central bank or some special institution, which takes the place of the market by becoming the sole buyer and seller of foreign exchange. The controlled exchanged rate is determined by bureaucratic decisions which require that all exchange earnings must be sold to the control authority at its stipulated rate and that all foreign expenses must be bought from the same authority at its prescribed rate.

Controlled exchange rates can be classified into single controlled rate systems and multiple exchange rate systems.

Single controlled rate systems are usually found in lesser developing countries who obtain most of their foreign exchange from one staple export crop. Thus, the country has a limited supply of foreign exchange which has to be rationed among buyers. This rationing function is executed by usually tight foreign exchange control or strict licensing whose objective is basically to curb excess demand for foreign currency.

The alternative is the multiple exchange rate systems which in essence, discriminate among different categories of foreign

transactions. It is based on the principle that those who demand foreign exchange will be able to pay the price rather than their ability to obtain a license. The controlling authority has a preference of certain types of import transactions and so it will allocate foreign exchanges resources accordingly. In this case, it will charge increasingly higher exchange rates according to the essentiality of the import transactions. Thus, a low exchange rate will exist for import items such as, raw materials, essential food commodities, machinery and spare parts, while luxurious goods will be discouraged by a much higher exchange rate.

2.2.2.5 Pegging

Ther are some countries whose currencies are not recognised internationally for trading purposes. Such countries usually peg their currencies to a major international currency such as the US dollar, pound sterling, French franc. Some countries have currencies tied to the value of the special Drawing Rights (SDRs) issued by the IMF. Examples of such countries are Tanzania, Malawi, Jordan, Kenya. Countries such as Tunisia, Austria, Cyprus follow a basket pegging policy.

2.3 The Determination of Forward Exchange Rate

The forward exchange market is one where currency can be bought or sold for future delivery. It is generally regarded as a market

where the risk of adverse foreign rate fluctuations can be sold off to professional risk bearers. The type of transactions which take place in this market is referred to as forward exchange contracts. A forward contract involves a commitment between two parties which calls for delivery of a specified amount of one currency for another at a fixed future date, with the exchange rate fixed at the time that the contract is made. Like most contracts, the agreement is irrevocable and in particular, the actual subsequent appreciation or depriciation of the currencies used in the transaction will bear no weight on the original contract.

To exemplify, consider the case of a 90 day forward sale contract of five hundred thousand pounds for US dollars at the rate of \$1.38 per £1. The contract, which should stipulate the maturity date (90 days in this case) the amount (£500,000) and the price (US \$1.38 per £), will be binding at the initial time (t_i), and to fulfil, the commitment of £500,000 will be exchanged for US \$690,000 at the final time (t_f).

The forward exchange rate is determined side by side with spot exchange rate in the foreign exchange market. The continual sale and purchase of different currencies on the forward market more or less determines the exchange rate, which is expected to reflect the traders' market assessment of the future value of currencies and the current interest-rate position of each currency. The forward exchange rate is symbolised here in the following manner (in terms of the dollar and currency i):

$$F_{\$,i}(d)$$

where d is the time interval between the day the contract is signed and the day the actual transaction takes place.

When one unit of a foreign currency i forward price is greater than one unit of the spot price of a domestic currency, the foreign currency is said to be at a discount. Using £ as the domestic currency, this can be expressed as:

$$F_{£,i}(d) < S_{£,i}(0)$$

Conversely, a forward premium arises wherever the domestic currency forward price of one unit of a foreign currency i is greater than the spot exchange rate, expressed symbolically as

$$F_{£,i}(d) > S_{£,i}(0)$$

Forward exchange operations entail the same credit risk as spot transactions but the exchange risk involved is significantly greater. This aspect of forward exchange will be discussed later in another section. The analysis here will continue by examining what determines the forward exchange rate from a market point of view. This will be done in the context of the Interest Rate Parity Theory (IRPT) and the Modern Theory.

2.3.1 Interest Rate Parity Theory (IRPT)

Referring to Brain Kettell[12], the interest parity theory maintains that, in equilibrium, the premium (or discount) on a forward contract for foreign exchange is (approximately) related to

the interest rate differential according to:

$$\frac{F - S}{S} = i - i^*$$

where F and S are the forward and spot exchange rates (the domestic currency price of foreign exchange) respectively; i is the domestic rate of interest; and i* the foreign rate of interest on comparable securities for the same maturity.

The rationale underlying the IRPT is that risk-averse investors are likely to shift funds from one market to another given that there exist interest rate differentials among equivalent risk-class securities and they will do so until rates are bought back into equilibrium. However, if the interest-bearing securities are denominated in different currencies, the investor will be faced with foreign exchange risk that may negate the differential in interest rates which he sought. Usually the investor expects a return in his local currency and hence this will depend on the spot exchange rate prevailing at the time he is prepared to convert his returns to his local currency.

To illustrate, assume that on July 17, 1985 three-month US certificates of deposit were yielding 7½ per cent annually but simultaneously UK certificates of deposits were yielding 12 per cent. The nominal difference of 4½ per cent is expected to attract US investors to the extent that they are prepared to invest their dollar funds in UK certificates of deposits. The pertinent question is

whether the venture will be satisfactory to the investor, given the risk that the spot exchange may be lower or higher in three months. For instance, will an investor who invested US $100,000 in UK certificates of deposits receive his principal plus the anticipated interest. Assume that the spot exchange rate at the time of the investment was $S_{\$,£}(t)$ = $1.41. At this rate, his investment is £70922 and at the interest rate of 12 per cent his expected return is £2152 (3 months).

The concern of the US investor is whether the real rate of interest will be less than the nominal rate of 12%/4 or even lower than what is available domestically (7½%/4). If the dollar price of the pound were to appreciate, conversion of his investment will yield less dollars. Naturally, one would not expect a risk-averse investor to engage his capital in such a venture freely, given the circumstances described above. As Herbert G Grubel[13] describes:

> "Investors, however, are often conservative, and in order for them to be encouraged to lend, there must be a means of removing the investment from the realm of speculation. The market for forward exchange provides such a means: it allows the investor to determine, at the time he initially purchases the sterling, the price at which he can resell it."

To generalise, let $S_{\$,E}(0)$ be the spot exchange rate expressed as the dollar price of one pound sterling prevaling at time t=0; $F_{\$,£}(90)$ be the forward exchange rate for delivery in 90 days; $i_{US}(90)$ and $i_{UK}(90)$ as interest rates on three month US and UK certificates of deposit respectively.

If a US investor has X amount of dollar to invest over a three-month period in US certificates of deposits at an interst rate of $i_{US}(90)$, his return will be

$$\{X \cdot [1+i_{US}(90)]\}_{\$}$$

Alternatively, he could invest in UK certificates of deposit at the prevailing forward exchange rate of $F_{\$,£}(90)$ yielding a return in dollars as follows:

$$\left\{ \frac{X}{S_{\$,£,}(0)} \cdot [1+i_{UK}(90)] \cdot F_{\$,£}(90) \right\}_{\$}$$

The forward contract element of the fomulation makes the investment foreign exchange risk-proof.

If the investor chooses to invest in UK certificates of deposit without covering either the principal or interest earnings against a risk of depreciation of the pound against the dollar, he would have to wait for the maturity of the investment and convert back into dollars at the prevailing spot exchange rate ($S_{\$,£}(90)$. The dollar return will be an unknown quantity as follows:

$$\left\{ \frac{X}{S_{\$,£}(0)} \cdot [1+i_{UK}(90)] \cdot S_{\$,£}(90) \right\}_{\$}$$

The risk-averse investor will be able to compare dollar quantity at time t = 0:

$$X \cdot [1+i_{US}(90)] \gtrless \frac{X}{S_{\$,£}(0)} \cdot [1+i_{UK}(90)] \cdot F_{\$,£}(90)$$

dollar return on US investment

dollar return on covered UK investment

The theory is whichever inequality exist, the US investor will either decide to invest in US securities or UK securities and in doing so forces of demand and supply in both markets will bring both expressions above towards equality. Assuming the following inequality exists:

$$X \cdot [1+i_{US}(90)] < \frac{X}{S_{\$,£}(90)} \cdot [1 \cdot i_{UK}(90)] \cdot F_{\$,F}(90$$

It is expected that arbitrage operations will cause movement of fund from the US money market, putting upward pressure on $i_{US}(90)$, to the UK money market, putting downward pressure on $i_{UK}(90)$. The added demand for spot £ will cause the pound to appreciate in relation to the dollar (higher $S_{\$,£}(0)$) and the added supply of forward sales contracts will depress the forward rate of exchange (lower $F_{\$,£}(90)$) causing equality in the expression as follows:

$$X \cdot [1+i_{US}(90)] = \frac{X}{S_{\$,£}(0)} \cdot [1+i_{UK}(90)] \cdot F_{\$,£}(90)$$

The forward rate of exchange $F_{\$,£}(90)$ in one side of the above equation can be isolated so that the no-profit forward rate of exchange $F_{\$£}(90)^*$ can be derived as a function of $i_{US}(90)$, $i_{UK}(90)$ and $S_{\$,£}(90)$:

$$F_{\$,£}(90) = \frac{1+i_{US}(90)}{1+i_{UK}(90)} \cdot S_{\$,£}(0)$$

The theory purports further that whenever the prevailing forward rate coincides with its equilibrium value, arbitragers will have no incentive to shift their funds from one money market to the other. In practice, the IRPT can be approximated by using the interest rate differential and the implicit interest rate. If it is assumed that $i_{US}(90)$ and $i_{UK}(90)$ are both small fractions, the equilibrium condition of the forward market

$$X \cdot [1+i_{US}(90)] = \frac{X}{S_{\$,£}(0)} \cdot [1+i_{UK}(90)] \cdot F_{\$,£}(90)$$

$$X>0$$

can be approximated as follows:

$$i_{US}(90)-i_{UK}(90) = \frac{F_{\$,£}(90)-S_{\$,£}(90)}{S_{\$,£}(0)}$$

If US and UK interest rates are expressed on a yearly basis, $i_{US}(360)$ and $i_{UK}(360)$, the above equation became

$$\underbrace{i_{US}(360)-i_{UK}(360)}_{\text{interest rates differential}} = \underbrace{\frac{F_{\$,£}(90)-S_{\$,£}(0)}{S_{\$,£}(0)} \cdot \frac{360}{90}}_{\text{implicit interest rate}}$$

A graphical illustration of the IRPT is provided below base on the approximation described above.

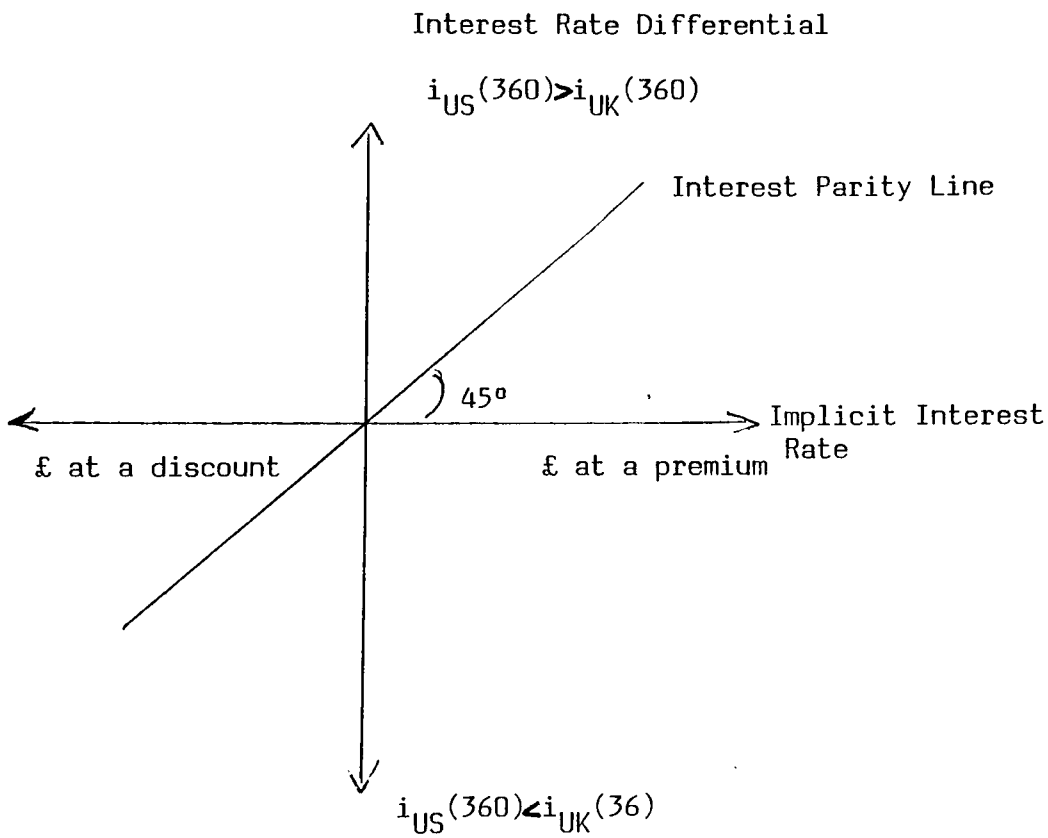


FIGURE 2.10: The Interest Parity Theory

In Figure 2.10. the vertical axis measures the rates differential, $i_{US}(360) \gtrless i_{UK}(360)$, where the positive portion of the axis corresponds to an interest rates differential favouring the US money market vis-a-vis the UK money market with $i_{US}(360)$. The implicit interest rate is measured by the horizontal axis where the positive portion relates to the pound sterling being at a premium as

$$\frac{F_{\$,£}(90)-S_{\$,£}(0)}{S_{\$,£}(0)} \cdot \frac{360}{90} > 0 \Rightarrow F_{\$,£}(90) > S_{\$,F}(0)$$

and vice-versa.

The interest parity line described the equilibrium situations, shown as 45-degree line, which was previously described as the position where arbitragers have no incentive to shift funds from one market to another.

According to Shapiro[14], in reality, the interest parity line is a band, because transaction costs arising from the spread on spot and forward contracts and brokerage fees on security purchases and sales, cause effective yields to be lower than nominal yields. In other words, for interest arbitrage to occur, the covered yield must be at least equal to the transaction costs involved.

Jacque[15] identifies the major critics of the IRPT as follows:

(1) it is difficult to specify short-term interest rate for individual countries without unambiguity as different rates prevail on bank deposits, bank loans, treasury bills, commerical paper, banker's acceptances, etc. This poses a problem of finding a definitive rate of interest which can be applied in the IRPT harmoniously.

(2) increase borrowing normally is faced with corresponding rising interest rates and therefore the marginal interest rate relevant ot actual lenders and borrowers will differ from average interest rate parity recorded in statistical series.

(3) because of the fact that beyond a certain point returns to diversification diminish, arbitragers may not readily respond to substantial covered interest rate differentials. Furthermore, arbitrage funds are limited, coupled with the fact that foreign assets are more risky than domestic assets in regards to inconvertibility and expropriations.

2.3.2 Modern Theory

Brian Kettell[16] states that the modern theory of forward exchange suggest the supply and demand for forward exchange is a function not only of speculation but also covered interest arbitrage, and possibly of net supply or demand from commercial hedgers. Unlike the IRPT which takes into consideration only the activities of arbitragers, it does not ignore the activities of the traders, hedgers and speculators in the forward market. In this section,

the activities of all foreign market participants will be taken into consideration in terms of their relationship as a whole.

2.3.2.1 The Arbitrager

The IRPT postulates that when an equilibrium situation is reached in the forward market, that is, returns in local currency of the domestic investment and foreign covered investment beccome equal, there will be no incentive for arbitragers to move their funds in pursuits of higher return elsewhere. Consequently, no forward contracts would be entered into during that period. Recall this equilibrium condition for a two country situation was expressed as

$$F_{\$,£}(90)^{*} = \frac{1+i_{US}(90)}{1+i_{UK}(90)} \cdot S_{\$,£}(90)$$

Relaxing the equilibrium assumption and assuming instead that arbitrage opportunity exist between the UK and US foreign exchange market depicted symbolically below as

$$1+i_{US}(90) < \frac{1}{S_{\$,£}(0)} \cdot [1 \cdot i_{UK}(90)] \cdot F_{\$,£}(90)$$

when the forward rate exchange factor is isolated, the inequality becomes

$$F_{\$,£}(90) > \frac{1+i_{US}(90)}{1+i_{UK}(90)} \cdot S_{\$,£}(90)$$

This equation conveniently shows that when the existing forward rate is greater than the "no-profit" situation, that is,

$$F_{\$,£}(90) > F_{\$,£}(90)^*$$

funds will be shifted from the domestic to the foreign country (from the UK to the USA) and thus forward exchange contracts will ensue.

A further assumption is that the stock of arbitrager forward commitments, $K_a(90)$, can be expressed as a simple linear, homogeneous function of profits:

$$K_a(90) = C \quad [F_{\$,£}(90) - F_{\$,£}(90)^*] \qquad \text{with } c > 0$$

where the superscript "a" denotes arbitragers, can assist to show graphically the arbitrage schedule. As Stoll[17] explains, the size of the coefficient and the factors determining the value of "c" depends on the amount of risk attached to the arbitrage operations and the degree of risk aversion on the part of arbitragers. It is only larger expected returns that could induce larger forward commitments, given that risk aversion exists.

If the reverse of the relationship described above exists, that is,

$$F_{\$,£}(90) < F_{\$,£}(90)^*$$

then, it is expected that funds will flow from the foreign country to the domestic market. Arbitragers will enter into forward contracts of the pound.

Generalising, when

$K_a(90) > 0$ forward sales of £ exist

$K_a(90) < 0$ forward purchase of £ exist

Figure 2.11 shows graphically the arbitrage schedule.

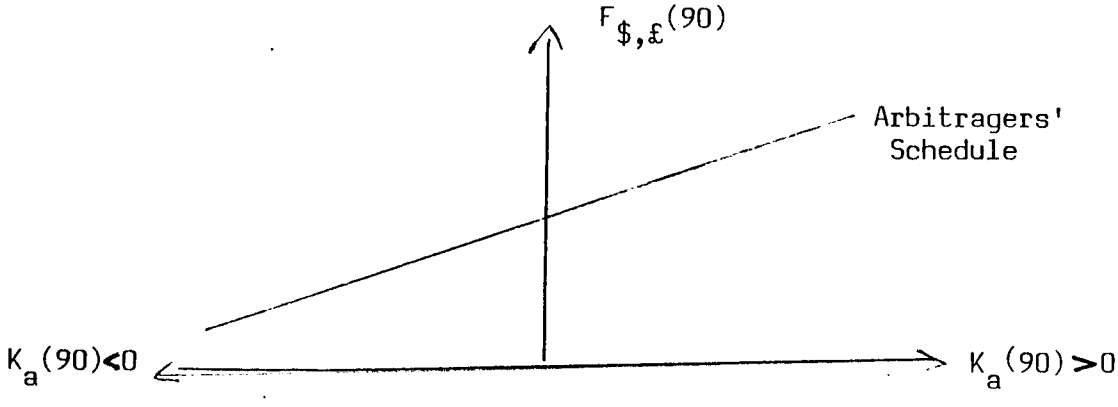


FIGURE 2.11: The Arbitragers' Schedule

The key point about the arbitragers' schedule, according to Stoll[18] is that its slope is determined by the risk of default and the degree of arbitrager risk aversion and thus arbitragers will hedge themselves against any chance of profit or loss on a fluctuation of the exchange rate.

2.3.2.2 The Speculator

The objective of the speculator is to profit from the fluctuation in the exchange rate. He can be regarded as a deliberate risk-taker whose estimation of the future spot exchange differs from the overall market expectations and accordingly seeks to capitalise on that open position.

To illustrate, assume, a two currency situation (£,$) where the speculator's expectation is that the future spot rate $S_{\$,£}(90)$ will be greater than the prevailing forward exchange rate $F_{\$,£}(90)$. With such expectation, the speculator will purchase pounds forward. If

$$S_{\$,£}(90) > F_{\$,£}(90)$$

as expected, then the speculator will gain the differential $S_{\$,£}(90)-F_{\$,£}(90)$ per pound sterling bought forward. If his expectation was incorrect, that is,

$$S_{\$,£}(90) < F_{\$,£}(90)$$

then his loss would be the differential $F_{\$,£}(90)-S_{\$,£}(90)$ per pound sterling bought forward.

In summary, it can be taken for granted that speculators will buy pounds 90 days forward if their expectation of the future spot rate (90 days) is greater than the prevailing forward exchange rate, symbolically expressed as follows:

$$E[S_{\$,£}(90)] > F_{\$,£}(90)$$

Likewise, if $E[S_{\$,£}(90)] < F_{\$,£}(90)$ prevails, then speculators will sell pounds 90 days forward.

It is is assumed that forward exchange commitments of speculators $K_s(90)$ can be expressed as a simple linear homogenous function of the profit expected:

$$K_s(90) = d \quad F_{\$,£}(90) - E[S_{\$,£}(90)] \quad \text{with } d > 0$$

where the superscript "s" designates speculators, with the following conventions:

$K_s(90) > 0$: speculators sell forward pounds

$K_s(90) < 0$: speculators purchase 90-day forward pounds.

then the speculator's schedule can be drawn as follows:

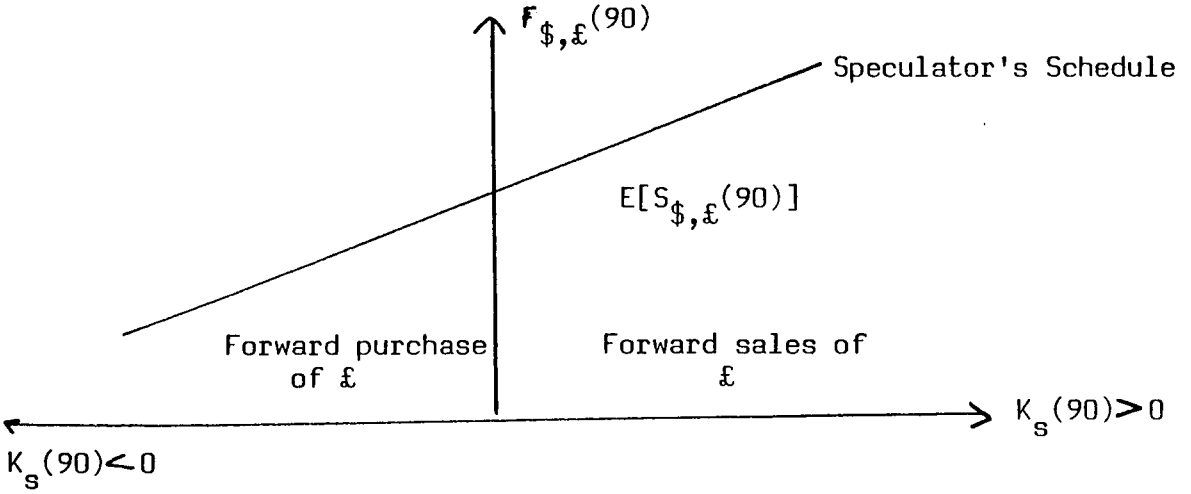


FIGURE 2.12: The Speculator's Schedule.

The degree of risk aversion of speculators and confidence in expectation will determine the size of the coefficient "d".

2.3.2.3 Traders and Hedgers

According to Stoll[19], the roll of current trade in the forward exchange market is similar to arbitragers and speculators. If a trader protects himself against adverse exchange fluctuation by selling or buying forward, he is an arbitrager. If he does nothing, he is a speculator. The role of traders and hedgers will be discussed in greater detail under managing exposure to exchange risk.

Using Stoll's[19] definition, the equilibrium rate is

> "the rate at which the buy (sell) commitments that arbitragers desire to hold equals the sell (buy) commitments that speculators desire to hold. No new forward commitments will be undertaken from one period to the next unless there is a change in $S_{\$,£}(90)$, $F_{\$,£}(90)$, or the extent of and/or attitude towards risks. Since forward commitments of arbitragers are always offset by spot commitment of the opposite sign, there will be no current flow of short-term capital either. The equilibrium position, in short, is one in which both speculators and arbitragers have acquired the amount of forward commitments balancing risk and return, that takes them to their highest risk-return utility function with respect to all assets."

