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AN OVERVIEW OF EXCHANGE AND INTEREST RATE RISK MANAGEMENT

(How to make risk management strategy a competitive weapon)

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AN OVERVIEW OF EXCHANGE AND INTEREST RATE RISK MANAGEMENT

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Abstract

This paper surveys traditional as well as more recent approaches to measuring and managing the foreign exchange and interest rate risks associated with the uncertainty that has emerged from changes in the international financial environment over the last two decades. The paper presents a comprehensive model of risk management which takes into account the firm's competitive environment.

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1. Introduction

Since the introduction of the floating-exchange system upon the breakdown of the Bretton-Woods Agreement in 1973, uncertainty over interest rates and foreign exchange rates has become the dominant force in financial markets. To manage the risks associated with this uncertainty and their adverse effect on a firm's performance, it is necessary to measure the firm's exposure to these risks.

Measuring and managing foreign exchange and interest rate risk in a volatile financial environment is a complex task; however, it has generally been met by relatively simple rules. The objective of this paper is two-fold: first, to survey traditional as well as recent approaches to measuring and managing these macroeconomic risks and uncertainties; second, to present a comprehensive model of risk management given the firm's competitive environment.

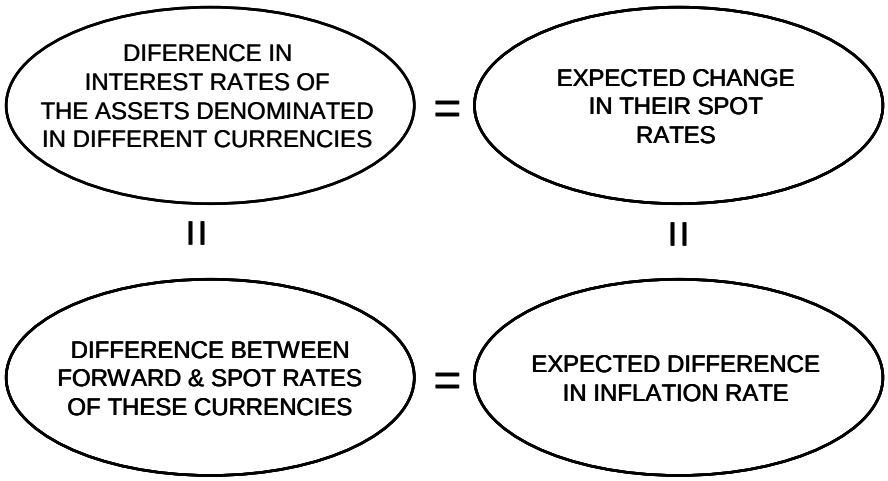
In the academic literature, foreign exchange rate risk has received substantial attention. The emphasis on exchange risk can perhaps be explained by the relatively recent breakdown of the fixed exchange rate system in 1973, and the difficulties in coping with this kind of risk in the new competitive financial environment.

Though the emphasis in the literature is on exchange rate risk, this paper also discusses the measurement and management of financial risk, in particular interest rate risk. But before any further elaboration of these points, a careful review of some basic relationships observed in the international financial markets is in order.

The remainder of this paper is organized as follows: in section 2, some basic relationships observable in the international financial markets are discussed. The suggested techniques for measuring and managing foreign exchange and interest rates risks are surveyed in section 3 and 4 respectively. Section 5 provides an introduction to the off-balance-sheet hedging techniques that firms might use to protect their positions against adverse movements in interest rates and currency exchange rates. Section 6 presents a comprehensive model of risk management which takes into account the firm's competitive environment. A summary and conclusions are provided in section 7.

2. Basic Relationships

Assuming that there are no costs or barriers to international trade, and investors do not worry about risk, the following relationships hold:



Source: Brealey and Mayers, "Principles of Corporate Finance;" with minor modification.

The first relationship is known as the International Fisher Effect (IFE). According to IFE or the Fisher Open Relationships (FO), the difference in interest rates between countries (taking financial risk as constant) should equal the expected changes in the exchange rate movements. That is:

$$(E_{t+1} - E_t) / E_t = (I_{Dt} - I_{Ft})/ (1+I_{Ft})$$

Where:

E_t = Spot exchange rate at time t.

E_{t+1} = Market expectations at time t regarding future spot exchange rate at time t+1.

I_{Dt} = Domestic interest rate for one period at time t.

I_{Ft} = Foreign interest rate for one period at time t.

For example, if the one-year United States interest rate is 8 percent while the equivalent Spanish interest rate is 14 percent, and the current spot rate of exchange is 120 pesetas = US$1, the (FO) says that the Spanish peseta is expected to decline by 6% during the year. That is, substituting in the above formula we have:

$$(E_{t+1} - 120) / 120 = (0.14 - 0.08) / (1 + 0.08)$$

$$E_{t+1} = 126.67$$

or $(126.67 - 120) / 120 * 100 \approx 6\%$

Of course, interest rates adjusted for currency changes usually diverge from such expectations. Cumby and Maurice (1981) have shown that this is largely because of the existence of a foreign exchange risk premium for most major currencies. Thus the expected changes in exchange rates might be consistently more than the difference in interest rates.

According to the Interest Rate Parity Theory (IRPT), the interest rate differential must equal the difference between the forward and spot exchange rates. In our example of FO this relation holds, as the 6% difference between the forward and spot exchange rate of peseta to US$ is equal to the deference in the interest rates on assets denominated in these two currencies, i.e., (14% - 8%) or 6%.

The relationship between the expected change in spot rate and the expected change in inflation rate is based on a theory known as the Purchasing Power Parity theory (PPP). The PPP[1] says that any changes in the equilibrium between domestic and foreign prices tends to be offset over the long run by an equal but opposite change in exchange rates. For example, if inflation is 6% in the United States and 4% in Spain, then in order to prevent arbitrage opportunity the peseta price of goods in the two countries should be equalized. This means that the dollar price must fall by about 2%, i.e., (0.04-0.06)/ 1.06 * 100 ≈ 2%.[2]

Although PPP does not explain all changes, a large portion of exchange rate changes over the long run are explained by equal and opposite changes in the national price levels.[3] However, the PPP does not necessarily hold, because of, for example, the industry structure, the competitive position of the firm, and the price elasticity in different countries.

The relationship between the expected change in spot rate and the difference between the forward and spot rates is based on the Expected Theory of Forward Rates (ETFR). The ETFR says that the percentage difference between the forward rate and today's spot rate is equal to the expected change in the spot rate. The theory assumes that traders don't care about risk. If they do care, the forward rate can be either higher or lower than the expected spot rate, i.e., more volatile. For example, if the one year forward exchange rate on the peseta to US$ is 126.17 pesetas = US$1, that can only be because traders expect the spot exchange rate to be at this rate in one year's time. If they expected it to be lower than this, nobody would be willing to buy United States dollars at this forward rate, and if they expected it to be higher, nobody would be willing to sell United States dollars at this forward rate. Therefore, the forward rates should be equal to the expected future spot rate. Empirical evidence shows that on the average the forward rate is equal to the future spot rate (Cornell, 1977).

