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ACCOUNTING FOR MACROECONOMIC INFLUENCES ON THE FIRM

by

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ACCOUNTING FOR MACROECONOMIC INFLUENCES ON THE FIRM

Synopsis

Increased exposure of national economies to global markets has at the level of corporate stakeholders meant increased attention to exchange rates, interest rates, inflation and relative prices. These variables cannot be viewed as independent, since they adjust in various ways to macroeconomic shocks. Corporate external accounting must be able to take this interdependence into account and, furthermore, help the different stakeholders to sort out the influence from the changes in macro-price variables as distinct from changes in factors within the firm's primary business sphere.

This article presents measures to be used in order to improve traditional methods of accounting for fluctuations in the firm's macroeconomic environment. The presented measures provide the stakeholders with means for assessing the vulnerability of the firm. They also help the stakeholders to sort out excess profitability due to e.g. an undervalued domestic currency or a subsidized low interest rate.

Key words

Macroeconomic fluctuations, exposure, vulnerability, functional currency

ACCOUNTING FOR MACROECONOMIC INFLUENCES ON THE FIRM

In the aftermath of the stock market crash of 1987 and the perceived increase in market volatility additional market regulation has often been advocated. A review of the empirical evidence on financial market volatility indicates that stock prices occasionally deviate from their fundamental value, but there is less or almost no evidence that prices deviate from fundamental value in another important market, the bond market (see e.g. Scott 1990). A plausible explanation for this difference may be the investors' lack of adequate firm-specific information. Hence, if any new regulation to mitigate stock market volatility is required, it could be of accounting character and aimed at guaranteeing the investor better information about the prospects of the firm in which he intends to invest.

Finance theory tells us that if risk-averse shareholders can reduce their portfolio variance by diversifying, then the firm need not be concerned with the variance of its cash flow or value. The risk-averse shareholder is expected to handle systematic risk by diversifying his own portfolio based on - for instance - beta-coefficients derived within a Capital Asset Pricing Model- framework. It is usually assumed that such coefficients can be obtained from historical stock market data. Many arguments can be raised against this view. For example, there is a vast body of criticism of the CAPM in its different forms based on the lack of intertemporal stability in the beta-coefficients. Other arguments have been raised also by those going beyond the view of traditional finance theory arguing for the need for information in excess of beta-coefficients (see e.g. Dufey and Srinivasulu 1983). They argue that corporate financial reports provide little information for a proper assessment of the risk-adjusted growth prospect of an individual firm. Such information about a particular firm is of interest to investors interested in "stock-picking" and M&A activities, but also to other stakeholders in the firm like employees and lenders.

If there exist convincing arguments for the firm to be risk neutral it may find the cost of providing risk measures to external stakeholders prohibitive. However, for most firms there is a strong case for a degree of risk-aversion. Bond-holders and other lenders can, for instance, induce risk-aversion with respect to cash flows or economic value, and employees can induce risk-aversion with respect to the optimal output/employment level. This kind of risk-aversion would be consistent with stockholders wealth maximization as well, if the firm has to carry higher labor costs with output uncertainty. In this case there is no reason for the management for not estimating the firm's risk exposure and vulnerability for risk management purposes as well as for presentation to financial market participants and other stakeholders unless such presentation influences the firm's competitive position (see e.g. Lessard 1989).

The existing body of rules for external accounting state little about disclosure of vulnerability to macroeconomic shocks or of corporate exposure to macroeconomic risks that would enable outsiders to distinguish this type of exposure from exposure to changes in firm-specific conditions. A possible exception is the revelation of translation gains and losses under FASB 52. Hence, in trying to assess an observed profit figure the analyst gets no information in the financial report about the forecast value of this figure. A high profit may have resulted from an undervalued home-currency, a subsidized interest rate

etc. Moreover, it can be the result of the firm assuming more political risks and the profit may consist mainly of collected risk premia. Some market participants have in the beginning of the 1990s got this message the hard way. Shareholders in, for instance, the banking industry may have realized that increasing profits in the near past had bad signalling value in their non-risk-adjusted accounting version. They were just created by banks collecting "under-priced" risk premia for assuming more credit and political risks. Moreover, many shareholders in the US manufacturing industry failed to assess properly the impact of the overvalued USdollar during the first half of the 1980s.

A relevant question is if the disclosure of traditional risk measures such as transactions and translation exposure in original or extended versions can provide any guidance. The answer is probably no since they are partial in terms of risk-sources considered and have hardly any relation to the economic exposure of a firm (see e.g. Oxelheim and Wihlborg, 1987). The measure of transaction exposure provides e.g. no guidance to what extent a firm may be outcompeted in its domestic market by foreign competitors which are "subsidized" by an undervalued currency for that market. Measures of interest rate risk in terms of, for example, duration, suffer from similar problems of partiality.

Traditional measures can be criticized for being partial also since they do not consider the links among exchange rates, domestic and foreign interest rates and domestic and foreign inflation rates. Moreover, traditional measures tend to be partial in terms of which part of the firm is considered affected. For example, the vulnerability of the firm to unanticipated interest rate fluctuations is often discussed or disclosed in terms of the firm's key financial ratios. The trend toward increased leverage may to a certain extent motivate this. But, the vulnerability of commercial flows to interest rate fluctuations deserves attention as well, as noted, for example, by Lessard and Lightstone (1986).

Considering these shortcomings of accounting-based exposure measures Choi (1991) claims that financial managers and accountants oriented towards "generally-accepted accounting principles" will find themselves replaced by those who embrace the notion of "decision-relevance". Decision relevance according to Choi is in this context exposure measures based on "what-if" scenarios with inputs from all relevant operating units of the firm.