Accordingly, the equilibrium forward rate condition can be expressed as

$$K_{a+t+h}(90) = -K_s(90)$$

where $K_{a,t,h,s}(90) > 0$ refers to a 90 day forward sale of £.

and $K_{a,t,h,s}(90) < 0$ refers to a 90 day forward purchase of £.

Diverting slightly, the individual functions of arbitragers, traders, hedgers and speculators can be aggregated as follows:

$$K_{a,t,h,s}(90) = K_a(90)+K_t(90)+K_h(90)+K_s(90)$$

$$= C' \cdot [S_{\$,£}(90)-F_{\$,£}(()*]$$

The coefficient C' is obtained through summing horizontally the individual schedules of owner-arbitragers, borrower-arbitragers, trader-arbitragers, and hedger-arbitragers resulting in an aggregate arbitragers schedule that is less sloped than each of its individual component and intersects the vertical axis at a no-profit forward rate of exchange. This reflects, in a weighted average sense, the slightly different no-profit forward rates of exchange faced by each class of arbitragers.

In regards to the equilibrium condition, Jacque points out that because both the stock of forward contracts entered into by arbitragers-traders-hedgers ($K_{a+t+h}(90)$) and by speculators, ($K_s(90)$) are functionally related to the forward exchange rate, it is possible to derive its equilibrium value from

$$K_{a+t+h}(90) = -k_s(90)$$

by substituting as follows

$$C'[F_{\$,£}(90)-F_{\$,£}(90)^*] = -d \quad F_{\$,£}(90)-E[S_{\$,£}(90)]$$

Isolating $F_{\$,£}(90)$, the result is

$$F_{\$,£}(90) = \frac{C'}{C'+d} \cdot F_{\$,£}(90)^* + \frac{d}{C+d} \cdot E[S_{\$,£}(90)]$$

Thus, the equilibrium forward rate can be regarded as a weighted average of the "no-profit" forward rate exchange, $F_{\$,£}(90)^*$ and is shown in the diagram below.

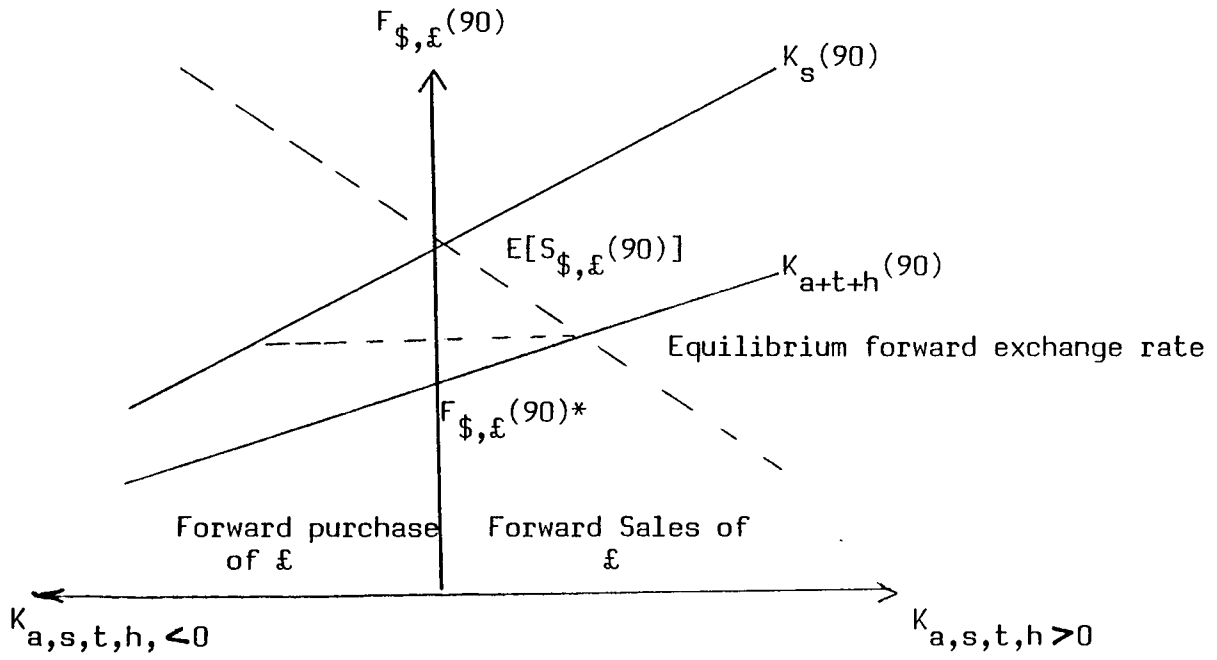


FIGURE 2.13: Equilibrium Forward Exchange Rate.

In Figure 2.12, arbitragers are selling $K_{a+t+h}(90)$, investing in UK interest-bearing securities and selling forward £ (principal and interest) against dollars along with traders and hedgers. Speculators are purchasing forward $K_s(90)$ in anticipation of an

appreciation of the dollar price of £ to $E[S_{\$,£}(90)]$. The expectation of the speculators emanates from the upward pressures on the dollar price of the £ created by arbitragers, that is, owner and borrower arbitragers are buying spot £.

2.4 Conclusion.

The objective of this chapter is to highlight the developmental stages of the international money system and the determinants of foreign exchange rates, in particular, spot exchange rate and forward exchange rate.

The foreign market acts, more or less, as an intermediary between international business. The crucial factor is the confidence of participants in the value of a foreign currency. When this confidence is undermined, international trade is hampered and this can seriously affect economic development as a whole. Therefore, in efforts to bolster the confidence of traders, various monetary systems have been tried from an international point of view. The success of these systems have been limited, thus encouraging major currency countries to pursue unilateral monetary policy suitable to their economic development.

The present system of floating exchange rate, where currencies are allowed to find their own value against other currencies, is thought to be the main source of foreign exchange fluctuation. This fluctuation is caused mainly by the interaction of the forces of demand for and supply of foreign currency. Some countries attempt to stave off the full effects of currency exchange

fluctuation by manipulating demand for and supply of foreign exchange in the short term.

The international community is aware of the implications of the unstable monetary system for international trade. The importance attached to this phenomenon vary from country to country depending on domestic preferences and priorities. At present, there are no definite rules to enhance optimal economic operation of the foreign exchange market although the willingness exists among countries for monetary cooperation.

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CHAPTER THREE

THE RELEVANCE OF FOREIGN EXCHANGE RISK MANAGEMENT

3.1 Introduction

This chapter will attempt to establish whether there is a need for foreign exchange risk management. In this regard, the nature of foreign exchange risk will be explained. Then the arguments whether or not a firm should engage in activities aimed at hedging against foreign exchange rate fluctuation will be considered.

The basic assumption here is that the firm wishes to maximise its market value at all times. Likewise, the investors are risk-averse and therefore seek compensation proportionate to the level of risk undertaken.

The scenario is that many firms, by their calculations, have found that currency devaluation or revaluation has decreased or increased their cash flow to a level much less than expectations. As a result of this phenomenon, firms naturally have adapted defensive measures to avert adverse effects on their resources. However, there are arguments which purport that these defensive measures are useless based on the logic of certain financial economic theories. On the contrary, there are others which project that the arguments opposing hedging are based on unrealistic assumptions to some extent and, thus in a real world situation

hedging is desirable. The purpose of this chapter is to highlight these arguments and their implications for international business.

3.2 Foreign Exchange Risk - A Definition

The fluctuation of major currencies against each other in one form or another, as explained in Chapter Two, is the predominant cause of foreign exchange risks. This volatality in the foreign exchange market causes problems for international trade in the sense that apart from the usually associated business risk, such as, government interventions, unfamilarity in an alien environment, etc., the risk of unanticipated change in the exchange rate could affect the profitability of operations with far reaching effects on the business entity.

Jilling[1] refers to exchange risk as:

> "the possibility of loss (or gain) resulting from a change in the rate of conversion of one currency with another. For purpose of financial reporting, it exists whenever a company has either assets or liabilities expressed in a foreign currency or when transactions are conducted in more than one country."

For instance, in a multinational transaction, an importer who is invoiced in a supplier's currency is exposed to exchange risk. Likewise, if the importer's currency is used then the exposure of risk is shifted to the supplier. In fact, the risk element emanates from the probability that the exchange rate fluctuations could

produce adverse effects on the cash flow of a firm.

Basically, foreign exchange rate fluctuation expose dealers in international trade to at least one of these two categories of risk:

(i) those due to transaction effects which relates to exposure in foreign currency (gains or losses) from the date that a transaction is initiated to the date of settlement.

(ii) those due to translation effects, that is, subsequent adjustments of the unsettled portion of transactions (the amount owed by or to the trader) to reflect the current rate at balance sheet date between the transaction date and the settlement date.

The multinational corporation (MNC) is affected by both categories. A full discussion of these types of risk will be undertaken in Chapter Four.

3.3 Does Exchange Risk Matter?

There are questions which have been raised in regards to the relevance of foreign exchange risk management. The question of whether the market value of the firm is increased by this exercise is pertinent. Dufey and Srinivasula[2] summarise the arguments against hedging for this category of risk as follows:

> "Foreign exchange risk does not exist; even if it exists, it need not be hedged; even if it is to be hedged, corporations need not hedge it."

In this regards, Wihlborg[3] asserts that it cannot be ruled out that efforts geared towards exposure management is a waste. Usually wide fluctuations in exchange rates occur simultaneously with relatively high and different inflation in most countries and thus changes in the value (purchasing power) of one money relative to the value of another will sooner or later reflect in the exchange rate. Because exchange rate is regarded in nominal price, for instance, the amount of pounds sterling per dollar, as against the real price, for example, quantity of English goods per unit of American goods, it implies that the real significance of the exchange rate should not be beyond showing that countries have different inflation rates. In this light, exchange rate fluctuation, considered alone, does not necessarily add to the risks which the MNC is exposed to.

McRae and Walker[4] believe that the rationale for the view that foreign exchange risk is irrelevant to the operation of the MNC is based on two economic theorems:

(i) the interest rate theory of exchange rate expectations (the Fisher effect)

(ii) the purchasing power parity (PPP) theory.

Both theorems are based on arbitrage, i.e. commodity arbitrage in regards to the PPP theory and covered interest arbitrage in regards

to the Fisher effect. The arguments along these lines will be explored here. Also, the implications of the Miller and Modigliani theory and the capital asset pricing model for exchange risk management will be examined.

3.3.2 The Interest Rate Theory of Exchange Rate Expectations (The Fisher Effect)

The interest rate theory of exchange rate expectation states for any pair of countries the interest rate differential must equal the forward rate differential (premium or discount), otherwise riskless arbitrage will take place[5]. Consequently, any exchange loss or gain would eventually be offset by an interest rate advantage or disadvantage given a sufficient length of time and thus it would not matter in which currency the firm borrowed or loaned funds. See section 2.3.1 of Chapter Two for more detailed discussion on the nature of the Fisher Effect.

Logue and Oldfield[6] used a Hamada model of firm valuation to demonstrate that hedging for foreign exchange risk is irrelevant given that interest rate parity conditions exist. The demonstration is reviewed here. It is done in relation to a multinational operation under the assumption of market efficiency.

Assuming a US MNC is expected to obtain a constant perpetual cash flow stream from its foreign subsidiary denoted by $E(CF_t)$, the market value expressed as the present value of the certainty equivalent net cash flow generated for the parent company is denoted as follows:

$$E(CF_j) = (1/R_f)E[X_j - k\ Cov(X_j,X_m)]$$

where $E(CF_j)$ = market value of subsidiary;

R_f = risk-free rate of interest (US);

X_j = subsidiary's net income after taxes;

k = market price per unit of risk;

$Cov(X_j,X_m)$ = $W_k\ Cov(X_j,X_k)$, the covariance between the subsidiary's X_j and the X_j of all in the market weighted by W_k, the proportionate value of the k^{th} firm.

It is also assumed that market values can be determined internationally because there are sufficient capital movements between countries. Using the values used by Logue and Oldfield, at period 0 the net income after taxes of the subsidiary is 2.5 dollars when the spot exchange rate, $S_{£,\$}(0) = 2_j$ at period 1, the $S_{£,\$}(1) = 1$ and so adjusted net income after taxes of the subsidiary becomes 7.5 dollars. The value of k is 0.41 (Solnick's suggestions); $Cov(X_j,X_m)$ is equal 3.05; and R_f is 0.05.

Given that pre-devaluation conditions exist, the value of the subsidiary at $_j = 0$ is

$$E(CF_j) = (1/0.05)E[(2.5)-(0.41)(3.05)] = 25$$

After the devaluation, $_j = 1$. The market value is

$$E(CF_j) = (1/0.05)E[(7.5)-(0.41)(3.05)] = 125$$

The model therefore demonstrates that exchange rate fluctuations affect the income stream of the MNC.

The firm may wish to protect its after-tax profits from exchange fluctuations and this can be achieved by purchasing forward contracts to offset effects of changes in spot rates. This position can be written as

$$E(CF_j) = (1/R_f)E[X_i^t-(1/-dF/dS)(NFP)$$
$$(1-T)(F_o-F_t)-k\ Cov(X_j,X_m)]$$

where F_o = dollar per pound initial forward exchange rate;

F_t = dollar per pound forward exchange rate at time t;

dF/dS = the change in the forward rate induced by a change in the spot rate;

NFP = nominal revenues minus nominal expenses;

T = foreign corporate tax rate.

The volume of contracts to write is indicated by the factor $(-1/dF/dS)(NFP)(1-T)$. The term $(NFP)(1-T)$ covers the flow equivalent of leverage and forward rate changes are insulated with the term $(-1/dF/dS)$.

From the interest rate parity theorem, it is known that $F = S\ exp(R_f-R_B)$ for a period forward rate where R_f and R_B are the domestic and foreign risk-free rates of interest respectively. This means that $dF/dS = exp(R_f-R_B)$. Therefore, $(1+R_f-R_B)$ approximately equals a change in the forward rate induced by a change in

the spot currency rate. If for simplicity, it is assumed that $R_f = R_B$, then $dF/dS = 1$. Given the above characteristics, the operation of the hedging model at the intial time (when the forward position is established) give

$$E(CF_j) = (1/0.05)E[2.5-(-1)(-10)(0.05)(2-2)-(0.41)(3.05)] = 25$$

$$F_o = F_t = 2$$
$$j = 0$$

when the dollar value of the pound falls, the net position is

$$E(CF_j) = (1/0.05)E[7.5-(-1)(-10)(0.05)(2-1)-(0.41)(3.05)] = 25$$

The inference from the model is that the forward position insulates the subsidiary's value from exchange risk. Thus gains in spot earnings are exactly offset by losses in the forward contracts and vice versa which, in effect, makes the operation of the foreign subsidiary equivalent to a domestic operation. In summary, hedging provides no gains because the firm's market value is not altered.

Logue and Oldfield recognised that there are over simplifications in their analysis:

(i) that all prices move together implying that revenue and cost items are linearly related in value. Logue, Sweeney and Willett[7] in an unpublished study showed that the greater the inflation rate, the greater the dispersion in relative prices.

(ii) that the firm's creditors are not concerned with the total variability of returns from the operations. They usually are concerned with total variability of cash flows where default is possible. Thus random exchange rate fluctuation may have an effect on debt capacity.

Logue and Oldfield conclude that floating exchange rates do not provide a rationale for hedging, given an efficient foreign exchange market, where currency prices reflect all relevant economic information.

Giddy[8] argues that exchange rates frequently change more or less sharply than what is expected in the basis of interest rate differentials because of unexpected events although it is generally accepted that inflation rate, interest rate, and exchange rate tend to be strongly associated. Giddy's exploration of whether the Fisher effect provides good approximations for the purpose of exchange risk valuation is reviewed below.

Recall that the Fisher effect holds that the interest rate differential equals the anticipated rate of change of the exchange rate. Thus, if the two relationships are perfectly true, then a linear relationship would exist as depicted by the International Fisher Effect Line in Figure 3.1, overleaf.

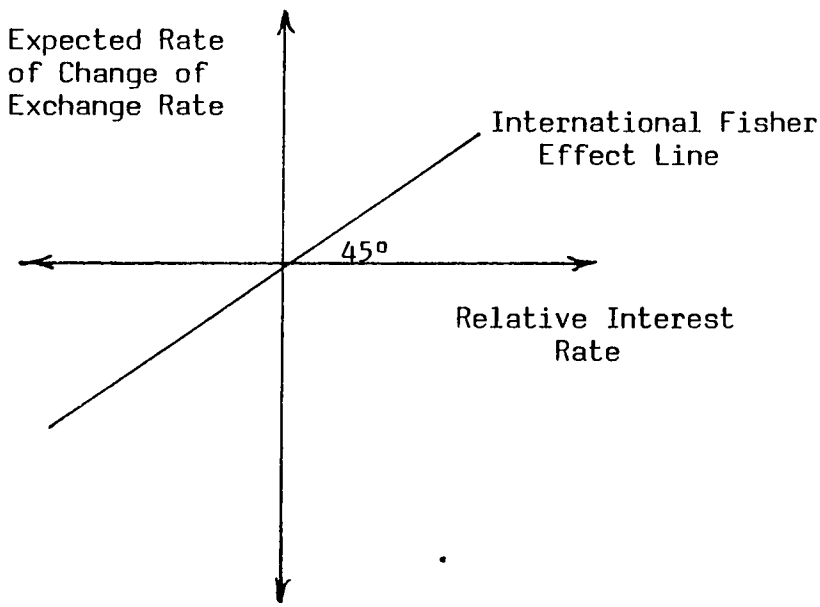


FIGURE 3.1: The International Fisher Effect Line.

The Fisher effect can be tested by plotting the market expected rate of change of the exchange rate against the relative interest rates assuming that the market's expectations are not biased and that the actual exchange rate changes provide the best estimation for the expected ones. The proposition tested was whether the rate of change of the exchange rate,

$$\frac{X_{t+1}-X_t}{X_t}$$

equals the relative interest rates, measured as

$$\frac{1+R_t^D}{1+R_t^F} - 1$$

where X_t is the spot exchange rate at time t (in domestic units per foreign currency unit); R_t^D is the one-period domestic interest rate at time t; and R_t^F is the corresponding foreign interest rate. Figure 3.2(a,b,c) shows the relative ex ante interest rates plotted against ex post exchange rate changes for periods of three months, twelve months, and three years respectively.

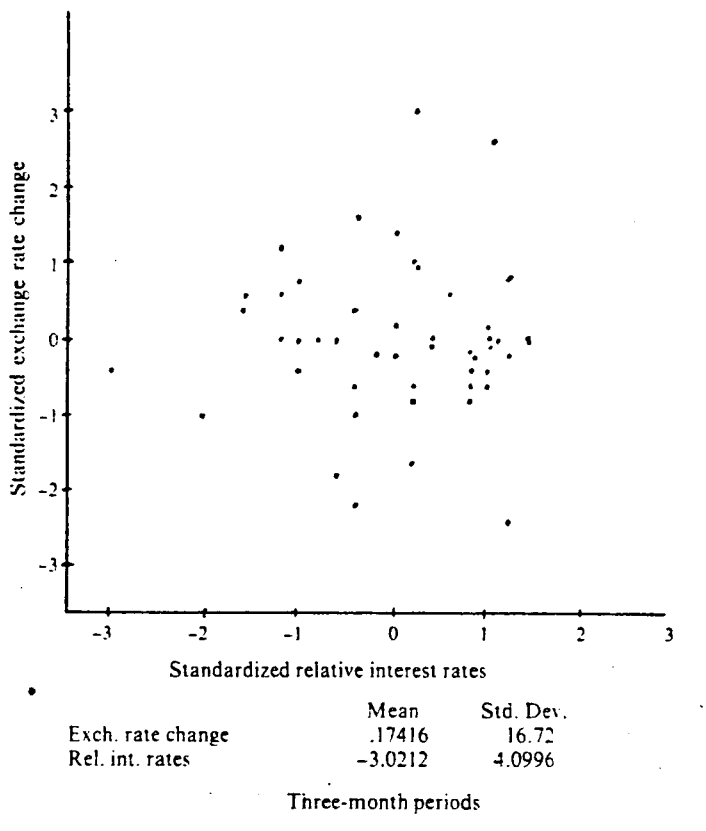
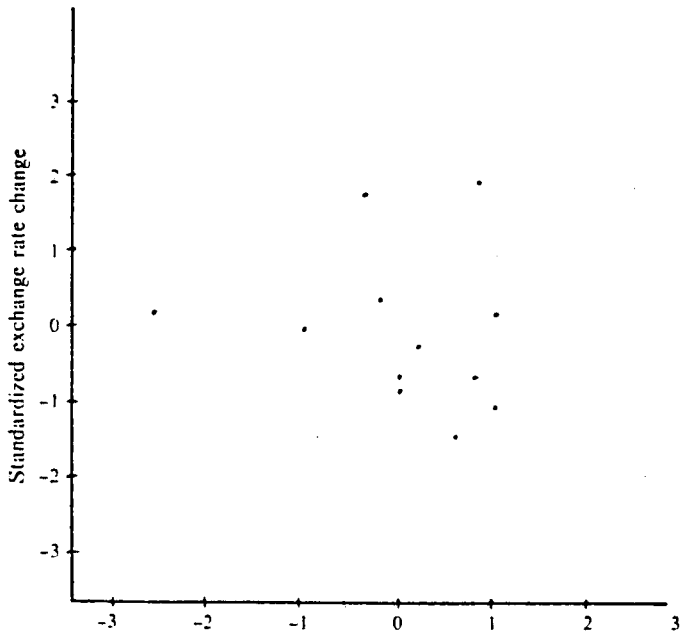


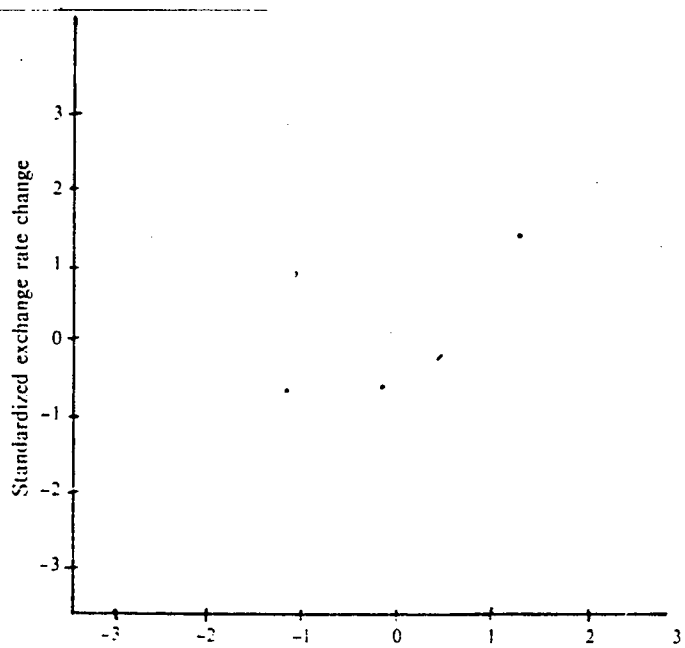
FIGURE 3.2(a): Interest Rates & Exchange Rate Change (Data expressed as annual percentage rates of change).



	Mean	Std. Dev.
Exch. rate change	.381667	11.16
Rel. int. rates	-2.23417	4.14

One-year periods

FIGURE 3.2(b): Interest Rates & Exchange Rate Change (Data expressed as annual percentage rates of change).



	Mean	Std. Dev.
Exch. rate change	-.07000	5.03
Rel. int. rates	-2.6425	2.97

Three-year period

FIGURE 3.2(c): Interst Rates & Exchange Rate Change (Data expressed as annual percentage rates of change).

Figure 3.2(a) indicates a plot of the above relationship calculated for 12 three-month periods, July 1972 through June 1975 for each of four countries: Canada, Britain, France and Italy. Data was obtained from International Financial Statistics (exchange rates) and the Harris Bank (Euro-currency interest rates).

From the results of Figure 3.2, it can be seen that the Fisher Effect did not hold especially in the short-term (three and twelve months periods) although the three-year period showed a greater concentration around the 45 degree line for the longer period. In summary, the shorter the period, the more diverse are the correlation coefficients, although the relationship held more closely in longer time frame.