So far, we have described four simple relationships that link interest rates, forward exchange rates, spot exchange rates, and inflation rates. These relationships are mutually consistent. This means that, if any three hold, the fourth must also hold. Conversely, if any one is not holding, at least one other is not holding. Moreover, the arbitrage between the domestic money markets and the international market will mean that the aforementioned relations hold, given that regulatory restrictions do not prevent arbitrage transactions from taking place.

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[1] According to Einzing (1962), this theory can be traced back to the Spanish economists of the 16th century Salamanca school.

[2] The relationship suggests that the expected difference in the inflation rate equals the expected change in the exchange rate. However, the PPP also implies that the actual deference in the inflation rate always equals the actual change in the exchange rate.

[3] Empirical evidence shows that, in the long run, PPP seems to hold well. For further details see, for example, Errunza and Losq (1987).

3. Foreign Exchange Risk Management

3.1. Types of Exposure and their Measurement

Literature in the field of international finance and major textbooks on international business management[4] agree that there are two major types of exchange rate exposure: a) accounting exposure, and b) economic exposure.

Accounting exposure to exchange risk (often simply called translation exposure), is defined as the uncertain domestic value of a *net accounting position* denominated in a foreign currency at a certain point of time, usually the date of financial statements. Change in the exchange rate leads to a new accounting measurement of the firm's assets, liabilities, revenues and expenses originally measured in a foreign currency, which results in translation gains or losses. The latter is largely determined by accounting conventions.[5] However, it should be noted that translation gains or losses do not affect the firm's cash flow because they are purely on paper.

If translation gains and losses are recorded on the income statement, this results in a change in reported earnings. This affects the firm's earning per share, which would affect the price of its stocks, as well as the firm's cost of capital and its ability to raise capital.

Economic exposure to exchange risk can be divided further into transaction exposure and real operating exposure, sometimes called strategic exposure (See Table 1). Transaction exposure is defined as an uncertain domestic currency value of *an open position* denominated in a foreign currency with respect to a known transaction; that is, a future foreign currency denominated flow. Although transaction exposure is often captured by the accounting measure of exposure, it is also a cash flow exposure and hence part of economic exposure.

Real operating exposure, or economic exposure, arises because currency fluctuations together with price changes can alter the firm's expected future revenue and cost streams, i.e., its operating cash flows. The essence of the economic exposure is that currency changes alter the price of the firm's output and the cost of its input, thereby changing its competitive capability profiles across its various markets and products.

Whereas accounting exposure can be quantified objectively by using accounting concepts and rules, quantification of economic exposures is inevitably subjective, because they depend on strategic planning in the choice of products, markets, sources, etc., and, on the finance side, depend on estimating future cash flows over an arbitrary time horizon. In this part I will briefly explain some of the suggested models for measurement of economic exposure in the finance literature.

Applying the concepts of the Capital Assets Pricing Model (CAPM), Adler and Dumas (1980), and Hodder (1982) proposed a model for measuring the firm's economic exposures. This model is related to the concept of asset risk from the stockholders' point of view, i.e., the beta measuring of the contribution of a particular asset's return pattern to portfolio variance.

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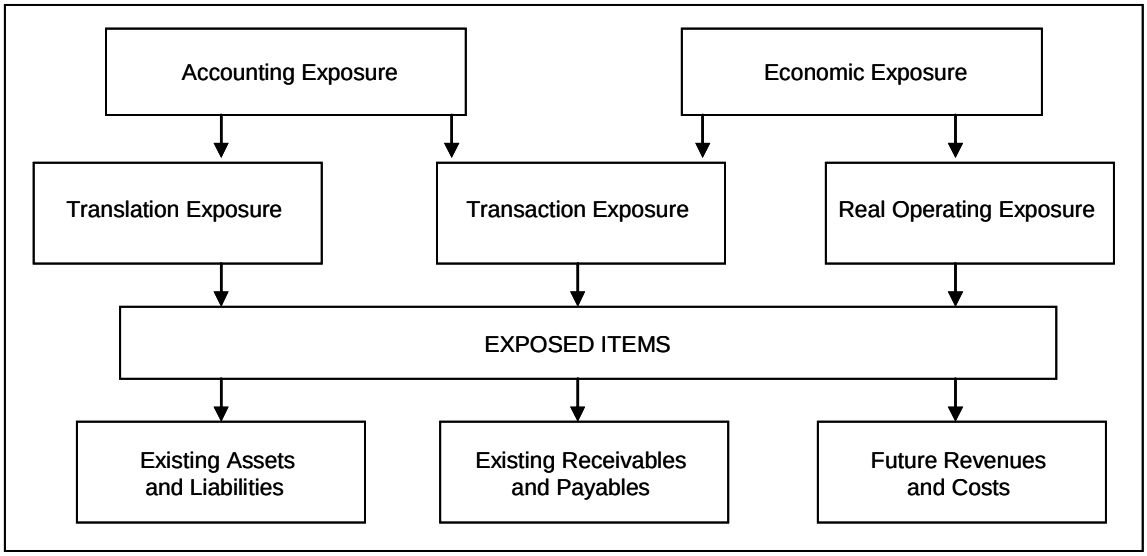
[4] Including those of (Lessard, 1986; Cornell and Shapiro, 1983; Garner and Shapiro, 1984, Wihlborg, 1980; Oxelheim, 1981; Glick, 1986; Aliber, 1978; Eiteman and Stonehill, 1982; Feiger and Jacquillat, 1982; Jacque, 1978; Levi, 1983; Prindle, 1976; Rodriguez and Carter, 1976 and Shapiro, 1983).

[5] The extent of accounting exposure is determine by accounting conventions such as Financial Accounting Standard Board (FASB) Nº 8, or FASB Nº 52 in the United States, and Statement of Standard Accounting Practice (SSAP) Nº 20 in the United Kingdom.

Assuming that a firm is concerned with cash flow variance or value, exchange risk from a firm's point of view could be defined as the contribution of exchange rate fluctuations to a firm's cash flows or value variance. Since the value depends on expected cash flows, a suitable starting point is to determine cash flow exposure to exchange rate changes.

Table 1

Types of Foreign Exchange Risk Exposure



The suggested measure of exchange rate exposure is defined as the covariance between the exchange rate and the firm's cash flows relative to the variance of the total cash flows generated from firm's international operations, i.e.:

$$ß = cov[E_t, X_t]/var[X_t]$$

Where:

ß = Cash flow exposure.

E_t = Exchange rate in period t.

X_t = Total cash flow from foreign operations in period t.

An important advantage of this exposure measure is that it includes *volume* effects as well as *price* effects of exchange rate measures. Volume effects may be very important for exporting firms or firms facing substantial competition from foreign firms.

Taking most of the ideas of the former model, Garner and Shapiro (1984) propose a more complete model. By running a regression on historical data, they measure the correlation between the firm's cash flows from foreign operations and the variation in the exchange rate, that is:

$$X_t = a + ß\ E_t + \mu_t$$

Where:

X_t = Total cash flow from foreign operations.