In this article we aim to contribute to the theory for accounting. We suggest new measures for exposure to macroeconomic risks based on hard data which can be disclosed in the firm's financial statements with the purpose of making management and outside stakeholders able to distinguish exchange rate- and other macroeconomic risks from inherent business risks. In terms of accounting traditions we follow Ijiri (1975) focusing on hard data and his view that:

Accounting is a system for communicating quantitative information about the economic events of an entity.

A measurement scheme must be carefully designed in the light of the known real relation among the attributes and the objects.

The major theme of this article is that as long as exchange rate changes are viewed independently of other prices it is impossible to develop a consistent accounting principle for measuring exchange rate exposure. The exchange rate is only one of several variables in the macroeconomic system that adjust to different kinds of shocks. The exchange rate rarely changes alone but turbulence in the environment would have impact on price levels, interest rates, and relative prices among commodity groups, as well as on exchange rates. The implication of this view of exchange rate changes is that focusing on exchange rates in isolation may provide a misleading risk measures.

Other authors have also emphasized that the exchange rate's correlation with other variables should be taken into account when measuring exchange rate exposure (see e.g. Adler and Dumas, 1983; Cornell, 1980; Glick, 1986; Hekman, 1985; Oxelheim, 1984; Wihlborg, 1980). However, there is little emphasis on the measurement - for accounting purposes - of different kinds of macroeconomic exposure simultaneously.

In Section I we discuss the aims of external accounting and the related information problem. Section II provides a discussion how the macroeconomic environment requires a firm to take a view beyond the traditional measures of exchange rate exposure. Disclosure aspects are discussed in Section III. Thereafter, in Section IV, we suggest new risk measures to be used in corporate financial statements. Information requirements for different methods of measuring exposure are discussed in section V. The arguments are summarized in Section VI.

I. External accounting for risk as an information problem

The information problem regarding the impact of macroeconomic fluctuations is a matter of signalling and choice of relevant information content. One overriding problem for external accounting is that the objectives which are to steer the choice of relevant information do not immediately permit a formulation in operational terms due to the difficulties in aggregating the objective of the different stakeholder groups. Whose goals should be considered in the accounting? The answer may be that the information must meet some minimum requirement satisfying everyone with **stake** in the firm.

Chambers (1966) gives some guidelines about the normative goal of external accounting: It should provide

...a method of retrospective and monetary calculation
the purpose of which is to provide a continuous source
of financial information as a guide to future action in markets

In more general terms, all stakeholders require *information with predictive value for evaluating firm's prospects and risks..* Thus, information should enable stakeholders to compare firms' performance and risk, and it should be useful as a basis for action in markets. Internally, information should be useful for evaluation of performance relative to the firm's objective. In the following we focus entirely on requirements for external accounting, however.

By the very nature of things the accounting discipline is a dynamically changing one. However, a common denominator within the discipline is the view that information about the company's future prospects must somehow be formulated in terms of periodically recurring measurements of wealth (capital) and/or results (profit and loss).

A generally accepted profit concept, which agrees with that adopted by the Sandilands committee (1975) (compare also Hicks 1946), is

Profit for the year ... may usefully be defined as the amount of the total gains arising in the year that may prudently be regarded as distributable ... The practical purpose of the concept of profit is to ensure that a company does not prejudice its future by distributing too much of the gains arising during the year (p. 28).

We can link our view to this concept by recalling from the Introduction the example of risk-taking in banks. If the shareholders of American banks had been able to estimate the risks taken and the potential size of risk premia they should have been better able to sort out "true" profits or risk-adjusted profits and to reassess the growth prospects of the banks. Another aspect of the concept related to profits being distributed is that stakeholders may be interested in having measures of how sensitive profits, cashflows or value are to unanticipated fluctuations in macroeconomic price variables. Anticipated changes on the other hand should be included in the firm's budget. Every stakeholder can then form his own expectations about future profits and risks by applying the sensitivity measures to his own scenarios. Rules of today in external accounting prescribe no such disclosure of the corporate exposure or vulnerability and provide no means to facilitate the assessment of risks and the sustainability of profits.

A basic requirement of any rule for reporting is that it should be clearly understood and its objective clearly defined. For example, the objective may be to capture effects of changes in the value of exchange rates in the parent company's currency. Such value changes differ from *real* value changes for shareholders, however, since inflation must be taken into account to determine real values, and the consumption bundle differs among shareholders, especially when they reside in different countries. A translation rule could never take all such real value changes into account, but if shareholders can interpret the data given in nominal terms, then individuals may determine exposure themselves with their knowledge of consumption bundle and transactions currency.

Another possible objective of accounting rules may be to make changes in income and/or changes in owners' equity comparable among subsidiaries in different countries. Even so, translation rules need not capture economic value changes. Such changes depend strongly on expectations about the future and are, therefore, subjective. Thus, corporate release of information should enable individuals to make comparisons based on their expectations. The choice of translation rule may not be very important for market valuation when market participants learn to understand it and learn to extract information from it. If sufficient information is provided then market participants can reinterpret accounting data themselves and form their own valuation. However,

empirical evidence is contradictory on whether translation rules influence the market's valuation (see e.g. Doukas 1983 and Evans et al. 1978).

In addition to the relationship between accounting (translation) and economic value, it is important to understand the relationship between transaction exposure on the one hand, and economic and translation exposures on the other. Are, for example, transaction and translation exposures complementary or substitutes? Can they be added together to obtain a measure of economic exposure? These issues can be discussed by considering the different implications of locking in dollar values of transaction, accounting values, and economic values, respectively (See Oxelheim and Wihlborg 1989).