Like the purchase power parity which will be discussed in the next section, some writers believe that even if substantial deviations from the Fisher effect occur for periods, this effect will be cancelled out in the long run through adjustment in interest rate inflation ratio and exchange rate changes induced by market efficiency. The reasoning behind this thought is that while government intervention and transactions cost may cause short run deviations from the Fisher Effect, market forces will react to capitalise on profit incentives and so, such deviations will be small and will not exist for long. Thus positive deviations will cancel out negative ones in the long runs. [Gaillott(9)].

Giddy tested further the hypothesis described in the above paragraph covering a 24 year time span. The average annualised

deviations from the Fisher Effect for periods of length one year, two years, three years and so forth up to 24 years, is shown in Table 3.1, using Canada, Britain, France and Italy again.

The calculation for the average annualised deviations for the Fisher Effect was

$$\text{Average annualised percentage deviation} = \left(\sqrt[n]{\left(\frac{1+R_t^D}{1+R_t^F}\right)^n \Big/ \frac{X_{t+n}}{X_t}} - 1 \right) \times 100$$

where X_t = the spot exchange rate in domestic currency;

R_t^D = the domestic interest rate expressed as a decimal fraction;

R_t^F = the corresponding foreign interest rate j;

n = the length of the period considered (n = 1 to 24 years).

Data for the calculation was obtained from various issues of international Financial Statistics. The interest rates were long-term bond yields prevailing at the start of the period while the exchange rates were end-of-previous-period data.

The annualised deviations were obtained by averaging all available periods for each time span, for instance, 24 periods in the case of one-year maturities. These averages were in turn averaged across all countries and the across country standard errors of the means calculated in the following manner. Let $\underline{A}_j$

TABLE 3.1: Average Annualised Deviation from Fisher Effect and Purchasing Power Parity, 1971-1975.

Length of Periods Periods	Sample Size Size	Deviations from Fisher Effect		Deviations from Purchasing Power Parity	
		Av Dev.	Std. Error	Av. Dev.	Std. Error
1	24	-.0103	.0043	-.0009	.0023
2	23	-.0104	.0034	-.0003	.0024
3	22	-.0105	.0028	-.0025	.0029
4	21	-.0108	.0025	-.0022	.0026
5	20	-.0100	.0021	-.0021	.0023
6	19	-.0099	.0098	-.0016	.0020
7	18	-.0098	.0015	-.0013	.0018
8	17	-.0094	.0014	-.0015	.0015
9	16	-.0097	.0013	-.0016	.0013
10	15	-.0099	.0013	-.0020	.0012
11	14	-.0100	.0011	-.0024	.0012
12	13	-.0103	.0011	-.0027	.0012
13	12	-.0106	.0012	-.0027	.0013
14	11	-.0108	.0013	-.0024	.0013
15	10	-.0113	.0014	-.0020	.0013
16	9	-.0123	.0013	-.0017	.0014
17	8	-.0123	.0011	-.0015	.0013
18	7	-.0127	.0007	-.0014	.0011
19	6	-.0131	.0006	-.0018	.0009
20	5	-.0136	.0007	-.0023	.0010
21	4	-.0140	.0009	-.0025	.0008
22	3	-.0151	.0014	-.0028	.0006
23	2	-.0166	.0019	-.0033	.0011
24	1	---	---	-.0020	---

be the average deviation for the i^{th} country. Then $A + A_j/k$ is the across-country average deviation for k countries. The A_j's are random variables whose variances can be estimated independently. The formulation for the standard error of the mean was:

$$[\text{Var}(a)]^{\frac{1}{2}} = [\text{Var}(\Sigma A_j/k)]^{\frac{1}{2}} = [\frac{1}{k^2}\text{Var}(\Sigma A_j)]^{\frac{1}{2}}$$

$$= \frac{1}{k}[\Sigma \text{Var}(A_j)]^{\frac{1}{2}}$$

assuming A_j to be independent.

Because the periods overlap, the standard errors were biased downwards for $n \geq 2$.

The result of the test showed that the average deviations from the Fisher Effect did not appear to cancel out with the length of the period, thus, emphasising that the exchange rate changes for long as well as short periods are larger than would be expected from interest rate differences. The indication was that the deviations are significantly different from zero at the 5% significance level, since most of the averages fall outside the 2 standard error (95%) confidence limits.

Recognition should be given to the fact that the tests previously discussed in this section are subject to error and thus some of the problems may arise out of inaccurate estimation. For example, the deviations from the Fisher Effect may arise from errors in

expectations rather than from interest rates incorrectly reflecting those expectations. Likewise, the results of long-term maturities beyond, say, fifty years, should not be emphasised since the sample size was too small.

For the MNC and other business with international involvements, the preliminary verdict is that there are systematic and persistent deviations from international Fisher Effect for long periods as well as short ones although they are uniformly small (close to 1% per annum). From an economic point of view, the results suggest exchange rate changes can be approximately estimated by interest rate differentials unbiasedly regardless of temporary deviations from the interest rate parity theory. Thus this theory can serve as a standard for measuring the value of special opportunities provided by the foreign exchange market.

3.3.3 Purchasing Power Parity Theory (PPP)

The PPP theory holds that given an equilibrium condition in the spot exchange market between two countries, any change in the differential rate of inflation between them tends to be offset in the long-run by an equal but opposite change in the spot exchange rate. Accordingly, the currency which the firm chooses to buy its inputs or to which to sell its product is irrelevant given that any appreciation or depreciation of a foreign currency will somehow be offset by a corresponding higher or lower rate of inflation in that currency. Figure 3.2, overleaf, illustrates the general concept of the PPP theory.

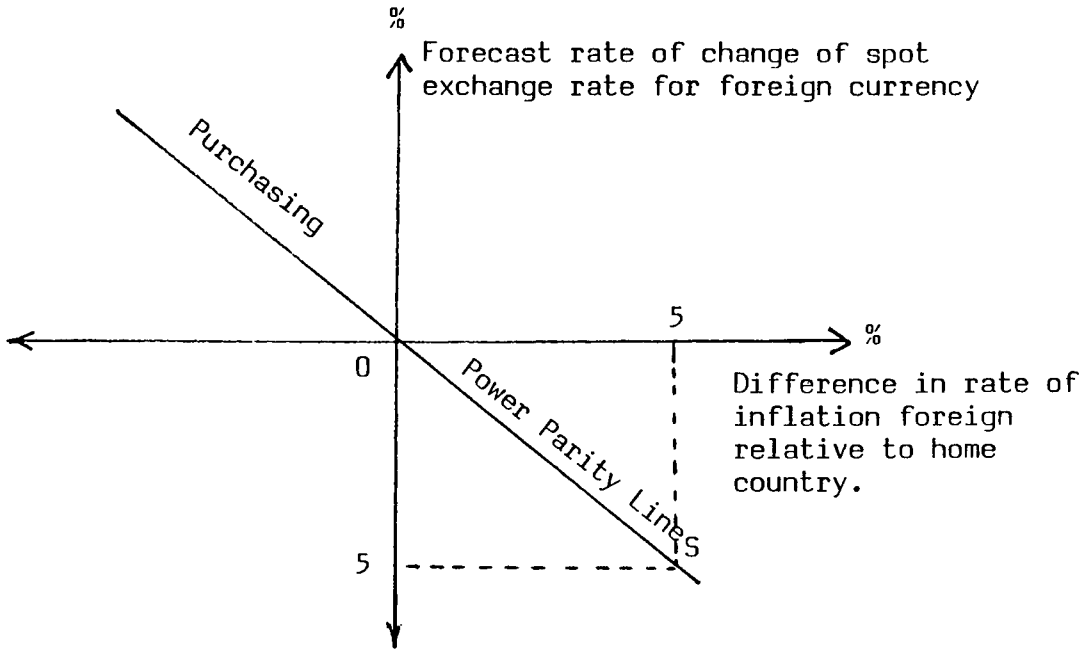


FIGURE 3.3: Purchasing Power Parity Line.

In Figure 3.3, the percentage of appreciation or depreciation of the foreign currency is shown by the vertical axis and the horizontal axis shows the percentage higher or lower rate of inflation in the foreign currency relative to the home country. The equilibrium position between a change in the exchange rate and relative inflation rates is shown by the diagonal parity line. Point S demonstrates an instance where a 5% higher inflation rate in the UK is offset by a 5% depreciation in the spot exchange rate of UK pounds for US dollars. The underlying thought is that if the ratio of exchange for a US commodity and UK commodity is one to two, that ratio will remain unchanged regardless of whether the currency of each country fluctuates or not during the period in question. The UK exporter or the US importer will not be affected by the depreciation of the pound because the change in nominal

price of the local currency will be offset by the change in exchange rate.

One proponent of the typical argument that fluctuating exchange rate per se do not introduce a new element of risk into corporate management is Bradford Cornell[10]. In fact he believes that the fund spent mananging foreign exchange could be more productively employed in almost all cases. The basis of Cornell's proposal is reproduced below.

The main thesis of Cornell's proposal is that the impact of a change in price level or in relative prices is often attributed to a change in the exchange rate since relative prices, the price level, and exchange rates are all inter-related. His arguments are projected from two angles; (i) changes in relative price and (ii) changes in the general price level.

3.3.3.1 The Price Level and the Exchange Rate

To begin with, it is assumed that the price relative of a country i can be measured without ambiguity and this is denoted by P_i. Assume further that the price of an individual commodity is the same in all countries (i.e. the law of one price hold). Given the conditions described above, then the PPP will hold at every instant so that

$$X_{ij} = \frac{P_i}{P_j}$$

where X_{ij} = exchange rate between countries i and j.

If the profit function of the firm is given by

$$\pi.P_i = S.P_i - V.P_i$$

where S is the real sales (independent of P_i) j and V are the real variable costs (independent of P_i), then the firm does not have to worry about real business real when there is no relative price changes. The real profits of the firm is independent of P_i since

$$\pi = \frac{\pi \cdot P_i}{P_i} = S-V$$

Even if the firm was a foreign subsidiary repatriating all profits, leaving profits unchanged, the result for real profits would be, after necessary adjustments such as inflation

$$\frac{\pi \cdot P_j \cdot X_{ij}}{P_i} = \frac{\pi \cdot P_j}{P_i} \cdot \frac{P_i}{P_j} = \pi$$

The PPP condition assures that the movement of the exchange rate exactly cancels price level variation in the two countries leaving real profits unchanged.

Recognising that the analysis as described above will not be true if the firm enters into contracts fixed in nominal terms, Cornell introduced a constant in the profit function of the firm which is an assumption that effects of such contracts will be of a

perpetual nature. Thus, the nominal profit function becomes

$$\pi \cdot P_i = S \cdot P_i - V \cdot P_i - d$$

where d is the fixed payment in perpetuity. When divided by P_i, the real profits will depend on the realised rate of inflation, depicted as follows

$$\pi = S - V - \frac{d}{P_i}$$

Extending the analysis to a foreign subsidiary again, assuming profits are repatriated, the result is as follows:

$$\pi = \frac{\pi \cdot P_j \cdot X_{ij}}{P_j} = \frac{S \cdot P_j \, X_{ij}}{P_i} - \frac{VP_j \cdot X_{ij}}{P_i} - \frac{d \cdot X_{ij}}{P_i}$$

Using the PPP relationship, the equation can be restated as:

$$\pi = \frac{S \, P_j}{P_i} \cdot \frac{P_i}{P_j} - \frac{VP_j}{P_i} \cdot \frac{P_i}{P_j} - \frac{d}{P_i} \cdot \frac{P_i}{P_j}$$

Simplifying

$$\pi = S - V - \frac{d}{P_j}$$

The intuitive appeal of the above equation is that for a subsidiary operating overseas, inflation risk surfaces because of alteration in the value of fixed contracts due to unexpected changes in the foreign price. In the case of a domestic firm, the relevant factor is the unexpected changes in the domestic price level.

Cornell thought that the effects of inflation can be erroneously attributed to the exchange rate. To clear this error, a further assumption was that P_j is approximately equal to one ($P \equiv 1$) so that there is no inflation in the home country. In this regard, the equation

$$\pi = \frac{\pi \cdot P_j X_{ij}}{P_j} = \frac{S \cdot P_j \cdot X_{ij}}{P_i} - \frac{VP_j \cdot X_{ij}}{P_i} - \frac{d \cdot X_{ij}}{P_i}$$

becomes

$$\pi = S - V - d \cdot X_{ij}$$

implying that the fixed commitments are exposed to foreign exchange risk. This exchange risk is due to uncertainty arising out of the foreign price level.

The conclusion drawn from the analysis as described above is that variations in the level of prices and accompanying movements in the exchange rate need not concern the corporate manager since real profits are independent of the firm's location and the rate of inflation, given the assumption that relative prices are

constant and the law of one price holds. Thus, in general, the only parity conditions that matter are those based on arbitrage with special reference to interest rate parity and the law of one price.

3.3.3.2 Relative Price Changes and the Exchange Rate

Cornell used an example from Solnik[11] to illustrate that relative price changes can produce exchange rate fluctuations under the assumption that the law of one price holds and no inflation exists. This example is reproduced below.

Imagine that only two goods, wine and sake, are traded between Japan and France for time period t equal 0 and 1. In period 0, the relative price is one litre of wine per litre of sake, and the exchange rate is one French franc per Japanese yen. The Japanese are consuming a basket of 9 litres of sake and 1 litre of wine while the French are consuming 9 litres of wine and one litre of sake, given the existing relative price. Because of a shortfall in production of wine in period one, the relative price changed to 1.5 litres of sake per litre of wine. The change in the consumption basket is 8 litres and 1½ litres for the French and 9½ litres of sake and $\frac{1}{3}$ litre of wine for the Japanese. With inflation held to zero in both countries, the new exchange rate can be solved as in Table 3.2 overleaf.

TABLE 3.2: Relative Price Changes and Exchange Rates.

	France				Japan			
	Period 0		Period 1		Period 0		Period 1	
	Price (FF)	Consumption	Price (FF)	Consumption	Price (y)	Consumption	Price (y)	Consumption
Wine	1	9	1.11*	8.0	1	1	1.5	$\frac{1}{3}$
Sake	1	1	0.79	1.5	1	9	1.0	$9\frac{1}{2}$
Cost of Basket		10		10		10		

Fix Exchange (FF/Y)**

Period 0	Period
1	.741

* Prices are derived from relative price data and zero inflation condition.

** Exchange rate is ratio of prices for each good, since law of one price holds.

It can be observed in Table 3.2 that the value of the yen has depreciated from 1FF to .741FF because the cost of the French consumption bundle has risen compared to the Japanese basket in real terms and thus the value of the Japanese yen must depreciate in relation to the French franc given zero inflation in both countries. Thus, variations in relative price implies the PPP does not hold and therefore significant deviations are expected in the short term. Also, the exchange rate effect occurs because individuals in the two countries concluded that relative price changes are responsible for the bulk of monthly variations in exchange rate except for countries like Brazil, Argentina and Chile which have abnormally high inflation rates.

Cornell notes that the temptation to infer that the PPP does not hold under condition of relative price variations may be founded on grounds that risk created by changing relative prices or other trade impediments may be erroneously attributed to exchange rate. His conclusion is that both domestic and multinational firms are exposed to inflation and relative price risk but none of these problems are uniquely international nor can it be attributed to the existence of multiple currencies. Therefore, financial managers should not worry about foreign exchange risk since it is redundant.

It will be observed that the assumptions used in the PPP theory explanation by Cornell are highly simplified. In this regard, Dufey and Srinvasulu[13] assert:

"(i) all empricial tests have confirmed that the adjustment between changes in prices and exchange rates is not instantaneous and that there are lags in this relationship: the longer the time horizon, the greater empirical validity of PPP. For shorter time periods, however, there are substantial deivations. So if a firm's planning horizon is shorter than that required for PPP to hold, the firm is exposed to exchange risk.

(ii) even assuming that PPP holds in the aggregate with respect to the price level indices (the weighted average prices) of two countries, it need not (and usually does not) hold for every commodity. Thus, the "law of one price" does not hold. If the increases in the price levels of wheat in the US and wine in France do not correspond to the increases in the inflation levels in their respective countries, there will be a relative price risk. Even if PPP and law of one price hold, prices of a firm's specific inputs and output might change relative to each other, and thus expose the firm to risk, which - if caused by unexpected exchange rate changes - must be viewed as exchange risk."

Solnik's[14] response to a Grauer, Litzenberger and Stechle (GLS) study on traditional theory of foreign exchange risk with uncertainty helps to assert further the existence of exchange risk.

The GLS[15] study was exploring the argument that exchange rate

variations are only caused by inflation or monetary uncertainty. Accordingly, the exchange rate between two currencies will always equal the ratio of all goods prices expressed in the two currencies and therefore, fluctuation in currency exchange rates can only be caused by pure monetary inflation and so real goods prices will be equal everywhere. Since investors have the consumption taste, each is faced with the same investment and consumption opportunity set and therefore residence in a particular country is irrelevant. Thus, in an almost perfect world with complete financial markets (existence of a real risk-free asset), perfect goods market and a single consumption basket, exchange rate fluctuation are some kind of "white noise" which should not affect asset prices.

Solnik developed a model based on real differences between countries; assuming marked differences in tastes but a free and perfect international capital market. He assumed further that no pure (neutral) money inflation exists in order to study the real impact of consumption differences. Thus, only real exchange risk was considered which emanates from differences in tastes and/or real price differentials and not from monetary inflation.

Referring back to Table 3.2, Solnik's conclusion was that given different tastes, exchange rate movements (uncertain) will be created by changes (uncertain) in the real values of national consumption baskets. He contends that the argument is valid also in cases where everyone consumes the same goods but with randomly varying prices in each country because of uncertain transaction costs, import or export taxes, etc. The major requirement is

that respective governments maintain a zero or certain inflation policy in their domestic currencies. The conclusive view is that real exchange risk differs according to citizenship and the monetary exchange risk is global and identical for everyone. Thus, given the unrealistic nature of some of the assumptions of the PPP theory, deviations are expected at least in the short run, and this is the prerequisite for the existence of real exchange risk.

Dufey and Srinivasulu[16] believe that a firm should plan to cope with deviations in PPP rather than relying on the broad macro-economic relationship of the PPP theory. To exemplify this point, they drew reference from the British jet-engine producer Rolls-Royce, who relies on the international markets for the sale of its products. This firm experienced a loss of £58 million in 1979 which was attributed to the effect of the continued weakness of the US dollar against sterling. The value of its direct exports to the USA amounts to approximately £348 million, 41 per cent of its total sales of £848. Inflation had increased higher than expected and more sharply in the UK than the USA. In this period, the pound appreciated against the dollar not reflecting the differential rates of inflation. According to the PPP theory, sterling should have depreciated since the inflation rate in Britain was higher than that in the USA. Rolls Royce' losses were on both its dollar-denominated receivables and its sale revenues. It can be further argued that even if sterling had depreciated as PPP predicted, there would be no guarantee that the extent of depreciation would have been adequate to offset exactly the rate of inflation

relevant for Rolls Royce, since the production cost of jet engines in the UK rose at a different rate from that of the general inflation.

Giddy's[17] study in exchange rate risk and interest rate differentials was simultaneously carried for the PPP theory. The conclusion derived was similar to that of the Fisher effect. The result can be seen in Figure 3.4 and Table 3.1

The PPP theorem test plots the rate of change of the exchange rate, $(X_{t+1}-X_t)/(X_t)$ against the relative change in wholesale price indices (WPI) defined as follows:

$$\frac{WPI^D_{t+1}}{WPI^D_t} \Big/ \frac{WPI^F_{t+1}}{WPI^F_t} - 1$$

The PPP will hold if these two rates of change are equal.

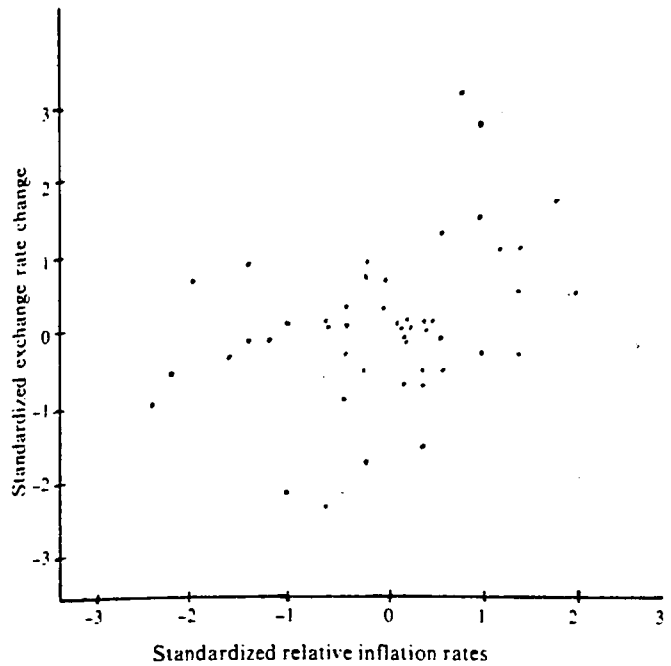
The average annualised percentage deviation for the PPP theory was defined as follows:

$$\left(\sqrt{\left(\frac{WPI^D_{t+n}}{WPI^D_t} \Big/ \frac{WPI^F_{t+n}}{WPI^F_t} \right) \Big/ \frac{X_{t+n}}{X_t}} - 1 \right) \times 100$$

where WPI^D_t is the domestic wholesale price index at time t;

WPI^F_t is the foreign wholesale price index at time t;

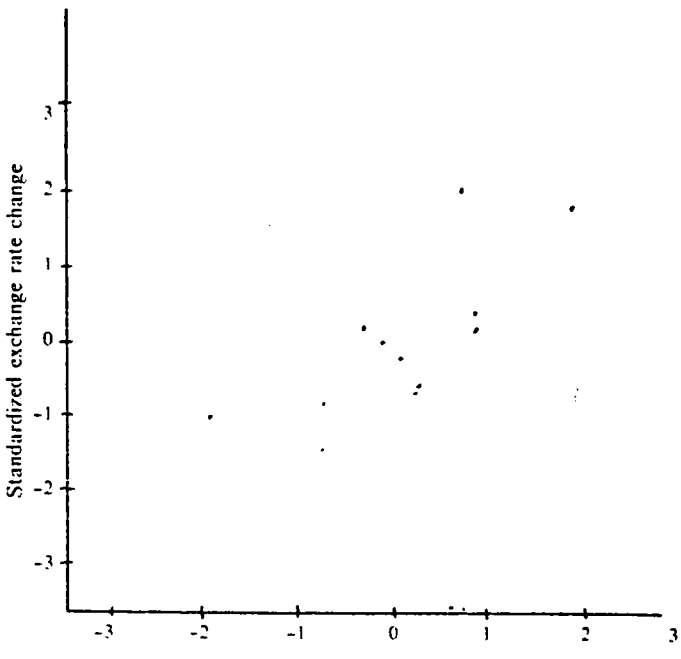
n is the length of the period considered (n=1 to 24 years)



	Mean	Std. dev.
Exch. rate change	.17416	16.72
Rel. infl. rates	-3.2483	12.3436

Three-month periods

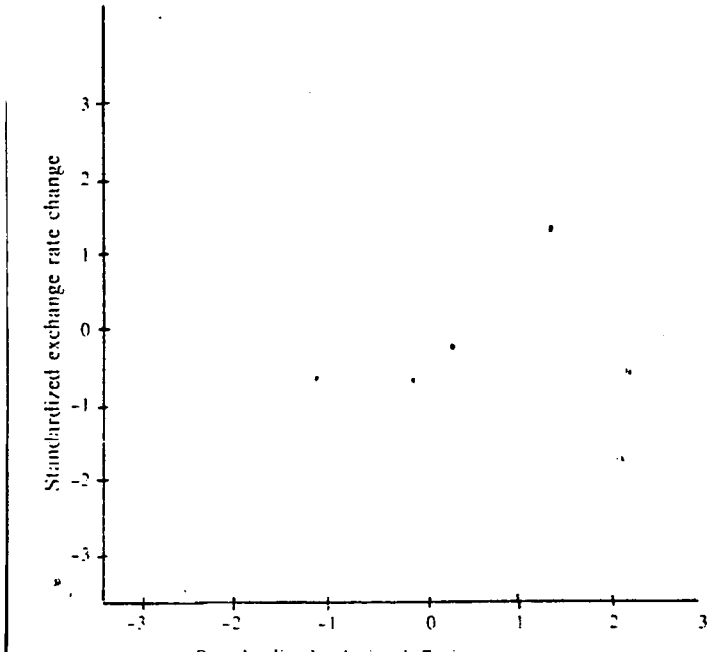
(a)



	Mean	Std. dev.
Exch. rate change	.381667	11.16
Rel. infl. rates	-3.73833	10.42

One-year periods

(b)



	Mean	Std. dev.
Exch. rate change	-.07000	5.03
Rel. infl. rate	-3.3750	3.67

Three-year period

(c)

FIGURE 3.4 (a,b,c): Inflation Rates and Exchange Rate Changes (Data expressed as annual percentage rates of change).