E_t = Exchange rate in period t.

ß = Cash flow exposure coefficient.

μ_t = Error term capturing variations in cash flows that are not linearly related to the exchange rate.

For example, if ß = 200, then a one-unit increase in the exchange rate causes a 200 peseta increase in cash flows. In other words, the exposure coefficient measures the cash flow's sensitivity to exchange rate change. Thus, knowledge of a coefficient such as ß enables the firm to cover exposure through a proper hedging instrument.

Looking at the firm's operating profits instead of cash flows, Lessard (1986), argues that the sensitivity of a firm's profits to shifts in exchange rates may be greater than one for one. This is to say, if volume does not change, the sensitivity of operating profits can be defined as:

$$S_\pi = S_R * (R/\pi) - S_C * (C/\pi)$$

Where:

S_π = Operating profits sensitivity.

S_R = Sensitivity of revenues.

R = Revenues.

π = Profits.

S_C = Sensitivity of costs.

C = Costs.

For example, let us assume that the operating profit margin under normal parity conditions is 15% and costs are 85% of the total revenues. If a one percent change in the real dollar/peseta rate results in 0.5% change in the peseta prices and 0.25% change in the peseta costs, the sensitivity of operating profit would be:

$$S_\pi = 0.5 * (100/15) - 0.25 * (85/15)$$

$$S_\pi = 1.92$$

In other words, a one percent changes in the real exchange rate would result in almost 2% change in operating profits.

3.2. An Overview of Exchange Rate Risk Management Practices

The authors reviewed agree that an effective strategy for managing exchange rate risk should consist of the following steps: a) determination and definition of exposure; b) identification of objectives of the risk management program, and c) design of an operational strategy and organization for achieving these objectives. Cornell and Shapiro (1983), Rodriguez (1981), Oxelheim (1981), and Shapiro and Titman (1985) have argued that most existing corporations' foreign exchange risk management programs lack a coherent and theoretically sound approach to the problem.

According to Shapiro and Titman, this is largely due to the lack of adequate guidance on this topic in modern financial theory. They argue that:

> "Unfortunately, modern financial theory offers little guidance in such matters (risk management). Indeed, the theory of risk in modern finance, as embodied by the capital

asset pricing model (CAPM) and the more recent arbitrage pricing theory (APT), seems to regard as irrelevant, if not actually wasteful, a range of corporate hedging activities designed to reduce the total risk, or variability, of the firm's cash flows. Both the CAPM and the APT demonstrate that, under reasonable circumstances, diversifiable risks are not 'priced' by sophisticated investors and, hence, do not affect the stock markets' required rates of return. Systematic or 'markets' risks (those which cannot be diversified anyway by investors) are priced; but because the price of risk is the same for all market participants, there is no gain to shareholders from 'laying them off' to financial markets. Consequently, as this reasoning goes, the expected net present value of buying insurance or futures or forward contract should be zero in an efficient market. In this light, management decisions to insure or hedge assets appear, at best, 'neutral mutations' (having no effect on the value of the firm). At worst, such actions, to the extent they are costly, are viewed as 'irrational behavior' penalizing corporate stockholders."

However, in practice firms do hedge against these risks. In a study on American multinational companies, Rodriguez (1981) discovered that 86 percent of the companies studied found translation exposure to be the most relevant exposure measure. However, economic exposure has come to mean different things to different companies. In a similar study on Swedish companies, Oxelheim (1981) discovered that almost all companies gave priority to transaction exposure.

Different methods for managing exchange rate risks are suggested in the financel literature. Although different in treatment, these methods are based mainly on two distinct approaches. One approach is based on some financial techniques, while the second approach suggests the utilization of financial instruments. According to ABUAF (1986), the most popular techniques, which are also called *on-balance-sheet transactions* or the traditional methods, are: a) borrowing and lending; b) leading and lagging, and c) matching. Table-3 shows a summary of these techniques together with their respective advantages and disadvantages.

Among financial instruments which are also known as *off-balance-sheet instruments,* particularly *forwards, futures, swaps,* and *options* are increasingly used as risk management tools. Given the importance of these financial tools in today's capital markets,[6] we will give a detail description of these techniques in section 5 of this paper.

[6] For an overview of the recent developments in the international capital markets see Kirrane and Rahnema (1989).

Table 2

On-Balance-Sheet Techniques for Foreign Exchange Risk Management

Techniques	Description	Advantages	Disadvantages
Borrowing and Lending	Creates a synthetic forward by borrowing and lending at home and abroad. For example, a long forward foreign-exchange position is equivalent to borrowing at home, converting the proceeds to foreign exchange and investing them abroad. The converse holds for a short forward foreign-exchange positions.	Useful when forwards futures or swaps markets are thin - particularly for long-dated maturities.	Utilizes costly managerial resources. May be prohibited by legal restrictions.
Leading and Lagging	Equating foreign exchange assets and liabilities by speeding up or slowing down receiveables or payables.	Avoids unnecessary hedging costs.	Appropriate matches may not be available. Utilizes costly managerial resources.
Matching	Equating assets and liabilities denominated in each currency.	Avoids unnecessary hedging costs.	Appropriate matches may not be available.

4. Interest Rate Risk Management

The last few years have witnessed exceptional volatility in interest rates. This has resulted in the creation of an additional concern for financial managers, "interest rate risk." Uncertainty about the future cost of a firm's debt, from the stockholder's point of view, is a source of risk. Uncertainty increases when unanticipated movements in interest rates result in a potential loss (or gain) because of the mismatch existing between the maturity of the debts (liabilities) and of the assets which they are financing.

Traditionally this problem was solved by matching the maturity of debts and the life span of the assets they were financing. However, due to relatively high and uncertain inflation which started in the late 1960's, the long-run cost of debt become uncertain. As pointed out by Putnam (1983), this is mainly because of the strong correlation that exists, over the long-run, between changes in the inflation rate and movements in interest rates. That is, if inflation were known with certainty by both lenders and borrowers, then by adding an inflation premium the long-term interest rates could be kept relatively constant.

In practice, however, changes in inflation are not known with certainty. Therefore, the first step in managing the firm's interest rate is to assess its long-term exposure to changes in the rate of inflation.

One way to deal with the high inflation uncertainty has been the use of flexible interest loans (floating rate) on which the interest rate may be reset every six months or may be based on short term interest rates. The main drawback of floating rate loans is that the short-term interest rate may change as a result of real interest rate (nominal interest rate minus inflation rate) changes in the economy. This means a higher real interest cost for the borrower, because the cost of the firm's inputs will increase, while the price of the firm's outputs will stay constant.

4.1. Exposure Measurement

In the finance literature, different techniques are suggested for measurement of interest rate exposure. According to Smith, Smithson and Wilford (1988), Davies and Kisby (1987), Schaefer (1984) and Toevs (1983), two of the most widely used techniques, particularly by financial institutions, are gap and duration.

