FOREIGN EXCHANGE EXPOSURE: ACCOUNTING MEASURES AND ECONOMIC REALITY

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INTRODUCTION AND OVERVIEW

Foreign exchange risk directly affects all areas of international cash management — the management of cash receipts and disbursement as well as the short-term investment of excess cash balances. The topic is also receiving considerable attention at the more general levels of corporate financial management because short-term investment strategy has become the most effective and important tool for foreign exchange risk management. These constraints reflect a realization that the effective foreign exchange risk of any short-term portfolio investment is a function of the foreign exchange risk of the entire corporation; the exchange risk of a particular investment may either aggravate or mitigate aggregate corporate risk.

For these reasons, cash managers must understand aggregate corporate foreign exchange risk as well as the foreign exchange risk of specific investments which are directly under their control.

Unfortunately, many cash managers view foreign exchange risk as a complex and threatening element of international cash management. This confusion arises primarily because there has been little agreement on how foreign exchange risk should be measured.

This article attempts to reduce this confusion by outlining two basic methods for measuring foreign exchange exposure.

A STANDARDIZED APPROACH: ACCOUNTING EXPOSURE

In general, foreign exchange exposure is defined as the sensitivity of corporate value to changes in foreign exchange rates. However, accounting standards which govern the translation of foreign currency financial statements imply a more specific definition — the sensitivity of balance sheet net worth to changes in exchange rates. The rules currently in effect are described in the Financial Accounting Standards Board’s Statement Number 52 (hereafter, FASB-52) which replaced Statement Number 8 (FASB-8) in 1981. Both sets of rules are standardized measures of foreign exchange rate exposure in accounting terms.

A CUSTOMIZED APPROACH: MARKET-VALUE EXPOSURE

Because all companies are different, translation standards will be closer to economic reality for some companies than for others. If a standard is well-conceived and companies are more similar than different, the negative consequences of standardization may be slight. If not, the system of standardization may generate serious conflicts between the standard and economic reality.
In the context of foreign exchange sensitivity, economic reality is loosely referred to as "real" or "economic" exposure. In this article, economic reality will be based on market value. The economic exposure of an investment is defined as the sensitivity of market value to changes in exchange rates.

Clearly, market value sensitivity is determined by factors that are specific to particular companies, particular currencies, and particular circumstances. It also depends on expectations of future events. These factors are recognized in the market-value approach to foreign exchange exposure measurement described subsequently.

COMPARING THE METHODS

Both the accounting-balances and market-value methods of exposure measurement condense the relevant information into a single summary measure of sensitivity. This measure is a coefficient or parameter which reflects the effect of exchange rate changes on either accounting net worth or on market value. For example, a coefficient of .3 implies that net worth or market value will rise by 3% in response to a 10% appreciation of the relevant foreign currency.

In describing each method, this article focuses on the specific accounting standards and the particular company and currency characteristics which influence the measurement of this aggregate sensitivity coefficient. The emphasis is on the difference between the two methods and on the company and environmental characteristics that make the accounting standards relevant for some companies but not for others.

CHOOSING A RISK MEASUREMENT METHOD

Managers of firms with operating and financial characteristics that are similar to those assumed by FASB-52 will find that the new rules provide a satisfactory description of reality. For such firms the aggregate sensitivity coefficient estimated on a market-value basis will approximate the coefficient estimated on an FASB-52 basis of accounting net worth. Where there is no conflict between the two measurements of foreign exchange sensitivity, short-term investment decisions may be based on the more convenient FASB-52 measurement basis.

However, few financial managers are likely to find that economic and FASB-52 sensitivities are very similar. For most companies, the difference between the market-value sensitivity coefficient and the accounting net worth sensitivity coefficient will be quite large. This difference creates a potentially dangerous conflict between economic reality and the accounting measurement of that reality. Accurate measurement of exchange risk is particularly important for these companies.

Awareness of the difference between market-value exchange risk and accounting exchange risk is very important to the managers of such companies. An understanding of this difference and an appreciation of the corporate characteristics that distinguish a particular firm or investment can be the basis for education and information programs. Such programs might describe and justify an investment management program which is based on economic reality rather than on financial statement implications.

THE ACCOUNTING VIEW OF FOREIGN EXCHANGE EXPOSURE

The accounting method used to translate financial statements from one currency to another determines the effect of exchange rate changes on accounting net worth. In 1976, the FASB first chose to standardize both the translation treatment and the recognition of gains and losses. The objective was to simplify and improve investors' evaluation processes. The FASB-8 standards were designed to describe the "average" corporation's exchange rate sensitivity. Moreover, it was hoped that the actual sensitivity of most companies would be close to this average.