3.3.4 The Modigliani-Miller (MM) Theory

The MM theory states that under domestic conditions the debt-equity ratio is irrelevant to the value of the firm because a share-holder can obtain "home-made leverage" by borrowing on his own accord. The extended international version argues that corporate hedging decision is irrelevant since a shareholder can obtain "home-made hedging" by hedging on his own account. Based on these propositions, it has been held that there is no need for corporate foreign exchangement because the investor can undertake his own measures to protect his investments from foreign exchange risk.

A proof provided by Feiger and Jacquillat[18] is examined below. They claim that it is based on arbitrage argument, completely parallel to the original MM proof.

Assume two firms, F_1 and F_2, in two different countries C_1 and C_2 with quoted current values of V_1 and V_2 composed of values of debt and equity in the currency of one of the countries. Assume also that the income stream of the two firms are positively correlated income streams, denoted by X. The currency to be used in this instance is the one of the country where the firm with value V_1 exists. A further assumption is that F_1 has a beginning debt of D_1, denominated wholly in the currency of C_1 while F_2 has D_2 in currency of C_2. Accordingly, the end of period payments due to debt and equity owners, as measured in currency of C_1 are tabulated below.

	Equity	Debt	Sum
Firm 1	$X-R_1 \cdot D_1$	$R_1 \cdot D_1$	X
Firm 2	$X-S \cdot R_2 D_2$	$S \cdot R_2 \cdot D_2$	X

Where R_1 and R_2 are is the risk-free, one-period nominal rate of return on the C_1 and C_2 bonds, plus unity, and S is the spot exchange rate between the two countries.

The following profitable arbitrage will exist, if V_1 V_2 under the general conditions:

1. Sell short the fraction of the equity and the debt of F_1; the result of such action is that an income $\propto V_1$ will be produced and the obligation to pay $\propto R_1 \cdot D_1$ to owners of the debt, and $\propto [X-R_1 \cdot D_1]$ to owners of equity.

2. Purchase the fraction of the equity and debt of Firm 2 at a cost $\propto V_2$. This produces cash flow $\propto S \cdot R_1 D_2$ on the debt and $\propto [X-SR_1 D_2]$ on the equity.

3. Step 2's cash flow, $\propto X_1$, corresponds precisely with the obligation to pay under Step 2, $\propto X$. But given $V_1 \geq V_2$, profit on arbitrage will be $\propto (V_1-V_2)$ 0.

Because of this profitable arbitrage opportunity, investors will negate this favourable condition, creating a new equilibrium position in trying to capitalise on the situation.

The conclusion is that if currency denomination of the capital structure of any firm does not satisfy shareholders, they will be able to buy foreign exchange contracts, foreign bonds or foreign stocks in order to effectively hedge or unhedge their share holding.

Dufey and Srinivasulu[19] believe that there are several barriers to investors engaging in their own hedging. These are discussed below.

3.3.4.1 Entry Barriers

Two types of barriers are identified. These are (a) size barriers which are created by minimum size requirement for transactions of goods and services imposed by certain markets; (b) structural barriers arising from the manner various firms can manipulate their operations.

In regards to size barriers, the constraints emanate from the fact that principal hedging instruments are wholesale in nature and minimum transaction deals may be beyond the capacity of individuals and similarly, institutions, such as banks, tend to inhibit customers' access to forward and currency option markets. Non-residents may be denied easy manoeuvre in the local foreign exchange market by imposition of discriminatory sanctions and taxes. By contrast the local subsidiary of an MNC is not likely to face as much adverse constraints as the individual, suggesting that the firm is better geared to hedge against foreign exchange rate fluctuation.

In regards to structural barriers, many of the effective methods of hedging are only available to the firm. These methods include inter-company invoicing, leading and lagging of inter-company or third party payments and transfer pricing. In addition, certain tax imperfections may be applicable only to the firm.

3.3.4.2 Information Gaps

The information required for optimal exposure hedging decision-making available to the individual investor is very much inadequate. In fact, his information requirments should cover level and timing of foreign exchange exposure for all the companies in the portfolio on a current and forecasted basis both in the financial and operational sense. Indeed, this may prove to be a costly exercise on an individual basis. The firm is in a better position to obtain this type of information at a lower cost. Thus, it is in a better position to assume hedging activities than the individual.

3.3.5 The Capital Asset Pricing Model (CAPM)

The capital asset pricing model (CAPM) purports that there is an equilibrium relationship between an asset's required return and its associated risk expressed as follows

$$E(R_i) = R_f + B_i[E(R_m) - R_f]$$

where $E(R_i)$ = equilibrium expected return for asset i

R_f = rate of return on a risk-free asset

$E(R_m)$ = expected return on the market portfolio consisting of all risky assets

B_i = $Cov(R_i,R_m)/\ ^2(R_m)$ where $Cov(R_1, R_m)$ refers to the covariance between returns on security i and $^2(R_m)$ is the variance of returns on the market portfolio.

Portfolio theory states that an investor is faced with systematic and unsystematic risk. Systematic risk arises out of general economic conditions which affect most firms while unsystematic risk is unique to a particular business organisation. Systematic risk cannot be diversified but unsystematic risk can be. The CAPM implies that since unsystematic risk can be diversified, only systematic risk will be rewarded with a premium on the capital market.

The inference from CAPM in reference to foreign exchange risk is that if it is unsystemtatic, it can be diversified away by the investors in the process of portfolio construction. Conversely, if the exchange risk is systematic and if forward exchange contracts are priced accordingly to CAPM, a firm only need to move along the security market line. Thus, the value of the firm has not increased. This means that hedging against foreign risk is a futile exercise given that there is no imperfections in the foreign exchange market [Grubel(20)].

The pertinent counter-argument to the CAPM proposal in regards to foreign risk is, in essence, centred around the desire by firms to alleviate financial distress. Dufey and Srinivasulu(21) summarise the arguments as follows:

"However among other objectives, the concern of corporate management about total variability is motivated by the need to avoid the cost of financial distress. Thus greater variability of net cashflow implies a higher probability of bankruptcy and this, in turn, affects the firm's cost of funds and its ability to raise them."

3.3.5 Summary and Conclusion

This chapter attempted to define foreign exchange risk in regards to international business. Also, some of the pertinent arguments for and against hedging foreign exchange risk were reviewed under the headings of interest rate parity theory, purchasing power parity theory, Millar-Modigliani model and capital asset pricing model.

The important observation from the argument is that there is agreement that in the long-term, effects from exchange rate fluctuation tend to cancel out and consequently a firm need not worry about this factor. Also, the significance of short-term fluctuation cannot be discarded as serious cashflow problems can be created for the firm. Some of the proposals posit that it is this short-term fluctuation which matters.

The assumptions made by the proponents against hedging for foreign exchange risk tend to be over-simplified and are described as somewhat unrealistic, preventing attainment or more plausible explanations of exchange rate risk. What is important for the firm is the avoidance of financial distress and for this reason a firm should be concerned about the total variability of its financial resources. Therefore, the short-term effects of currency fluctuation is regarded as significant.

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CHAPTER FOUR

MEASURING EXPOSURE TO FOREIGN EXCHANGE

4.1 Introduction

The question of how should foreign exchange risk exposure be measured meaningfully should be an important concern to the firm with international operations. In Chapter Three, foreign exchange risk was regarded more or less as a short-run phenomenon arising out of unanticipated exchange rates changes which are characteristics of various floating or controlled currency systems. As stated before, foreign exchange exposure is defined as a measure of the potential for a firm's profitability, net cash flow and market value to change because of a change in exchange rates. When a firm accedes to foreign exchange exposure, then the natural follow-up procedure is to measure this level of exposure. In other words, the firm needs to investigate what assets, liabilities or income stream, it has exposed to currency fluctuation.

In this chapter, the types of foreign exchange exposure faced by an internationally operating company and the methods used for measuring these exposures will be discussed with a view to determining their appropriateness to corporate decision-making.

Different companies may have different motives for engaging foreign exchange exposure defensive strategies. Some may just want to reduce adverse effects on cash flows to the minimum, while

others may be concentrating on minimising this type of loss in their reported earnings. The objective of this chapter is to examine the conceptual approach to measuring foreign exchange exposure aiming to pinpoint their analytical strengths and weaknesses as they apply to the firm with international involvement, particularly the MNC.

For the purpose of this analysis, firms with international involvement may fall into two categories:

(a) those with foreign transactions which are settled in foreign currencies such as an export/import firm;

(b) those with foreign operations in one form or another as well as export/import activities as in (a), such as the MNC.

4.2 Types of Foreign Exchange Exposure

There are three main types of foreign exchange exposure, that are, (1) economic, (2) translation (accounting) and (3) transaction. Each type will be examined in the following sections.

4.2.1 Economic Exposure

The possibility that the net present value (NPV) of a firm's cash flow will change upward or downward due to an unexpected change in foreign exchange rates is referred to as foreign exchange economic exposure. The factors which are likely to be affected are sales revenues, costs and prices. Financial theory purports

that the economic values of an asset is the NPV of the future cash flows which the asset produces given a corresponding level of risk. In the case of a firm with international operations, there is an additional element of risk when cash flows from foreign operations are translated into home currency. The intention here is to concentrate on the MNC as this particular organisation has all characteristics of an internationally operating firm.

Walker[1] defines the NPV of a foreign subsidiary as follows:

$$NPV_o = \sum_{t=0}^{n} \frac{(CIF_t - COF_t)ER_t}{(1+d)_t}$$

where NPV = net present value (parent currency equivalent)

CIF = cash inflows (denominated in foreign subsidiary's local currency)

COF = cash outflows (denominated in foreign subsidiary's local currency) including corporate tax payments

ER = exchange rate (parent currency value of one unit foreign currency)

d = discount rate (the rate of return required by the parent company for its investment in the foreign subsidiary)

t = time period

n = the last period in which the cash flow is expected.

For example, if at t=0, ER in terms of $ is equal to £0.74 and assuming CIF = $100,000, COF = $75,000, d = 10%, then NPV will be

$$\frac{\$(100,000 - 75,000)(.74)}{1.10} = £16,818$$

If in period t = 1, the ER falls to £0.72, the NPV becomes £16364 (assuming CIF and COF remain constant). The above example demonstrates that the value of the foreign subsidiary fluctuates with the upward or downward movements of the exchange rate, thus emphasising that foreign currency economic exposure is the likelihood that exchange rate movement will adversely affect the parent-currency denominated net present value of the future cash flows from the subsidiary.

There are at least two different effects of exchange risk on an MNC and its subsidiary. One effect is the possibility cash transferred between MNC and subsidiary will increase or decrease as a result of exchange rate fluctuation. The other is that the cash inflows and cash outflows of the subsidiary and the timing of these flows may change significantly and not necessarily in a correlated pattern. The conceptual underpinnings of economic exposure analysis is ably described by Laurent Jaque[(2)] assuming purchasing power parity condition exists for the case of an oligopolistic MNC with a foreign subsidiary operating in an economy experiencing a one-period inflation-devaluation cycle. In this regard, the analysis will examine (1) the principle of economic exposure and (2) devaluation and profitability. Inflation will be kept constant for simplicity. Also, a case used by Jacque will be considered in Section 4.2.1.3 to demonstrate the practicability of the analysis.

4.2.1.1 The Principle of Economic Exposure

The nature of the markets where a subsidiary obtains its inputs (costs) and sells its output (sales revenues) is the chief determinant of the impact of inflation-devaluation cycle on its profitability.

The output of a subsidiary can be exported or sold in a domestic market, import-competing sector or sold in a pure domestic market. The impact of an exchange rate change in the currency of subsidiary's country will affect the sales revenue of the subsidiary by altering the size of the market where the output is sold and/or by changing the market share of the subsidiary.

In the export sector, a devaluation will have a favourable market share effect in that revenue from export will increase in terms of local currency and thus devaluation should produce increased sales and/or higher profit margins either by the subsidiary reducing its foreign currency selling prices to local currency equivalent which should lead to a higher sales value or by maintaining foreign currency prices which should increase the local currency revenue per unit of unchanged sales volume.

In a domestic market, importing-competing sector, the effect of a devaluation will be favourable because the competitiveness of the local vis-a-vis the foreign good will be improved. In this vein, revenue should be increased. However, it should be noted that real income may be reduced as a result of dampened demand caused by the rising price of imports and import-competing goods in the

devaluing country. The impact is that any advantage from a favourable market will be partly offset by adverse effects on the domestic market as a whole.

In the purely domestic market situation, the subsidiary will most likely lose from a devaluation since there are no favourable market share to offset the adverse effect on income.

The cost factor of the subsidiary can be distinguished in terms of real input costs such as plant and equipment, labour and raw materials, and financial costs, such as working capital and borrowing. The inputs used may be imported or obtained locally.

In regards to real inputs, devaluation will increase the local currency cost, especially those countries which import a large proportion of their inputs. However, competition from local producers may prevent the cost from rising by the full percentage of depreciation by forcing overseas suppliers to reduce their prices. Expansion in the import and exporting competing sectors will also force up input prices and therefore even firms employing domestic inputs will be affected. Walker[3] noted that:

> "... the extent to which devlauation-induced expansion leads to rising inputs prices will also crucially depend on the pre-devaluation employment situation, the effectiveness of the Government deflationary programme and the speed with which inputs can be shifted between different sectors of the economy."

The impact of devaluation of financing costs is two-fold in that both working capital requirements and cost of borrowing will

be affected.

The effect on working capital is that large cash and inventory balances will be required as well as larger customers' credit needs bearing in mind the argument that a devaluation may lead to increased sales revenue and increased input costs. This may result in a reduction in the rate of return of the subsidiary.

In terms of borrowing costs, the impact will be that the effective interest rate will be increased by the percentage of depreciation but the increase will be greater for foreign-currency denominated loans.

In Figure 4.1, the classification for a subsidiary's (S_i) markets and inputs is illustrated.

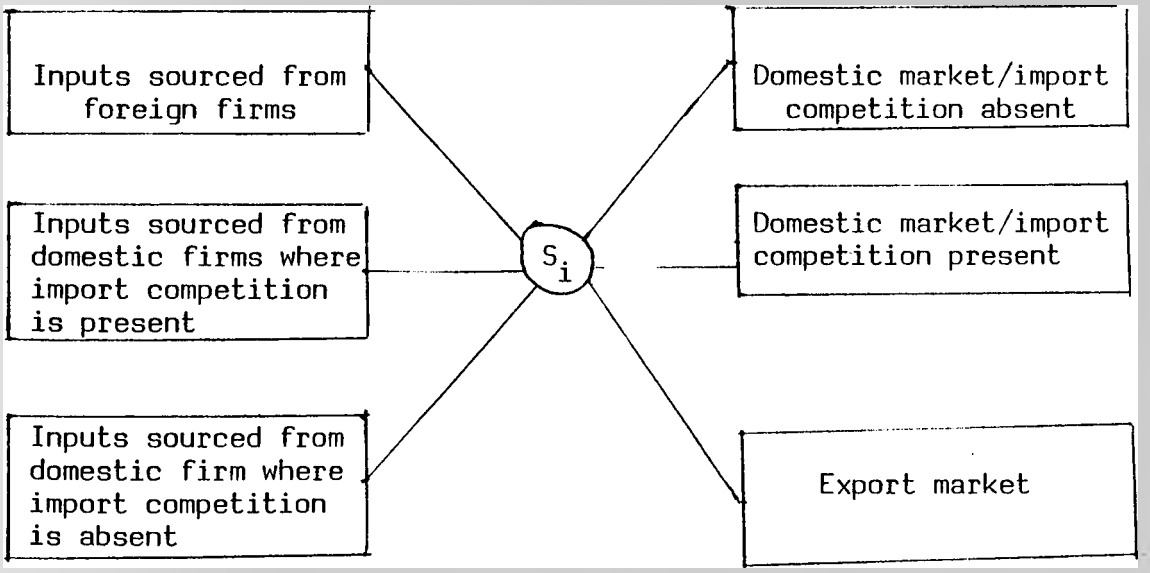

FIGURE 4.1: Classification of S_i sources of inputs and markets.

4.2.1.2 Devaluation and Profitability

This section presents a quantitative analysis of the effect of a devaluation on the profitability of a subsidiary S_i. For simplicity, it is assumed that the impact of the devaluation is immediate. Assume further S_i exports are directed to country j and S_i inputs are imported from country k. In this regard, currencies i and j are assumed to be devalued at time t* from $S_{ij}(0)$ to $S_{ij}(t)$ and similary currency k from $S_{i,k}(0)$ to $S_{i,k}(t)$.

A devaluation of currency i in relation to currency j implies essentially that fewer units of currency i, or alternatively, more units of currency i are required to purchase one unit of currency j. S_i will be at a competitive advantage of $S_i$export to country j or sells its products domestically in competition with imports from country j. The effects of this factor on S_i revenue will be examined under the following course of activities.

(a) output is exported to country j.

(b) output is sold locally where import competition is present.

(c) output is sold locally in the absence of competition.

(a) Output is exported to country j:

Assuming S_i export product z to country j, let post-inflation predevaluation revenue from its export of product z be expressed as:

$$R_x(t) = p_x(t) \cdot q_x(t) \cdot S_{ij}(0)$$

where $R_x(t)$ = post-inflation predevaluation revenue from export of product z.

$p_x(t)$ = the post-inflation price charged by S_i to its customers in country j.

$q_x(t)$ = quantity actually demanded by country j's customers when the unit price of product z increases from $p_x(0)$ to $p_x(t)$.

$S_{ij}(0)$ = spot exchange rate for currency i in relation to currency j.

The next step is to investigate the effect of currency i's devaluation on the unit currency j price of product z, $p_x(t)$, and the quantity, $q_x(t)$, of product z demanded by market j given a devaluation of $\Delta S_{ji}(0)$ per cent has occurred. $\Delta S_{j,i}(0)$ can be calculated as such

$$\Delta S_{j,i}(0) = [S_{j,i}(t) - S_{j,i}(0)]/Sj,i(0)$$

If it is assumed that S_i will pass through the devaluation of currency i vis-a-vis currency j at a rate of θ_x^*, generally found between 0 and 1, then $p_x(t^*)$ can be expressed as:

$$P_x(t^*) = p_x(t)\cdot[1 + \theta_x^* \cdot \Delta S_{ji}(0)]$$

where θ_x^* = pass through coefficient where S_i may reflect the effects of devaluation in the price of the commodity.

Likewise market j's demand for product z will depend on the extent of the devaluation passed through by S_i and the characteristic price elasticity, ϵ_x, expressed as follows:

$$q_x(t^*) = q_x(t)\cdot[1 + \epsilon_x \cdot \theta_x^* \cdot \Delta S_{ji}(0)]$$

Given the price and quantity of products sold by S_i, the post-inflation devaluation revenue can be expressed as:

$$R_x(t^*) = p_x(T^*)\cdot q_x(t^*)$$

$$= p_x(t)\cdot[1 + \theta_x^* \cdot \Delta S_{ji}(0)]\cdot q_x(t)\ [1 + \epsilon_x \cdot \theta_x^* \cdot \Delta S_{ji}(0)]\cdot S_{i,j}(t)$$

Revenue should be larger when the coefficient of devaluation pass-through selected by S_i is closer to 1 and when the price elasticity is high in absolute magnitude ($\epsilon_x < -1$). But this is on condition that additional manufacturing capacity is readily available to take advantage of the situation.

(b) Output is sold locally where import competition is present.

Devaluation of currency i will generally benefit the competitiveness of S_i in its domestic market because competing imported goods will be more expensive. It should be noted that foreign producers may ignore the devaluation and attempt to maintain their market share (θ_m^* close to 0) if the price elasticity of domestic demand is substantially higher than 1 in absolute magnitude ($\epsilon_d < -1$). A one per cent increase in the unit currency i price of product z

(or of imported equivalent products) is likely to bring a reduction of more than 1 per cent in the quantity demanded by market i. The action open to S_i, if it cannot increase its production capacity, will be to increase its unit currency i price of product z by a percentage that corresponds to the price increase of import competing products. If S_i can increase its capacity, then it can enlarge its market share by undercutting price increases of imports. Under these circumstances, S_i's revenue on a post-inflation devaluation basis from its domestic market depends on its level of production capacity utilisation.

At full capacity, currency i revenue maximisation can be achieved by increasing the unit currency i price, $p_m(t^*)$, of product z with a view to match the price increase of imported competing goods, reflecting a coefficient of devaluation passed through of θ^*_m. This is expressed as follows:

$$p_m(t^*) = p_m(t) \cdot [1 + \theta^*_m \cdot \Delta S_{ij}(0)]$$

The actual quantity of product z demanded after the post-inflation devaluation period will equal the post-inflation but pre-devaluation amount of $q_m(t)$ adjusted for the percentage change of ΔY^* per cent in national income. This is denoted as follows:

$$q_m(t^*) = q_m(t) \cdot (1 + \eta_d \cdot \Delta Y^*)$$

where $\Delta Y^* = [Y(t^*) - Y(t)]/Y(t)$

Accordingly, the currency i post-inflation devaluation revenue, $R_m(t^*)$, obtained by S_i domestically with import competition is:

$$R_x(t^*) = p_x(t^*)\, q_x(t^*)$$

$$= p_m(t^*)\cdot[1 + \theta_m^*\cdot \Delta S_{i,j}(0)]\cdot q_m(t)\cdot(1 + \eta_d\cdot\Delta Y^*)$$

At less than full capacity, there is an opportunity for S_i to enlarge its market share by pricing its product z less than imported ones. A positive quantity response in the post-inflation devaluation domestic demand $q_m(t^*)$ will be encouraged by the price differential which is expressed as:

$$q_m(t^*) = q_m(t)\cdot(1 + \epsilon_d\cdot\delta)\cdot(1 + \eta_d\cdot\Delta Y^*)$$

In this case, the currency i post-inflation devaluation revenue, $R_m(t^*)$, obtained by S_i domestically is:

$$R_m(t^*) = p_m(t^*)\cdot q_m(t)\cdot(1\cdot\epsilon_d\cdot\delta)\cdot(1 + \eta_d\cdot\Delta Y^*)$$

(c) Output is sold locally in the absence of import competition.

S_i's revenue will not directly be affected by a devaluation although S_i's sales are likely to benefit from a generally expected favourable effect upon real national income if its income elasticity of product z is in excess of 1. The domestically obtained post-inflation devaluation revenue of S_i, $R_d(t^*)$, given below full

capacity utilisation exist, is expressed as:

$$R_d(t^*) = p_d(t^*) \cdot q_d(t^*)$$

$$= p_d(t^*) \cdot q_d(t) \cdot (1 + \eta_d \cdot \Delta Y^*)$$

where $p_d(t^*)$ is the unit currency i price of product z. Depending on the pricing strategy of other domestic competitors, price controls imposed, capacity utilised, source of inputs, etc., the price of product z may or may not be different from the post-inflation but predevaluation price of $p_d(t)$. The post-inflation but pre-devaluation and post-inflation quantities of product z demanded by the domestic market i in the absence of import competition is $q_d(t)$ and $q_d(t^*)$ respectively.

The effects of a devaluation on cost will be examined in this section given the following situation:

(a) imported inputs with no competition from domestic market;
(b) imported inputs with competition from domestic market;
(c) domestic inputs with no import competition.

The main caveat of this discussion is that a devaluation of currency i will tend to make imported inputs more expensive if passed through by foreign producers while there will be a greater price stability in domestically sourced inputs providing they are not composed of a high content of imports.

(a) Imported inputs with no competition from domestic market

It is expected that foreign producers' prices will contain devaluation effects. Accordingly, post-devaluation prices can be expressed as:

$$C_m(t^*) = C_m(t)\cdot[1 + \theta^*_m \cdot \Delta S_{i,k,}(0)]$$

where $C_m(t)$ and $C_m(t^*)$ are the total currency i price of imported inputs before and after devaluation of currency i respectively in relation to to currency k which took place at a rate of $\Delta S_{i,k}(0)$ (θ^*_m close to 1).