4.1.1. Gap

This method, particularly used by financial institutions to measure their exposure to interest rate, is called the "maturity gap." The approach is based on a procedure which determines the difference between the market values of the assets and liabilities that are sensitive to the changes in the interest rate over a specific period of time which is called the "gapping period." For example, if a firm wants to measure its interest rate exposure over a period of six months, then the gapping period is six months. According to this model, the changes in interest rates affect the firm's market value by changing its net income (in the case of a financial institution, net interest income). Therefore, the impact of changes in the interest rates on the firm's market value can be calculated as follows:

$$\Delta NI = (A_S - L_S) * \Delta r_i$$

where,

ΔNI = Changes in the firm's net income.

A_S = Sensitive assets.

L_S = Sensitive liabilities.

Δr_i = Changes in the interest rate.

The main drawback of the gap approach is that interpretation of gap patterns for a portfolio of assets and liabilities can be extremely complex and difficult. Also, the model does not generate a single number as an index of interest rate risk.

4.1.2. Duration

Duration is a measure of the interest rate exposure of any series of cash flows, indicated as a single number measured in years. The longer the duration the larger the exposure to interest rate risk. Duration is the sum of the product of the net present value (NPV) of each cash flow and the time at which the cash flow occurs divided by the NPV of all the cash flows. That is,

$$\sum_{i=1}^{n} p_i t_i / P$$

Where,

p_i = NPV of the ith cash flow.

t_i = Time of the ith cash flow.

P = NPV of all cash flows.

Despite their wide utilization, gap and duration are inadequate to deal with interest rate risk measurement in the context of the firm's competitive forces. We will discuss this point in detail in section 6 of this paper.

4.2. Managing Interest Rate Risk

As discussed earlier, one way to manage interest rate risk emanating from high inflation uncertainty is the use of roll-over credits and floating rate loans on which the interest rate may be reset every six months or so based on short-term interest rates. On the other hand, if the short-term interest rate fluctuations depend on economical factors such as fiscal policy, savings propensity, or the level of aggregate investment, then the long-term loans are more favorable from the risk point of view.

Interest rate risk, whether its source is changes in rate of inflation or real interest rate movements, can be diversified by creating an international debt portfolio. That is, issuing debt or bond denominated in currency baskets such as European Currency Unit (ECU) or Special Drawing Right (SDR). However, if the inflation rates underlying the different basket-currencies' values are very similar, then there is little value in this diversification (Oxelheim, 1981).

An alternative approach to the above mentioned practices of interest risk management is the hedging instrument offered by the futures markets, i.e., the financial futures contracts. Financial futures contracts are perhaps the most common hedging tool used against interest rate swings.

Over the last few years, the dynamic evolution in the development of the market in options and swaps, together with the growth of the forwards and futures markets, has provided financial managers with new tools for managing interest rate and exchange rate risks. These so called "off-balance-sheet instruments" are now available in most European countries,[7] and firms can use them for hedging their positions against changes in the interest rates swings. In the next section we will review the main off-balance-sheet instruments in detail.

5. Off-Balance-Sheet Hedging

The need to manage risks associated with the uncertainty that has emerged from changes in the financial environment over the last few years, and their adverse effect on the performance of the firms, has led to the development of new financial services to assist protecting against adverse rate movements. Among these services, which are also known as "off-balance-sheet hedging instruments," the most popular are forward rate agreements, financial futures, interest rate and currency swaps, and options.

Firms can adopt different strategies toward their exposure to possible rate changes. Some companies might try to fix their position with respect to interest or foreign exchange rates for a long period, others might ignore risk and merely pay the current market rate, while others might seek great flexibility to move from fixed to floating rates or between currencies according to how rates move. All of these strategies and many more are possible by using the instruments previously mentioned.

[7] At the time of writing, the Barcelona Futures Market is expected to start operations very soon. The Madrid Options Market is going to start operations by the end of 1990.

5.1. Forward Rate Agreements (FRAs)

Forward rate agreements offer companies the facility to fix interest rates for a specified period at a future date. The two parties to the transaction, the lender (or seller) and borrower (or buyer), arrange a notional loan or deposit (no actual deposit is made) of an agreed size, duration and contract rate. When the agreement period occurs, which may be, for example, six month to two years in the future, the lender or borrower might have to compensate the other party in cash if interest rates have changed since the agreement was arranged. If the interest rates have fallen the lender would receive a payment from the borrower in compensation for the lender having to actually invest, at this future time, at a lower rate of interest than the market rate. The borrower pays this compensation amount plus the current market rate on its actual borrowings. The overall effect is that both the lender and borrower are locked into the initial contract rate, no matter what happens to current market rates. The borrower in the example above would have to give up the fortuitous gain which would occur if interest rates were to fall after the forward rate agreement was arranged. If interest rates were to rise after the agreement was made, the lender would have to make a compensation payment to the borrower reflecting the change in the interest rate. Again, the overall rate for both parties is the initial agreed contract rate for the notional deal.

FRAs are very flexible in size and maturity, and do not have the initial price or margin requirements as exist with options or futures. They are, however, difficult to cancel prior to the end of the agreed period.

5.2. Financial Futures

Financial futures are binding contracts which enable the price of a variety of interest rates, currency prices and Stock Exchange index prices to be fixed for “delivery” on a specified date up to two years in the future.

From a corporation’s point of view financial futures offer hedging facilities against interest rate and exchange movements. Interest rate futures are the most widely used. A company that has short-term investments or expects to have funds to invest in the near future might use the financial futures market to protect the future yield on these investments at a time when interest rates are expected to fall. Similarly corporate borrowers might wish to protect themselves from a possible rise in interest rates.

Usually, the activities of the market are overseen by a central clearing house. The clearing house of each futures market guarantees the transactions of its members, and is a safeguard against default. A feature of futures markets is the existence of margin, effectively a security deposit. The initial margin, which is fixed by the clearing house, is a very small proportion of the contract size, for example as little as US$500 on a one million dollar contract. The margin position on any contract is examined daily with reference to the official settlement price. In practice, this process is called “marked to the market.” If the price has moved in favor of the contract holder a margin surplus will exist, which is the price available for distribution to the contract holder (via a broker). If it has moved in an adverse direction the contract holder must deposit an additional variation margin to restore the margins account to the required level.

For example, assume that a company purchased five three-month Eurodollar futures contracts with face value of $1 million each at a price of $85.50.[8] The initial margin required will be 5 x $500 = $2,500. If next day the price moves to $86, the balance of the margin account will alter. Eurodollar three-month contracts have a value of one basis point movement of $25 per contract.[9] If the new price is $86, this a 50 basis point movement giving a profit of 50 x $25 per contract or $1,250. Hence, the total profit is $1,250 x 5 = $6,250. The $6,250 is a margin surplus and may be taken as profit. If the contract is kept open, with the surplus not immediately taken, and the next day price fall to $85.25, then there will be a loss of 75 x $25 x 5 = $9,375. In order to keep the margin at the required $2,500, the company must make an additional payment. The balance of the company´s margin account on day 2 was $2,500 plus the surplus of $6,250, a total of $8,750. Given the day 3 loss of $9,375 a "margin call" would be made on the company to return the margin account to $2.500. This call would be for:

$9,375 + $2,500 - $8,750 = $ 3,125

From a corporate viewpoint, the major use of the financial futures market is for hedging. A hedging transaction temporarily offsets a position at risk in a cash market with a related position in a future market. The benefit of hedging is that if the price of the cash market position falls, the value of the future contract will rise offsetting the cash market fall (and vice versa). If the futures contract gain exactly offsets the cash market loss the hedge is said to be perfect.