In Figure 1 we link the traditional exchange rate exposure measures to each other. *Transaction exposure* is defined in the conventional way as the cash flows in foreign currency in each period. The *translation exposure* in the table is the foreign currency present value of cash flows. More often translation exposure is measured by the foreign currency value of assets minus liabilities on the balance sheet. *Economic exposure* is defined as the sensitivity of the dollar value of the firm to an exchange rate change during a period. Economic exposure defined this way takes into account that a near-term change may or may not be expected to be permanent. In the figure we also present our ideal exposure measure as the change in firm value caused by an unanticipated change in the exchange rate at given levels of other macrovariables related to the exchange rate. We emphasize the importance of considering the effects of unanticipated exchange rate fluctuations and of considering only those exchange rate changes that are independent of other macroprice variables. Analogous reasoning applies to definitions of interest rate and inflation exposure. (See section 4 below). Note also that as an alternative to measuring changes in value, changes in cash flow can be measured. Individual expectations of future developments of exchange rates and other variables would thereby influence the inference of value changes from observations of cash flow changes.

INSERT FIGURE 1

We would expect the financial analyst to be interested in the sensitivity of the share price and economic value to unanticipated fluctuations in macroeconomic price variables. Fluctuations in the price variables, which by the firm are regarded as unanticipated and thereby constitute risk components, should affect stock prices, while anticipated fluctuations would not. Extended accounting could serve a need by disclosing the exposure of corporate cash flow to unanticipated such shocks. Today, the analyst depend entirely on the managers' action and voluntary information release.

II. The macroeconomic environment of the firm

Figure 2 provides a frame of reference for our discussion by demonstrating the link between uncertainty about macroeconomic disturbances and cash flow effects on the firm, as well as the categories of risk and their sources. The figure illustrates three potential levels on which to measure macroeconomic exposure. This can be done at the source-level of the shock, at the policy-level or at the macro price-level.

INSERT FIGURE 2

Starting on the far left we distinguish between domestic and foreign, as well as between policy- and non-policy generated disturbances. In addition there are firm- and industry-specific disturbances. Ideally, the stakeholders of the firm would like to link cash flow effects and risks directly to these fundamental disturbances. However, in between there might be policy reaction to disturbances in the form of monetary, fiscal, as well as industrial and trade policies as in the third column of the figure. 'Rules' for policy responses in the form of exchange rate regimes, money supply growth targets etc., determine how a particular disturbance influences exchange rates, inflation rates, interest rates, and relative prices in the fourth column. Uncertainty about such rules or regimes is an important aspect of political risk. For our purposes, it is sufficient to mention in examples some kinds of shocks in the environment that have strongly influenced most firms during the last decades.

An example of a policy-generated shock of monetary character is the increase in US interest rates in the beginning of the 1980s. The increase was to a certain extent triggered by the change in monetary policy in the USA in 1979, when the Federal Reserve Board started to set and comply with money supply targets. Abandoning interest targeting meant higher US interest rates. A wave of interest rate increases over the world as well as realignment of exchange rates followed. The extent to which the increased US rate became a shock to firms in different countries was dependent on how efficient these individual countries were to prevent the US increase from influencing the domestic rate. Thus, the example highlights how important uncertainty about governments' policies is for the nature and magnitude of macroeconomic risk in the corporate perspective.

Examples of policy generated shocks of a real character are the three oil price increases in 1973, 1979 and 1990. For industrialized countries these shocks can be compared to substantial decreases in the productivity of the labor force and the capital stock. They have sometimes been accompanied by large fiscal and monetary policy adjustments, and gigantic flows in international financial markets as the oil producers' revenues have been recycled. The combination of the productivity decreases and policy responses have had drastic effects on the level of aggregate demand, inflation rates, interest rates, and exchange rates as well as on the relative prices among different commodities and services. Thus, there are a large number of channels through which the original disturbance affected firms.

In the fourth column we list the relevant market price variables for discussing macroeconomic uncertainty. It is obvious that one and the same shock would have different effects on the macro price-variables depending on the macroeconomic structure. It is common in economics as well as in accounting to describe structure by means of market equilibrium relationships in goods and financial markets and by specifying adjustment processes towards these equilibria. International macroeconomic exposure depends particularly on two equilibrium relationships - the Purchasing Power Parity (PPP) and the International Fisher Parity (IFP) or uncovered interest rate parity.

Deviations from the above equilibrium relationships cause profit opportunities, if they are anticipated, while unanticipated changes are the major source of the different kinds

of macroeconomic risks in the last column. This column contains also the commercial risk, reflected in unanticipated relative price changes as a result of firm- and industry-specific disturbances, as well as industrial and trade policies. In practice it may be a major problem for the firm to identify the risk since macro-shocks, affecting all firms in a country, may appear from firm's perspective as shifts in demand and price conditions.

In a hypothetical world without information and transactions costs or other obstacles to immediate price adjustments, there are no deviations from the equilibrium relationships - PPP, the Law of One Price (LOP) for industrial goods, or IFP. In the real world there is no perfect link between the macro-price variables, neither can they be regarded as independent. Hence, they have to be studied simultaneously in order to find the "true" influence for each variable.

With very stable relations in Figure 2 it would be possible to calculate sensitivity coefficients for macro-shocks. An example would be that a 1 % unanticipated increase in labor productivity implies a 3 % increase in economic value of the firm.

Though the macroeconomic environment is the same for a large number of firms the exposure to macroeconomic risks depends on the particular product the firm produces. It would depend on whether the firm exports or not, the level of its debt relative to equity, its capital intensity, the extent to which inputs are imported, etc. Thus, exposure is always firm-specific while macroeconomic uncertainty is not.