(b) Imported inputs with competition from domestic market.

S_i has the advantage of being able to resort to the locally produced inputs if the foreign producers attempt to pass through the devaluation. In this case, it is relatively less exposed to higher cost inputs. Since domestic inputs are expected to remain constant. S_i will be affected by the devaluation only when there is full capacity operation at domestic level. Therefore

$$C_m(t^*) = C_m(t)$$

where $C_m(t)$ and $C_m(t^*)$ are respectively predevaluation and post-devaluation total costs of imported inputs competing against domestic input manufacturers.

(c) Domestic inputs with no import competition.

In this case, devaluation should not change the price of domestic inputs, which is expressed as follows:

$$D_d(t^*) = C_d(t)$$

where $C_d(t^*)$ and $C_d(t)$ are respectively predevaluation and post-devaluation total costs of domestic inputs.

Profitability can be measured by subtracting costs from revenue. In this instance, the impact of devaluation on S_i's profitability can be calculated by finding the difference between the post-devaluation level of S_i's net income and its predevaluation net income. This will give S_i's economic exposure. However, to reach unambiguous conclusions, the characteristics of S_i experience with devaluation in its domestic market should be identified. That is, precise information in regard to the geographical distribution of S_i sales, market origins of inputs and input elasticity should be known.

4.2.1.3 Case Illustration

The case of a very profitable French subsidiary, Textron S.A. of a leading American incorporated producer of chainsaws. This subsidiary is an assembly operation that obtains its components from its US parent, invoiced in US dollars and cost $35 per chainsaw assembled in France as of June 30, 1968. Assembly cost total FF200 per assembled chainsaw as of June 30, 1968 and it is assumed that this cost consists of labour cost only. Between June 30, 1967 and June 30, 1968 it produced 100,000 units.

Sixty per cent of Textron S.A. production were sold in France in the fiscal year 1967-68. It faces no significant competition in its domestic market but competition from local manufacturers in West Germany is stiff, selling at a unit price of $P_x(0)$ = DM 300. The estimated price elastocity of demand in West Germany is $\epsilon_x = -2.5$. In the French market, the unit price of chainsaws is $p_d(0)$ = FF500 and the income elasticity is generally estimated at $\eta_d = 1.5$.

At the beginning of the period the exchange rate was $S_{FF,\$}(0) = 5$ and $S_{FF,DM}(0) = 1.5$, but the French franc devalued to FF560 to \$1 and to FF1.70 to DM1 on August 15, 1969. On a percentage basis, the devaluation is by $\Delta S_{FF,\$}(0) = (5.60 - 5)/5 = .12$ and $\Delta S_{DM,FF}(0) = (.58 - .66)/.66 = -.12$.

The impact of the FF devaluation on the Textron, S.A. for the 1969-70 fiscal year will be assessed assuming that the effects of devaluation are immediately passed through, inflation remains constant (relative increase is 10 per cent) and that an increase of 5 per cent in the French real national income ($\Delta Y^* = .05$) will be generated by the devaluation.

The general position is that the FF devaluation should bolster the competitive position of Textron, S.A. in its export market but components imported from the US will cost more in FF terms. The problem is solved as follows:

(a) Revenue from export market (West Germany)

It is expected that additional export sales will be generated

because of a lower unit DM price of chainsaws resulting from a passed-through FF devaluation. The post-inflation devaluation unit price of chainsaws, $P_x(t^*)$ can be obtained from

$$P_x(t^*) = P_x(t)\cdot[1 + \theta^*_x \cdot \Delta S_{j,i}(0)]$$

$$= 300[1 + \theta^*_x \cdot (-.12)]$$

θ^*_x would depend on the extent to which Textron, S.A. is prepared to pass through the French devaluation when quoting post-inflation devaluation unit DM prices. The post-inflation devaluation quantity, $q_x(t^*)$ can be obtained from:

$$q_x(t^*) = q_x(t) \quad [1 + \epsilon_x \cdot \theta^*_x \cdot \Delta S_{ji}(0)]$$

$$= 40000[1 + (2.5)\theta^*_x(-.12)]$$

$$= 40000[1 + .3\theta^*_x]$$

Assuming that Textron, S.A. is operating below full capacity, it is thought that it would be in its best interest to fully pass through the FF devaluation ($\theta^*_x = 1$). In this way, Textron, S.A. will be quoting a lower unit DM price (DM264 instead of DM300) and will be maintaining the unit FF price of FF450 since 300 (1.50) = 264(1.70).

The post-inflation devaluation revenue derive from West Germany is:

$$R_x(t^*) = P_x(t^*)\, q_x(t^*)$$

$$= p_x(t)\,[1 + \theta_x^* \cdot \Delta S_{ji}(0) \cdot q_x(t) \cdot [1 + \epsilon_x \cdot \theta_x^* \cdot \Delta S_{j,i}(0)]$$

$$= \frac{10.5}{12}(300)(1 - .12)(40000)(1 + .3)(1.70)$$

$$= FF20,420,400.$$

(b) Revenue from domestic market (zero import competition).

The overall domestic market for chainsaws is expected to increase as a result of the 5 per cent increase in French national income. Textron is not expected to gain a larger share of the domestic market unless it is ready to under price its French competitors because of new profitability in export operations and only if competitors are operating at full capacity.

The post-inflation devaluation unit FF price from chainsaws will remain the same, given price controls (relative inflation is 10%). Thus,

$$p_d(t^*) = p_d(t) = FF550$$

The post-inflation devaluation quantity, $q_d(t^*)$, of chainsaws demanded is expected to respond positively (income elasticity of 1.5) to the rise in real national income ($\Delta Y^* = .05$) arising out of the devaluation. Accordingly,

$$q_d(t^*) = q_d(t)\cdot[1 + \eta_d \cdot \Delta Y^*]$$

$$= 55000[1 + (1.5)(0.05)] = 59,125.$$

The post-inflation devaluation FF revenue, $R_d(t^*)$ can be calculated as follows:

$$R_d(t^*) = p_d(t^*)\ q_d(t^*)$$

$$= p_d(t^*)\ [1 + \theta_d^* \cdot \Delta S_{ij}(0)]\ q_d(t)(1 + \eta_d \cdot \Delta Y^*)$$

$$= \frac{10.5}{12}(550)(59,125) = FF28,453,906$$

(d) Costs

Only the cost of imported inputs will be changed in the case of Textron. Given that their prices are denominated in dollars, imported inputs will be increased by the full amount of devaluation of FF vis-a-vis the dollar. In this regard, the full cost of imported inputs will be

$$C_m(t^*) = C_m(t)\cdot[1 + \theta_m^* \cdot \Delta S_{i,k}(0)]$$

$$= \underbrace{\frac{10.5}{12}(52,000 + 59,125)}_{\text{post-devaluation sales units}}\ \underbrace{(175)(1 + .12)}_{\text{post-devaluation FF unit price of imported inputs}} = FF19,057,937$$

The total FF cost of labour $C_d(t^*)$ equals

$$C_d(t^*) = \underbrace{\frac{10.5}{12}(52{,}000 + 59{,}125)}_{\text{post inflation total sales unit}}\underbrace{(260)}_{\text{FF labour cost per chainsaw assembled}} = FF25{,}280{,}938$$

(e) Profitability.

The post-inflation devaluation FF income $I(t^*)$ of Textron, S.A. for 10.5 months of the fiscal period (August 15, 1969 to June 30, 1970) is given as follows:

$$I(t^*) = [R_x(t^*)+R_d(t^*)]-[C_m(t^*)+C_d(t^*)]$$

$$= (20{,}420{,}400 + 28{,}453{,}906)-(19{,}057{,}937 + 25{,}180{,}938)$$

$$= FF4{,}535{,}431$$

If there was no devaluation, Textron, S.A.'s net income would be

$$I(t) = [(60{,}000 \times 500)+(40{,}000 \times 450)]-[(100{,}000 \times 175)+(100{,}000 \times 200)]$$

$$= FF10{,}500{,}000$$

The difference between the post-inflation devaluation and predevaluation net income is FF5,964,569 (10,500,000 - 4,535,431). The economic exposure to the parent company can be obtained by converting this net income differential at the prevailing exchange rate of the parent

company currency (dollars in this case).

Economic exposure is generally regarded as more useful for the long-term operations of the MNC than accounting exposure since it is based on future cash flows. It contains predictive qualities which are considered beneficial for corporate planning. However, the economic exposure measurements are thought to be somewhat impractical because they are complex and difficult to apply given the close association of exchange rates with inflation, especially in a floating rate system. Furthermore, vital economic information needed for such analysis may not always be available.

4.2.2 Accounting Exposure

According to Shapiro[4], accounting exposure emanates from the need to translate the results of foreign operations from the host country currency to the home country currency for purposes of reporting and consolidating. The conventions that direct methods of translation are usually governed by professional accounting institutions, government bodies or firms themselves. When there is a change in the exchange rate, a new value for the currency measure of the MNC investment in a foreign subsidiary, foreign assets and liabilities emerges. The result is a change in reported earnings in the accounting sense. Walker[5] summarises the function of accounting exposure as follows:

> "... indicates the possibility that those foreign currency-denominated items which are consolidated into a company's published financial statements at closing rates will show a translation loss (or gain) as a result of currency movements since the previous balance sheet date."

The three dominating conventions for translating foreign currency accounts into the reporting currency of the parent company are:

(1) current rate methods
(2) monetary/non-monetary methods
(3) current/non-current methods.

The key issue is which items should be translated at which rate in determining an MNC accounting exposure since it is only those currency items converted at the closing rate are exposed to exchange-risk from an accounting viewpoint. Not surprising, disagreement on this issue is common. The three methods mentioned above will be discussed in the following sections.

4.2.2.1 Current Rate Method

The application of the current rate method varies from country to country. The main aim of this method is to express all foreign-currency denominated items into the currency of the parent company at the closing rate of exchange. The basic tenet is that all foreign assets and liabilities are equally at risk and so the accounting exposure inherent by a foreign subsidiary is simply its net equity. Therefore, it is envisaged that the current rate method will bring all balance sheet accounts to a common basis. Simplicity is thought to be the main advantage of this method, having conceptual appeal if the foreign subsidiary books are constructed using current market value or replacement value.

The current rate method is the prevalent practice worldwide. Among countries using it are Denmark, France, Netherlands, Norway, Switzerland and UK in Europe; India, Japan, Hong Kong, Australia, Malaysia and Singapore in the Far East; and Botwana, Kenya, Ivory Coast and Sengal in Africa. In the UK, the Institute of Chartered Accountants in England and Wales surveyed 1975/76 published accounts and found that 91 per cent of the companies who disclosed their translation practices used the current rate method. However, it is not considered as acceptable by the AICPA in the USA.

4.2.2.2 Monetary and Non-monetary Method

The monetary/non-monetary method attempts to translate monetary assets and monetary liabilities at current exchange rate and other assets and liabilities at historical rates. Monetary assets consist of cash, marketable securities, accounts receivables and long-term debt and monetary liabilities includes current debt and long-term liabilities. A periodical average exchange rate is used to translate revenue and expense items except for depreciation and cost of gold sold which is directly associated with non-monetary assets and liabilities.

The monetary/non-monetary method is widely used in Sweden, Taiwan, Korea, the Phillipines and a number of Latin American countries. This method was first approved for use in the USA by the AICPA in 1965. Lack of uniformity in financial reports ensued. In this regard, the FASB, in attempting to correct the situation, required that for fiscal years beginning on or after January, 1976, must adopt the temporal method.

The temporal method more or less gives the same results as the current/non-current method based on the principle that the translation rate used must preserve the accounting principles used to value assets in the original financial statements. In this case, the historic rate should be used for items stated at historic cost and for items stated at expected future value, market value or replacement value, it should be the closing rate. The temporal method has the additional characteristic of giving the same result as the current rate method if applied to current cost accounts.

4.2.2.3 Current/Non-current Method

The current/non-current method is regarded as the oldest approach, based on the conventional accounting distinction between current and long-term items. Under this method, all current items of foreign subsidiaries are translated into the home currency at the current exchange rate. Accordingly, the foreign exchange risk exposure of a foreign affiliate is its net assets.

The current/non-current method has been criticised within the accounting profession for excluding certain items. For example, it is assumed that inventory is exposed but not long-term debt. Thus, a shift away from the method has resulted during the last twenty years.

In Table I, overleaf, a world perspective in translation method used is shown [McRae and Walker[6]].

TABLE 4.1:Translation Method used on a Worldwide Perspective.

	Closing Rate Method	Current/ Non-Current Method	Monetary/ Non-Monetary Method
Britain	2	3	3
U.S.A.	4	4	1
Commonwealth	3	3	3
Continental Europe	2	3	3

1. Sole method used
2. Predominant method
3. Occasional method used
4. Not Accepted

In regard to recent developments Nobes[7] noted that a new exposure of October 1980 in the UK preference for the closing rate method was made more obvious but allowed the use of the temporal method under certain circumstances. In the USA, the FASB, which advocated the temporal method, had come under heavy criticism, particularly from practitioners rather than from academics. In March 1980, the FASB recognised that the closing rate method has a number of advantages and announced an intention to prepare a new exposure draft on that basis. This was issued in August, 1980. In Canada, there were similar uncertainties about the introduction of the temporal method. An exposure draft based on the temporal method was issued during 1979 in Australia. The IASC proposal is to allow both the temporal and the closing rate methods.

Eiteman and Stonehill[8] produce an analysis purporting to show how closely any of the accounting methods capture the "true" economic value of the assets within each account when exchange rates change. This analysis will be reviewed to show the significant differences between translation methods.

The primary difference between the current rate, temporal and current/non-current methods of translation is how they treat inventory, fixed assets and long-term debts. The treatments are summarised below.

Item	Current Rate Method	Temporal Method	Current/Non-current Method
Inventory	Exposed	Not-exposed	Exposed
Net fixed assets	Exposed	Not-exposed	Not-exposed
Long-term debt	Exposed	Exposed	Not exposed

In regard to treatment of inventory, the crucial question is what are the effects of the currency devaluation of the host country on the economic value of the inventory of the foreign subsidiary. Bearing in mind the value of inventory is based on replacement cost and its selling price, the four combinations of effects of a devaluation are:

	No Change in Post-devaluation Inventory Replacement cost	Increase in Post-devaluation Inventory Replacement cost
No change in post-devaluation sale price	Combination 1	Combination 3
Increase in post-devaluation sale price	Combination 2	Combination 4

It is assumed that inventory replacement cost does not change in local currency terms following a devaluation if it is manufactured or purchased locally.

In combination 1, the local currency gross profit of a subsidiary will remain the same if the local sales price does not change after a devaluation. In such instances, gross profit will be reduced after conversion in parent home currency.

The treatment of this event by all the methods of accounting is that the loss will be eventually reflected. The current rate and current/non-current methods record the loss of inventory value immediately while the monetary/non-monetary (temporal) method records the loss over the period in which the inventory is sold. The latter is in effect matching decreased revenue from inventory against unchanged cost of inventory.

In combination 2, the current rate and current/non-current methods at the time of devaluation will produce an inventory

translation loss followed by increased gross profits during the ensuing inventory turn, that is, the period of time that the inventory is sold, if the local sales price can be increased after the devaluation to maintain the gross margin in the currency of the parent. Since the sale price was raised immediately, no economic loss will be experienced. What is worth noting is that these two methods produce a translation loss in the first instance and then a greater-than-usual operating profit. This characteristic is likely to confuse users of financial reports. The temporal method shows no transaction loss at the time of devaluation and therefore financial reports do not show no greater-than-usual operating profits. It is thought that the latter method produces more meaningful data.

In combination 3, a loss will ensue if the local sales price cannot be raised, assuming that the local currency replacement cost increases after a devaluation. The current rate and current/non-current methods approximately provides an instant report of the loss. The temporal method produces a less meaningful way of reporting by spreading the loss over the period of time that the inventory is sold. However, it does show that the reason for the loss is because of inability to restore traditional margins.

In combination 4, there are two perspectives of analysis if the local sales price can be increased following a devaluation. There will be inventory loss from the affiliate's stock, if the traditional gross margin is maintained by sufficiently increasing sales price. In this case, the temporal method provides more meaningful

information.

The other important aspect is more of economic significance. The basic question is whether to continue import or manufacture and sell the product involved. In other words, whether future cash flows from operations can justify involvement in the venture. Translation exposure is irrelevant here since it is based on accounting for past operations. None of the translation methods provide a suitable information network in this regard.

In regards to treatment of net fixed assets, the current rate method translates property, plant and equipment and the contra-accounts pertaining to these assets at the current rate. The temporal and the current/non-current methods translate same at the historic exchange rate. The current rate procedure is based on the assumption that the value of fixed assets will rise or fall with a currency appreciation or depreciation. It is felt that this assumption is somewhat misleading since the economic values of plant, equipment and property is the higher of (1) the net present value of the future cash flows they generate or (2) the cash sales or scrap value of these assets if sold to another party. The current rate method thus record gains or losses before they are realised which is of no practical significance. The temporal and current/ non-current methods assume that the reporting currency value of net fixed assets does not change in reporting currency terms in the face of exchange rate changes.

The current/non-current method translates long-term debt at the historic rate assuming that fluctuations in exchange in rates may move upwards or downwards and so it would be premature to speculate that new rates reflect a permanent change in value. This means that only when the long-term debt is fully repaid, gain or loss on such debt can be recognised, i.e. only the final year of the debt period will be burdened with exposure loss or gain.

Any change in the reporting currency value of foreign currency denominated long-term debt is shown fully in the current rate methods and the temporal method currently. The assumption is that there is a permanent direction in any present change in exchange rates instead of fluctuation in opposite directions. In this case, exposure losses or gains are recorded on a current basis. The temporal method recognises the gain or loss in the reported earnings immediately while the current/non-current method allows the gain or loss to flow into the "equity adjustment for translation". account immediately which subsequently flows into reported earnings on the maturity of the debt.

4.2.2.4 Case Illustration - Translation Loss Measured During a Year of Operations

The translation loss for a US parent company owning a subsidiary in France called Instruments France is measured at the end of 1983. It is assumed that during that year the franc depreciates from $S_{FF,S}(0) = 0.20$ (December 31, 1982) to $S_{FF,S}(0) = 0.15$ (December 31, 1983) and the historic exchange rate remains at $S_{FF,\$}(-1) = 0.24$.

The following are the major business activities during 1983:

(a) Instruments France sells 1,000,000 units at the rate of 250,000 unit per quarter. Thus the annual sale revenue if FF10,000 at a unit sales price of FF10.

(b) Accounts receivables collected consist of year-beginning receivables of FF2,500,000 and proceeds from sales of the first three quarters amounting to FF7,500,000. The account receivable totals FF2,500,000 consisting of sales of the fourth quarter.

(c) Cost of goods sold is FF6 per unit. 250,000 units year-beginning inventory is sold during 1983. 250,000 new units were manufactured per quater and year-end inventory is that manufactured in the fourth quarter valued at FF1,500,000 (250,000 units at FF6/unit).

(d) General and administrative expenses incurred and paid in cash during 1983 amounts to FF1,700,000. Annual depreciation expense if FF300,000.

(e) Income taxes are paid in cash throughout 1983 at a rate of 50%.

(f) No cash dividends are paid.

(g) Accrued current liabilities and short-term bank debt are rolled-over and renewed, respectively, for the same amount as that at the end of 1982.

Additional information includes average rates for each quarter for current operating expenses and for cost of goods sold as follows:

	Operating Expense Calculation $	Cost of Goods Sold Calculation $
4 quarter 1982 average exchange rate	-	.20
1st " 1983 " " "	.20	.20
2nd " " " " "	.19	.19
3rd " " " " "	.17	.17
4th " " " " "	.16	-
Total	.72	.76
Average	.18	.19

In Tables 4.2 and 4.3, the income statement and balance sheet as of December 31, 1982 and 1983 is reproduced based on the given information. It will be observed that each method produces a different result. The current rate method emerges with net income of $180,600 but an equity adjustment from translation of $360,000 resulted. The temporal method shows foreign exchange loss of $84,000 while current/non-current methods translation loss is $159,000.

TABLE 4.2: Instruments France, S.A. translation loss during year of operations; income statement, Year Ended Dec. 31. 1983.

	Current Rate Translation			Temporal Method Translation		Current/Non-current Translation	
	French Francs	Rate	Dollars	Rate	Dollars	Rate	Dollars
Sales (1,000,000 units - at FF 10/unit)	10,000,000	.18(a)	1,800,000	.18(a)	1,800,000	.18(a)	1,800,000
Cost of goods sold	6,000,000	.18(a)	1,080,000	.19(h)	1,140,000	.19(h)	1,400,000
General and administration	1,700,000	.18(a)	306,000	.18(a)	306,000	.18(a)	303,000
Depreciation	300,000	.18(a)	54,000	.24(h)	72,000	.24(h)	72,000
Total Operating Expenses	8,000,000		1,244,000		1,518,000		1,518,000
Operating Profit	2,000,000		360,000		282,000		282,000
Income Tax (50%)	1,000,000	.18(a)	180,000	.18(a)	180,000	.18(a)	180,000
Post-tax Income	1,000,000		180,000		102,000		102,000
Foreign Exchange gain (loss)	n/a		n/a		(84,000)		(159,000)
Net Income (loss)	1,000,000		180,000		180,000		(57,000)
Retained Earnings Dec. 31 1982	3,400,000		660,000		720,000		672,000
Less Dividends paid	0	.18(a)	0	.18(a)	0	.18(a)	0
Retained Earnings Dec 31, 1983	4,400,000		840,000		738,000		615,000

Notes
n/a - not applicable;
(a) - average exchange rate;
(h) - historic exchange rate.

TABLE 4.3: Instruments France, S.A. translation loss during year of operations; Balance Sheet as of December 31, 1982 and 1983.

		Current Rate Translation		Temporal Method Translation		Current/Non-current Translation	
	French Francs	Rate	Dollars	Rate	Dollars	Rate	Dollars
Balance Sheet December 31, 1982-							
Cash	1,000,000	.20	200,000	.20	200,000	.20	200,000
Accounts Receivable	2,500,000	.20	500,000	.20	500,000	.20	500,000
Inventory	1,500,000	.20	300,000	.20	300,000	.20	300,000
Net property & Equipment	3,000,000	.20	600,000	.24	720,000	.24	720,000
	8,000,000		1,600,000		1,720,000		1,720,000
Accrued current liabilities	600,000	.20	120,000	.20	120,000	.20	120,000
Bank Loan (short term)	800,000	.20	160,000	.20	160,000	.20	160,000
Long-term debt	1,200,000	.20	240,000	.20	240,000	.24	288,000
Capital Stock	2,000,000	.24	480,000	.24	480,000	.24	480,000
Retained Earnings	3,400,000	comp-osite	660,000	comp-osite	720,000	comp-osite	672,000
Equity adjustments from translation	n/a		(60,000)		n/a		n/a
	8,000,000		1,600,000		1,720,000		1,720,000

/...

TABLE 4.3: Instruments France, S.A. translation loss during year of operations;
Cont'd... Balance Sheet as of December 31, 1982 and 1983.

		Current Rate Translation		Temporal Method Translation		Current/Non-current Translation	
	French Francs	Rate	Dollars	Rate	Dollars	Rate	Dollars
Balance Sheet December 31, 1983							
Cash	2,300,000	.15	345,000	.15	315,000	.15	345,000
Accounts Receivable	2,500,000	.15	375,000	.15	375,000	.15	375,000
Inventory	1,500,000	.15	225,000	.16	240,000	.15	225,000
Net property & Equipment	2,700,000	.15	405,000	.24	648,000	.24	648,000
	9,000,000		1,350,000		1,600,000		1,593,000
Accrued current liabilities	600,000	.15	90,000		90,000	.15	90,000
Bank Loan (short term)	800,000	.15	120,000		120,000	.15	120,000
Long-term debt	1,200,000	.15	180,000		180,000	.24	288,000
Capital Stock	2,000,000	.24	480,000		480,000	.24	480,000
Retained Earnings	4,400,000		840,000		738,000		615,000
Equity adjustments from translation	n/a		(360,000)		n/a		n/a
	9,000,000		1,350,000		1,608,000		1,593,000

Note: n/a - not applicable

It is generally recognised that accounting methods of exposure measurements give only an arbitrary insight into the real effects of exchange rate flucutation on a company's foreign operations. As Shapiro[9] aptly describes:

> "It is becoming clearer that retrospective accounting techniques no matter how refined, cannot truly account for the economic effects of a devaluation or revaluation on the value of the firm, since these effects are primarily prospective in nature. The inevitable result of using an inappropriate definition of exchange risk is that the accounting information describing the impact of exchange rate changes, as presented in a firm's balance sheets and income statements, becomes sufficiently distorted as to render it almost useless to an investor or corporate manager."