An example of an interest rate hedge might be a borrower wishing to protect against rising interest rates by undertaking a "short position".[10] Let's assume that a company has a $2 million floating rate bank loan, currently at a 15% interest rate, with the rollover date of January 1 when the interest rate might alter. It is now November 15. If the financial director or treasurer is worried about interest rates rising by the rollover date, he could sell two March Eurodollar 3 month futures contracts now at the current price, for example $85.5 (an interest rate of 100 - 85.5 = 14.5%).

If on January 1, the interest rate on the company's floating rate loan has risen to 16.5%, the extra cost for 3 months to the company in the market is $2m x 1.5% x 1/4 year = $ 7,500. On January 1 the price of a March futures contract is likely to have fallen as interest rates have risen. If the price of March Eurodollar three-month futures is now $84, the financial manager could purchase two contracts on January 1. The gain on the future contracts (as the contracts can be bought back cheaper than they were sold) is:

$25 (for each basis point) x 2 (contracts) x 150 (basis point) = $7,500

The loss on the cash market has been offset by the futures market hedge (ignoring the margin requirement and fees).

The futures price need not move by exactly the same amount as the interest rate changes in the cash market. Less–than-perfect correlation between futures market and cash market rate movement is known as "basis risk" and can affect the efficiency of the hedge, the gain relative to the loss. A perfect hedge is 100% efficient with the gain equaling the loss in the two markets. Perfect hedges are rare both because of basis risk and because the use of standard contract size might prevent hedging against the exact amount of the company's exposure.

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[8] This is an interest rate of 14.5%; found by 100 - 85.50= 14.50.

[9] A basis point here is one hundredth of one percent, or 0.01 percent. The value of one basis point is found by: $1,000,000 x 90/360 x 0.0001 = $25.

[10] Selling short or taking a short position, means that you sell an asset that you do not already have.

Financial futures may be used to protect against foreign exchange risk, although forward contracts and foreign currency options are much more popular for hedging against such risk as they are more flexible than futures contracts. An example of a foreign currency futures hedge might be a Spanish company which imports goods from the United States with payments in US$ due in the February with a total value of US$4 million. It is now 15 November, the company might wish to protect itself from a rise in the value of the US$ relative to the Spanish Peseta before payment is due in February. Given the following data:

- Spot exchange rate: 116.85 Ptas. - 117.35 Ptas./$1.
- March Ptas./US$ futures contract in units of 250,000 Ptas. is available at the current price of 116 Ptas/$1.[11]
- The current spot equivalent of US $4m payment is Ptas. 469.4 m.

The company can hedge its foreign exchange risk by selling "short" (Ptas. for $) 1,840 March contracts at 116 Ptas./$1 ($4m x 116 = Ptas. 464 m; this requires 1,856 of Ptas. 250,000 contracts) 12 for a total of $4 million.

If in the February, when the payment is due the spot rate has moved to: 118.55 Ptas. - 19.55 Ptas./$1 and the futures price to 118 Ptas./$1, the company can close out the futures contracts by buying 1,856 March contracts at118 Ptas./1$ for a total of $3,932,203; a futures profit of $67,797 or Ptas. 8,037,288 at the current spot rate of 118.55 Ptas./$1 (taken in margin surplus during the life of the contract).

Payment to the United States company will be made by buying US$ in the spot market at a cost of $4 x 119.55 = Ptas. 478,2 m. This is a loss relative to the spot rate on November 15, of Ptas. 8.8 m. Most of this "loss" has been covered by the futures market profit but it is not a perfect hedge. The hedge efficiency in this case is 8,037,288/8,800,000 x 100% or 92.33%.

5.3. Interest Rate and Currency Swaps

During recent years, swaps have developed into one of the most important and flexible tools of corporate treasurers. Currency swaps have existed since the mid-1970s, but swaps did not initially develop rapidly. Early swaps were matched deals between two counterparties, with a bank acting as an intermediary. Finding a counterparty to match with was often difficult. However, since 1984, banks have been willing to enter into swap agreements with only one counterparty, and to take out a temporary hedge (often in the bond or futures markets) until an offsetting swap could be found (Antle, 1989). This process, known as warehousing, has greatly facilitated the development of the swap market.

A swap is an agreement to exchange one stream of future cash flows for another stream of future cash flows with different characteristics. An interest rate swap, for example, is an agreement between two parties to exchange the interest flows on a notional or a theoretical principal amount over a specified time period, calculated on different interest rates. This usually does not involve an exchange of principal.

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[11] On the futures markets there is a single price, not a buying and a selling rate as on the foreign exchange markets.
[12] The size of futures contracts on Pesetas is invented by the author. At the time of writing, futures contracts on Pesetas do not exist.

Specific forms of interest rate swaps include swaps involving an exchange between a fixed and a floating rate in the same currency (also known as the plain vanilla), and basis swap between two floating rates in the same currency with different bases, for example, three month LIBOR (London Inter-Bank Offering Rate) and three month treasury bills.

The cost savings possible through this process of arbitrage in the international credit markets is best illustrated through an example. Consider two companies, Co.A and Co.B and their financial intermediary, with the profiles illustrated in **Exhibit 1** below.

Company A can issue US$ denominated fixed debt at 10.75% or it can issue floating rate debt at LIBOR + 25 basis points (bps). Company B, which has a lower credit rating than company A (BBB compare to A's rating of AAA), can issue fixed rate debt of the same maturity at 11.70% or floating rate debt at LIBOR + 37.5 bps. It would like to issue fixed debt but with a lower coupon. Company A would prefer to issue floating debt, given the nature of its asset portfolio. A financial intermediary facilitates a swap between the two companies. The details are summarized in **Exhibit 1**.

Interest rate swaps may be arranged for periods of up to ten or fifteen years in all major currencies and are arranged according to the need of the user, both with respect to the size and to the terms of the contract. The main risk of swaps is that one of the parties to the contract defaults and does not make the agreed interest payments.

Currency swaps are contracts to exchange payments denominated in one currency for those denominated in another. Such swaps sometimes involve an initial exchange of a principal sum (for example, Spanish Pesetas for US$), which is re-exchanged at the end of the swap at the prevailing exchange rate when the deal was arranged. Currency swaps may be arranged on a variety of interest rate bases. Fixed/fixed, fixed/floating (known as currency coupon cross swaps), and floating/floating are the most common forms of the currency swaps.

