EXCHANGE RISK MANAGEMENT IN THE MODERN COMPANY - A TOTAL PERSPECTIVE

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Presented at the Academy of International Business,
International Meeting in Singapore June 14-16, 1984

ISBN 91-7810-143-3

minab/gotab Stockholm 1984

Preface

This report was prepared for presentation at the International Business Academy, International Meeting in Singapore in June 1984. What is reported are findings from a research project that investigates the practices of Swedish multinational companies in the area of foreign exchange management. The objective of the report is to create a better understanding of how firms cope with exchange risk. This is accomplished by relating exchange risk management to the company's total risk management and by discussing different managerial systems.

The exchange risk management analysis, given here, is one of the main parts of the project, called Corporate decision-making under foreign exchange uncertainty, which was initiated in 1977 and which has partly been financed by funds from the Bank of Sweden Tercentenary Foundation. The relationships between different parts of the project and references to reports from those parts can be found at the end of this publication.

Stockholm in June, 1984

Lars Oxelheim, Scandinavian Institute for Foreign Exchange Research.

Contents

1 Introduction

In this paper various systems for the management of corporate exchange risks will be discussed. At present there is no uniform theoretical framework for the design of such systems. The observations and arguments outlined below are based on the author's empirical analyses of foreign exchange and capital markets under a variety of institutional forms, and of risk management in those Swedish companies which are most dependent on international business.

Risk management in a total perspective should be based on an assessment of the dependence between the economic value of the company on the one hand, and changes in interest rate, inflation rate, price, volume and exchange rate on the other. In this paper we will examine corporate exchange risk management as part of the company's total handling of risks arising from these changes.

The second section will be concerned with the nature of exchange risks and the way in which they fit into the company's total risk situation. The third section is devoted to an elucidation of the size of the exchange risks, and the consequent importance of effective risk management. Various systems concerned with the management of exchange risk are discussed in general terms in section 4, while section 5 reviews the systems in use at the present time in the largest internationally oriented companies in Sweden. Finally, in section 6 some trends in the development of systems for corporate exchange risk management are discussed.

2 Risks attaching to the company's international business

The company is exposed to many risks. One of its main tasks is to handle these risks. "Risk" refers to uncertainty about the future value of the company. This value is affected by changes in interest rates, inflation rates and exchange rates from a macro perspective but also by changes in prices and volumes on the company level. All these five variables are sources of unfavourable changes in the company's future economic value. They are interdependent and should be analysed simultaneously in order to obtain an assessment of their aggregated effect.

On a theoretical level "market value stabilisation" is often the aim of corporate risk management. The exposure to a given combination of the above-mentioned variables can be defined as the sensitivity of the real domestic market value of the company's equity, to the concomitant random variations in that combination. Given this aim, the company has to estimate the way the market forms its expectations about the company's value.

To avoid the problem of assessing market expectations, the aim of risk management is often formulated in terms of the company's economic value (flows) or book value (stocks) instead of the market value. In practical risk management, companies try to avoid the problems connected with market value objectives by relying on accounting figures.

2.1 The company's total risk

There are two main elements of risk traditionally said to arise when a company is engaged in international business. These risk elements, which are regarded as attaching specifically to

export/import business and overseas investments for example, consist of *foreign exchange risks* and *country risks*. However, it is difficult to draw clear boundaries between these risks and the other corporate risks - the *financial* and *commercial*. These last must presumably also include elements of risk specific to the international commitments, over and above the pattern of risk generated by the foreign exchange and country risks.

A broader approach to the company's specifically international risk exposure is needed - e.g. the linking of foreign exchange risks to financial risks - because of the substitutability at the central bank level, where action may take the shape of a change in interest rate or an intervention on the foreign exchange market. The growth in the volume of foreign loans with flexible interest rates in corporate portfolios over the past few years suggests that interest rate fluctuations may become as serious a problem for companies in future as fluctuations in exchange rates. A broader view of risk in the individual company should lead to greater awareness of the equal importance of the two components in the capital cost - interest rate and exchange gain/loss - and, in the long run, to symmetrical treatment of the two in corporate planning and control.

Similarly the financial risk and the foreign exchange risk can be said to affect the commercial risk, and they can all be said to possess a certain substitutability. In the company's product calculus the first two of these risks are connected with the factor side (input) and the financial side. They are also evident in the company's sales and financial investments in the shape of variability in the cash flows generated in foreign currencies. The choice of pricing strategy will be the company's main action parameter, when it comes to deciding what is to be expressed as exchange risks and financial risks on the one hand, and commercial risks on the other. It is a question of choosing a pricing philosophy geared to the company's goals. Depending on the industry to which they belong, companies will have some difficulty in passing on to the market the favourable or unfavourable changes in interest

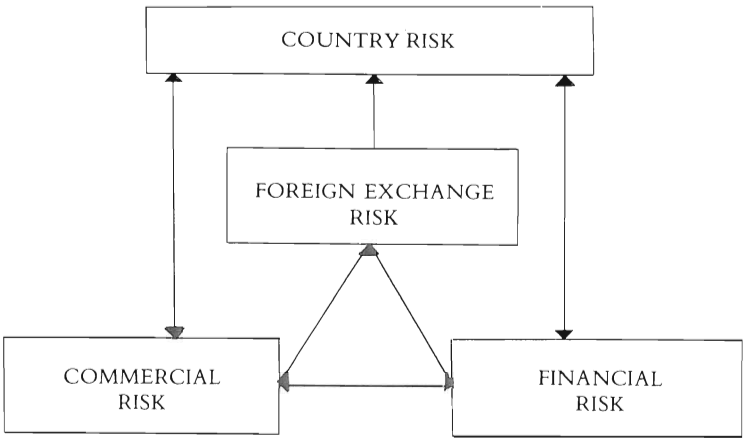
or exchange rates. For various reasons the connection between changes in interest and exchange rates, on the one hand, and their effect on the market price and thus ultimately on sales volume and the commercial risk on the other, is rarely allowed for in corporate risk analysis. The difficulty in assessing the price elasticities of the company's products is one important reason for neglecting this connection, despite its great importance.

Overlapping with all three risk categories mentioned above, is what is known as the *country risk*. The relations between all these types of risk are illustrated in Figure 1. The overlapping nature of the country risk stems from the fact that it is generated mainly by the exchange régime in a particular country, while the other risks are largely market-generated. The country risk can be analysed in terms of potential imbalances on the supply and demand sides in a country's economy, and in terms of political changes which may ultimately threaten a company's ownership rights in the country concerned. The analysis shows that the country risk can be expressed in two components: political risk and the risk of suspended payments. The two components are intimately connected.

The political risk includes, for example, the risk of future legal changes which may affect the return on the company's investment or the risk of socialisation or the nationalisation of its assets. The risk of suspended payments does not include the risk of crashes like that of the Herstatt Bank or the Franklin National Bank; it refers to suspension of payment and dislocations directly due to decisions by the exchange régime (usually the central bank) in a country.

The connection between foreign exchange risk and the risk of suspended or delayed payment, has lately been brought home to many companies operating in Brazil, for example. In an attempt to protect its own exchange rate, the central bank of Brazil has seriously affected the timing of the payment flows out of the country.