The FASB-8 rules failed on both accounts. Most managers felt strongly that the economic sensitivity of their foreign operations was very far from the value implied by the FASB-8 standards.

An important pair of criticisms were generally shared by most financial executives.

1. Exposure Overstatement. FASB-8 implied a sensitivity to foreign exchange rate changes which far exceeded any actual exposure. The rules dramatically exaggerated foreign exchange risk.

2. Accounting Versus Economic Reality. The gains and losses resulting from the translation of foreign statements were often at variance with a perceived change in "real" economic value.

The rules were revised in 1981. FASB-52, the new standard, was designed to move the "average" corporation, as implied by the accounting rules, into line with an informed perception of the actual "average" corporation.

Two important elements of
FASB-8 and FASB-52 determine the level of exposure as well as its effect on accounting ratios — translation rules and recognition of economic gains and losses.

1. Translation Rules. The first element is the designation of those foreign currency account balances which are to be translated at historic exchange rates as opposed to those balances which are to be translated at current exchange rates. The latter are exposed accounts since their translated dollar values depend on the effective exchange rate on each statement date. In contrast, any assets and liabilities which are translated at historic exchange rates are not exposed. The translated dollar values of the exposed accounts change from one periodic statement to another when the exchange rate used for translation has changed in the intervening period. Net exposure, is the difference between the assets and liabilities which are translated at current exchange rates. Net exposure determines the size of the translation adjustment.

2. Gain-Loss Recognition Rules. The second important element of an accounting translation system is the disposition of the translation gain or loss. Prior to FASB-8, accounting conventions allowed the smoothing of periodic translation adjustments through the use of reserve accounts. With FASB-8, translation gains and losses were posted directly to income. The use of reserve accounts was prohibited.

The elimination of reserve accounts was one of the most controversial aspects of FASB-8. Some observers felt that the inclusion of translation gains and losses in quarterly income statements induced shareholder overreaction for two reasons. First, the period-to-period (say, quarter-to-quarter) variability of foreign exchange gains and losses is increased. Second, any overstatement of accounting measures vis-a-vis an economic measure further magnifies the reported variability over the true economic variability.

FOREIGN EXCHANGE EXPOSURE UNDER FASB-8

FASB-8 mandated the use of the temporal method of translation. All monetary (i.e., exposed) assets and liabilities were translated at the prevailing foreign exchange rate. These exposed assets included cash,

### EXHIBIT 1

FOREIGN EXCHANGE EXPOSURE: A SAMPLE CALCULATION
British Subsidiary of International Manufacturing Co. (£000,000)

<table>
<thead>
<tr>
<th></th>
<th>Foreign Currency Balance Sheet</th>
<th>Exposed Assets/ Liabilities FASB-8</th>
<th>Exposed Assets/ Liabilities FASB-52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>£ 11</td>
<td>£ 11</td>
<td>£ 11</td>
</tr>
<tr>
<td>Accounts Receivable</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Inventories</td>
<td>19</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Net Fixed Assets</td>
<td>53</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>Total Assets</td>
<td>£100</td>
<td>£ 28</td>
<td>£100</td>
</tr>
<tr>
<td>Short-term debt</td>
<td>£ 10</td>
<td>£ 10</td>
<td>£ 10</td>
</tr>
<tr>
<td>Long-term debt</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Net Worth</td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Total Liabilities and Net Worth</td>
<td>£100</td>
<td>(£22)</td>
<td>£50</td>
</tr>
<tr>
<td>Net Exposed Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
marketable securities, and accounts receivable. Exposed liabilities included accounts payable, pension fund liabilities, and all foreign currency debt. Exhibit 1 illustrates the use of the FASB-8 rules to determine exposure for the British subsidiary of the hypothetical International Manufacturing Company. It shows a £22 million liability exposure.

This example demonstrates an important consequence of the temporal translation method. Inventories and long-term assets were translated at historic exchange rates so that the translated dollar values of these assets were unchanged even though current exchange rates changed. Inventories and long-term assets were unexposed. As a result, foreign investments that were supported by some share of foreign currency debt were reflected as net liability exposures because exposed cash and receivables accounts were insufficient to offset exposed foreign currency debt. The contribution to total corporate net worth declined for these investments when foreign currencies appreciated relative to the dollar. Because the issuance of FASB-8 in 1976 coincided with a downturn in the foreign exchange value of the dollar relative to most major currencies, many companies found themselves reporting losses for most foreign investments even when the investments in these strong currencies seemed to appreciate in market value.