The pricing strategy adopted by each firm for responses to macroeconomic shocks determines the overall size of exposure. A firm that pass-through all cost increases immediately is not exposed to any risk if sales volumes remains unchanged, while the firm operating in a market that gives no opportunities to pass cost increases through is heavily exposed. Most firms are somewhere in between facing the trade-off between market shares or gross margins in there choice of pricing strategy to cope with, for instance, an unanticipated cost increase.

III. What information should be disclosed?

A target variable for macroeconomic exposure measurement may be defined in terms of accounting or economic principles, and in real and nominal terms. Risk refers to unanticipated fluctuations in the target variable. Firms concerned with their stockmarket value may often consider accounting measures of income and net worth important, since published statements are accounting based. Nevertheless, it is hard to argue that pure accounting gains and losses without tax effects should matter to the firm. Stock market analysts learn over time the relationship between accounting income and economic income. Furthermore, even when there are specific rules for dealing with exchange rate changes and inflation in accounting, there is nothing that prevents firms from informing stockholders and stock market analysts about their managers' views of the economic relevance of specific accounting rules. The best way to do so today might be to disclose how sensitive the cash flow or value of the firm is believed to be to unanticipated changes in different macroeconomic price variables.

Assuming now that an economic objective is chosen, the target variable could be profits, cash flows, economic value, market value or, for risk management, the stability of sales if wage costs depend on such stability. Market value depends on market participants' subjective expectations about the prospects of the firm. In the long run one would expect market value to coincide with economic value. Since the latter cannot be manipulated by management's information releases, it makes more sense to use economic value as the target variable for our discussion even when shareholders' wealth maximization constitutes the ultimate objective.

Any operational exposure measure based on current information must be stable in the sense that the relation between changes in shocks and changes in a target variable remains constant - otherwise the measure provides no guidance for the future. Figure 2 suggests that the sensitivity of the firm to macroeconomic shocks is related to the firm's choice of pricing strategy. The figure indicates also that interdependence among macroeconomic variables can be expected.

The exposure or sensitivity measure that can be easily presented to the stakeholders should be accompanied by information about pricing strategy in order to be fully informative. This information can be presented as the firm's "functional currency". We discuss the meaning of this term next before turning to the problem of measuring exposure.

A pricing strategy in terms of a rule for price response to exchange rate fluctuations translates into what many call a functional currency. The functional currency concept is established in accounting. Normally it is the currency of the host country of a MNC subsidiary but according to FASB 52, firms can choose to use the dollar as the functional currency of a subsidiary, if, for example, most transactions occur in dollars.

The functional currency in economic terms can be defined as the currency in which profits or cashflows are independent of exchange rate fluctuations. Exposure to exchange rate fluctuations occurs when the functional currency is different from the corporation's home currency or shareholders' home currency. The invoice currency, in principle, is irrelevant, since the invoice price can always be set in the home currency and allowed to change when its value changes relative to the functional currency.

The functional currency is not always easy to define unambiguously and may in fact be seen as a composite of several currencies. It depends not only on the company's rule for adjusting price to exchange rate fluctuations, but also on the currency in which its competitors set prices, and the sensitivity of sales to price changes relative to the competition.

A company operating entirely in the domestic market with only domestic inputs may find itself with a foreign functional currency when major competitors are foreign. Another factor is the costs of imported inputs in raw materials, since their prices and accordingly the profit margin could be sensitive to exchange rate fluctuations. Most companies do not have a well defined functional currency even for sales in a specific country, but cash flows from one country are stable only in a weighted average of two or more currencies.

An example is a pulp manufacturer in a small country. Pulp is a relatively homogeneous product and international competition is strong. American and Canadian producers dominate the market and the world price is determined in US dollars. The manufacturer must set its price in the home currency equal to the world dollar price times the home currency/dollar exchange rate. Companies may invoice in any currency, but the dollar is in any case going to have a strong weight in the functional currency. The dollar price depends mainly on world market demand conditions and cost conditions of major producers. However, profits in the home currency depend strongly on exchange rates. How strongly depends on the nature of inputs. Labor costs, for example, may be most stable in local currency. Thus the functional currency will be a weighted average of the dollar and the local currency.

The pricing strategy typically followed by pulp-producers can be called "market share strategy", since in order to keep the market share constant in the face of an exchange rate fluctuation, the price in the home currency will change in proportion to the exchange rate. Since sensitivity of demand to price differentials among pulp producers is very high, producers do not really have a choice of functional currency and the exposure of their business operations.

For most producers of differentiated goods, the sensitivity of sales to changes in prices relative to competition is rarely as high as for the pulp manufacturer. Thus, exposure to exchange rate fluctuations and functional currency is to some extent under the control of the company. By choosing an appropriate price and output strategy, the producers of differentiated goods can determine how sensitive cash flows are going to be in response to unforeseen exchange rate fluctuations.

Take as an example a non-US car manufacturer selling in the US. During the strong dollar period of the early '80s, many European car manufacturers adopted the strategy of keeping dollar prices nearly constant in the US. Instead, home currency prices increased dramatically until 1985 and thereafter fell by a large amount, when the dollar depreciated. Japanese car manufacturers, on the other hand, lowered their dollar prices when the dollar appreciated, increasing their market shares.

If the major competition for both European and Japanese car manufacturers came from US companies, keeping their dollar prices independent of the exchange rate, then European companies will have experienced gains and losses in direct proportion to exchange rate changes. The dollar would then be the functional currency.

With their strategy of adjusting dollar prices to the exchange rate, in what currency were Japanese car manufacturers exposed? Their sales would have increased as the dollar strengthened and vice versa. The effect of exchange rate fluctuations on cash flows would depend on the sensitivity of sales to price changes. The functional currency in which cash flows were stable for Japanese manufacturers may be a weighted average of the dollar and the yen.