5.4. Interest Rate and Currency Options

Forward rate agreements, financial futures and swaps all offer ways of hedging against adverse rate movements, by fixing rates for some future period. However, although protection against adverse movements is achieved because the rate is fixed, these hedging techniques do not allow the company to benefit from any favorable rate movements that might occur. In contrast, options offer a company protections against adverse rate movements while retaining the opportunity to benefit from favorable movements.

An option contract is an agreement that gives the buyer of the option the right, but not the obligation, to buy an "asset" at a predetermined price (a call option) or to sell an "asset" at a predetermined price (a put option) on or before the fixed date at which the option expires. The crucial feature of the option is that it needs not be exercised unless it is beneficial for the buyer of the option to do so. The writer (or seller) of the option receives a premium (the option price) from the buyer of the option. The price at which the option may be exercised is known as the "strike price." If the option can be exercised before the expiration date, it is called an "American option;" if only on the expiration date, a "European option."

Options are particularly attractive to companies that wish to hedge against a contingent liability such as the liability that exists when bidding for a contract. If the bid is not successful, the option is not exercised if the exchange rate is unfavorable, or will be sold if the rate is

favorable. The main deterrent to companies using currency options is that the option premium or price can be considerable.

Currency options are now traded on most of the official exchanges throughout the world.[13] They are available at a limited number of different striking prices and maturity dates. Typical details of currency options contracts might include:

British pound, £25,000; cents per pound

	Calls			Puts		
Strike Price	**Dec**	**Jan**	**Feb**	**Dec**	**Jan**	**Feb**
1.5725	2.80	3.85	4.55	1.90	2.95	3.65
1.6000	1.55	3.85	3.45	3.20	-	4.95
1.6250	0.90	1.80	2.55	4.15	-	6.45

All contracts here relate the US$ to the British pound. The standard contract size is £25,000 and the option prices shown are in United States cents per pound.

An example of a currency option might be an American company which has agreed to import goods from the UK with a value of £50,000 payable in February. The American company might wish to protect itself from a rise in the value of British pound relative to the US$ before payment is due in February, but still have the opportunity to benefit from favorable exchange rate movement. The company can hedge its foreign exchange risk by taking out an option to purchase £50,000 in February at a striking price of $1.5725 = £1. This requires two contracts (£50,000/£25,000 = 2), and, since the pounds are being purchased, a call option would be required. The call option price for February with strike price of $1.5725 is 4.55 cents ($0.0455) per pound. Hence, the total premium payable for the option is: 25,000 x 2 x 0.0455 = $2,275. This premium is payable whether or not the option is exercised.

If in the February, when the payment is due, the spot rate on the foreign exchange market is $1.5720 = £1, then the option will not be exercised because the company can obtain the British pound at a cheaper price in the spot market. This is the worst outcome which means a loss of $2,275 for the company. Had a forward contract been used, assuming a forward contract rate for February delivery of $1.6750 = £1, the losses would have been still higher:

£50,000 x 1.6750 = $83,750	Total cost on the forward market
£50,000 x 1.5720 = $78,600	Total cost on the spot market
$ 5,150	The loss

However, if the spot rate in February is $1.6725 = £1, then the option will be exercised and the pounds will be purchased at $1.5725 = £1. The cost of using a forward contract is still $83,750, while the total cost of the option contract in this case is:

$1.5725 x 50,000 = $78,625 + 2,275 = $80,900

which is cheaper than the forward. So, with the option contract, the company can protect its position against an adverse movement in the exchange rate, and at the same time keep the right to take advantage of a favorable movement in the exchange rate.

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[13] According to the Bank of Spain's Circular nº 9/88 of 28 June 1988, both American and European currency options can be traded in Spain, but with the exclusive intention of covering exchange risk. In other words, the opening of purely speculative positions is not allowed.

The option premium or price depends upon a number of factors:

a) The maturity or time to expiration of the option. Longer maturity will be more expensive because there is a greater chance that rates will move in favor of the option holder.
b) The striking price or exercise price. The more favorable the striking price to the buyer of the option, the higher the option price.
c) The current market price of the underlying security.
d) The expected volatility during the life of the option of the price of the underlying security.
e) Current interest rates.

Interest rate options can be used to manage the interest rate swings in the same way as a futures contract, but with some additional flexibility. To illustrate this flexibility, consider a firm which is planning to raise funding in six months from now at a rate set today. To do this, the firm can attempt to protect itself by selling a six-month futures contract. This hedge works only if the transaction proceeds as planned. That is, if the firm is able to find a lender who commits itself to lend the money in six months time at the predetermined rate. However, if the lender does not fulfill its commitment, then the firm will be left with an open futures position, i.e., exposing itself to the possibility of unexpected gains or losses.

By using an option contract the firm can protect its position against this uncertainty. This can be done by buying a call option, which, while minimizing or even eliminating potential losses, will not create an open position for the firm as a futures contract would.

There are three main types of interest rate options (and many more variations): caps, floors, and collars. Interest rate caps (or ceilings) allow borrowers to protect their positions against rises in interest rates. A cap or ceiling rate is selected (for example, 14% on 6 months LIBOR), and the actual LIBOR rate will be compared to the cap rate every 6 months or another agreed period. If the actual LIBOR rate is higher than the cap rate the buyer of option will be compensated for the difference in rates; if the actual LIBOR rate is lower than the cap rate then no payment will be made. Therefore, a cap ensures that its buyer (or the borrower) pays no more than the agreed cap rate during the period of the option agreement. The buyer of the cap pays a premium for the cap option when the agreement is arranged.

Interest rate floors offer an investor of funds an option agreement which pays compensation to the investor if the interest rates fall below an agreed level. A company with floating investments can use floors to guarantee at least a minimum return from the investment over its entire life, and still profit from interest rate rises. The cost of the premium payable for the purchase of caps and floors should be considered as part of the overall percentage cost or return to the borrower or investor respectively.

Collars are a combination of caps and floors where one party sells the cap and the other sells the floor. Collars may be used by either borrowers or investors. A borrower would buy a cap to limit the maximum interest rate payable, but would sell a floor which then fixes the minimum borrowing cost. The borrower, by selling the floor, is effectively giving up the possible benefits from market interest rates falling below the floor level. Collars would be cheaper in premium cost than the equivalent cap and could give a net premium return to the borrower depending on the rate at which the cap and the floor are set. If 6 month LIBOR rates are currently 14%, a cap might be purchased at 17% and a floor sold at 12%. If LIBOR rates in 6 months move to 17.5% the borrower will be compensated by 0.5% as the cap becomes effective. If rates in

6 months move to 11%, the borrower would have to pay the buyer of the floor 1% as the floor becomes effective. If rates are between 12% and 17% no payments will be made.

6. The Comprehensive Approach

The models reviewed so far share a common drawback; they mainly measure the financial effects of fluctuations in the currency and interest rates. Our main contention is that, in the new competitive and financial environment that has emerged over the last two decades, corporate risk management is playing an increasingly important strategic role. The result of our review, which synthesizes the recent work of the top scholars in the field, strongly supports our main contention.