Adding to the aggravation was the requirement that all translation gains and losses be posted directly to income rather than a reserve account. As a result, the quarter-to-quarter volatility of both net income and earnings per share increased, sometimes dramatically.

Synthesis: FASB-8

FASB-8 rules assumed a reality in which the dollar value of the average foreign investment fell as the foreign exchange value of the dollar fell. For virtually all U.S. companies, the economic reality was exactly the reverse.

THE AGGREGATE EXPOSURE COEFFICIENT

The foreign exchange exposure can be conveniently summarized as a single coefficient which captures the proportional relationship between percentage exchange rate changes and percentage changes in a foreign subsidiary's contribution to net worth.

On an FASB-8 basis, this coefficient is \( -0.44 \) for International's British subsidiary, an absolute exposure of £22 million on a net worth of £50 million. Therefore, a 10% increase in the dollar value of the pound sterling will result in a 4.4% decline in the contribution of International's British subsidiary to consolidated net worth.

This coefficient provides an important perspective on the exchange risk of a foreign subsidiary. The coefficient can be used to adjust the value of such an investment to a fully exposed equivalent.

Consider the following adjustment to the £50 million net worth of International's British subsidiary. The level of risk generated by an aggregate exposure coefficient of \( -0.44 \) implies that the foreign exchange risk on this £50 million asset is equivalent (in accounting terms) to the foreign exchange risk incurred by issuing £22 million debt against dollar assets of equal value. A 10% depreciation of the pound sterling will increase the values of both positions by the equivalent of £2.2 million, or 4.4% of the accounting net worth of International's British subsidiary.

FOREIGN EXCHANGE EXPOSURE UNDER FASB-52


FASB-52 utilizes the all-current method of translation, i.e., all account balances, with the exception of net worth, are translated at the current (prevailing) foreign exchange rates. With this single change, foreign inventories and long-term assets were changed from unexposed status under FASB-8 to exposed status under FASB-52. As a result, the average foreign investment was designated a net asset exposure.

Let us again examine International's British subsidiary. As shown in Exhibit 1, its exposure under FASB-52 is £50 million, a net asset exposure. For these assets the translated dollar value of net worth increases when the dollar depreciates relative to foreign currencies, the opposite of FASB-8.

The British subsidiary's foreign exchange exposure, expressed as an aggregate exposure coefficient, is 1.0. Thus, a 10% appreciation of sterling will cause a 10% increase in accounting net worth.

In exchange risk terms, the foreign exchange exposure of International's British subsidiary is equivalent to the exchange exposure incurred in the purchase of a £50 million government bond.

Comparison with FASB-8

It is especially interesting to note
that the FASB-52 treatment of International’s British subsidiary completely reversed the direction of the implied exchange exposure under FASB-8. Under the old method (FASB-8), the investment’s dollar value fell with a sterling revaluation; under the new method its value rises with revaluation.

This change in the accounting net worth sensitivity involves an implied relationship between the true investment value and foreign exchange rates. This divergence emphasizes the arbitrariness of any set of accounting standards. Clearly, some foreign investments are effectively net asset exposures whose real values will increase when foreign currencies appreciate. On the other hand, some foreign investments must be net liability exposures whose real values decline as foreign currencies appreciate. Unfortunately, accounting standards will force some companies into the wrong category.

Gain-Loss Realization

FASB-52 also answered the second major criticism of FASB-8, the allocation of each period’s translation gains and losses directly to income. Under FASB-52, translator adjustments bypass both net income and earnings per share. They are posted directly to a special category of net worth. This procedure is clearly a close cousin to the reserve accounts forbidden by FASB-8. Apparently, it is hoped that hiding the accounting recognition of gains and losses in net worth will be less disconcerting to investors than the direct recognition in income. It should at least make the reported quarter-to-quarter income and earnings per share less volatile.

FOREIGN EXCHANGE EXPOSURE: THE ECONOMIC REALITY

The true economic exposure is defined as the sensitivity of market value to changes in currency rates. For simplicity, we shall use the term market value exposure to refer to economic reality. To understand market value exposure we must first consider the elements of the market values of foreign investments with emphasis on how changes in foreign exchange rates impact market value.

A useful framework for the description of foreign investment values has come from a body of research produced by proponents of an economic model of foreign exchange exposure. The framework is developed and described in articles by Hecker [4], Shapiro [10], Gidd [3], Rodriguez [9], Levi [8], and Hekman [5, 6, 7]. The framework emphasizes the valuation of cash flows rather than the translation of accounting balances.