For example, if a 10 % appreciation of the dollar, causing a similar fall in dollar prices, led to a 10 % increase in sales, then sales revenues in dollars would remain unchanged while yen revenue would increase by 10 %. In terms of sales revenue, the dollar may

seem to be the functional currency, but taking into account that volume and therefore production costs in yen increased, the increased sales revenues in yen may only have offset increased production costs. Thus, in terms of net cash flows, the yen would have a larger weight in the functional currency.

In this example, it is important to note the impact of volume changes on cash flows and exposure. For the Europeans, volume changes were negligible under the assumption that most competitors were from the US. For the Japanese, adopting a different strategy, the sensitivity of sales was such that yen net cash flows remained constant.

As soon as the assumptions about the origin of competition and the sensitivity of sales are changed, the functional currencies will change and may become ambiguous. It is possible that competitive conditions in the US have changed, so that the major competitors for Europeans manufacturers are now the Japanese.

In order to hold the market share constant, European manufacturers must adjust dollar prices along with the Japanese. Accordingly, the yen would gain weight as the functional currency for European manufacturers if the Japanese hold on to their strategy of constant yen prices.

Exposure to the exchange rate could be partially offset by exposure to interest rate changes or inflation. Therefore, reducing cash flow exposure to exchange rates alone may leave the company exposed to interest rate fluctuations or inflation. For example, if the functional currency is determined to be the home currency but inflation uncertainty is high in this currency, then the total macroeconomic exposure may be high in the home currency. Choosing a foreign currency as the functional currency by means of pricing strategy may be a deliberate corporate action in order to reduce exposure by providing protection against inflation uncertainty in the home currency.

IV. Proposals for new measures in accounting for macroeconomic influence on the firm

In this section we show how exposure to different macroeconomic risks can be measured taking into consideration interdependencies among exchange rates, inflation rates, interest rates and the relative prices of the firm's outputs and inputs. The exposure measure we suggest expresses the sensitivity of either cash flows or the firm's market value to changes in relevant variables. We demonstrate how such measures can be thought of as coefficients in regression analysis of historical data. According to Oxelheim (1984), many firms desire an exposure measure closely related to sensitivities of this kind. Once sensitivity coefficients to different variables, including exchange rates, have been obtained, the functional currency basket can be estimated given the pricing strategy in effect when coefficients were estimated.

Regression analysis is useful for evaluating the independent "pure" exposures of different variables without having to develop a theory for the exact relation among variables. Specifically, if monthly or quarterly cash flow data exist for a number of years, regression

analysis can identify the sensitivity of cash flows to independent changes in each of the macroeconomic variables under the pricing strategy chosen by the company.

We have previously assumed that the firm has an economic objective. Such an objective may be defined in terms of the net present value of future expected cash flows as in Lessard (1979), or in terms of near-term cash flows, or profits. Here we define exposure as the sensitivity of cash flows to changes in different macroeconomic variables. Since the net present value depends on future expected cash flows, it is simple - at least conceptually - to take the additional step of defining exposure in terms of the net present value. (See Oxelheim and Wihlborg 1987).

The complexity of the relationship among macroeconomic variables and the firms' cash flows provides a strong reason for using multiple regression analysis to measure exposures. The firm trying to evaluate its exposure could run the following regression in levels or rate of change using, for example, quarterly data on cash flows and market price variables:

$$\begin{aligned} \frac{X_t^{\$}}{P_t^{US}} = E_{t-1} \left[\frac{X_t^{\$}}{P_t^{US}} \right] &+ a_1 (P_t^{US} - E_{t-1} [P_t^{US}]) \\ &+ a_2 (P_t^F - E_{t-1} [P_t^F]) + a_3 (e_t - E_{t-1} [e_t]) \\ &+ a_4 (i_t^{US} - E_{t-1} [i_t^{US}]) + a_5 (i_t^F - E_{t-1} [i_t^F]) \\ &+ a_6 (r_t - E_{t-1} [r_t]) + \epsilon_t \end{aligned} \quad (1)$$

where:

$X_t^{\$}$ = total cash flows in dollars

P_t^{US} = price level in the USA (shareholders' habitat)

E_{t-1} = expectational operator in period t-1

P_t^F = foreign price level

e_t = exchange rate

i_t^{US} = interest rate in the US ;

i_t^F = foreign interest rate

r_t = relative price(s) of relevance for firm's profitability

ϵ_t = error term

Equation 1 has the shareholders' real value of cash flows as the dependent variable. Thus, nominal accounting data should be deflated with a price index. The independent

variables are separated into *expected* cash flows as of period $t-1$ and cash flow effects of *unanticipated* changes in the domestic price level, the foreign price level(s), the exchange rate(s), the domestic and the foreign interest rate(s), and relative prices in the firm's commodity markets. Expected cash flows would depend on the expected levels of the different variables and the cash flow sensitivity to expected changes in the variables in the following way:

$$E_{t-1} \left[\frac{X_t^{\$}}{P_t^{US}} \right] = a_0' + a_1' E_{t-1} [P_t^{US}] + a_2' E_{t-1} [P_t^F] \\ + a_3' E_{t-1} [e_t] + a_4' E_{t-1} [i_t^{US}] + a_5' E_{t-1} [i_t^F] \\ + a_6' E_{t-1} [r_t] \quad (2)$$

where the primed parameter $a_1' - a_6'$ shows the sensitivity of cash flows to expected changes in variables. The expected values of different variables are forecasts and should be incorporated in the firm's budget unless this is overly tainted by wishful thinking.

The sensitivities $a_1' - a_6'$ would not normally be the same as coefficients $a_1 - a_6$ for unanticipated changes.