Figure 1 The company's risk



2.2 The nature of the foreign exchange risk

Foreign exchange risk is the risk of a change (gain or loss) in the company's future economic value resulting from a change in exchange rates. For a company with overseas commitments there are, in principle, two ways in which these losses or gains can arise, assuming in both cases that there is a "base" accounting currency. One of the risks is connected with the company's cash flows in different currencies, and can be described as *active risk:* a change in exchange rates has an immediate effect on the value in the base currency of funds to be converted from one currency to another (exchange differentials arise). When, for example, a company's export is invoiced in the currency of the home country of the receiving company, such a risk will exist between the time of invoicing and the time when payment is received. If this risk is not covered, it may lead to a gain or loss in the base currency on the particular exchange item. These gains and losses will affect the amount of cash available to the company.

The other risk category, *latent risk,* refers to the company's stocks (assets/debts) and it belongs in the short perspective to

the accounting sphere. In the long run even this risk will become active in the sense that subsidiaries are sold. It arises, for example, in the course of consolidating a group with overseas subsidiaries (translation differentials arise). This risk, which is related to the corporate balance sheet, does not necessarily result in a gain or loss calculated in the base currency. Thus the latent risk implies that a change in exchange rate may affect the value in the base currency of non-transferable assets and debts in an overseas subsidiary.

Exchange risk measured in terms of changes in balance-sheet items could be expected to agree with the exchange risk on the cash flows during the period corresponding to the change in the balance sheet. But because of the variety of measuring methods used, this agreement is seldom a practical reality. This creates problems when the measurement, reporting and control systems are to be built up.

In textbooks the foreign exchange risk is generally measured in terms of the increased variability in the company's consolidated yield, which can be regarded as caused by unexpected fluctuations in exchange rates. In modern capital market theory, where the exchange risk is defined as the systematic risk connected with costs and revenues in foreign currencies, the risk is measured in terms of the covariance between the exchange rate and the domestic yield.

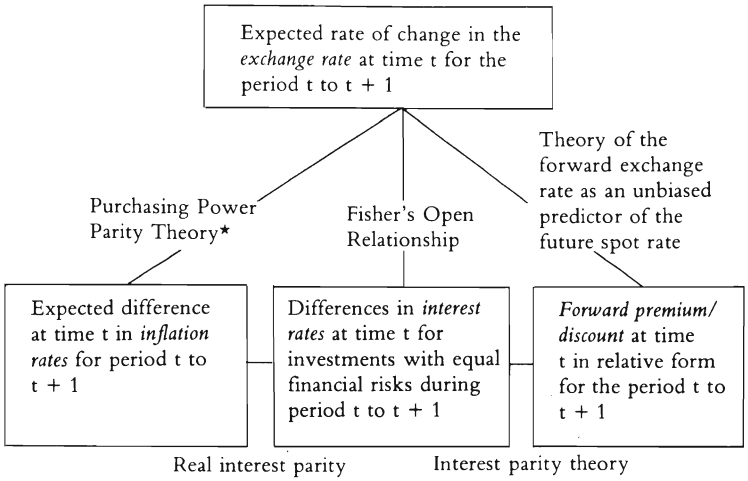
For practical reasons the textbook way of measuring foreign exchange risk is not always followed. The point of departure in practice is the currency position, i.e. the company's net claims or net debts in a given currency expressed in its own base currency. But the position only expresses the size of the risk exposure. In order to obtain a complete picture, the risk should be linked to the pattern of fluctuation in the relevant exchange rate. However, even working solely with the currency position does give a first indication of the risk dimension in the company, as the position can be compared with such quantities as total corporate foreign exchange flows, turnover, export and import.

The currency position as a useful and practical approximation of the exchange risk must be used with discrimination. In practice there are rarely any variance calculations; instead, the exchange risk is expressed as the risk of the company suffering exchange losses of a certain size. Although symmetry would require it, exchange opportunities are rarely used as a measure of possible exchange gains. Foreign exchange risk, as referred to in everyday speech, generally reflects the likelihood that a particular exchange rate movement will occur, leading to a loss of a certain size. The risk can be formulated for example as follows: "There is a 20 per cent probability of losing SEK 1 million on our contract with Y International."

2.3 Relations between forecasts of exchange rates, inflation rates and interest rates

There is an element of surprise built into the term "risk" - a deviation from the *estimates*. We have already mentioned that there is a certain degree of substitutability between the risks to which a company is exposed. In assessing the exchange risk the regularities which largely underlie this substitutability can indicate what may be regarded as estimated exchange losses, beyond which the exchange risk assumes a value greater than 0 (probability greater than 0). The equilibrium relationships in Figure 2 should show where the boundary goes between exchange rate movements that can be estimated and those that cannot. The market actors guarantee reasonable validity in these relationships (see Oxelheim, 1981 and 1983 b).

Figure 2 Equilibrium relations between exchange rate movements, inflation rates and interest differentials



* The Purchasing Power Parity Theory is generally formulated in terms of differences in inflation rates and the rate of change in the exchange rate.

For further description see Appendix 1 or Oxelheim, 1981.

In their annual reports many companies speak of exchange losses without apportioning these between estimated and non-estimated losses. The size of the losses can often endow these companies with an undeserved image as bad risk managers. Take, for example, a Swedish company which borrows in CHF at an annual interest rate of 5 per cent. The alternative to this loan would have been a loan in SEK - carrying an equivalent financial risk - at an annual interest rate of 12 per cent. The above-mentioned equilibrium relationships - in this example particularly Fisher's Open Relationship - suggests that the company should reckon on an exchange loss on its loan in CHF of 7 per cent, i.e. the difference. The risk of a change in exchange rate in excess of 7 per cent provides the basis for the actual exchange risk, i.e. the risk of non-estimated changes. For a more detailed illustration, see Appendix 1.

2.4 Exchange risk and types of company

The foreign exchange risk can also be classified in terms of its source. It can be seen from Table 1 that the sources are different for different types of companies. The table also includes the strictly home-based company, in view of its indirect effect on the exchange risk by way of the financial and commercial risks.

Table 1 Sources of exchange risk

Source of Risk	**Type of Company**			
	Multinational companies	Domestic company with export and import	Domestic company with all operations in Sweden but with loans in foreign currencies	Strictly home-based companies – no transactions in foreign currencies
Monterary and negotiable securities in foreign subsidiaries	x			
Real assets in foreign subsidiaries	x			
Present and future gains in foreign subsidiaries	x			
Stocks	x	x		
Export and import	x	x		
Claims and debts in foreign currencies	x	x	x	

3 The importance of the issue - foreign exchange gains and losses in Swedish companies

Since 1973 the main exchange risk affecting Swedish companies has been connected with changes in parity, mainly devaluations. The Swedish krona has also been devalued six times during a period of slightly over ten years. The accumulated devaluation potential created by the chosen currency arrangements - the currency snake and the currency basket - has caused serious disturbances in the allocation of corporate results over time. Sometimes the Swedish krona has been greatly overvalued, and this has made itself clearly felt in reduced market shares in world trade (Oxelheim, 1983 a). Let us illustrate the kind of disturbance, stemming from the capital cost side, that can occur, with the consequent problem of how to allocate the cost. A Swedish company contracts a medium-term loan in CHF on the Euromarket at the beginning of 1974; after running at about 15 per cent of the original loan sum during the period 1974-76, the capital cost suddenly rises in 1977 to 60 per cent of this sum. Total corporate net exchange losses on foreign loans in Sweden that year were in the region of SEK 6 billion (Oxelheim, 1981). For purposes of comparison it can be mentioned that the total profit for Swedish industrial companies before depreciation in the same year was SEK 14 billion. As a result of the devaluation in October 1982, the corporate medium-term and long-term international debt rose "over night" by about SEK 12 billion (Oxelheim, 1982b).