We encountered the first evidence in the work of Lessard (1986), who believes that the emergence of global competition, together with an integrated and increasingly volatile financial environment, increases the importance of hedging policy; this increasingly requires much more sophisticated strategic and tactical choices. He further argues that,

> "...finance not only comes into play in addressing issues that arise because of global competition in product markets, but also become a direct factor in that competition."

Cornell and Shapiro (1983) warn that most of the existing corporate risk management programs (especially those related to exchange rate risk) are not adequate or effective. They are generally focusing exclusively on traditional financial responses. Cornell and Shapiro propose an integration of marketing and production decisions into the risk management strategies, because they consider one of the international marketing managers' tasks is to identify the likely effects of changes in the environment and then to act on them by adjusting pricing, product, credit, and market selection policies. Hence, hedging decisions are directly related to the firm's marketing and production strategy.

According to Cornell and Shapiro, market selection and segmentation provides the basic parameters within which a company may adjust its marketing mix over time. Hence, in considering major strategic issues, such as in which markets to sell or how much marketing support to devote to each market, management must take into account the effects of fluctuations in the foreign exchange and other financial variables. They believe that it is also necessary to consider, in this context, issues related to: 1) market segmentation; 2) timing of the introduction of new product; 3) decisions to eliminate products, and 4) product line decisions.

Shapiro and Titman (1985) argue that risk has a negative effect on the firm's expected cash flow. Therefore, as a company's total exposure to risk goes up, its cost of doing business rises, reducing its prospects for survival. There are two main factors behind this phenomenon. First, the negative effect of risk on the company's sales, because the incentive of companies in financial distress to produce lower quality products will scare off potential customers. Second, the negative effect of risk on the company's operating costs, which is, in part, a function of its suppliers' view of its long-run viability.

The message that emerges from these observations indicates that volatility of financial variables directly affect both the marketing and production costs of company. In other words, they directly affect company's competitive position.

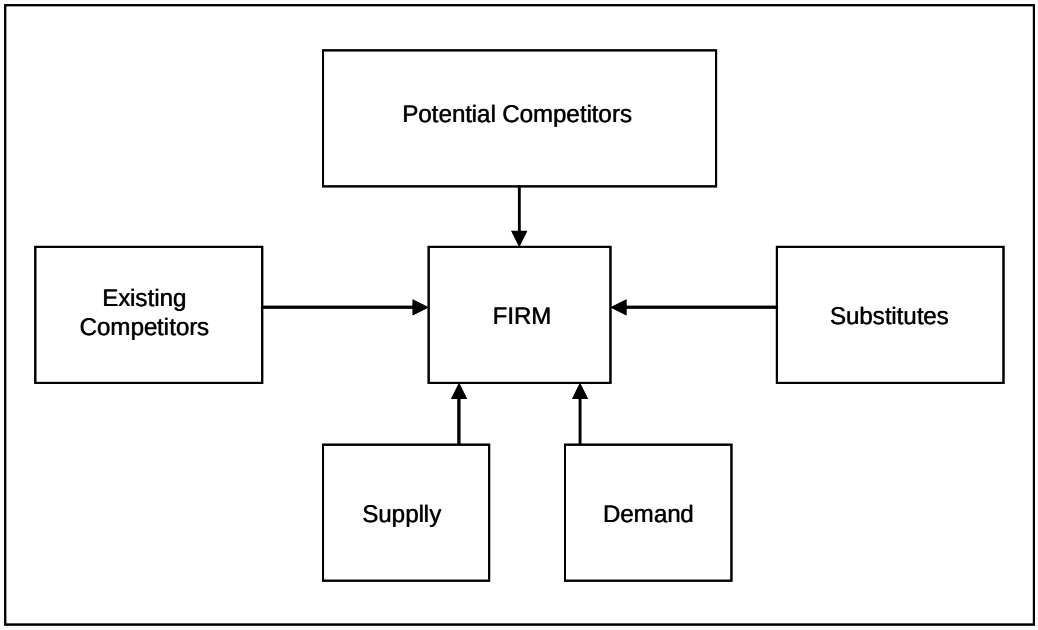
In the words of Hax and Majluf (1984),

> "...the essence of strategy is to achieve a long-term sustainable advantage over competition in every business in which the firm participates."

Hence, in the new competitive and financial environment, a company may not achieve a long-term, sustainable advantage over its competitors without taking into account the consequences that changes in the financial environment have on the all basic corporate decisions. This is our contention that, in the competitive environment which is characterized by an increasing integration of global capital markets and the high degree of volatility in interest and foreign exchange rates, *measuring* and *managing* these risks has to be made an integral part of the firm's global strategic planning. From this perspective, it seems to make sense to analyze the effects of swings in the interest and currency rates on the firm's competitive forces, as is shown in Table 3.

Table 3

Risk Management and Competitive Forces



Changes in the exchange rate and movements in the interest rate can affect practically all of the firm's value added chain[14] activities, i.e., the firm's competitive position.

Firms that consider themselves global competitors should carefully analyze the effects of any change in the real exchange rates and the interest rates on both their own competitive position and the positions of their competitors. In the short run, the volatility of currency and interest rates might obscure long term trends in the firm's international competitive position by affecting the components of its value added chain. Currency and interest rate changes alter the

[14] By "value added chain" we mean the concept as described by Porter (1985). According to him, the value added chain covers all stages in the development of a product, from product development to delivery of the finished product to the final customer. A generic value added chain covers two groups of activities: primary and support activities. The former group covers the following steps: Inbound logistic, Operation, Outbound logistic, Marketing and sales, and Services. The latter group covers Procurement, Technology development, Human resource management, and the firm Infrastructure.

cost of a firm's inputs and the price of its outputs, thereby shifting the locus of a multinational corporation's relative competitive strength across its many product/market segments.

On the financial side, proper techniques for coping with these risks are: appropriate choices with respect to currency of denomination of debt, place of issue, terms of interest and maturity structure. It should be emphasized that there are many different ways by which a company can modify or adjust its existing debt characteristics. For example, company A has to finance a project in Deutsche Marks (DM). There are two possible alternatives: first, issue DM denominated fixed debt; and second, issue US$ denominated floating debt. Management likes the latter choice, given the company's competitive advantage position in that market. Company A could issue floating in US$ and then, by using currency and interest rate swaps, convert its debt to DM denominated fixed debt.

Volatility of exchange and interest rates might affect entry as well as exit barriers of the industry in which the firm operates. This might result in attracting some new entrants to the industry which could later on become potential competitors. For example, when the DM and Japanese Yen appreciated by over 40% during 1971-1973, entrance into the United States market through the acquisition of local firms or investment in setting up new installations became much cheaper for both German and Japanese firms. Swings in the currency and interest rates may also affect the industry's structure by changing the cost of both the primary and support activities of the value added chain.

The experience of Volkswagen (VW) during the 1970s is an excellent illustration of why and how currency risk analysis should be part of global strategic planning. VW built up a highly successful export market in the United States for its "Beetle" model. By 1970, the company had 6% of the United States car market. However, following the collapse of the Bretton-Woods system of fixed exchange rates and the appreciation of the DM, the company faced many problems.