Aliber and Stickney[10] contended the assumptions regarding exposure to exchange losses (gains) implied in the current accounting methodology for translating foreign financial statement items into the home currency of the parent, say dollar, are both logically inconsistent and empirically unjustifiable. The assumptions purport that monetary items are considered exposed to exchanged losses while non-monetary items are not. In other words, the PPP theory holds and the Fisher effect does not.

The basic explanation provided by Aliber and Stickney is that the PPP theory and the Fisher effect may not hold precisely although it is generally recognised that national interest rates, changes in relative price levels, and exchange rates are logically connected. Violations of these relationships may occur in economies where the central government maintains exchange parities under a pegged rate system, despite increases in relative prices. Further-

more, exchange rates may change for structural as well as monetary reasons, such as sharp increase in export because of mineral discoveries, technological changes or changes in taste.

Aliber and Stickney supported their argument empirically by determining the average deviation from the PPP theory and the Fisher effect.

The formulation for determining the percentage deviations from the PPP theory for any period was as follows:

Percentage Deviation from the PPP theory $= \left[\left(\frac{P_{f,t}/P_{f,t-1}}{P_{d,t}/P_{d,t-1}}\right) \Big/ \left(E_t/E_{t-1}\right)\right] - 1$

where $P_{f,t}; P_{f,t-1}$ = foreign commodity price level at time t and t - 1.

$P_{d,t}; P_{d,t-1}$ = domestic commodity price level at time t and t - 1.

$E_t; E_{t-1}$ = exchange rate at time t and t -1 expressed as the number of foreign currency units per domestic currency unit.

Based on the above definition, the annual percentage deviation from the PPP theory were computed for 48 countries for the period 1960 to 1971. The measure for relative price changes used were the consumer price indices based on a yearly average. The average rates were the official or buying rates in effect on December 31 of each year. The date for the test was obtained from the "International Financial Statistics".

The average annual deviation for the 11-year period 1960 to 1971 as well as the maximum annual deviation for each of these 48 countries is presented in Table 4.4. Using the date in Table 4.4 the average annual and maximum annual deivation from the PPP theory is grouped in Table 4.5. The general observation is that in the short-term, the deviations are more apparent but as the length of periods are expanded the validity of the theory is more real. This is the factor which Aliber and Stickney believe is the source of empirical unjustification when the current translation methodology is used to measure exposure to exchange gains and losses.

The same empirical test was carried out for the Fisher effect, calculated on the basis of the following information:

$$\text{Percentage Deviation from the Fisher Effect} = \left[\left(\frac{1 + R_f t-1}{1 + R_d t-1}\right) \Big/ \left(E_t / E_{t-1}\right)\right] - 1$$

where $R_f t-1$ = rate of interest on a foreign currency-denominated security at time t-1.

$R_d t-1$ = rate of interest on a domestic currency-denominated security at time t-1.

E_t = exchange rate at the maturity date of the security expressed as the number of foreign currency units per domestic currency unit.

E_{t-1} = exchange rate at the issue date of the security expressed as the number of foreign currency units per domestic currency unit.

TABLE 4.4: Percentage Deviations of the Change in Relative Prices from the Change in the Exchange Rates for the Period 1960 - 1971.

Country	Average Annual Percentage Deviation	Maximum Annual Percentage Deviation
Argentina	1.68	23.97
Australia	0.50	8.57
Austria	1.69	9.55
Belgium	1.25	11.01
Bolivia	2.44	8.69
Brazil	1.96	21.08
Canada	-0.19	3.80
Chile	-3.68	28.36
Colombia	-1.20	32.08
Costa Rica	-1.82	13.60
Denmark	2.71	7.57
Dominican Republic	-0.68	8.00
Ecuador	-2.36	28.48
El Salvador	-2.30	5.32
Finland	-0.02	21.11
France	.75	10.40
Germany	2.37	12.57
Greece	-0.71	3.61
Guatemala	-2.12	4.59
Haiti	0.55	7.89
Honduras	-0.66	3.47
Iceland	1.41	29.75
India	-0.25	31.97
Iran	-0.90	4.04
Ireland	1.46	13.50
Israel	-3.64	35.07
Italy	1.53	5.94
Japan	4.19	15.66
Korea	-3.96	35.68
Malaysia	-1.14	4.96
Malta	-1.32	16.11
Mexico	-0.19	2.15
Netherlands	2.98	13.87
New Zealand	0.24	16.38
Norway	2.34	8.45
Panama	-1.44	12.56
Paraguay	0.63	17.20
Peru	3.36	25.98
Philippines	-5.21	46.12
Portugal	2.63	11.92
South Africa	-0.49	5.12
Spain	2.56	11.38
Sweden	2.01	9.45
Switzerland	1.66	12.59
Turkey	1.12	38.79
United Kingdom	0.89	14.02
Uruguay	5.60	72.90
Venezuela	-4.18	29.25

TABLE 4.5: Matrix of Average Annual and Maximum Annual Percentage Deviations from the PPP theory for the period 1960 to 1971 with Associated Exchange Rate History*.

Maximum Annual Percentage Deviation	Average Annual Percentage Deviation							
	less than or equal to -3.00	-2.00 to - 2.99	-1.00 to -1.99	00 to .99	00 to .99	1.00 to 1.99	2.00 to 2.99	Greater than or equal to 3.00
0.00 to 4.99		Guatemala (N)	Malaysia (R)	Canada Greece (N) Honduras (N) Iran (N) Mexico (N)				
5.00 to 9.99		El Salvador (N)		Dominican Republic (N) South Africa(A)	Australia(R) Haiti (N)	Austria (R) Italy (R)	Bolivia (N) Denmark (B) Norway (R) Sweden (R)	
10.00 to 14.99			Costa Rica (D) Panama (N)		France (B) United Kingdom (B)	Belgium (R) Ireland (B) Switzerland(R)	Germany (B) Netherlands(R) Portugal (R) Spain (B)	
15.00 to 19,99			Malta (D)		New Zealand (B) Paraguay (N)			Japan (R)
20.00 to 24.99				Finland (D)		Argentina (D) Brazil (D)		
25.00 to 29.99	Chile (D)	Ecuador (D) Venezuela (D)	Colombia (D)			Iceland (D)		Peru (D)
Greater than or Equal to 30.00	Israel (D) Korea (D) Philippines(D)			India (D)		Turkey (D)		Uruguay (D)

* Exchange rate history during the period 1960-1971 is designated in parenthesis as follows* D - currency was devalued; R - currency was revalued; B - currency was both devalued and revalued; N - no change in exchange parity.

For the Fisher effect, the percentage deviations were calculated for seven developed countries for the period 1960 to 1971 and for 6 developing countries for the period 1966 to 1971. The data for the analysis was obtained from the "International Financial Statistics". The results are reproduced in Table 4.6.

When the deviations from the PPP theory and the Fisher effect were compared, it was found that those from the latter were all smaller. Aliber and Stickney thought that it was inconsistent to regard the PPP theory as valid for measuring exchange exposure and the Fisher effect as not acceptable. Accordingly they concluded that the current translation methodology was not appropriate as a measure of exposure based on the empirical findings described above. Thus, the critical variable is not the accountant's classification (monetary/non-monetary, current/non-current). The critical element is the planning horizon since over relatively short periods (two to three years) all assets and liabilities tend to be exposed but over longer periods, the exposure is negated.

4.2.3 Transaction Exposure

Gains or losses that stem from the settlement of transactions whose terms are expressed in foreign currencies are called transaction exposure. Types of transactions include goods and services sold as credit terms stated in foreign currencies, foreign denominated loans, forward foreign exchange contract, etc. This type of foreign currency exposure is conceptually straightforward and is fully recognised in international trade. Consequently, no detail analysis will be undertaken.

TABLE 4.6: Percentage Deviations of the Fisher Effect for Selected Countries for the Period 1960 to 1971.

Countries for which Data are available for the Period 1960 to 1971	Average Annual Percentage Deviation	Maximum Annual Percentage Deviation
Belgium	0.99	11.09
Canada	0.17	5.71
France	0.46	9.34
Germany	1.75	11.72
Netherlands	0.83	16.02
Switzerland	1.04	8.29
United Kingdom	0.49	13.27

Countries for which Data are available for the Period 1966 to 1971	Average Annual Percentage Deviation	Maximum Annual Percentage Deviation
Argentina	10.42	32.00
Brazil	6.35	23.10
Chile	17.18	26.00
Colombia	1.00	10.70
Mexico	5.58	6.50
Venezuela	2.72	6.30

4.2.4 Conclusion

This chapter examined economic, translation and transaction exposure, highlighting their conceptual nature and their usefulness in practical terms.

In terms of economic exposure, a subsidiary which exports its output or a proportion of it, devaluation will increase its revenue if the devaluation is passed through in the export prices, given a high price elasticity in absolute magnitude (ε_x -1) and that additional manufacturing capacity is readily available. In cases where output is sold with import competition, devaluation will not generally benefit the competiveness of the subsidiary since competing imported goods will be more expensive. Where output is sold without import competition, revenue is not likely to be affected by a devaluation although sales is likely to benefit from a generally expected favourable effect on real national income, given the income elasticity of its output is greater than 1.

In terms of costs, the effect of devaluation is likely to make imported inputs more expensive if it is passed through by foreign producers while a greater price stability in domestically sourced inputs will exist.

Economic exposure can be determined by finding the difference between the post-devaluation level of net income and the pre-devaluation net income of the subsidiary discounted at a relevant rate. Economic exposure measurement is considered useful for its predictive capabilities in the planning horizons of a corporation.

However, it is difficult to apply because of its complexity.

The three dominant methods of measuring accounting exposure are current rate, monetary/non-monetary (temporal) and current/non-current. Each method is likely to produce different results in the same circumstances. For this reason and the fact that these accounting techniques are utilising historical data, it is generally felt that accounting methods of measuring foreign exchange exposure are inappropriate for corporate decision-making.

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CHAPTER FIVE

MANAGING FOREIGN EXCHANGE EXPOSURE

5.1 Introduction

It is assumed that the floating exchange system or variations of it, will remain for the unforeseen future. Once the international monetary system is dominated by this system, foreign exchange rate fluctuation will be a reckoning factor in international finance and trade. Some financial economic theories, predominantly the purchasing power parity (PPP) and the Fisher effect, purport that exchange risk has a balancing characteristic and therefore foreign exchange exposure management is a futile exercise. Nevertheless, various empirical studies tend to suggest that these theories are valid only in the long-term (over three years). For short periods (two to three years) exchange rate fluctuations are evident. It is this short-term fluctuation which is the source of concern for the firm. In the short-run, cash flows can be seriously affected by changes in exchange rates to the extent that financial distress may result. Most firms dread this financial distress factor as it inhibits their ability to borrow or obtain credit. This is one of the important reasons why firms pursue defensive measures to offset the effects of exchange rate fluctuations.

In this chapter, the defensive measures adopted by the firm to manage foreign exchange risk will be examined. In particular, the management function and the techniques of exposure management

will be discussed based on the assumption that the floating exchange system predominates the money market.

5.2 The Management Function

The question of when and how should a firm respond to foreign exchange exposure is one which in practical terms may be best addressed to the management of the firm given the broad financial management objective. From previous discussions, it seemed plausible to assert that if the objective of management is to maximise the long-term value of shareholders' wealth, then attention should be directed towards economic exposure. On the other hand, if management's aim is to maximise after tax earning per share, then the translation and transaction exposures are more important. This study will not judge the wisdom of adopting any particular objective, however, it should be emphasised that the ultimate goal of the corporate management is to maximise the wealth of the owners which can be achieved by maximising the level of the expected earning stream and/or minimising the risk class as well as the discount rate associated with the expected earnings.

It was seen earlier that because the MNC is in a better position to handle market imperfections such as exchange controls, high transaction costs, and taxation, than shareholders, then the function of managing exposure should be its responsibility.

According to Ankrom[1] in an aritcle based on the experiences of the Chrysler Corporation in managing its foreign exchange exposure,

the foreign exchange position must be subjected to active management analysis, like other economic elements of the business because if neglected a corporation can lose more money than it can make by pushing for a marginal increase in international market penetration and sales. He believes that top management has little choice but to participate in a continuous basis in foreign exchange decisions and to gain an appreciation of the alternatives available, the risks that can be assumed, and the costs involved.

The pertinent questions confronting management of the MNC are (a) what is the level of foreign exchange exposure? and (b) should the firm hedge this exposure? The first question involves forecasting of exchange rates and/or analysis of the forward exchange market, the outcome of which would be applied to the assets and liabilities to determine exposure accordingly. The second question concerns the benefit and cost factors, depending on strategies adopted and hedging techniques used.

Jilling[2] noted that as recently as 1971, a large number of US MNC had no formal programme to protect the value of their international operations from adverse exchange rate changes. In a survey, he found that more than 88 per cent of respondents disagreed that the foreign exchange risk, if ignored, will have no serious effect on their companies. Organising defence strategies against the effect of exchange rate changes is now a major concern of top corporate management in the US.

Dufey and Walker[3] have distinguished at least two ideal-type

exchange-risk management strategies, that is, profit-maximising and risk-minimising. They explained the difference between the two by assuming the case of a single and one-off export credit sale. The natural course of action by the risk-minimiser is to invoice the export sale in his home currency and where this is not possible, he will automatically cover his exposed receivable regardless of what he thinks of future currency movements. Since the cover policy is automatic, the firm will not be concerned with exchange rate forecasting. By contrast, exchange rate forecasting plays a key role in the invoicing of the profit maximising exporter. His intention would be to invoice the sale in what he expects to be a hard currency and would only cover the currency receivable when the forward rate of exchange was more favourable than the spot rate expected to prevail at the date of settlement.

Jilling's[4] survey of US MNCs found that the majority of participating companies expressed their preference for a foreign exchange exposure management programme with the objective of minimising the adverse effects of an exchange rate adjustment. In fact, more than half would prefer neither gains or loses. Indeed, a policy of profit maximising would require a superior forecasting model, one that is expected to do better than the market in the long-run. The efficient capital market theory teaches that this feat is impossible. The actions of monetary authorities in most floating exchange systems have become much less predictable even under the managed float and not too surprisingly, they are not too certain of what actions to pursue.

he implications for the firm, are that the forecasting procedure is much more complex and it is not certain that a correct forecast will result and indeed a cost is attached to a decision taken on a wrong premise. Hence, the general assumption here is that the foreign exchange market is reasonably efficient and so market rates are systematically unbiased. Therefore, the objective of the international business should be one of risk-minimising.

Dufey[5] proposed the following specific considerations in developing appropriate financial policies:

(a) prediction and forecasting of devaluations and revaluations of foreign exchange;

(b) good working-capital management which protects liquid assets from currency fluctuation;

(c) the possibility of currency changes must be an intrinsic part of decisions dealing with expansion or contraction of operations or shifting operations from one country to another;

(d) proper analysis of how the possibility of exchange rate changes will directly affect financing decision.

In the same light, Aggarwal[6] recommended that the MNC should adopt a policy that optimises the management of foreign exchange over the entire planning horizon for all currencies involved. Therefore, for the MNC with extensive overseas operations and long-term international commitments, it is one that is co-ordinated with the

company's overall financial planning, such as financing, working capital management, capital budgeting, intra-corporate borrowing and lending, dividend remittance and transfer pricing, tax planning, and other short- and long-term policies. The main caveat is that allowance should be made in the planning process for the risk of exchange rate fluctuations in every financial decision which involves foreign currency cash flows.

5.3 Techniques of Exposure Management

This section will examine various discussions on techniques of exposure management from (a) an economic and (b) transaction and translation perspective. For this purpose, it is assumed that the firm is only interested in risk-minimising in regard to foreign exchange fluctuation. In other words, the effort put into management of foreign exchange is directed at reducing the effects of adverse foreign exchange rate changes.

5.3.1 Managing Economic Exposure

Eiteman and Stonehill[7] describe the objective of economic exposure management as follows:

> "to anticipate and influence the effect of unexpected changes in exchange rates of a firm's future cash flows."

They propose that the firm can achieve this if it is able to diversify internationally both its operating and financing base. Operational diversification involves spreading of sales, production locations, and raw material sources internationally. Financial diversification

entails sourcing of funds in more than one capital market and more than one currency. In this situation, the requirement of management is to prepare the firm to react to disequilibrium condition when it occurs. The opinion of Jacque[8] in this regard is that the sensitivity of the firm's cash flows to sectoral price movements should be carefully monitored and incorporated in marketing and production plans.

The main benefit to be obtained from diversification of operations is regarded as the advantageous position of management to react competitively to a disequilibrium when it occurs. For example, if the PPP is in a state of temporary disequilibrium, signs of changes can be observed from differences in comparative costs of operations in subsidiaries located in different countries, as well as changes in profit margins or sales volume on a comparative basis, given individual country income elasticities and competitor's reactions.

Once the disequilibrium condition can be recognised in good time, operations can be altered to suit the prevailing economic conditions by, for example, seeking sources of cheaper inputs, increasing output if there is spare production capacity or expanding of market. Even if the firm adopts a passive policy by not altering operations in response to changes in foreign exchange rate, diversification still provides some benefits because of the portfolio nature of its cash flows which is increased in some areas and reduced in others.

The situation is different for undiversified firms. It will be exposed to full impact of foreign economic exposure. For example, it will have to compete with firms with production in countries with undervalued currencies. The domestic firm's disadvantage is embedded in the fact that it is unable to recognise in good time that a disequilibrium exists since it does not have the international apparatus as in the case of the MNC. Even if the situation was recognised on time, it is doubtful whether it would be able to adjust its operations quickly enough to suit the prevailing circumstances.

The main benefit of financing diversification is that the firm will be placed in a better position to take advantage of temporary deviations in the Internationl Fisher Effect. In other words, opportunities for the firm to lower its cost of capital will exist, if the interest rate deviates from expected changes in exchange rates. However, to achieve this, the firm in question, must be well established in the international investment community. Indeed, domestic firms do not have such an advantage.

A case example of economic exposure described by Eiteman and Stonehill[9] is reviewed here to consolidate the explanation of the concept of economic exposure management by diversification.

The scenario for this illustration is set in the international automobile industry when several of the largest manufacturers decided to follow a policy of producing and selling automobiles world-wide before World War II. For instance, General Motors (GM)

acquired manufacturing facilities in Germany (Adam Opel), the United Kingdom (Vauxhall) and Australia (Holden's Pty, Ltd.) which created permanent economic exposure in German, British and Australian currencies. After the war, more economic exposure was created by building manufacturing plants in countries such as Mexico, Brazil and Argentina.

Ford had also established an even larger overseas manufacturing base, in Germany and United Kingdom particularly with equal degree of economic exposure. By comparison, most European and Japanes manufacturers concentrated their production at home but sold output internationally. The impact of exchange rate changes on production, marketing and finance is described below.

Ford and GM possess the facilities to shift component sourcing and labour-intensive operations to exploit advantages of prevailing economic circumstances. There were production flexibility in both firms and therefore, they were in a better position to exploit a disequilibrium in the PPP by taking advantage of periodic shift in comparative costs. It should be noted that factors such as labour relations and politics inhibited the degree of production shifting flexibility. Also, temporary foreign exchange rate considerations was offset by the cost advantage of longer production runs and rationalisation of component production in countries with a comparative advantage.

The effect of the disequilibrium in the PPP on Volvo was that it was gradually priced out of some of its best export markets,

particularly in the dollar area, since both components and labour were sourced in Scandinavia. The reason given for this situation was that an appreciation of the Swedish Krona relative to the US dollar could not be justified by the PPP. Volkswagen had to establish a large manufacturing operation in the US in order to ward off the effect of the appreciation of the Deutsch mark vis-a-vis the dollar and to keep their product at a competitive price in that country. This move placed Volkswagen in a profitable position and its competitive viability in regards to US competitors was maintained.

Although they were late to react to the appreciation of the yen, it is believed that the Japanese firms will be in the best flexibility position as they are in the process of establishing manufacturing operations in the USA and Europe. This means they will have operations in three major competing markets.

The other production strategies available to offset economic exposure if a firm chooses not to diversify are keeping cost down by improved productivity and economies of scale. Volkswagen, Toyota, Nissan Motors, Fiat, Renault, Volvo and the other major non-US firms used these strategies for many years and were successful at least until late 1978. From then on Japan and Germany could not offset effects of all foreign exchange rate changes with compensating cost reductions as the dollar was obviously undervalued. In this situation, profit margin reduced, although sales unit volumes were maintained. Volvo lost most of their share of the US market because of this unfavourable exchange rate changes. The French franc was in PPP equilibrium with other European currencies

and so Renault was not greatly affected and in the case of Fiat, the lira was devalued in line with the Italian inflation differentials.

Firms in Japan, Germany and Sweden adopted marketing strategies which projected product quality to justify rapid increases in local currency prices of their exported cars. They also feature new luxury models with the intention of competing effectively in the less price-sensitive segment of the market.

In terms of finance, deviation from the International Fisher effect was not considered a major competitive factor in the international automobile industry. It is thought most of the firms were large enough and sufficiently known in the investment community to obtain desired foreign debt and equity capital. Many German and Japanese firms were able to partially offset foreign exchange losses on operating cash flows from the US operations by foreign exchange gains from dollar-based financing and they did this by increasing their dollar borrowing in order to match their dollar currency inflows.

The conclusion is that from a historical viewpoint, the PPP and the International Fisher effect will be in disequilibrium periodically and therefore those firms that are prepared to diversify production, marketing and financing are most likely to survive the continuous effect of exchange rate changes.

5.3.2 Managing Transaction and Translation Exposure

Numerous proposals purporting to be managing techniques of transaction and translation exposure exist in various literature on international business finance. These techniques are basically centred around the concept of hedging. According to Jacque [10] the essence of hedging is to substitute a known cost of buying protection against foreign exchange risk for an unknown translation loss, given a level of exposure exists. In other words, it is a process of acquiring safety by entering into agreements which will counterbalance or offset losses from exchange loss.

Shapiro[11] identifies some of the frequently occurring objectives in management behaviour towards hedging are:

(1) Minimising translation exposure which usually entails protecting foreign currency denominated assets and liabilites from depreciating in value because of exchange rate fluctuations.

(2) Minimising periodical (quarter-to-quarter or year-to-year) earnings fluctuations due to exchange rate changes by considering both transaction and translation exposure.

(3) Minimising transaction exposure which involves managing a subset of firm's time cash flows exposure.

(4) Minimising economic exposure by reducing cash flow fluctuations due to currency fluctuations.

(5) Minimising foreign exchange management costs which require a firm to balance off the benefits of hedging with its costs.

(6) Avoiding surprises by preventing large foreign exchange losses, whether or not these losses will ever be realised.

Shapiro believes that some of the reasons why financial managers engage in hedging are (a) the conviction on their part that shareholders are concerned about earnings fluctuations, (b) some managers do not believe the market is efficient and thus are more concerned with short-term fluctuation, and (c) many managers are evaluated by the balance sheet impact of a devaluation.

An indepth explanation on the mechanics of hedging suitable for this discussion is provided by Jacque[12]. It covers contractual hedging and financial hedging.

Be begin with, the translation loss (gain) function will be examined. Let the net translation exposure of a subsidiary, S_i, at the beginning of a period be $e_i(t)$. A resulting translation loss from a devaluation of currency i vis-a-vis its reference currency over a given accounting period can be expressed as:

$$T[S_{\$,i}(t)] = e_i(t) \cdot S_{\$,i}(t) - e_i(t) \cdot S_{\$,i}(0)$$

where $T[S_{\$,i}(t)]$ is a translation loss (gain) function;

$e_i(t) \cdot S_{\$,i}(t)$ is the reference currency value of S_i's net exposure at time t;

$e_i(t) \cdot S_{\$,i}(0)$ is the reference currency value of S_i's net exposure at time 0.