The length of one period over which cash flow effects are estimated would depend on the length of time over which the firm forms its expectations of cash flows. The length may also reflect internal considerations as to the speed with which it may wish to take action in the form of hedging, etc. For realism we may envision that all data are quarterly averages.

Exchange rate changes may correspond to either a country's inflation rate or to deviations from PPP, in which case there are *real* exchange rate changes. The coefficient a_3 captures effects of *real* changes, i.e., of nominal exchange rate changes at constant price levels. The cash flow effects of the two kinds of exchange rate changes are bound to be different, since a real exchange rate change implies a change in relative prices between countries. The cash flow effect would depend on which relative prices and which demand and cost effects are associated with domestic inflation, foreign inflation, and real exchange rate changes, respectively (see e.g., Cornell, 1980). It is important also to distinguish between the impact of those relative price changes which are *independent* of exchange rates and inflation, and relative price changes which occur in the macroeconomic adjustment process. The former impact is captured by coefficient a_6 and the latter by a_1 , a_2 and a_3 , since the cash flow effects of inflation and exchange rate changes would depend on the relative price effects that occur in the macroeconomic adjustment process. Without using this kind of approach to measuring exposure, a firm could easily be misled by relative price changes, believing their source is a fundamental change in business conditions rather than a temporary effect of macroeconomic disturbances. And disclosing exposure figures without taking the more elaborated stance would also mislead the external stakeholders.

Each a -coefficient is an exposure measure, i.e., a sensitivity measure in the form of a covariance between real cash flows and each variable *holding other variables constant*, relative to the variance of each variable. The coefficient in front of expected cash flows should be equal to one and the error term should be randomly distributed. If not, additional variables may have to be introduced into the equation, for example, by distinguishing between several foreign currencies. It is also important econometrically to determine whether the regression is most properly run in levels or rates of change.

There are econometric and data availability problems associated with multiple regression analysis. Econometric problems may arise as a result of multicollinearity - high correlation among independent variables - when the number of independent variables increases. Such multicollinearity forces the analyst to reduce the number of variables in order to capture the most essential relationships. If regression analysis cannot be conducted, then it becomes necessary to form judgment based on an understanding of macroeconomic relationships and the cash flow effects of changes in different variables. In Oxelheim and Wihlborg (1987) we look in more detail at information requirement for forming such judgments, and scenario approaches to measuring exposure are also presented as an alternative to the regression approach. Conceptually, the coefficients of the multiple regression provide the information we are looking for in scenario analysis as well.

As Lucas (1976) has pointed out, shifts in the behavior of policy authorities influence coefficients in regressions like equation 1. The stability of each of the coefficients depends on the stability of policy rules for domestic and foreign policies influencing expectations formation and therefore the relation between current policy shocks and the magnitude of changes in exchange rates, inflation and interest rates. (See Ibrahimi, Oxelheim and Wihlborg 1991 for more details).

Uncertainty about policy rules is an element of *political risk*. It causes *uncertainty about the coefficients* of sensitivity of cash flows to macroeconomic disturbances. Another source of political risk is the potential imposition of exchange controls and credit controls. Such controls could influence structural relationships among, for example, real exchange rates, interest rates and money supplies. Direct regulatory policy measures may have direct cash flow effects as well (see Dooley and Isard, 1980), but to the extent they are not forecast, their most important effects would be structural, i.e., they would influence sensitivity coefficients like policy rule shifts do (see, e.g., Wihlborg, 1982). In principle, exposure to the shocks on the left hand side in Figure 2 can be estimated as an alternative to exposure to price variables in equation 1. Econometric considerations, information requirements and the stability of the coefficients over time must determine the exact specification of the regression for measuring exposure.

In case of instable coefficients, cash flows of the firm must be broken down into categories (by e.g. product and country of sales and production) that remain structurally unchanged over time and with unchanged pricing strategy. By aggregating these coefficients, stable coefficients for the total firm can be estimated.

V. Information requirements and exposure measurement

Different methods for exposure measurement require different kinds of information as inputs. Therefore, the relative advantage of each depends largely on the costs and availability of relevant information. The traditional measurement methods, as previously discussed, have the additional disadvantage of not recognizing the interdependence among different macroeconomic exposures, although their relative economic validity depends strongly on assumptions about the relations among inflation, exchange rates and interest rates as pointed out by e.g. Aliber and Stickney (1975) and Oxelheim (1985).

The requisites in terms of data availability, policy regime stability etc. for different methods of estimating the corporate sensitivity to macroeconomic shocks are exhibited in Figure 3.

INSERT FIGURE 3

On the far left we state the common objective of all methods; to measure macroeconomic exposures. Thereafter, we make a major distinction based on the availability of historical cash flow data. These data could be detailed cash flow figures for financial and commercial cash flows by product line, country of sales, currency of denomination, and other characteristics. They should exist on a quarterly basis for a minimum of five years.

If historical data of this kind are available then regression analysis can be performed. However, the resulting exposure coefficients are stable over time and applicable on future periods only if there is some stability of policy regime, i.e. political risk is absent or negligible. This kind of stability implies that the exchange rate regime does not change and that central banks' and fiscal authorities' responses to economic events remain unchanged over time. For example, if central banks move from interest rate targeting to money supply targeting there is a regime shift.

Regression analysis on money supply and other macroeconomic disturbances can be applied, if there is both stability of policy regime and firms can observe shocks quickly. On the other hand, if firms cannot observe shocks when they occur but they observe only market price variables like exchange rates and interest rates, then their actions are based on these prices and the regression for sensitivity coefficients based on price variables is most appropriate as noted in Ibrahimi, Oxelheim and Wihlborg (1991).