Some companies have matched assets and debts, and their only problem is the irregularity in cash flows caused by a devaluation. Other companies may gain nothing from a devaluation. All they can do is to hope that the additional cost

of their foreign loans will be balanced by the low interest rate which they managed to get, so that the effective interest rate over the whole term of the loan will agree with their original calculations. Companies with only a few large contracts in foreign currencies during the year of operations must await with the greatest interest the equivalent value of these contracts in Swedish kronor under the prevailing exchange uncertainty.

It is difficult to analyse the importance of exchange rate fluctuations to the individual company, since the accounting of exchange effects is rarely consistent. And because there is no uniform treatment of these effects between companies either, there are problems in studying the aggregated effects on industry as a whole. Bearing these reservations in mind, we can note that the profitability of equity capital in industrial companies with more than 50 employees fell from 11 per cent in 1980 to 5 per cent in 1981, rising again to 9 per cent in 1982. According to the Swedish Central Bureau of Statistics exchange losses account for a little over half the decline in 1981, and they reduce profitability by 5 percentage points in 1982, from 14 per cent to 9 per cent. Thus, according to these figures, in both 1981 and 1982 exchange losses caused a reduction in profitability of slightly more than 30 per cent. If we examine this trend in more detail and distinguish between domestic-market and export companies, we will find considerable variations between the different categories of company. These variations were particularly noticeable in 1983. The increase in the value of exports, due mainly to the 1982 devaluation, led to such high profitability in the large exporting companies that they pulled the average profitability up to 24 per cent. This figure is to be compared with 14 per cent, which was the corresponding figure in 1982.

These profitability statistics show how important it is to examine differences in the way the effects of exchange rates fluctuations are allocated timewise on both the commercial and the financial sides.

The problems of definition and measurement in the accounting make any interpretation of the figures mentioned here extremely hazardous. Nonetheless they are good enough to show the importance and the scale of the foreign exchange problem at the company level.

4 Systems for exchange risk management

We have already noted that exchange risk is generally defined in terms of the increased variability in a group's consolidated yield which can be assumed to stem from unexpected fluctuations in exchange rates. It is also generally implied that this often considerable variation can be partly or entirely eliminated, at a certain *cost*. The cost of exchange risk management is often the price the company is willing to pay in order to show an even yield from period to period, and thus to increase its ability to acquire the necessary capital, for example, at reasonable cost.

The concept of the cost of risk management is often the subject of some confusion, partly because many companies look at the actual cost effect on the cashflow, while other companies argue in terms of an opportunity cost.

To illustrate the difference, let us take the simple case of buying currency on the forward market. For the first type of company the forward premium/discount then represents the actual cost, while the second group regards the difference between the forward exchange rate and the spot rate at the delivery date as the relevant cost figure. Both cost concepts are justified. The small company often wants to avoid uncertainty about exchange rate movements at a certain pre-fixed price; the opportunity cost is of little interest to them. But the large company may have good reason to look into the costs on an opportunity cost basis, in order to reveal any systematic additional costs in their recurrent hedging operations. The large company often has some freedom of choice in its hedging procedures, allowing scope for selective hedging - something which is denied the small company. As a result of hedging the market expectations of exchange rate

movements are "built in" as a realised component. With the help of new instruments and constructions such as currency options, this built-in element can be limited to one direction only.

We noted above that in practice the exchange position is often regarded as an approximation of the exchange risk. The size of the position is a measure of the company's *exposure* to exchange risk. The existence of open positions, i.e. positions deviating from 0, shows that exchange management is called for.

The risk exposure of the strictly home-based company which contracts a loan on the international capital market is easily understood. Similarly, the importing Swedish company is exposed to exchange risk, when it is invoiced in the supplier's currency; or a Swedish exporter is exposed when a delivery is paid for at a later date in a currency other than SEK. In all three cases we know which party is exposed to risk, and the strength and duration of the exposure can be measured fairly easily.

It is more difficult to determine the risk to a company which has extensive international operations, or which over and above its export and import activities also possesses overseas assets not normally intended to be transferred and debts whose value is expressed in currencies other than its own. Thus the multinational company has an additional risk to consider apart from the risk facing domestic companies whose international activities are limited to export and import. The exchange risk can attach to different items in the overseas operations, as we have seen in Table 1, and it can be calculated on a basis of the size of the company's flows or its net worth.

Three different exposure concepts can be used as the basis for the corporate risk calculus. For a more detailed discussion of these concepts, see for example Oxelheim (1981). The three concepts can be described in terms of their focus, and in terms of the items which are considered and which are thus regarded as exposed to risk. The choice of time horizon in the

risk calculus also affects which items will be included. Table 2 summarises some important characteristics of the concepts.

Table 2. Foreign exchange exposure

Type Characteristics	Translation exposure	Transaction exposure	Economic exposure
Character	Latent	Active	Active
Goal orientation	Book value	Economic/ book value	Economic value
Focus	Assets/debts	Cash flow	Cash flow
Period	Limited	Limited	Unlimited
Data base	Book items plus size of estimated items in forecast	Book items plus size of estimated items in forecast	Book items plus size of estimated items

The size of the risk depends further on the method of calculation used. In the case based on translation exposure there are four main alternatives for estimating the size of the translation differential: the monetary-nonmonetary method, the temporal method, the current method, and the current-noncurrent method. The four methods differ in the items which are regarded as being exposed to risk, and which are thus to be evaluated at the closing rate, and so comparisons of the different measures usually reveal differences in the size of the exposure to risk.

In assessing a company's exchange risk and focussing on either transaction or translation exposure, the risk or uncertainty has to be split into three parts:

1. size of assets or debt components according to a certain definition,

2. equivalent value of the item determined according to (1), calculated in the domestic currency,
3. the time at which valuation and conversion take place.

In the case of transaction and translation exposure the company starts from items in the accounting, and extremely rarely incorporates items not registered there, for example activities planned but not accounted for.

If defensive action is to be taken in case of economic exposure - measures influencing the position, for example - it will be necessary to estimate balance-sheet and profit-and-loss-account items at given times in the future, i.e. times beyond the period considered in cases of transaction exposure. There will then be uncertainty on two counts:

1. the future scale of the asset or debt position concerned (commercial or financial uncertainty), and
2. the equivalent value in the domestic currency of the item calculated under (1) (exchange uncertainty).

The total system for managing corporate risk should be based on some form of economic exposure and should build on an overall approach to the risk concept. In this kind of system the exchange risk is linked to the other corporate risks, allowing for the substitutability of different risks that we have referred to above. The total system should be developed so that the following steps will be consistent with one another:

Input or institutional framework

1. Character of the flows and assets/debts
2. Foreign exchange goal and perception of risk
3. Organisation of risk management
4. Vulnerability to changes in exogenous variables

Information

5. Exposure measurement
6. System of exchange rate forecasts

Management

7. Foreign exchange strategies

Feedback

8. Accounting for exchange effects
9. Evaluation of risk programme.

There are several opportunities for choice at each stage, so the number of possible combinations and thus of risk programmes is very great. The design of the management system falls mainly under (3), but it has to be chosen so as to be consistent with what is chosen under the other points.

Point (2) is concerned with the corporate goal. Traditionally this is either maximisation of the company's economic value or maximisation of its book value. A related choice concerns the particular focus in identifying risk, and control. As we have seen, the emphasis may be on cash flows or net assets. Definitions of these measures do not always agree, so that the suggested ways of influencing risk may conflict with one another. The choice of management system will be affected among other things by the formulation of goals.