Simplifying, the equation becomes

$$T[S_{\$,i}(t)] = e_i(t)\cdot[S_{\$,i}(t) - S_{\$,i}(0)]$$

$[S_{\$,i}(0)]$ is the reference currency price of one unit of currency i prevailing at the beginning and at the end of the accounting period. The function measures the translation loss resulting from consolidating S_i'S balance sheet with its parent at a new exchange rate $S_{\$,i}(t)$ which has depreciated (appreciated) since the last consolidation, executed at $S_{\$,i}(0)$.

To illustrate, assume on January 1, 1984, the expected net accounting exposure for a French subsidiary of General Foods was FF10,000,000 one year hence. The spot and forward exchange rates (360 days) was $.15 and $.13 respectively, per FF. The translation loss function of the subsidiary can be formulated as follows:

$$T[S_{\$FF}360] = 10,000,000[S_{\$,FF}(360) - .15]$$

A graphically representation of the function is presented overleaf.

The purpose of hedging is to allow an MNC to offset an unkown potential translation loss with an expected forward market was discussed in Chapter Two. On that basis, a speculative gain (loss) function can be expressed as follows:

$$S[S_{\$,i}(t)] = h_i(t)\cdot[F_{\$,i}(t) - S_{\$,i}(t)]$$

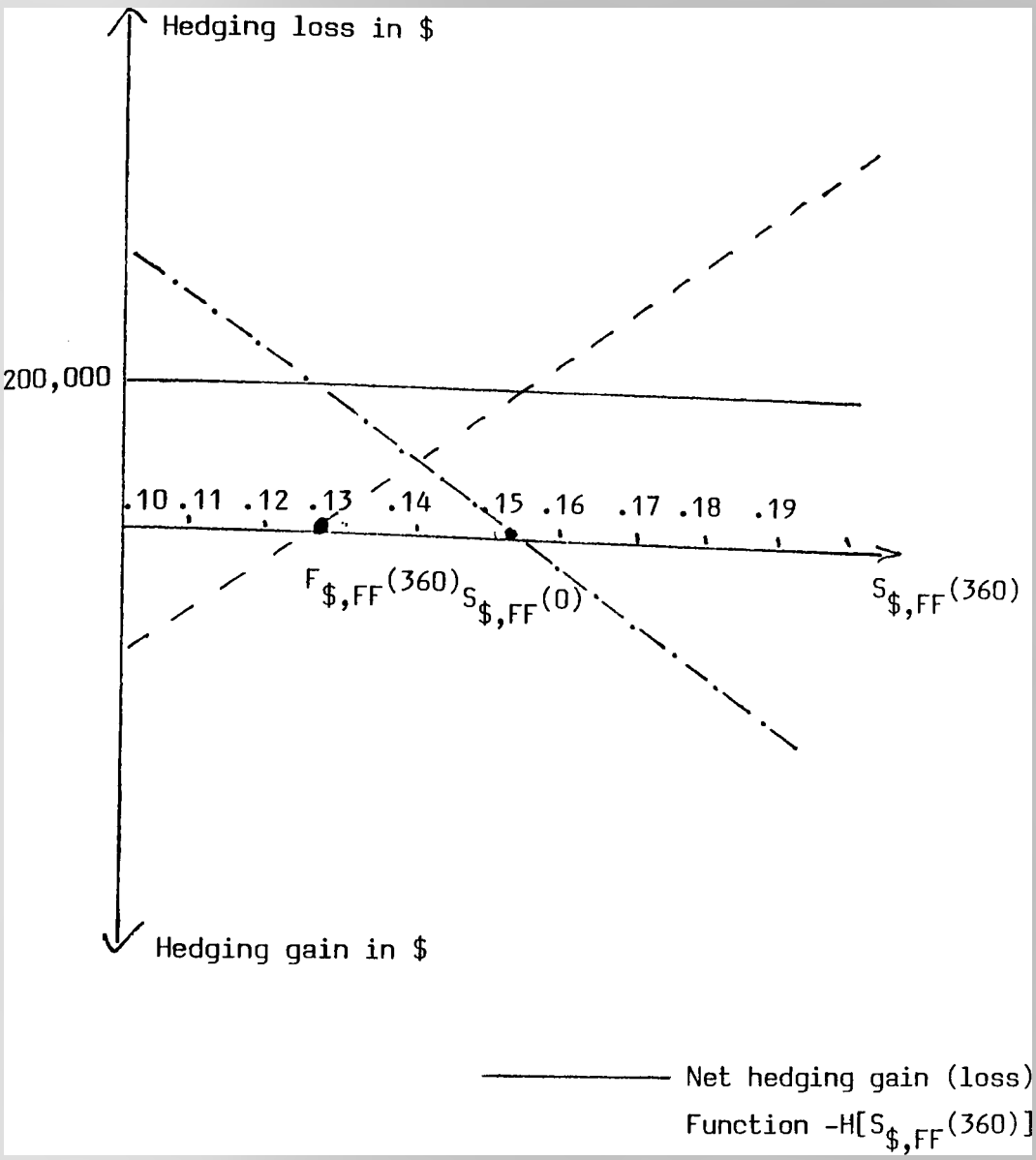

FIGURE 5.1: Net Hedging Gain (Loss Function).

where $S[S_{\$,i}(t)]$ is the dollar gain (loss) resulting from the speculative position $h_i(t)$ taken (the amount of currency i units sold t days forward at time t=0). The function provides

(1) when $S_{\$,i}(t) < F_{\$,i}(t)$, a speculative dollar gain of $S[S_{\$,i}(t)] > 0$ occurred.

(2) when $S_{\$,i}(t) > F_{\$,i}(t)$, a speculative dollar loss of $S[S_{\$,i}(t)] < 0$ occurred.

In Figure 5.1, a graphical representation of this function is shown based on the same illustration used for the translation gain (loss) function. Even if the situation was reversed, the function will still remain valid. In this case, $S[S_{\$,FF}(360)] = h_{FF}(360)\ [.15-S_{\$,FF}(360)]$.

The crucial question is what is the net effect of aggregating a translation loss with a speculative gain on the accounting value of the firm. The answer to this question is expected from the concept of a net contractual hedging function.

The net contractual hedging function is simply regarded as the algebraic sum of the translation loss and speculative gains functions expressed as follows:

Net hedging function = Translation loss function plus speculative gain function.

Symbolically, this is

$$H_c[S_{\$,i}(t) = T[S_{\$,i}(t)] + S[S_{\$,i}(t)]$$

$$= e_i(t)\cdot[S_{\$,i}(t) - S_{\$,i}(0)] + h_i(t)\cdot[F_{\$,i}(t) - S_{\$,i}(t)]$$

The net hedging function is expected to take numerical values in accordance to what the future spot exchange rate $S_{\$,i}(t)$ turns out to be. However, the net hedging gain (loss) function can be made independent from what the future spot rate may turn out to be by giving a particular undetermined value to $h_i(t)$. In this case, the net hedging function can be rewritten as follows:

$$H_c[S_{\$,i}(t)] = S_{\$,i}(t)\cdot[e_i(t) - h_i(t)] - e_i(t)\cdot S_{\$,i}(0)$$

$$+ h_i(t)\cdot F_{\$,i}(t).$$

If an amount exactly commensurating with the net currency i currency is hedged, the hedging function can be made independent of the future spot exchange rate by choosing $h_i(t) = e_i(t)$. The hedging function is now reduced to

$$H_c = {}_i(t)\cdot[F_{\$,i}(t) - S_{\$,i}(0)]$$

The conclusion is that the firm will be removing uncertainty in regards to the outcome of hedging strategy. The translation loss will not be compensated exactly by a speculative gain by hedging but the net hedging cost will be limited (on a percentage basis to the

forward discount of currency i).

Referring back to the earlier numerical example in this section, the net hedging function will be formulated and the cost of contractual hedging computed.

The net hedging function is

$$H_c[S_{\$,FF}(360)] = 10,000,000[S_{\$,FF}(360) - .15] + h_{FF}(360)\cdot$$

$$[\cdot 13 - S_{\$,FF}(360)]$$

If the choice is that the FF amount should be equal the net FF exposure, independence of the net hedging cost function from the future spot exchange rate $S_{\$,FF}(360)$ is provided. Setting $h_{FF}(360) = 10,000,000$ allows the above equation to be reduced to

$$H_c = 10,000,000\cdot[\cdot 13 - \cdot 15] = - \$200,000.$$

The cost of protection against translation loss is expected to be charged against operating income as hedging is regarded as a way of minimising unknown translation losses to the forward discount existing in the French franc contract. See Figure 5.1 for diagrammatic representation.

Financial Hedging is an alternative approach to contractual hedging which entails eliminating currency exposure in the balance sheet through adjustments in the subsidiary's financial practices.

In countries where there are no forward trading of currencies, it may be the only form of hedging available. The concept of financial hedging can be explained through the interest rate arbitrage practice which is explained below.

Based on the premise that translation exposure is the difference between exposed assets and exposed liabilities, a starting point is the creation of an exposed liability matching the amount of currency i exposure and engaged the proceeds into an unexposed account such as a devaluation-safe money instrument. If it is assumed that the local affiliate borrows $h_i(0)$ units of the devaluation-prone currency i at the interest cost of i_f and that the loan proceed is immediately converted into a safe reference currency asset with a return of i_d, the reference currency gain (loss) emerging from this interest arbitrage process is expressed symbolically as follows:

$$A[S_{\$,i}(t)] = h_i(0)\cdot S_{\$,i}(0)\cdot(1 + i_d) - h_i(0)\cdot(1 + i_f)\cdot S_{\$,i}(t).$$

where $A[S_{\$,i}(t)]$ is the reference currency gain (loss)

$h_i(0)\cdot S_{\$,i}(0)\cdot(1 + i_d)$ is the reference currency proceeds of investing in reference currency-denominated assets.

$h_i(0)\ (1 + i_f)\ S_{\$,i}(t)$ is the reference currency cost of repaying both principal and interest lending source.

Analogous to the net contractual hedging function, the net financial hedging function can be defined as the algebraic sum of the translation loss and the interest rate arbitrage functions as follows:

$$H_f[S_{\$,i}(t)] = T[S_{\$,i}(t)] + A[S_{\$,i}(t)]$$

$$= e_i(t)\cdot[S_{\$,i}(t) - S_{\$,i}(0)] + h_i(0)\cdot S_{\$,i}(0)(1+i_d)$$

$$-h_i(0)\cdot(1 + i_f)\cdot S_{\$,i}(t).$$

The amount of currency i to be borrowed so that there is consistency between financial hedging and the concept of hedging is a local currency amount which will make the net financial hedging function independent from the future exchange rate. In this way, the possibility of substituting an unknown accounting loss for a known hedging cost exists. Accordingly, the net hedging effect is rewritten as:

$$H_f[S_{\$,i}(t)] = S_{\$,i}(t)\cdot[e_i(t) - h_i(0)(1 + i_f)] + h_i(0)\cdot$$

$$S_{\$,i}(0)\cdot(1 + i_d) - e_i(t)\cdot S_{\$,i}(0).$$

If $h_i(0) = \dfrac{e_i(t)}{1 + i_f}$, the net financial hedging function will be

$$H_f = e_i(t)\cdot S_{\$,i}(0)\cdot\left[\frac{1 + i_d}{1 + i_f} - 1\right]$$

The conclusion is that the hedging cost will be known from the beginning of the accounting period, if the local currency i translation loss is properly forecasted.

The course of action recommended for a firm faced with a hedging situation is that the reference currency cost of "contractual" versus "financial" should be compared and a least cost policy adopted. The decision rule may be described as follows:

$$\text{Minimum } \{H_c, H_f\}$$

where $$H_c = e_i(t) \cdot [F_{\$,i}(t) - S_{\$,i}(0)]$$

$$H_f = e_i(t) \cdot S_{\$,i}(0) \cdot \left[\frac{1 + i_d}{1 + i_f} - 1\right]$$

The decision rule is fully compatible with the Interest Rate Parity theory.

Provided that the equivalent exposed asset (cash resulting from the loan proceeds) is immediately converted into a non-exposed asset, such as, a devaluation-safe reference currency security, an exposed liability that would offset the translation loss is created by borrowing in local currency to present value of the projected translation exposure. In other words, creating an offsetting exposed asset has to be matched by transforming the exposed asset item into a non-exposed item. The implication is that local borrowing as such is a necessary but not a sufficient condition for financial hedging to succeed. It is thought the principle

s perfectly sound and should be able to apply to any financial and commercial transaction that would allow the affiliate operating in a devaluation-prone currency to either/or:

(1) increase non-exposed assets and decreased exposed assets (e.g. sell local currency marketable securities and buy devaluation-safe currency market securities);

(2) increase exposed liabilities and increase non-exposed assets (e.g. borrow locally and purchase devaluation-safe marketable securities with proceeds);

(3) decrease exposed assets and decrease non-exposed liabilities (e.g. retire medium- or long-term debt and prepay accounts payable denominated in devaluation safe currency or prepay dividends to the parent company by using up cash or discounting accounts receivable denominated in local currency);

(4) increase exposed liabilities and decrease non-exposed liabilities (e.g. prepay accounts payable denominated in devaluation-safe currency or prepay dividends to the parent company by borrowing locally.)

The following example illustrates contractual and financial hedging techniques as discussed above.

The French subsidiary of International Harverster's balance sheet as of October 1, 1976 is detailed in Table 5.1, overleaf.

TABLE 5.1: Balance Sheet of French Subsidiary of International Harvester (December 31, 1976)

Assets (in millions of FF)		Liabilities (in millions of FF)	
Fixed Assets	1,000,000	Long-term debt to parent (denominated in $)	1,00,000
Account receivable (denominated in FF)	500,000	Long-term debt (denominated in FF)	500,000
Inventory of imported raw materials	300,000	Accounts payable denominated in $) (a)	500,000
Inventory of finished goods	300,000	Net worth	500,000
Marketable securities (denominated in FF)	300,000		
Cash	100,000		
	2,500,000		2,500,000

(a) Six month maturity.

The question of which hedging strategy should be used is considered in relation to these additional information:

(a) accounts receivable can be discounted at an annual rate of 12 per cent.

(b) dollar-denominated accounts payable can be prepaid with a saving of 10 per cent.

(c) six month treasury bills denominated in US dollars yield 7½ per cent annually.

(d) FF can be borrowed at an annual rate of 11 per cent.

(e) Spot and 90-day forward FF prevails at $.20 and $.185 respectively.

The first step is to determine International Harvester's net translation exposure in French francs calculated by finding the difference between exposed assets and exposed liabilities. Exposed assets are inventory of finished goods, marketable securities and cash. Numerically, that is 300,000 + 300,000 + 100,000 = 700,000. Exposed liabilities are FF denominated long-term debt which is 500,000. Net translation exposure is 200,000 (700,000 - 500,000).

By selling, the FF amount corresponding to International Harvester's net translation 90 days forward, contractual hedging will be executed. The cost incurred by doing so is

$$H_c = e_i(t)\cdot[F_{\$,i}(t) - S_{\$,i}(0)]$$

$$= 200{,}000(.185 - .20) = - \$3{,}000.$$

Before a decision on implementation is considered, the contractual hedging cost should be compared to the cost financial hedging first.

In regards to financial hedging, International Harvester-France has two sources of borrowing. One is by discounting accounts receivable which is tantamount to borrowing from its customers at an annual rate of $i_f = .12$. The other source is the French banking system which is slightly less expensive ($i_f = .11$). Likewise, the offsetting increase in non-exposed assets or decreases in non-exposed assets (investment in US treasury bills at $i_f = .075$ and prepayment of dollar denominated accounts payable at $i_f = .10$, respectively) should be arranged to maximise return or to minimise cost. Thus, the best course of action that International Harvester-

France should pursue is to borrow the net present value of its net FF translation exposure from the French banking system and use it to prepay its dollar-denominated accounts payable. The net cost of financial hedging in this case is:

$$H_f = e_i(t) \cdot S_{\$,i}(0) \left[\frac{1 + i_d}{1 + i_f} - 1 \right]$$

$$= 200{,}000 \cdot (.20) \left[\frac{1 + 10/4}{1 + 11/4} - 1 \right] = -\$97.32$$

(The factor 4 is to determine 3 month interest).

Naturally, financial hedging should be implemented.

5.4 The Role of Foreign Exchange Rate Forecasting

It may have been observed that the discussions above on hedging assumed the use of the market forward rate. However, it should be noted that a successful hedging programme depends significantly on a reliable foreign exchange rate forecast. The rate forecasted is expected to reflect certain economic eventualities which are likely to have an impact on the currency market (e.g. inflation) and hitherto the firm's foreign exchange management programme. As Eaker[13] describes, implementation of the decision rule requires the firm to be able to predict the direction of exchange rate change. There are a number of ways a firm might do this. One way is by economic analytical forecasting or subscribing to one or more forecasting services, or rely on the forward market. The

choice of procedure depends on the success of the method, its costs and the value of making the correct decision.

A significant amount of resources have been directed towards forecasting exchange rate changes or establishing the irrelevance of such efforts. According to Levich[14]

> "A small exchange rate forecasting industry has developed. In general, these firms sell information about future exchange rates. Their specific methodology and products cover a wide range of possibilities. Some firms rely on strictly qualitative approach; others are highly technical, utilizing simultaneous equation models, spectral analysis, or catastrophe theory. The output from these models may be a point estimated of the future spot rate, the quarterly average for some future period, or possibly just the future trend movement".

Jacque[15] noted that exchange rate forecasting models are systematic effort at uncovering a functional relationship between a set of explanatory (exogenous) variables, (such as, price level differentials, or differential in the rate of growth in the money supplies) and a dependent (endogenous) variable, that is, the exchange rate. The functional relationship may involve only the current period values of the exogenous variables or may incorporate past period values taken on by the exogenous variables.

There is also the argument that foreign exchange markets are efficient in the sense that forward contracts are priced on the basis of all currently available information. In this light, Kettell[16] posits that an understanding of the market participants theory would suggest that, while the forward market may temporarily over-estimate or under-estimate the subsequent spot rate, these

deviations will not be consistently negative or positive. Thus, over longer peiods of time, the average error of the forward rate will be small, and not statistically different from zero. The forward rate is an unbiased estimator under these circumstances, i.e. on average the error is as likely to be positive as negative. The implications for hedging policy is that if decisions are made or transactions are hedged on the basis of the forward rate, the firm should break even over a long period but it should be recognised that it may experience significant gains or losses over the short period. For the financial manager who is concerned with the short-term impact of currency fluctuation, say three months to one year, such a suggestion may not be too helpful.

Levich[17] notes further that the extremely efficient markets' view that prices continuously reflect all available information and so superior performance is not possible depends on a very strict set of assumptions, namely, continuous trading, no transaction costs and no information costs. Recent academic research attempting to explore models that relax some of these assumptions are resulting in shifting the academic view back toward a view generally purported by the financial community, that there exist rational models of behaviour in which investors will seek out and pay for professional advice. Levich is indeed cognigant of the fact that the efficient market hypothesis allows for heterogeneous expectations but the algebriac formulation and empirical testing of a model with heterogeneous expectations is considerably more complex.

Everett, George and Blumberg[18] observed that any forecast of

exchange rate contains three key elements: direction, timing and magnitude. The timing of change can be reliably inferred only to the case of freely floating and crawling peg currencies. Timing is less certain in the case of strictly managed float. In fixed exchange rate cases, timing of devaluations or revaluations should be anticipated in the light of the judgement of the political climate which may sometimes override economic factors for long periods. The magnitude of the deviation is less easy to predict but the extent of divergence of the actual rate and the parity rate at the time of the forecast serves as a valuable indicator of the likely adjustments that the market may make in the future.

These observations were made in a study which attempted to evaluate whether a currency is under- or overvalued at any given time. Empirical evidence were based on four prototypical cases i.e.

(a) the German mark - a more or less freely floating exchange rate;
(b) Spanish peseta - a strictly managed exchange rate;
(c) Columbia peso - a crawling peg currency;
(d) South African rand - a fixed exchange rate.

5.5 A Model of Optimal Foreign Exchange Hedging without Exchange Rate Projections

Kohlhagen[19] presented a model specifically designed for floating regimes that may be used for optimal hedging decisions for a large number of general international financial problems related to foreign exchange. The basic features of the technique are that

it does not require either exchange rate projections or the specificiation of a utility function for the decision-maker (although these may be included if so desired).

In the model, future exchange rates were treated as parameters instead of random variables, specifying a "reasonable range" within which future exchange rates will fall. The firm's optimal strategy for each of the possible sets of exchange rates within the reasonable range will be solved for, with each set of exchange rates used as a set of parameters in a separate linear programming problem.

To begin, a general model that is applicable for different currencies and for a firm concerned about its exposure to translation gains and losses is specified. Then, how various optimal strategies can be determined (one for each possible future set of exchange rates within the reasonable rate) is shown. A pay-off matrix can be developed, showing the profits from each of these strategies over all of the set of possible future exchange rates. The choice of the decision-maker is the strategy that meets his goals with respect to the management of his foreign exchange position, once the potential outcome of each strategy has been determined, assuming that exchange rates could fluctuate over this range during the relevant decision horizon.

The optimal hedging model with the variable exchange rates proposed here it a one-period model that does not deal with the effects of international taxation on optimal financing decisions.

Taxation aspects could be incorporated but it is thought that it will only complicate the analysis without significantly changing the general nature of the technique or conclusion. Also, the one-period model can be regarded as a simple version of a more complicated multiperiod model or the result of this special case can be treated as an indication of those decisions that would result from the solution of a general multiperiod version.

The model analyses the firm's "translation exposure". The decision criteria assumes that the firm's objective is one of loss-minimisation (or loss-avoidence).

The following is a list of notations associated with the model:

x = the spot exchange rate;

x^j = the forward exchange rate;

x^e = the expected future spot exchange rate;

p ≡ the number of periods under consideration in a year (i.e. if all assets and forward contracts are 90-day, then p = 4);

$i \equiv J$ ≡ the numeraire currency (usually the local currency of the country where corporate headquarters or the relevant subsidiary is located);

x_{ij} $\equiv$ the spot exchange rate for the relevant period in terms of units of the i^{th} currency per unit of the j^{th} currency ($e = 1,2 \ldots I$; $j = 1,2 \ldots J$);

$x_i = s_{ij}$; for conveience the numerical subscript is dropped when the (spot, forward or expected future) numeraire currency's exchange rate is expressed in terms of foreign exchange;

x_i^{en} = the n^{th} possible value for the i^{th} currency one period into the future ($x_i^{en} = a, x_i^{e2} = a+$, $x_i^{e3} = a + 2, \ldots x_i^{en} = b$), where it is expected a and b to be the lower and upper bounds respectively of the possible future exchange rate, and where there are N-2 possible values between the bounds. (There are then N values for x^e for each of the i currencies);

$x_{ji} \equiv \frac{1}{x_{ij}}$, the spot exchange rate in terms of units of the j^{th} currency per unit of the i^{th} currency;

r $\equiv$ the annual rate of return on short-term assets denominated in the i^{th} currency;

PAY_i $\equiv$ the total amount of payables denominated in currency i (expressed in currency i units);

REC_i ≡ the total amount of receivables denominated in currency i (expressed in currency i units);

C ≡ the amount of numeraire currency short-term funds available in the period;

AP_i ≡ the numeraire currency amount of currency i payables that should not be hedged, but that should be paid by purchasing foreign exchange at the time when the bills are due and payable;

F_i^s ≡ the numeraire currency amount of the currency i payables that should be hedged through forward sales of F_i^s amount of the numeraire currency;

S_i^s ≡ the numeraire currency amount of the currency i payables that should be hedged through spot sales of S_i^s amount of the numeraire currency;

S_i^p ≡ the numeraire currency amount of the currency i receivables that should be hedged through spot purchases of S_i^p of the numeraire currency;

AR_i ≡ the numeraire currency amount of the currency i receivables that should not be hedged, but that should be merely taken as payment and converted to numeraire currency at the spot rate in existence when payment is received at the end of the period;

F_i^p ≡ the numeraire currency amount of the currency i receivables that should be hedged through forward purchases of F_i^p amount of the numeraire currency;

k_i^u ≡ the numeraire currency amount of uncovered short-term investments in currency i;

k_i^c ≡ the numeraire currency amount of covered short-term investments in currency i;

A_{ij}^c ≡ the amount of the i^{th} currency borrowed (at an interest rate r_i) and converted to the j^{th} currency (and invested at a rate r_j) and covered in the forward market, measured in the currency units (i.e. covered interest arbitrage);

A_{ij}^u ≡ the amount of the i^{th} currency borrowed and converted to the j^{th} currency (and invested at r_j) but not covered in the forward market, measured in i^{th} currency (i.e. uncovered interest arbitrage).