One distinguishing feature of the market-value models is the incorporation of expectations about future events, especially the expected future cash flows associated with an investment. In contrast, accounting measures rely solely on the accumulation of historic costs. Adjustments in account balances proxy expected future cash flows only under very restrictive and, generally, unrealistic assumptions.

The market-value approach also differs from accounting measures in its disaggregation of cash flow expectations into several important components. These generally include inflationary expectations, exchange rate expectations, and the company’s adaptive capabilities. There is also consideration of the relationships between each of these factors. With the disaggregation of market value into a few important elements, an analyst is better able to gauge the expected sensitivity of market value to changes in exchange rates.

The market-value approach is a customized treatment of exchange exposure measurement. Because expectations about exchange rates, inflation, and their interaction are currency-specific, these components may be adjusted to reflect varying conditions in a company’s different markets at a particular time. Management’s ability to adapt to changes in inflation and exchange rate environments is not only company-specific but, generally, even investment-specific. The ease with which adaptability considerations are included also improves the specificity of the measurement. In summary, the resulting estimate of exposure can be both realistic and relevant because it captures specific and important company and currency characteristics.

FOREIGN INFLATION: A “NATURAL” HEDGE

Foreign exchange risk is the variability in the dollar value of foreign investments which is caused by movements in foreign exchange rates. For example, the C.D. (a Certificate of Deposit denominated in pounds sterling) is a risky investment for a U.S. corporation because a devaluation of the pound sterling relative to the U.S. dollar will cause an equiproportional decline in the U.S. dollar value.

Fortunately, most corporate investments in real assets are unlike C.D.’s in an important dimension. The foreign currency value of the asset is not fixed, but may vary with changes in foreign inflationary conditions. Thus, assessment of currency change
effects is generally much more complex for real assets than for purely financial investments.

An extreme example of such an asset is a foreign currency investment in precious metals. A British subsidiary’s investment in a quantity of gold bullion is generally free of devaluation risk. If the pound sterling devalues, the value of the gold in pounds sterling must increase by the amount of the devaluation. The U.S. parent holds, indirectly, foreign currency assets whose dollar value is insensitive to devaluation. The investment is, by its nature, naturally hedged.

The prices of most goods and commodities behave more like gold than C.D.’s and other financial obligations. For most countries changes in exchange rates and changes in price inflation are closely related for just this reason. As an extension, unexpected devaluations of foreign currencies are often accompanied by unexpected increases in foreign inflation forecasts. The consequence is that foreign investment returns, stated in a foreign currency, often increase to offset foreign currency depreciations. This “natural hedge” stabilizes the dollar value of the investment. Failure to recognize these linkages may lead to a dramatic overassessment of the level of an investment’s foreign exchange risk.

DISAGGREGATION IN THE MEASUREMENT OF EXCHANGE RISK

The degree to which an asset is naturally hedged depends on several factors. The most obvious is the extent to which foreign inflation and foreign exchange rates move in offsetting directions.

A second important factor is the sensitivity of foreign returns to changes in the foreign inflationary environment. This sensitivity depends on the cost structure as well as management’s ability to respond with changes in pricing structure. In some industries management may be free to raise prices to compensate for inflationary cost pressures; in others, margins may simply erode. Likewise, industrial structure will play a determining role as firms in more competitive industries may be unable to recoup inflationary losses while firms with greater market power may protect themselves. Finally, the existence of long-term sales or purchase commitments may severely limit management’s ability to respond to unexpected inflation.

These factors and relationships can be formalized within a simple framework.

1. Relative Inflation Effects. The relationship between relative inflation and currency devaluation can be captured in the following equation:

$$\hat{P}_j = m(\hat{P}_{us} - \hat{S})$$

Here $$\hat{P}_j$$ is the percentage change in expected foreign price levels. $$\hat{P}_{us}$$ is the percentage change in expected U.S. price levels, and $$\hat{S}$$ is the percentage change in expected foreign currency exchange rate in dollars per foreign currency unit. In Equation (1), the parameter $$m$$ reflects the proportionate relationship between foreign inflation, $$P_j$$, and “real” devaluation, $$\hat{P}_{us} - \hat{S}$$. Note that this relationship is currency-specific or country-specific because parameter values depend on relationships between specific pairs of currencies.