The management system can be described in two main

dimensions: how it is to function in terms of the centralisation of decisions, and the type of influence the risk management can take. By centralisation is meant that explicit steering and coordination is effected centrally in the group. Four combinations are identified in Figure 3.

Figure 3.

Risk influence via	Organisation or distribution of decision-making	Centralisation	Decentralisation
Internal measures		Comprehensive matching possible	Comprehensive matching not possible
External measures		Financial scale effects to the company, in influencing the residual risk	Financial scale effects to the bank, in influencing the company's residual risk

4.1 Centralisation or decentralisation

The *centralisation* or *decentralisation* of corporate risk management is a key issue. Centralisation allows for comprehensive matching, with a view to reducing the company's or the group's total risk exposure. Control of this kind cannot be achieved under decentralised risk management. Centralisation brings scale advantages on the capital and foreign exchange markets, and opportunities for concentrating the knowledge potential to one department, so that the synergy advantages attaching to multinational enterprise can be utilised to the best advantage. Thus centralisation offers the possibility of global tax and cash-flow planning. Centralisation opens the way for cash management systems with clearing and netting centres, thus reducing transfer costs in

the shape of transaction costs as well as floats (periods when capital is floating without interest).

The main objection to the centralisation of risk management is the great demands it makes on information: a centralised system is only as good as the reporting propensity in the subordinate units allows it to be. And the willingness to report among unit managers will depend on their motivation, when they are denied the opportunity to influence the exchange risk directly within their own units. The force of this objection to centralisation varies, depending on the risk measure applied in the company. The information aspect and its related costs, both direct and opportunity costs, will be a decisive factor in choosing the degree of centralisation in a company.

The advantage of centralised risk management depends on the prevailing pattern of physical management of products and factors in the group. The most complex models of physical management includes both production and sales units abroad, with any buying and selling between these both within a country and between different countries or to and from a third market. A graphic illustration of the physical or material flows in such a group looks like a spider's web. The simplest model would show production located in the home country, with flows to overseas sales units selling only within their own particular country. The difference between these two extreme types as regards what can be achieved by centralising risk and cash-flow management, is obvious.

4.2 Administrative solutions

In the simplest of these cases centralisation of the exchange risk is effected by invoicing the foreign subsidiaries in their own local currency and by letting these companies borrow in their own currency. If the foreign subsidiaries have no purchases in foreign currencies apart from their imports from the parent company, and no sales to a third market, then the parent company has succeeded in removing the exchange

risk from the subsidiary company and locating it in the parent company or in some central corporate unit.

A special form of this type of centralisation is based on a system of reinvoicing. It is particularly applicable to groups with foreign subsidiaries selling to one another, but it can also be used with advantage when foreign subsidiaries have external business on a third market. If an English subsidiary sells to a French subsidiary within the group, for example, the product is sent directly to the French company but the invoice, in GBP, is sent to a reinvoicing centre. This centre takes the exchange risk, and sends a new invoice in FRF to the purchasing French subsidiary. The creation of a reinvoicing centre is mainly an internal measure for centralising the risk, but it can also have implications for cash-flow management.

When home-based subsidiaries export to foreign subsidiaries and have to invoice these in the local currency, settlement can often be a sensitive business. In a reinvoicing system this problem is solved, in that an invoice in the domestic currency is made out to the reinvoicing centre. Otherwise we can find all kinds of ways of dividing responsibility between the domestic subsidiaries and the central financial unit - ranging from the central unit taking the risk at the tendering stage to the central unit assuming no risk at any time. In between, there are various internal hedging procedures. In the distribution of risk discussed here, there is an obvious source of conflict. Choosing internal forward rates and invoicing rates will be a sensitive business in the central finance unit. Centralisation thus generates a need for "keys" to use in allocating within a group any exchange gains or losses that arise.

In Figure 3 we also distinguished between internal and external measures. By internal measures we mean action which influences risk and which can be effected within the group or steered by way of customer relations. By external measures we mean measures effected through the agency of external capital markets, money markets or foreign exchange markets. For a description of various measures in these

categories, see Oxelheim (1981).

Centralisation provides good opportunities for applying *internal measures* in the control of risk, while decentralisation calls for greater reliance on external measures. Various forms of matching are among the internal measures available and, as we have already seen, centralisation provides opportunity for reducing risk by this means.

4.3 Matching

The point of departure in matching, when the cash flow is in the focus of attention, is that the currency mix for the relation between sales and input goods (and refining) should be adjusted so that changes in future sales revenues are neutralised by changes in the cost of inputs. However, it is usually difficult to achieve balance in this real sector of the company, in the shape of neutralised economic exposure. It is generally also necessary to make adjustments in the exchange risks on both short-term and long-term financing. This last is usually easier to achieve, since it is possible to alter the currency mix in the corporate financing, regardless of which country buys the company's products or which one provides the input goods. Consequently such action is important when it is a question of additional balancing of sales revenues and input costs, currency by currency.

In adjusting its operations, the company should concentrate its financial planning on structuring its debts in such a way that every non-predictable change in yield is balanced by a change in the effective cost of the debts. This is a way of protecting estimated yield from unexpected changes in conditions on the financial market. As we have already mentioned, such protection should be organised on the debt side, since the structure of the company's real assets is often determined by business and/or strategic considerations.

For a company whose operating yield is either uncorrelated or negatively correlated with short-term interest rates, it will be a question of long-term borrowing at fixed interest

rates. This makes for stable capital costs, thus reducing the effect of non-predictable changes in interest rates on the ultimate cash flow. The other factor that determines the capital cost of foreign borrowing consists of changes in exchange rates. Where the operational yield of a unit is positively correlated with the value of a particular currency, then the unit should be financed in the same currency. Every unpredicted depreciation of this currency reduces not only the yield but, to balance this, also the effective cost of the debt. "Effective" cost includes interest rate plus exchange rate movements.

4.4 Reducing risk by external means

It is a difficult task to see that, in every given currency, a change in the cash flow on the asset side is matched by an equivalent change on the debt side. Not infrequently there will be a difference, a *residual risk*. The size of this risk should be assessed and its implications considered at the highest level: some restructuring may be needed, perhaps involving strategic changes affecting fundamental areas such as production processes or technology.

As a result of matching, centralised risk management brings both direct and indirect cash-management advantages. However, the actual matching procedure has an opportunity cost aspect, which must be considered in each individual case. Centralisation also brings scale advantages to the company when the residual risk is to be covered by *external measures*, such as the buying/selling of foreign currencies on the forward market or the contracting of loans in foreign currencies.

Where risk management is decentralised, matching can only be applied at the lowest level in the decision chain. This means that there will be a greater residual risk and - depending on the company's attitude to risk - a greater number of covering operations of an external kind, where the scale effects can thus be largely expected to concern the bank.

Decentralisation calls for qualified staff, even in the smallest subsidiary, to handle exchange problems. As we have seen, this dispersion of the knowledge potential can be a serious objection to decentralisation.

4.5 Risk reduction in a total perspective

In the total perspective all the variables which could affect the economic value of the company should be considered, in order to obtain the aggregated effect. However, in foreign exchange risk management exchange rate movements are generally regarded as an isolated phenomenon, both in time and in their relation to other corporate risks. It is this time-bound view that lies behind the emphasis on transaction exposure rather than economic exposure in risk management.