The initial assumption is that the firm maximises the measured numeraire currency profits of its current activities as though the first set of future exchange rate (x^{e1}) were known with certainty.

There are four broad categories of constraints. These are

(1) the techniques for dealing with its payables (costs); (2) available techniques for maximising local currency proceeds from foreign currency receivables (revenues); (3) alternative channels for investing short-term funds; and (4) the possibilities for interest arbitrage. It is also felt that this programming technique can also examine a larger set of problems by specifying the appropriate constraints of increased activities, such as longer-term investment, materials and funds transfer among members of the corporate family, the investing of funds for any number of lengths of maturities. The broad constraints are described below.

The firm may have payables in any or all of the currencies it does business and so it may choose to deal with these payables by hedging in the forward markets, F_i^s, at the rate $x_{ij}^1 (=x_i^1)$, by hedging in the spot markets, S_i^s, by buying the foreign currency today at x_i and investing it at a return of r_i until payment is due; or by ignoring the problem for the moment and then buying foreign currency when it is needed on the payment date, AP_i at the rate prevailing x_i^{en}. The amount of constraints corresponds to each foreign currency in which payables are denominated, expressed as equalities in the form of:

$$x_i^{en} AP_i + x_i^1 F_i^s + s_i\left(1 + \frac{r_i}{p}\right) S_i^s = PAY_i$$

In other words, the firm has PAY_i amount of payables in the i^{th} currency. The firm is expected to choose that activity that minimises its numeraire currency cost of payables in each currency i

(subject to other constraints and opportunities, especially the short-term funds constraint in the case of S_i^s).

Receivables denominated in foreign currencies arise out of foreign currency transactions. The firm can deal with this problem in similar way as payables, that is, through the forward market, spot sales of foreign currency or by waiting until actually receiving the foreign currency receivables. The constraints, one for each foreign currency in which receivables are to be converted, are again expressed as equalities in the form of

$$x_i^{en} AR_i + x_i^1 F_i^p + x_i S_i^p = REC_i$$

That is, the amount of receivables denominated in the i^{th} currency which it may handle in one of three ways in $REC_i \cdot F_i^p$ is the amount of numeraire forward currency that the firm may purchase at the rate $x_{ij}(=x_i^1)$ to hedge its receivables. S_i^p is the amount of numeraire currency spot that may be purchased at the rate x_i and invested at a return of r_i. The firm also has the choice of doing nothing with some amount of AR_i of its receivables and wait until payment is received and convert the foreign currency received at the prevailing spot rate x_i^{en}. It is expected that the firm will choose the strategy that maximises the numeraire currency cash inflows from its foreign currency sales in each currency i.

The constraint for short-term funds on hand which can be invested in alternative investment instruments is:

$$\sum_{i=1}^{I-1} S_i^s + \sum_{i=1}^{I} k_i^u + \sum_{i=1}^{I-1} k_i^c \leq C$$

Hedging foreign currency payables spot (S_i^s) covered investments in currency i's money markets (k_i^c) and uncovered investments in currency i's money markets (k_i^u), (all denominated in numeraire currency) are the restrictions to the use of short-term funds.

The following inequality represent the constraints if the firm is able to take interest rate arbitrage opportuntities between different financial markets.

$$x_i S_i^p + \sum_{j=i}^{j} A_{ij}^c + \sum_{j=i}^{j} A_{ij}^u \leq REC_i + PAY_i$$

where $A_{ij}^c = A_{ij}^u = 0$ if $i = j$.

These constraints are limited to the numeraire currency. Borrowing in each currency is limited to the right-hand side of the above equation and the firm can only borrow in each currency an amount not more than the sum of its payables and receivables in that currency. Essentially, the firm is limited to 2 x I x J possible arbitrage transactions by the arbitrage constraints, that is, it can borrow any currency i at the rate r_i and convert it into the j^{th} currency, investing it at the j^{th} rate of return (r_i) either covered or uncovered in the forward market, and then pay back the loan at the end of the period, converting the profit (or losses) to

numeraire currency either at the current forward rate or at the then prevailing spot rate.

Given the above constraints, the objective function of the firm is given as follows:

$$\text{Max} = \sum_{i=1}^{I} AR_i + \sum_{i=1}^{I-1} F_i^p + \sum_{i=1}^{I=1} S_i^p\left(1 + \frac{r_i}{p}\right) - \sum_{i=1}^{I} AP_i - \sum_{i=1}^{I-1} F_i^s - \sum_{i=1}^{I-1} S_i^s$$

$$+ \sum_{i=1}^{I} + \left(\frac{x_i\left(1 + \frac{r_2}{p}\right) - x_i^{en}}{x_i^{en}}\right) k_i^u + \sum_{i=1}^{I-1} \left(\frac{x_i\left(1 + \frac{r_2}{p}\right) - x_i^1}{x_i}\right) k_i^c$$

$$+ \sum_{i=1}^{I} \frac{1}{x_i^{en}} \sum_{j=1}^{J} \left[\left(1 + \frac{r_j}{p}\right) \frac{x_{ij}^{en}}{x_{ij}} - \left(1 + \frac{r_i}{p}\right)\right] A_{ij}^u$$

$$+ \sum_{i=1}^{I} \frac{1}{x_i^1} \sum_{j=1}^{J} \left[\left(1 + \frac{r_i}{p}\right) \frac{x_{ij}^1}{x_{ij}} - \left(1 + \frac{r_i}{p}\right)\right] A_{ij}^c$$

Those activities that maximise the numeraire currency receipts from all receivables (i.e future revenues); that minimise the numeraire currency expenditures on all payables (i.e. future costs); that maximise the profits from short-term investment opportunities; and maximise the profits from all arbitrage opportunities are brought into the optimal solution by the above function after specifying a set of expected future exchange rate for all i currencies (e.g. x^{e1}, the lower bound of the reasonable range for all i currencies). Expected future exchange rates were treated as if they were known with certainty. Profits are expected to vary according to each

possible set of future exchange rates.

Solution of the objective function could be repeated for another specified set of expected future exchange rates (say x_i^{e2}, for all i) assuming that this set of rates were known with certainty. Each set of solutions is supposed to give a foreign exchange management strategy that would maximise the firm's profits if it so happens that the set of rate were the actual in the future.

A third type of solution is expected to be optimal if there is little change in the exchange rate or none at all. In this instance, the optimal activities will then be determined by marginal rates of return, being dependent on whether or not the expected future exchange rate is between the current spot and forward rates, and upon the size of forward premiums or discounts in relation to interest rate differentials.

The various set of solutions for the objective function should result in an $(N)^{I-1} \times (N)^{J-1}$ matrix of profits over all sets of possible exchange rates and over all strategies. The firm can choose the strategy that is most consistent with its foreign exchange management goals from such payoff matrix, given the uncertainties of the currency markets. In other words, if foreign exchange exposure management is directed mainly at cash flow protection, the firm could choose that strategy that maximises its minimum profits or minimises its maximum losses. This is referred to as a maximum strategy. The requirement of the decision-maker is to be able to specify broad ranges over which exchange rates

could fluctuate during the period in question. There is no need for specific exchange rate predictions, probability distributions for future rates or the decision-maker's utility function.

The optimal foreign exchange hedging described above is thought to provide the firm with a tool that can assist in minimising currency exposure losses by providing full information about the outcome of alternative foreign exchange strategies. Its strong feature is that it only requires an estimate of reasonable ranges of future exchange rates instead of deinitie exchange rate projections. Kohlhagen claims that the model at least guarantees a level of profits from sales and asset holdings while reducing as much as possible, the impact of exchange rate fluctuations.

5.6 The Canadian Experience (A Survey)

In this section, the finding of a study by Talaat Abdel-Malek[20] on exchange risk management under floating rates by a sample of Canadian firms will be examined. The review will be concerned primarily with principles because it is recognised that some of the circumstances that prevailed since the survey (1976) have changed.

The study was based on a national sample of firms involved in international business. Sixty-five firms were surveyed of which sixty responded. Data were collected through the medium of a personal interview conducted by researchers with the treasurer of each participating firm. To ensure uniform coverage of questions

for all firms, an interview guide consisting mostly of open-question was used. Table 5.2, overleaf, shows a profile of the main features of sample firms.

The findings of the study will be discussed under the following headings (1) Exchange Risk policies before and after floating; (2) Policy differences and given company features; (3) Setting and assessing exchange risk policies and (4) A perspective of managing risk under a floating system.

5.6.1 Exchange Risk Policies Before and After Floating

A distinction was made between the impact of floating the Canadian dollar in June, 1970, and the effect of the more general floating on an international basis since early 1973. The exchange risk policies adopted by the firms before and after floating is shown in Tables 5.3 and 5.4, overleaf, in respect to the extent of exchange risk coverage and the means of exposure coverage.

In regards to the firm's policies and actions, four conclusions were derived from the analysis of results and explanations obtained from participants. The first is that the floating of the Canadian dollar seemed to have at that time only a small effect on firms' exchange risk policies, with a few firms adopting a partial coverage policy instead of being passive. The number which continued to be exposed was over 40% of sample firms. The principal reasons for reluctance to hedge was the belief (or a hope) that instability resulting from the dollar's floating was temporary and that the currency would soon regain stability once the full adjustments in

TABLE 5.2: A Profile of the Main Features of Samples Firms

Features	Manu-facturing	Trading	Total
No. of Firms	44	16	60
Ownership			
Canadian	28	11	39
Foreign	16	5	21
International Operations			
Exports	44	8	52
Imports	37	14	51
Foreign Manufacturing	17	-	17
Annual Sales (1973-74)			
Less than Can $30 m	13	7	20
Can $30 - $300m	14	7	21
Over Can $300	17	2	19
Importance of International Operations			
(a) For firms with no foreign subsidiaries: Imports/Exports as % of total sales			
50% of less	20	-	20
Over 50%	7	16	23
(b) For firms with Foreign Subsidies also: Canadian exports and sales by subsidiaires as % of total corporate sales			
50% or less	3	-	3
Over 50%	14	-	14

TABLE 5.3: Exchange Risk Coverage Policies Before and After Floating.

	Before Can $ Floating		After Can $ Floating		After More General Floating	
Extent of Coverage	No. of firms	%	No. of firms	%	No. of firms	%
Full coverage	8	13.3	9	15.0	10	16.7
Partial coverage	22	36.7	26	43.3	42	70.0
No coverage	30	50.0	25	41.7	8	13.3
Total	60	100.0	60	100.0	60	100.0

TABLE 5.4: Means of Covering Exposure by Partially and Fully Covered Firms Before and After Floating.

Means of Coverage	Before Can $ Floating		After Can $ Floating		After More General Floating	
	No. of* firms	%	No. of firms	%	No. of firms	%
1. Hedging in forward market						
(a) as the only means	16	53	15	43	13	25
(b) as one of the means	8	27	14	40	28	54
Subtotal	24	80	29	83	41	79
2. Use of Can $	9	30	13	37	32	62
3. Leads and lags	5	17	5	14	11	21
4. Local borrowing	7	23	11	31	10	19
5. Currency clauses	-	-	-	-	7	13
6. Intercompany Transfers	4	13	7	20	10	19
Total**	30		35		52	

* Numbers refer to total of partially and fully covered firms in each period

** These totals are smaller than the respective sums of categories since firms used more than one means of coverage

rates were effected either through the market mechanism or being repegged. However, as the impact of exchange rate fluctuation continued to hamper cash flows, more attention was paid by management in many firms, helping to speed up policy adjustments.

The second conclusion was that the more general floating had become widespread and has pronounced effects on the firms policies in the sample. As many as two-thirds pursued more protective policies. The percentage of firms under partial or full coverage rose to over 85% of the total.

The third conclusion was that selective coverage had become even more dominant as a policy alternative with the more general floating, pursued by 70% of all firms. Full coverage was considered costly and unsound as a business practice and therefore was rejected. Those few firms which followed a full coverage policy argued that to do otherwise would be like speculating in an unfamiliar market. The few firms which carried full exposure thought that gains and losses would even out in the long-run or they had small level of exposures.

The fourth conclusion was that the forward hedging was used as a means of covering exchange exposure both before and after floating by most firms. A tendency to seek protection in other ways was evident after the general float, entailing lower cost coverage or coverage in terms of currencies for which restricted or no forward market facilities existed.

5.6.2 Policy Differences and Given Company Features

No significant associations were found between company size, ownership, type of primary activity, or type of international operations on the one hand and the firm's behaviour in terms of assuming full, partial or no exchange risk or of its usage of forward hedging on the other hand, under the present floating system. However, there was evidence that a larger proportion of firms with significant foreign trade covered their exposure and used forward hedging as a means of doing so than those which are less dependent on foreign trade.

5.6.3 Setting and Assessing Risk Policies

Most of the sixty firms in the sample lack a systematic approach to assessing policy decisions. Once a policy direction was decided, explicit assessment of its impact on the firm's financial resources was hardly ever undertaken. The policy aspect most commonly evaluated was the firm's forward hedging transactions. It was found that twenty-one out of of forty-one firms which were engaged in forward hedging made estimates of gains and losses resulting from forward contracts. The other twenty firms made no estimates, mostly because it was felt that the information was irrelevant or the gains and losses would be irrelevant.

It was noted that existing policies were changed more in response to events in the foreign exchange market than as a result of critical assessment. This was because of no systematic approach. In some cases, policies were more or less rushed or forced because of rapid pace of events and greater uncertainty about fluctuations in

the exchange market. Quick protective actions were encouraged without time to appropriately asses companies' needs and the available options. This led to ad hoc decision-making, resulting in expensive hedges or unwarranted risks, and waste of executive time.

It was found further that policies as well as specific decisions about exchange risk in the majority of cases appeared to be made almost exclusively by the financial manager with little or no effective participation from other members of senior management. The treasurer was found to have final authority to devise and set policy and to take action on his own in twenty-four cases. In the remaining cases, a higher authority sets policy guidelines and approves policies proposed by the treasurer. The higher authority consists of the presidence, vice-president, executive vice-president, or financial vice-president in seventeen firms, the Board of Directors in nine, a management committee in six and the foreign parent in four.

Parent companies roles in shaping exchange risk policies in their respective subsidiaries varied widely. Thirteen out of twenty-one foreign subsidiaries in the sample reported that they set policies independent of their parent companies, the other eight operated under specific instructions on policy guidelines set by the parents. Those firms with subsidiaries abroad tended to centralise policy at the Canadian head-office (15 out of 17). The rationale is that centralising exchange risk policies ensures an accurate view of the company's world-wide exposure, given that the company has ready access

to the necessary financial information on a regular and prompt basis.

Depending on how deficient the situation is, on the relative importance of international operations, and on the size of the exposure, the effects of the shortcoming in policy formulation and evaluation vary substantially from one firm to another. It was found that the five or six firms which have developed well defined and comprehensive policy statements and operating procedures for managing their exchange risk were very large and four of them were MNC, while the other two had a substantial volume of export business as well as some foreign manufacturing activities. On the other hand, the nineteen firms which lag behind quite vividly were small firms generally interested in improving exchange risk management but were dubious about justifying extra costs. Those firms with minimal international operations or very limited net exposure were not dissatisfied with their present practices. The remaining firms which fall between the two extremes were planning, or have already, to review policies and some were in the process of implementing changes already decided.

There was a general feeling from the survey that in a not too distant future, there will be an accelerating trend towards the development of more systematic and more refined policies and procedures of handling exchange risk. This is likely to help speed up the policy reviews currently in progress given the viewpoint that systematic and refined policies require constant monitoring of exchange markets and careful appraisals of alternative strategies and methods of covering risk.

5.6.4 A Perspective of Managing Risk Under a Floating System

Seventy per cent of the respondents felt exchange rate problems were becoming more manageable than during the first few months of floating because adaption of financial reporting system and streamlining of hedging policies, acquisition or re-enforcement of expertise to handle the problem, greater use of forward hedging and other means of coverage than before and greater stability of rates following their re-alignment. However, the other twenty-three per cent expressed the opposite, stressing increased uncertainty associated with floating rates, the need for constant attention to exchange risk and the difficulty of forecasting rates for the medium- and long-term.

The feeling of sixty-five per cent of respondents was that exchange rate problems were among the less difficult constraints of participation in international business while thirty-five per cent rated them among the more difficult ones.

There are feelings that financial managers' opinion of floating rates problems were over-exaggerated and the view is that the present system is no longer less desirable than the fixed rate system. What clearly emerged is that firms are acquiring skills to handle currency fluctuations in an effort to handle the new international business environment.

5.7 Conclusions

This chapter examined various discussions on the exchange risk

management. In particular, the management function, economic exposure management, transaction and translation exposure, the role of exchange rate forecasting and a survey of Canadian firms were discussed.

Most firms tend to follow a policy of exchange-risk minimising. However, there are a number of constraints, both internal and external to the firm which limits certain defensive actions such as exchange forecast and absence of forward exchange market facility.

In general, it is proposed that management of exchange rate exposure should be undertaken in the broad financial management scope of a company, assessing the impact of currency fluctuation on all operations which involves foreign currency. In this regard, most companies tend to go beyond the balance sheet to obtain the overall effect of exchange rate recognising that cash is the most likely asset to be affected.

The various views on management of foreign exchange exposure discussed seemed to agree that the process requires careful analysis involving sophisticated and technical models which may not be easy to implement in the ever-changing environment of the firm. It is recognised that the MNC because of its multi-national operations is in the best position to handle currency fluctuations, given its ability to diversify, shift resources, and obtain information from which disequilibrium in trade and financial market can be observed.

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CHAPTER SIX

CONCLUSIONS AND SUGGESTIONS

This study considered some of the crucial aspects of foreign exchange risk management. In particular, determination of the foreign exchange rate, the relevance of foreign exchange risk management, measuring currency exposure and techniques of exposurement management were discussed in relation to international business. The results and views which emanated from the various analyses undertaken concurred in some aspects but differed in some others. However, the subject is still regarded as a significant phenomenon by scholars and practitioners and thus, there is sustained interest directed towards providing more explicit explanations on how exchange rate fluctuations affect business.

Business organisations involved in international trade and/or possess foreign operations will no doubt have felt the impact of exchange rate volatility on their foreign income streams since the introduction of the somewhat chaotic system of floating exchange rate in early 1973. All indications seem to suggest that this system will remain indefinitely as long as there are differences in inflation, interest and economic growth rates among countries. The main problem for the import/export business or the multinational corporation is how to prevent decreased cash inflows from exports, increased cash outflows from imports and financial reporting that will impair investors' confidence.

There are theories which contend that exchange rate fluctuations do not pose any significant overturns for the firm and therefore corporate financial managers should not concern themselves with foreign exchange risk management. The main theme of the arguments against is that currency fluctuations balance out in the long-term and therefore the amount of earnings loss in one period will be exactly compensated by a gain in another period. Thus, foreign exchange risk management is superfluous. The notable theories holding this position are the Purchasing Power Parity, Interest Rate Parity, Efficient Market Hypothesis, Capital Asset Pricing Model and the Modigliani and Miller model. The assumptions on which these models are formulated are somewhat unrealistic and restrictive. The finding of empirical testings tend to suggest that although these theories seem to hold in the long-run (over three years), there are singificant deviations in the short-run (one to three years). This is the premise which some scholars and certainly almost all practitioners use to assert the need for foreign exchange risk management, placing emphasis on the minimising of impact on earnings or cash flows.

Of the three methods (economic, accounting and transaction) used for measuring exposure to foreign exchange risk, economic exposure is considered to be most useful for corporate planning. Transaction exposure measures the impact of currency fluctuations over the life of a foreign currency denominated transaction. Accounting (translation) exposure is concerned with the uncertain domestic value of a net accounting position denominated in a foreign currency at a certain future date. There is still some debate

over the usefulness of the three most commonly used methods of translation, i.e. current/non-current, monetary/non-monetary and current rate. The usefulness of translation exposure methods in terms of corporate planning is thought to be limited; not adequately considering the long-term impact of exchange rate fluctuations on the economic valuation of the firm. Economic exposure is determined by the sector of the economy in which a firm operates. The impact of currency fluctuation will differ among export oriented firms, purely domestic-oriented firms with no import competition and domestic firms with stiff import competition. Economic exposure measurement is deemed to be theoretically attractive but from a practical viewpoint, it is somewhat difficult to apply.

The recommended approach for optimal economic management is international diversification of operations and financing. In this way, a firm will have the flexibility of adjusting according to economic circumstances in the different location where it operates. Implementation of the economic exposure management concept will first entail formulation of relevant managerial policies regarding exchange risk and identifying operational characteristics and environmental parameters to which economic exposure is sensitive. The next step is to define the protective measures that should be pursued in order to minimise the adverse effects of unexpected exchange rate changes on future cash flows.

The main purpose of hedging is to even out prospective losses with corresponding gains by substituting a known cost of buying

protection against foreign exchange risk for an unknown translation loss within an accounting period. This process is undertaken predominantly in the forward exchange market and the securities market.

An efficient foreign exchange risk management programme depends to a large extent on accurate foreign exchange rate forecasting which is traditionally undertaken through economic forecasting models. However, it is sometimes advocated that the forward exchange rate is an unbiased forecast of a future rate since the currency market is efficient, that is, it fully reflects all available information about currency strengths. Models devised to test the efficiency of the foreign market are somewhat deficient, precluding clear-cut conclusions in this regard.

It is generally felt that the process of currency exposure management should be integrated and co-ordinated within the broad scope of financial management within a business organisation. In the case of an MNC, policy guidelines should be suitable for both parent and subsidiary. Exchange rate fluctuation policies which are geared towards the long-term economic survival of the firm are likely to produce better results than those aimed at short-term consequences.

Finally, a common and consistent attitude towards foreign exchange rate risk is yet to be developed. In contrast to other theoretical financial development, this area is a relatively new phenomenon which financial theory is attempting to explain. Needless

to say there is much room for further exploitation.

The writer would like to propose a few suggestions here. The first is concerned with accounting (translation). It was noted that this method of measuring exposure focused almost exclusively on short-term decisions on a pro forma basis assuming that exposure is known with certainty. In reality, the magnitude of accounting exposure is unknown. In this regard, it is suggested that a stochastic approach be considered for hedging decisions in foreign exchange risk management, i.e. treating the possible outcomes as random variables. In this way, a number of possible alternatives could be selected. Decision models may have to be extended beyond the one-period models frequently used. From a practical viewpoint, the onus of reaching a more realistic approach to measuring rise or fall in value of corporate assets and liabilities after changes in exchange rates rests with the accounting profession as it is somewhat soothing to note there are indications that this body is continually researching more acceptable methods of translation exposure measurements.

The economic approach to exposure management should be emphasised since this method is concerned with the future cash flows from an asset. However, models of economic exposure measurement are complex and may not be practical. Therefore it is thought that research should be undertaken with a view of obtaining less complex models using readily available economic data for future use in international business.

Exchange rate changes should be integrated into all aspects of decision-making of the firm whenever relevant. These include policies regarding operations, financing and sales in the context of working capital decision, manufacturing, inventory, long-term debt and fixed assets. Integration could be achieved by including in policy-formulation analyses the effect of changes in exchange rate on real rate of return from assets, real cost of long-term debt, etc.

It is recognised that the success of foreign exchange risk management is dependent, to a greater extent, on the forecasting of future exchange rates. The rate recommended in floating exchange rate system, given that the market is efficient, is the market-based forecast (the forward rate) which is expected to reflect all available information. It is regarded as an unbiased predictor of the future rate. However, it should be taken into account that in reality this rate is rarely exactly obtained and so the firm should complement this approach by assessing the impact of such unanticipated deviations from the expected rate on its cash flows. In cases where central bank or government interventions cause the market to be inefficient, firms may have to rely on their own assessment or purchase forecasting services to determine what future rates will be based on perceived market distortions.