With the existence of political risk, it could still be possible to measure exposures to exchange rates, price level and other market price variables by means of regression analysis for subperiods over which regimes can be identified. Exposure coefficients so derived can be published for hedging decisions if a forecast of the policy regime can be made.

Moving downwards in Figure 3 we see that in the absence of policy stability scenario analysis can be substituted for regression analysis. An advantage of the scenario analysis is that it does not rely heavily on historical cash flow data. Its disadvantage is that relatively detailed judgment about macroeconomic structure is required.

As noted above even if regression analysis is not directly applicable or reliable, the definition of exposure coefficients within regression equations, provides useful *guidance for the exposure measures a firm should try to arrive at by any method*. Regression coefficients are summary figures for the economic impact on cash flows of different disturbances through a whole variety of more or less obvious channels.

Internal knowledge about the impact of different kinds of disturbances on cash flows may be more or less detailed. The knowledge may be based on judgment and experience or it may be based on explicit formulation of macroeconomic relationships among disturbances and relative prices as well as market conditions of relevance for a firm. In the former case relatively loose judgement about exposure coefficients could be formed. In the latter case a scenario analysis is useful.

The scenario analysis is a useful tool for sensitivity analysis as well as in the budget process. Sensitivity analysis would refer to sensitivity to unanticipated macroeconomic events, while in the budget process the cash flow effects of anticipated events are analyzed. Many different assumptions can be made and the events to which cash flows are particularly sensitive can be identified. Budget alternatives may be analyzed under different forecasts about macroeconomic events.

Though we have presented the different exposure measures as substitutes, it is obvious that from management's perspective they are complementary. Ideal measures are hard to obtain. Political as well as data problems and other econometric problems make regression exposure coefficients unreliable under some circumstances. The scenario approach, on the other hand, requires assumptions about macroeconomic structure about which there is substantial disagreement. Therefore, the different exposure measures could be applied simultaneously. If the results are similar under each method they are highly credible. On the other hand, if results become different, there is reason to check underlying assumptions of each method in order to evaluate its relative validity.

It is obvious that without a substantial amount of data, sensitivity coefficients are subject to judgemental input and thereby potentially in conflict with two of the key-principles in accounting: the principles of objectivity and consistency. However, whenever objectivity refers to the reporting of verifiable events also the conventional exposure measures can be criticized for lack of objectivity. Exposure measures are by definition *ex ante* concepts. When the question of objectivity boils down to the validity of exposure measurement, the measure suggested in this article is superior to conventional measures. Moreover, conventional exposure measures are consistent only in the sense that mechanical rules are used to derive them. The choice of rule is nevertheless judgmental as is its interpretation from an economic point of view. Thus, also from a consistency point of view the use of our suggested measures in external accounting should be seen as superior to conventional exposure measures.

VI. Concluding comments

In this article we have argued that there is a need for additional information on exposure for external stakeholders. We have emphasized the need for measures of how sensitive

or vulnerable a firm is to changes in its macroeconomic setting. Traditional exposure measures give little guidance since they are either partial, accounting based, or both. Partiality reveals itself in two ways. First, exposure measures are often restricted to a limited share of cash flows. (e.g., transaction exposure). Second, they usually refer to exposure to exchange rate changes, inflation, or interest rate changes separately, neglecting that these variables may be related in a general equilibrium system.

We have here suggested that firms measure and publish a set of exposure coefficients as defined by coefficients in multiple regression analysis. In order to estimate the influence on the firm of macroeconomic shocks and disturbances, exposure may be defined in terms of market price variables or in terms of underlying macroeconomic disturbances. The advantage of one approach over the other would depend on the relative stability over time of estimated exposure coefficients. We argue that in times of high uncertainty about the behavior pattern of policy authorities, exposure should be defined in terms of market price variables. Then, a large share of the exchange rate variability will be independent of variability in exogenous macroeconomic variables.

As some instability is attached to the coefficients the firm has to reestimate the coefficients at least as often as major internal changes, like changes in the firm's pricing strategy, capital structures, acquisitions, have occurred. Under some circumstances scenario analysis may be superior to regression analysis to estimate the coefficients.

Today there are no formal rules for the disclosure of these coefficients, but since the need has been stressed there should be very few arguments against their disclosure. Certainly, the disclosure in the financial statements is in line with a view of accounting as the mean of providing information for future actions in markets. Moreover, it is in the interest of well-managed firms to have these coefficients estimated and incorporated in the informational base supporting corporate decisions. Hence, disclosure does not mean any additional work. Under current accounting rules in the USA, a particular exposure concept is "forced" on the corporation independent of its relevance. Our discussion of functional currency implies that each corporation has its own specific functional currency depending on pricing strategy, market structure, origin of competition, etc. Thus, there is no economic basis for standardizing or limiting a firm's choice of functional currency. Exposure measures as defined here can be used to define each firm's functional currency. This might be a basket and it should be disclosed along with information on sensitivity coefficients to enhance their information value.

Competitive reasons are the only arguments for not disclosing the sensitivity of the firm to unanticipated changes in the macroeconomic environment. On the other hand, knowledge of sensitivity coefficients would help firms as well as stakeholders distinguish between macroeconomic factors and firm- and industry-specific factors when evaluating the prospects of the firm. Obviously, there are both pros and cons for making the disclosure mandatory. We can see a prudential case for exchanges to make disclosure a requirement for listing. Today, the firm's financial report leaves very little guidance as to the vulnerability of the firm to different shocks in the economic environment. The shareholders constitute one group of stakeholders with great need for vulnerability or sensitivity measures of decision-relevance. Thus, to facilitate future fund raising firms

may have to measure and disclosure the sensitivity to meet the requirement from financial analysts and investors.