If the maximisation of a company's economic value is its main corporate goal, then traditional measures will provide only a partial picture of exposure to foreign exchange risk as a basis for gearing risk management towards the achievement of this goal. Translation exposure measures the implications of exchange rate movements for the book value rather than the economic value of the company. Transaction exposure measures the impact of exchange rate movements and their effect on the cash flow during a limited period, unlike economic exposure, which measures the effect on the present value of all future cash flows.

The difference between the cash flow for a limited period, which is the central issue in transaction exposure, and the cash flow included in economic exposure, is rarely emphasised. In some cases these two definitions are used synonymously, since they are both based on corporate cash flows. In practice, however, measures of transaction exposure have ignored any foreign exchange transactions which can be envisaged as occurring in an indeterminate future period, such as unspecified dividends and the volume of local sales which cannot be identified with foreign exchange transac-

tions during a specific period. The relation between transaction exposure and economic exposure is illustrated in Appendix 2.

Both the traditional measures of corporate exposure to exchange risk, namely translation and transaction, thus have drawbacks compared with the ideal of measuring the effect on the corporate economic value by way of the level and the variability of future cash flows. Hedging operations based on the traditional definitions may not only fail to reduce the exchange risks; they can create risks where none existed before.

The difficulty with economic foreign exchange risk exposure, which can be regarded as the most developed exposure base for the company's risk management, lies in calculating the company's new economic value, i.e. after the change in exchange rates. The assessment of this value results from an interaction between the new economic conditions, management's reaction to these conditions, and the new exchange rate. Estimating expectations and consequent operations of the market actors are major problems. An estimate of the new economic value that will obtain after a devaluation of a subsidiary company's host currency, calls for an analysis along the following lines:

Revenues:

1. How will aggregated demand be changed by the new prices?
2. Are price increases possible? How quickly? What price elasticity do our products possess?

Costs:

1. Will there be inflationary cost increases?
2. Will it be possible to use alternative sources of supply?
3. Are improvements in the effectiveness of production possible at the new production level? How much? When?

Working capital:

1. Will more working capital be required in the new circumstances? How much?
2. How much of the increase can be satisfactorily financed on the local capital market?

The commercial side is integrated. The economic foreign exchange risk exposure requires routines and information beyond what can be found in the company's traditional accounting system, and must capture the delayed effects of changes in the exchange rate. In any case the risk analysis will depend on information from operational management, which in turn must plan for the fluctuations in exchange rates. When corporate risk management is being based on the broader concept of exposure advocated here, this kind of information is an important determining factor in deciding how far centralisation should go.

This broader type of foreign exchange risk management comes up against difficulties as soon as we leave the corporate bookkeeping and the figures included there. We have already noted that the accounting figures do not incorporate temporally displaced exchange rate effects on coming cash flows. In disregarding these, the company may take action that is not in fact in line with its own overriding goals. As soon as the company abandons the accounting figures as the basis for its risk management, various estimates are required for assessing the development of the risk exposure over time.

Risk management in a *total perspective* goes beyond the partial analysis based on the economic foreign exchange risk exposure. In planning and acting from a total perspective, the company uses a number of consistent combinations of interest rates, inflation rates and exchange rates, all of which provide the same estimated result. On a basis of deviations from these combinations, the company undertakes hedging operations.

There is a big difference between risk management based on economic foreign exchange risk exposure and that based

on a number of consistent combinations in the total perspective discussed above. Given an imbalance in a macroeconomic sense, we try - if we are using a total perspective - to evaluate all the possible effects which this imbalance will have. In traditional foreign exchange risk management we only evaluate the alternative of the imbalance being expressed as a change in the foreign exchange rate.

Thus risk management in a total perspective should start from a broader concept of economic exposure, which allows for the substitutability of the different risk categories. In the simplest case a company may have contracted a loan of USD 100. A 5 per cent devaluation in the Swedish krona is expected. Expiry date is 5 months away. The company decides to buy USD 100 for delivery in 5 months. As a result of the devaluation the company sees an increasing export value, outside the present accounting period, which has not yet been invoiced. The exports were originally estimated at USD 100 and - measured in the base currency - will increase by the amount generated by the devaluation. The exports will be invoiced in USD, and payment will be made at the same time that the loan is liquidated. Given a measure of exposure that allows for the displacement of exchange effects in time, and for effects lying outside the accounting period, the company had a covered position before undertaking any forward hedging. Thus the forward purchase creates an open position. If the Swedish authorities then decide to postpone the devaluation and to protect their exchange rate by raising the rate of interest, then during the company's relevant risk period neither the increase in the SEK value of its exports abroad nor the increase in debt which it had expected as a result of the devaluation, will occur. The company will lose on its contract, as well as having extra costs because of its partial risk analysis. The domestic interest increase will also presumably affect the domestic demand for the company's output, but for the sake of simplicity we can assume here that this is balanced by the increase in the domestic financial net.

5 Systems for exchange risk management in Swedish companies - an interview study

An interview study was conducted during the autumn of 1983 among the Swedish companies which are most dependent on international business (Oxelheim, 1983d). All the companies in the study had a total turnover of over SEK 1 billion in 1981. In order to be included a company had to fulfil the three following requirements as regards international dependence:

1. they had to be among the 50 largest exporters in Sweden,
2. they had to be among the 50 largest international sellers in Sweden,
3. they had to be among the 50 largest foreign employers in Sweden.

Appendix 3 shows how Swedish corporations fulfilled these requirements. Altogether 26 companies fulfilled the turnover requirement and all three requirements regarding international dependence. For reasons of access to certain information, it was also required that the companies should be listed on the Stockholm stock exchange. This eliminated two state-owned companies (Statsföretag and Svenska Varv) as well as the Johnson Group and Tetrapak International. Of the remaining 22 companies in the middle area in the figure in in Appendix 3, KemaNobel and Billerud-Uddeholm were eliminated straight away because of difficulties in definition. The 20 remaining companies were all asked if they would like to take part in the study, and all answered in the affirmative. At that point ASEA was in the process of a radical reorganisation which affected those parts of the

company involved in decision-making under exchange uncertainty. New staff had been appointed to design a risk management programme from scratch. For this reason ASEA was also eliminated.

The 19 companies studied - underlined in Appendix 3 - accounted for more than 40 per cent of the value added in Swedish manufacturing industry in 1982. If we include the value added in overseas units, the total corresponded to 75 per cent of the value added of Swedish manufacturing industry.

The "interviews" were held in the companies, but were really seminars lasting from 1 to 3 days. Almost all those concerned with risk management, according to the traditional way of defining exchange risk, took part. They included managing directors, financial directors, controllers, treasurers, heads of financial planning, and accounting managers. Altogether about 100 people with responsibility for decisions under exchange uncertainty were involved. The data was collected in 9 blocks, ranging from an introductory section on the nature of the flows, followed by exchange goals, organisation, institutional framework, the identification of risk, the measurement of risk, the generation of exchange forecasts, foreign exchange strategies, and concluding with the reporting of exchange effects.

5.1 Centralisation of responsibility for handling exchange risk

The study showed that in 18 of the 19 companies the decision-making in exchange risk management was largely centralised. In the remaining company decentralisation was a fundamental principle applied in all areas. In 9 of the 19 companies centralisation had increased considerably since 1976. Of the remaining companies, only one showed any trend towards decentralisation.

Of the 18 largely centralised companies, 5 had delegated some foreign exchange responsibility to both Swedish and

foreign subsidiaries. Seven of the 18 said they had delegated some responsibility for foreign exchange only to foreign subsidiaries. Where responsibility had been delegated, it was mainly a question of foreign exchange decisions on the commercial side, such as pricing when doing business with a third market. In 2 of the companies centralisation implied that the foreign subsidiaries had been relieved of the risk, which was concentrated to Sweden, but that the various Swedish subsidiaries managed exchange risk on their own.