VW expenses were primarily in DM, but its revenues were primarily in dollars. Keeping the price of the vehicles constant in DM meant increasing the delivered price in dollars by the full percentage of change of exchange rates. That would have been disastrous; so, to partially counter the adverse effects of an appreciating DM, the company raised its prices in dollars. As the market was very price-sensitive, higher prices led to lower sales. Annual sales plunged from a high of 600,000 vehicles in 1968 to a low of 200,000 vehicles in 1976.

The losses incurred by the firm were enormous. In 1973, VW's losses were the highest (at that time) ever suffered by any corporation anywhere in the world. VW started responding strategically to the crisis. It expanded its product line and moved into a higher price range; it took dollar denominated loans in Euro-markets and in the United States; it developed sources in the United States; and, most important, it built plants in the United States. Overall, the firm's strategic profile was transformed from that of a one-product giant domestic exporter to that of a multi-product, truly multinational corporation.

Through these moves, VW synchronized its global financing, marketing, production, and purchasing strategies, taking into account not only the firm's strengths and weaknesses in each market, but also the currency prospects of the firm's markets.

Swings in foreign currency rates might also make substitute products more attractive by either reducing their sale price or production and/or importation costs. An example of this is the experience of the edible-nuts industry in Spain. As a key country in the world of the edible-

nuts, Spain is a significant consumer and exporter of almonds, hazelnuts and pine nuts. It also imports pistachios, walnuts, etc., from other countries. Until 1985, the Spanish consumption of pistachios, known as an expensive and even a luxury nut, was around 200 tons a year. However, the sharp depreciation of the US$ (the currency usually used by the exporter of pistachios) between 1985-1988, together with stable US$ price of this product over the same period, resulted in a significant reduction in its equivalent price in Pesetas. Consequently the consumption of pistachios jumped to 7,000 tons in 1988; while the consumption of almonds, and hazelnuts decreased over the same period.[15]

Short run changes in the exchange and interest rates might also affect long term trends in the supply and demand of a firm's products. By using both the commodities futures and the financial futures contracts together with forwards and options contracts, firms can assure the future supply of its inputs and outputs at a predetermined fixed price. A case in point is Nestlé, the multinational giant. Nestlé manufactures in 59 countries and is a raw materials producer and grower in many of them. The company owns about 430 factories and employs almost 200,000 people around the world. The company is the world's largest buyer of green coffee and one of the largest buyers of cocoa. It also is among the world's largest buyers of sugar, cereals and many other commodities. In terms of price risk management, Nestlé uses all major futures markets: New York's Coffee, Sugar and Cocoa Exchange, the London Futures and Options Exchange and the Paris Bourse.

Analysis of this kind leads to the conclusion that, given the increasing competitive global market, a well designed risk management program in line with the firm's overall objectives is a necessary step in achieving a long run sustainable competitive position. Moreover, the suggested model shows how to make risk management strategy a competitive weapon.

7. Summary and Conclusion

Over the last few years, changes in the international financial system have resulted in an increasing volatility of currency and interest rates. Fluctuations in the exchange rate and movements in the interest rates are linked to each other through some basic relations observed in the international financial markets. The emergence of a global market, together with the rapid integration of the international financial markets, has increased the adverse effects of these fluctuations on the firms' performance throughout the world.

There are two major types of exchange rate exposure; first, accounting exposure, and second, economic exposure. The latter can be divided further into transaction exposure and strategic exposure. We have reviewed several methods of measuring the exchange rate economic exposure as well as the interest rate exposure.

The traditional approaches to managing the macroeconomic risks and uncertainties were surveyed in detail. These approaches, which are also known as the on-balance-sheet methods, are mainly based on altering the company's equity and debt financing decisions. On the other hand, the recent approaches to managing these risks are based on the utilization of the new

[15] Extracted from the report presented by Borges S.A. at the conference of the 1988 International Nuts Council in Switzerland.

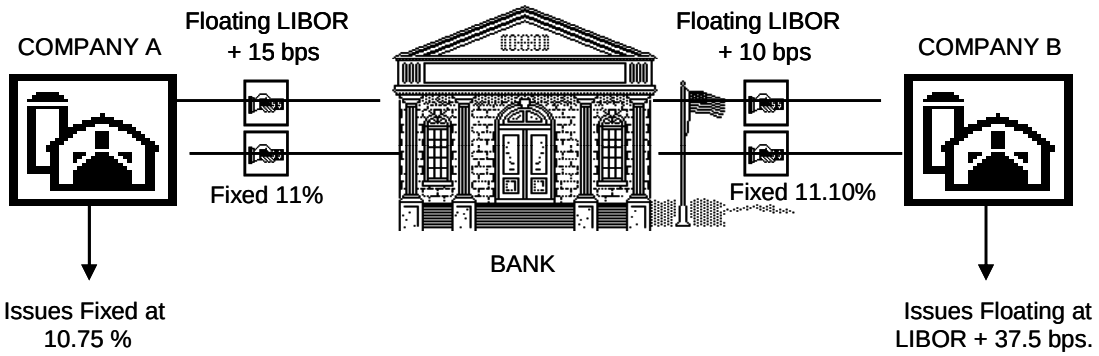
financial instruments. These ways of risk management, also known as the off-balance-sheet hedging, were thoroughly discussed.

It was noted that measurement models suggested in the finance literature share a common drawback; they do not analyze the effects of fluctuations in the currency and interest rates in the context of the firm's competitive position. Therefore, a comprehensive measurement model was suggested, which takes into account the effects of changes in currency and interest rates on the firm's competitive position.

As was noted, a company can achieve a position of competitive advantage if the cost of its value added chain activities are more favorable than those of its competitors. Therefore, the importance of decisions concerned with the reduction or elimination of the negative effect of fluctuation in the interest and exchange rates on the firm's value chain activities are obvious.

Exhibit 1

Interest Rate Swap



	Company A	Company B
Credit Rating	AAA	BBB
Cost of Raising Direct Fixed rate Funding	10.75%	11.70%
Cost of Raising Direct Floating Funds	LIBOR + 25(bps)	LIBOR + 37.7(bps)

	Company A	Financial Intermed.	Company B
Direct Funding Costs			
Fixed Rate Funds	(10.75%)		
Floating Rate Funds			(LIBOR + 37.5 bps)
Swap Agreement to Pay Floating Rate by A to Fin. Intermed.	(LIBOR + 15 bps)	LIBOR + 15 bps	
Swap Agreement to Pay Fixed By B to Fin. Intermed.		11.10%	(11.10%)
Fin. Intermed. Agreement to Pay A Fixed	11%	(11%)	
Fin. Intermed. Agreement to Pay B Floating		(LIBOR + 10 bps)	LIBOR + 10 bps
Net (Payment) Receives	(LIBOR - 10 bps)	+ 15 bps	(11.375%)
Comparative Cost of Equivalent Direct Funding	LIBOR + 25 bps		11.70%
Net Savings	35 bps		32.5 bps

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