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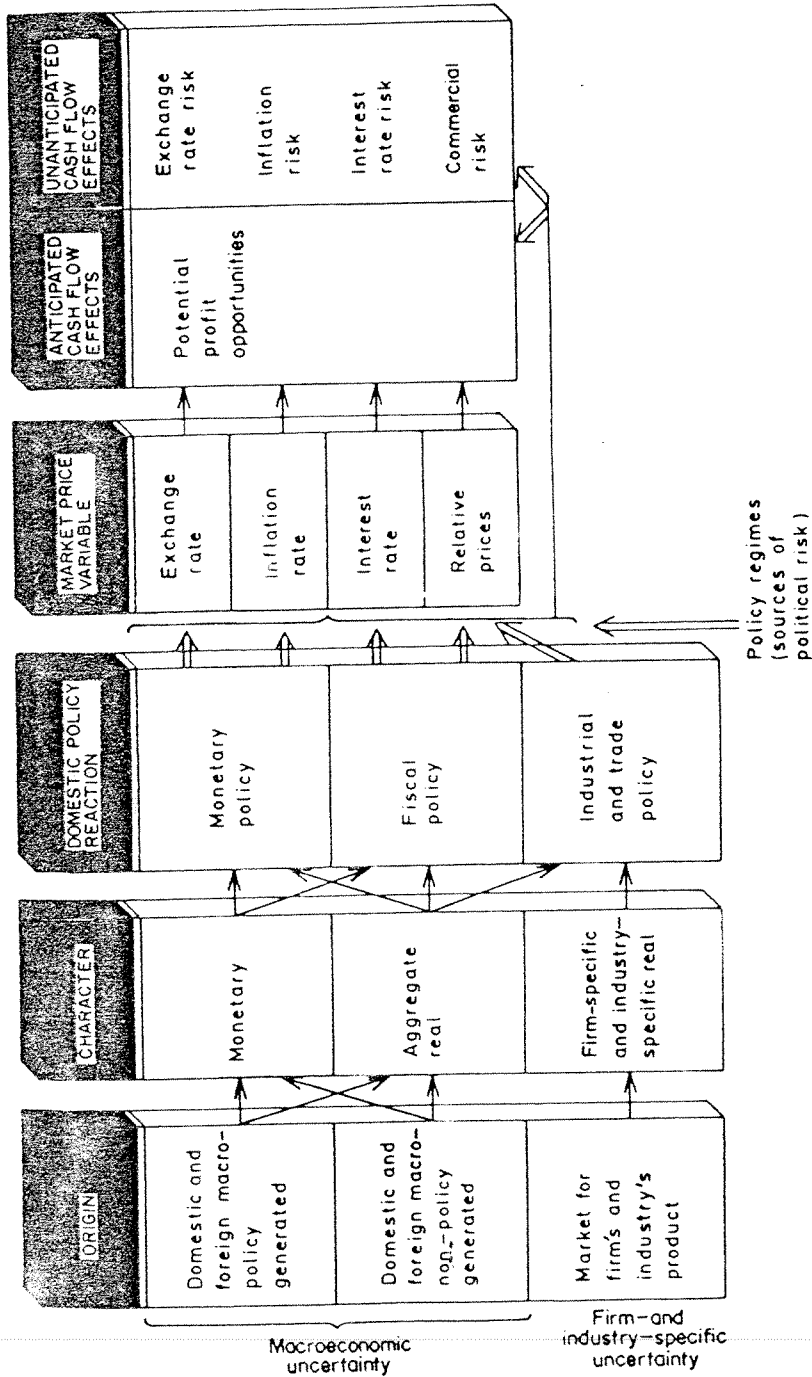
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Figure 1 Exposures of value and cash flows at time 0

A. Background				
Period		1	2	3.....n
Expected cash flow in foreign currency	$X_t^{FC}=f(e_t)$	X_1^{FC}	X_2^{FC}	$X_3^{FC} \dots\dots\dots X_n^{FC}$
Expected cash flow in home currency (\$)	$Y_t^{\$}=f(e_t)$	$Y_1^{\$}$	$Y_2^{\$}$	$Y_3^{\$} \dots\dots\dots Y_n^{\$}$
Exchange rate		e_1	e_2	$e_3 \dots\dots\dots e_n$
B. Traditional exposure measures				
Transaction exposures		X_1^{FC}	X_2^{FC}	$X_3^{FC} \dots\dots\dots X_n^{FC}$
Translation exposure (economic version)		$PV_0^{FC} = \sum_{t=1}^n \frac{X_t^{FC}}{(1+d)^t P_t^{FC}}$		
Economic exchange rate exposure for period 0 to 1		$\frac{PV_1^{\$} - PV_0^{\$}}{e_1 - e_0}$ <p>assuming exchange rate changes are unanticipated and where economic present value in \$ is</p> $PV_0^{\$} = \sum_{t=1}^n \frac{X_t^{FC} e_t}{(1+d)^t P_t^{US}}$		
C. Ideal and suggested exposure measure				
Economic exchange rate exposure for period 0 to 1		$\frac{PV_1^{\$} - PV_0^{\$}}{e_1 - e_0}$ <p>assuming exchange rate changes are unanticipated and all other macro-price variables held constant and where economic present value of the firm in \$ is</p> $PV_0^{\$} = \sum_{t=1}^n \frac{X_t^{FC} e_t + Y_t^{\$}}{(1+d)^t P_t^{US}}$		

Figure 2 External shocks and the cash flow of the firm



Source: Oxelheim and Wihlborg (1987).

Figure 3 Conditions for use of different methods for measuring macroeconomic exposure