Of those companies which organised their physical flows in accordance with what we have called the most developed model, none could be said to be fully centralised, in the sense that the parent company or the central group staff dealt with all questions of exchange risk. What remained outside central control was generally the flows to and from third markets. Thus the companies had concentrated on centralising the risk in their internal flows. The insignificant size of the external flows was often given as an explanation for this difference, but in many cases people appeared to have a very vague idea about how big these flows actually were.

5.2 Administrative systems

In managing their internal flows, 17 of the 18 companies with central risk management chose to invoice their subsidiaries from Sweden in the local currency, and they instructed their foreign subsidiaries to borrow in the local currency. The strictness with which this principle was applied varied somewhat in the different companies. Twelve of the 17 always invoiced in the local currency. Five companies generally used the local currency, but sometimes also used Swedish kronor or US dollars. Dollars were used mainly for internal deliveries to companies in South and Latin America. In companies with more complicated flows, reinvoicing centres were often used to centralise the risk.

Four of the companies had variously developed reinvoicing systems. In these cases some form of clearing or

netting system was also involved, to exploit the advantages of centralisation in the effective utilisation of cash flows. Control of buying and selling in the Swedish parts of the groups varied very much. Where there were reinvoicing centres, the risk was lifted off the subsidiaries altogether. Where there was no such centre, the central finance department issued binding conversion rates either when tenders were being made, when the contracts were signed, or when invoicing took place. Technically speaking, this prescribing of rates represents a procedure for internal forward exchange hedging.

External flows were generally the responsibility of the subsidiary's general manager, although the parent company usually controlled the acquisition of capital, while pricing and in almost all cases forward exchange hedging was left to the subsidiary manager's discretion. Express matching instructions regarding external residual flows were rare. Given the argument that a total centralisation will make the group inflexible and less adaptable to changes, perhaps this should be regarded as a way of achieving the conditions of competitiveness.

Most of the companies reported that centralisation had led to some conflict between the central finance staff and the subsidiaries, but it was felt that this was only temporary and that people would learn how to cope with it.

The majority of the companies managed their exchange risks on a basis of transaction exposure. This was updated at different intervals. At the time of the study only one company was on line, i.e. able to produce a more or less credible picture of current transaction exposure at a moment's notice. It would probably be going too far to say that this company was more sophisticated than the others in this respect, as the need to be on line varies from industry to industry, depending largely on the stability of cash-flow trends. The company which was on line used a kind of extended ledger system, whereby loan costs were incorporated in the exposure in full.

Transaction exposure is generally taken to mean the net of registered cash flows. Some companies went beyond this definition, thus approaching - if only to a limited extent - the economic definition. For instance, ordered but not invoiced purchases were included, and future dividends from foreign subsidiaries - i.e. items which would probably although not certainly generate cash flows.

Balance-sheet exposure is used by the majority of the companies only as a form of control. In an international comparison interest in this form of exposure is relatively low in Sweden, probably because of the limited hedging opportunities available to Swedish companies. Most companies calculate this form of exposure only once a year, when they are closing their books. Control over this form of exposure is exercised mainly by hedging operations undertaken by the foreign subsidiaries.

5.3 Risk reduction in a total perspective

One of the questions in the study concerned the extent to which the companies applied a *comprehensive approach* to risk management. There were several subsidiary questions on this subject, to see how the companies were affected by various economic-political measures, how vulnerable they were or what positive effects there might be. One subsidiary question, for example, asked how far corporate risk management was restricted by different elements in the currency regulations.

On the question of the comprehensive view, the questioner gave an example in simple terms. "Imagine that the Swedish short-term interest rate is raised by 2 percentage points. Your company has high liquidity at home. In the finance department they are pleased about the increase. In the foreign exchange department they say that the increase can be expected to strengthen the krona, and exchange losses are likely to be reduced or even transformed into estimated gains on the foreign loans. The positive view in these two

departments does not appear to be matched on the "real" side. Here people complain that the increase will probably mean more consumer saving and a convergent drop in demand for the company's products. Similarly there will often be difficulties on the overseas markets too, if the gross margin is to be protected. And then, after a time, higher financial costs will bring price increases. Depending on the market situation, this may be reflected in the gross margin or in the market shares for the company's products."

There was then a discussion about whether the companies had anyone responsible for a total overview, taking in the different effects on the company as mentioned above. Was there anyone who could relate interest, inflation and exchange rate movements together, to form an overall picture? No company admitted to having anyone who was supposed to try to monitor all three quantities at the same time. Such an overall view can be said to go beyond the consideration of economic exposure. And none of the companies used economic exposure in their position management either. Admittedly any attempt at estimating the necessary elasticities involves a good deal of uncertainty, but even if the estimates are pretty rough, a comprehensive approach can still be expected to bring advantages in the better total husbanding of the company's resources. That companies still concentrate mainly on visible exposure is probably because few of them have started using computers in risk management to any great extent as yet. We have seen above that only one company was on line as regards their transaction exposure. In the companies studied the use of computers in risk management was generally limited to reproducing Reuter or Dow-Jones financial data. And in two of the companies computers were not used at all in connection with risk management.

The accounting side clearly shows how little the comprehensive approach has been adopted. Of course there are difficulties in integrating the different concepts, but this does not justify the complete separation of financial costs/reve-

nues and exchange gains/losses that is so common, although the two represent equal parts of the capital cost. In some countries even the authorities view things in the same way, as the asymmetrical treatment of the two capital components in the law clearly shows.

Let us assume that a Swedish company can contract a loan in SEK at 12 per cent, in DEM at 8 per cent or in ITL at 20 per cent and that the financial risk is the same for them all. The cash flows will be different, if the differentials match market expectations. The Swedish accounting rules reinforce these differentials. If the loan is valued at the closing rate, and if the market expectations hold, the cost of the loan in DEM will be reported as a financial cost at 8 per cent, while an exchange loss, which can be amortised, represents the difference up to 12 per cent, or a part of this. A financial cost of 20 per cent is reported for the loan in ITL. First in connection with final settlement can part of the "extra price" of the loan in ITL be recouped in the shape of an exchange gain. Thus, the separation of the different components of the capital cost can have an unfortunate effect (Oxelheim, 1983c). The point of departure should be Fisher's Open Relationship, according to which the cost of loans in different currencies but with equal financial risks should be the same, provided only that we can assume efficient and integrated capital markets - a condition which will probably come closer to fulfilment in the future.

Many of the companies in the study reported large exchange losses on long-term loans. But we can now understand that calling these exchange "losses" can give an unfair impression of mismanagement. As we have seen, much of this misapprehension can be avoided if companies adopt an integrated approach to exchange rate movements and interest rate differentials. On this point the connection is obvious, and yet many companies still keep tight control on their interest rate budget, without recognising the substitutability with exchange rate movements. Naturally, exchange risk can be similarly integrated with prices on the factor and

export markets, and consequently with the commercial side of the company's operations.

The adoption of an overall view, involving the identification of consistent sets of prices, interest rates and exchange rates which together generate the same result in terms of maximising the economic value of the company, remains as an important step to be taken by the companies studied in developing their risk management programmes. Let us proceed in the next section by identifying some explanations to this and some trends in the development of systems for corporate exchange risk management.

6 Development of risk management systems - discussion

Most Swedish companies appear to have been ill prepared for the elements of risk that followed the breakdown of the Bretton Woods/Smithsonian agreements and the first oil crisis. Swedish society as a whole was also ill prepared, in that foreign exchange issues featured somewhat sparsely in the economics or business administration courses of the Swedish universities and other institutes of education. Change has been slow in coming, and courses in the foreign exchange field are still embarrassingly meagre for an open economy such as Sweden represents.

Because of this lack of education, together with the turbulence on the foreign exchange and capital markets and its impact on business companies, many business leaders since the mid-1970s have had a very modest approach to the idea of restraining risk other than by way of forward contracts and foreign loans. This situation is reflected in widespread corporate risk-aversion, although this does now seem to be beginning to dissolve. While the earlier attitude still prevailed there was less necessity for written foreign exchange policies, while today's more subtle and differentiated approach, characterised by selective hedging, has greater need of such policies.

The risk-aversion and the blinkered approach to foreign exchange risk management are also reflected in our study: only 2 of the 19 companies included made any kind of evaluation of their foreign exchange risk management. Small companies often have no alternative but to hedge a residual risk by forward transactions or loans, so as to acquire ex ante an acceptable guarantee of a project's yield. But larger companies have every reason to evaluate their risk manage-

ment programmes by making systematic checks, often in terms of opportunity costs. This kind of evaluation will probably become more common, as finance/foreign exchange departments are increasingly regarded as independent profit centres.

The increasing centralisation of exchange risk management in Swedish companies which our study revealed, appears to have led to a concentration of knowledge that has helped companies to look more optimistically on their own ability to deal with foreign exchange problems.

On the exposure side, more companies are beginning to include future items not yet accounted for, and this represents a step towards what is known as economic exposure. This trend is likely to accelerate both in scope and extent as computer terminals become more common in companies, with the on-line contacts that this will mean. Contacts of this kind should obviate many of the drawbacks often blamed on centralisation, connected with problems of information and motivation.

Centralisation should prepare the way for a comprehensive view of the company's risks, and thus for integrating foreign exchange risks with the other corporate risks. With greater integration on the capital market and fewer foreign exchange controls, the equilibrium relationships in Figure 2 will become increasingly important in corporate planning. For many reasons companies should feel encouraged to pay more attention to these relationships in the future than they have done in the past.

What we have referred to here as the total or overall perspective must be seen as a target at which companies should aim in developing their risk management programmes. Despite developments in computer technology, there are many practical difficulties. This suggests that individual companies will stop developing their programmes, when the cost of continuing is no longer expected to generate equivalent revenues. This may mean the adoption of economic exposure, but with certain limitations in the time dimension.

For example, the company considers flows only during whichever is longest of it's capacity planning horizon or a project's pay-off period. Or, on grounds of cost, the company may diverge from the total perspective by working with broader intervals regarding the substitutability of different risks.

Apart from the problem of estimating the elasticities of the various products and its vulnerability to economic-political action, the company faces another difficulty when it adopts a total perspective: behind every exchange rate there are *two* currency régimes whose actions have to be assessed and predicted.

As a result of their centralisation, companies have increasingly assumed the traditional functions of the banks vis-à-vis themselves. Scale advantages in all dimensions suggest that this trend is intensifying. At the same time companies will build up foreign exchange reserves (given changes in currency controls) as a basis for a selective hedging policy for the residual risk. Centralisation has made possible the integration of cash management systems with risk management. One of the synergy advantages of this integration, apart from the obvious saving on transfers, is that it opens the way for risk management in a total perspective, where the range of "unnecessary" hedging costs can be reduced to zero.

Appendix 1

According to Fisher's Open Relationship the nominal interest level reflects expected real interest rate level and the expected rate of change in the price level, or:

$$r_i^N = r_i^{R*} + \hat{P}_i^* \qquad (1)$$

where r_i^N = interest rate level in country i

r_i^{R*} = expected real rate of interest in country i

$\hat{P}_i^*$ = expected rate of change in price level in country i.

A lender who expects the price level to rise at a rate of 3 per cent per year, demands a nominal interest rate exceeding the expected real interest rate level by this amount.

On a complete, perfect and unified international capital market, the following obtains according to Fisher's Open Relationship:

$$r_1^N - r_2^N = \hat{S}_{12}^* \qquad (2)$$

where $\hat{S}_{12}^*$ = expected relative rate of change in exchange rates (currency in country 1/currency in country 2).

Thus Fisher's Open Relationship implies that on an efficient non-controlled capital market and in the long run it can be expected that the currency chosen for a deposit or a loan - which are equally risky except for the foreign exchange risk - will be a matter of indifference. According to economic

theory the choice of a particular currency becomes relevant as soon as the above equation is not expected to apply.

According to the Purchasing Power Parity Theory, the change in exchange rate can be estimated on a basis of the expected inflation rates:

$$\hat{S}^{*}_{12} = \hat{P}^{*}_{1} - \hat{P}^{*}_{2} \tag{3}$$

Assuming risk neutrality, purchasing power parity, homogeneous expectations and immediate response to change incentive, the real interest rates can be expected to be the same, i.e.

$$r^{N}_{1} - \hat{P}^{*}_{1} = r^{N}_{2} - \hat{P}^{*}_{2} \tag{4}$$

However, on the Swedish capital market during the 1960s and 1970s interest rates have been fixed largely by central controls, which has been a contributory cause of deviations from the above relation.

The loan cost for a Swedish company borrowing for example in DEM is nominally:

$$r^{N}_{Sw} = r^{N}_{WGer} + \hat{S}_{Sw,WGer} \tag{5}$$

where r^{N}_{WGer} = nominal interst rate on the loan in DEM

$\hat{S}_{Sw,WGer}$ = relative rate of change in the exchange rate.

The real rate of interest in its simplest form can be written, on a basis of (5):

$$r^{R}_{Sw} = r^{N}_{WGer} + \hat{S}_{Sw,WGer} - \hat{P}_{Sw} \tag{6}$$

where $\hat{P}_{Sw}$ = rate of inflation in Sweden

Providing the Purchasing Power Parity Theory holds, (6) can be written as:

$$r^{R}_{Sw} = r^{N}_{WGer} - \hat{P}_{WGer}$$

where $\hat{P}_{WGer}$ = rate of inflation in West Germany.

Assuming that the Purchasing Power Parity Theory holds, it can thus be expected that inflation in Sweden will not affect the real rate of interest for the loan in DEM, since the deterioration in the real value caused by inflation in Sweden is counteracted by an appreciation of the German mark.

Let us look at a short example of how the market can be expected to function, in order to elucidate the link between the actors' expectations and the incentive to arbitrage.

Assume that the nominal borrowing interest rates on an annual basis are 10 per cent for the Eurodollar and 8 per cent for the Euromark. An expected change in the exchange rate USD/DEM corresponding to the interest rate differential, means that costs can be expected to be equal at the time the loan is contracted. If the market is in imbalance and the appreciation on the Euromarket is expected to be less than the interest differential, there will be a rise in demand for the Euromark as a loan currency. Depositors, on the other hand, will transfer their investments to dollars. These movements will push up the interest rate on the Euromark. At the same time the sale of marks in order to acquire dollars on the part of both borrowers and investors will depress the USD/DEM exchange rate. The argument in favour of the Euromark as loan currency disappears when the interest rate on Euromarks is forced up and the USD/DEM exchange rate is depressed to a point at which the Euromark interest rate plus the expected appreciation of DEM are approximately the same as the interest rate on the Eurodollar.

However, some important reservations should be mentioned. For example, because of the transaction costs that occur, the state of equilibrium should be represented not by a

single point but by an interval, within which there are no arguments for arbitrage. If the relation is to hold, it is also very important that immediate adjustments take place.

Appendix 2

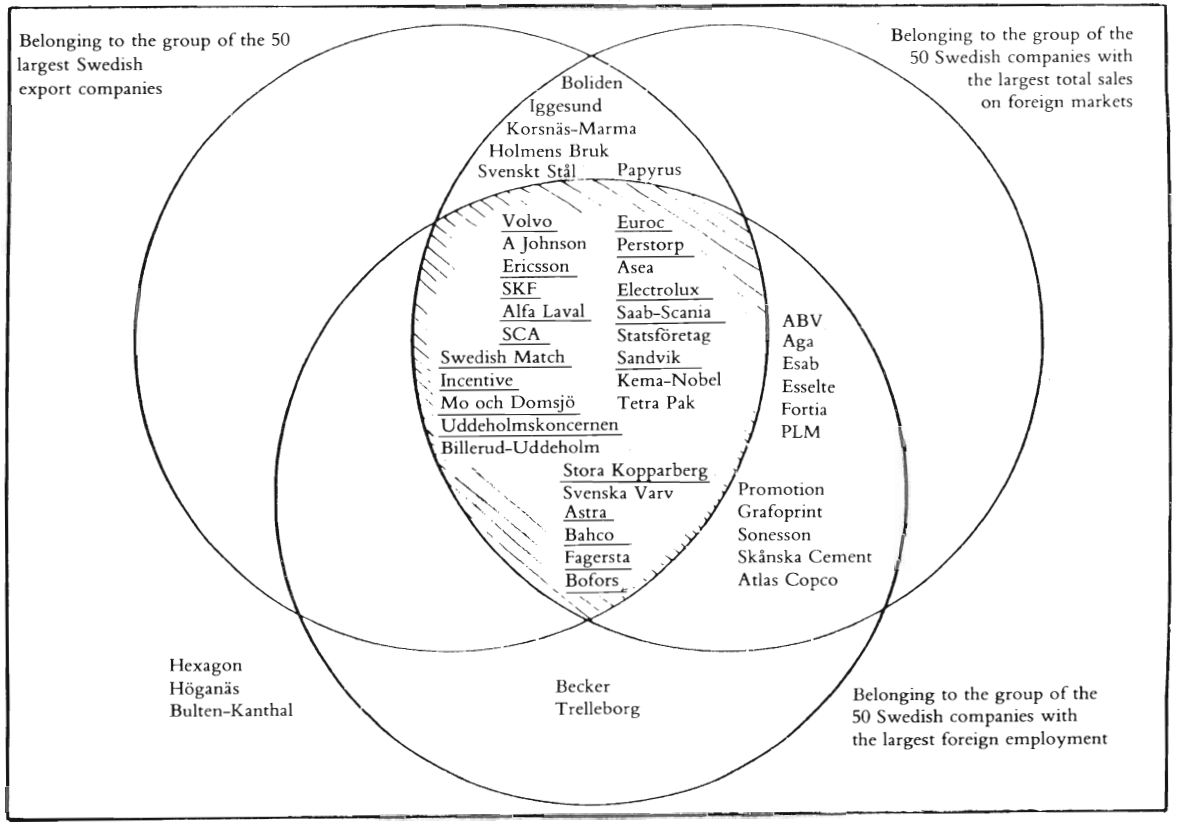
Corporate cash flows and exchange risk exposure

	Financial			
Character of the cash flow	**Operational**	**To creditors**	**To share-holders**	**Total**
Currency of the cash flow				
Foreign currency, i.e. parent company's or any other currency except the subsidiary's	Import or export	Payments on debts in foreign currencies	Dividends	*Transaction exposure*
Local currency, i.e. currency in the country where the subsidiary operates	Local sales and costs	Payments on debts in local currency	Reinvested cash	
Total	Profit on current operations	Financial costs	Equity/cash flow or *economic exposure*	

Source: Rodriguez, 1979.

Appendix 3

Swedish industrial companies with total sales exceeding 1 billion SEK in 1981



Source: Lars Oxelheim, *Företagets beslut under valutaosäkerhet*, Scandinavian Institute for Foreign Exchange Research, 1984.

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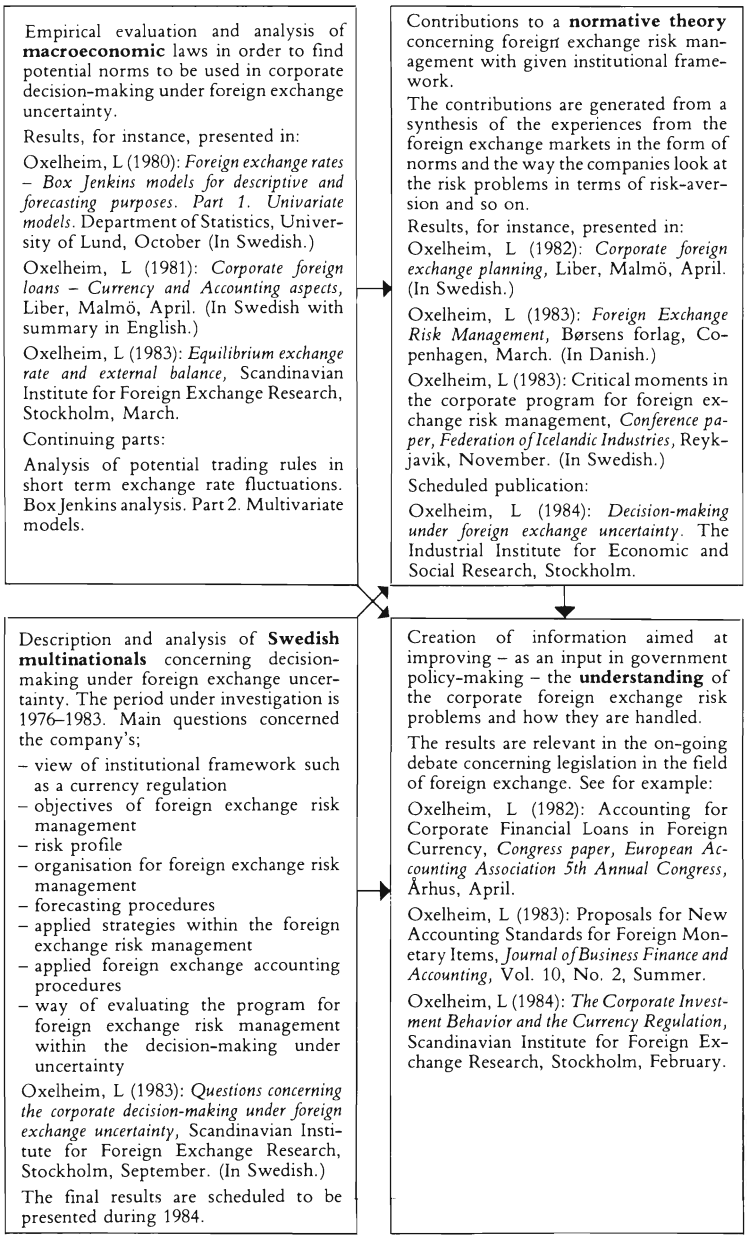
The relationship between different parts of the project "Corporate decision-making under foreign exchange uncertainty"



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