2. Local Response to Inflation. This relationship captures the firm-specific or investment-specific response to foreign inflation. It can be formalized as follows:

$$\hat{C}_i = f(\hat{P}_j)$$

Here $$\hat{C}_i$$ is the percentage change in the foreign currency cash flow forecasts, and $$\hat{P}_j$$ is the percentage change in expected foreign inflation. The parameter $$f$$ is the proportionate response of net foreign cash flows to changes in foreign inflation. This parameter presumes that management has made all attempts to recoup inflationary losses; incomplete responses ($f < 1$) reflect constraints on management, e.g., long-term commitments, barriers to price increases, or regulatory restrictions.

The combination of these parameters determines the extent to which the foreign cash flow is naturally hedged. If $$\hat{C}_{us}$$ denotes the percentage change in the dollar value of the foreign currency cash flow, and $$\hat{C}_j$$ denotes the amount of the foreign currency cash flow then the overall impact can be expressed by:

$$\hat{C}_{us} = (1 - m. f) \hat{C}_j \hat{S}_j$$

Here, the quantity $$1 - m. f$$ transforms a foreign currency cash flow, $$\hat{C}_j$$, into a fully-exposed equivalent. For example, when foreign inflation fully offsets foreign currency devaluation and the firm’s foreign cash flows increase in response, both $$m$$ and $$f$$ are one. Therefore, their product, $$m. f$$, is also one and the exposure coefficient, $$(1 - m. f)$$, equals zero. In this case, the foreign cash flow is completely hedged in the sense that its dollar value is insensitive to foreign currency devaluation. On the other hand, if inflationary effects could be reversed $$(1 - m. f)$$ would equal 5 and only 50% of the nominal foreign currency cash flow would be

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3. “Real” devaluation is the amount by which the devaluation of a foreign currency exceeds the internal decline in the dollar’s value which is caused by inflation. When foreign inflation acts as a perfect offset, foreign currency prices will increase commensurately.
### EXHIBIT 2

**EXCHANGE RATE SENSITIVITY CHARACTERISTICS**

<table>
<thead>
<tr>
<th>HIGH EXPOSURE</th>
<th>LOW EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENSITIVE TO DEVALUATION</td>
<td>INSENSITIVE TO DEVALUATION</td>
</tr>
<tr>
<td>(Exposure Coefficient Close to Unity)</td>
<td>(Exposure Coefficient Close to Zero)</td>
</tr>
<tr>
<td>* Large share of nominal assets such as cash and receivables in total assets</td>
<td>* Small share of nominal assets such as cash and receivables in total assets</td>
</tr>
<tr>
<td>* Small share of assets whose value is based on commodity values</td>
<td>* Large share of assets whose value is based on commodity values</td>
</tr>
<tr>
<td>* Prices of commodities on which value is based are set in each country independently</td>
<td>* Prices of commodities on which value is based are integrated on a world-wide basis</td>
</tr>
</tbody>
</table>
| * Margins decline with increases in local inflation  
  a. Costs increase  
  b. Pricing inflexible due to industry structure or government controls | * Margins are constant or increase with increase in local inflation  
  a. Costs constant or increase more slowly than increasing inflation  
  b. Prices can be raised rapidly to fully offset local inflation |
| * Foreign operations are predominantly in countries with rapid devaluation, thin or non-existent financial and foreign markets, and wage price controls or in currencies whose values do not conform to relative inflation experience. | * Foreign operations are predominantly in countries with deep financial and exchange markets and free market pricing. Currency values conform to relative inflation experience. |

Exposed to foreign devaluation.

In review, compare the characteristics of foreign currency assets whose market values are likely to be very sensitive to foreign currency devaluation and the characteristics of insensitive foreign assets. These characteristics are outlined in Exhibit 2.

### AGGREGATE MARKET VALUE EXPOSURE COEFFICIENT

Each of the separate cash flow streams, which comprise market value, may be sensitive to changes in exchange rates. These individual exposures may be represented by separate exposure coefficients as shown in Exhibit 3.

For simplicity, $m$ is assumed to be unity; that is, pound sterling depreciation is always exactly offset by British inflation. The asset-specific parameters, $t$, reflect the expected proportional change in the market values of the pound sterling assets which are caused by British inflation.

The pound sterling values of cash and receivables are fixed. Therefore, we assign inflation parameters of zero to these assets. In contrast, the value of inventories may be expected to increase in an inflationary environment. Here we assume such increases will equal 40% of any increased inflation. (Factors such as pricing latitude, cost structure, competition, and wage-price restraints will determine the size of this asset-specific response.) It follows that the remaining 60% of inventory market value is exposed to exchange rate risk.

Finally, we assume that the “residual” market value of £150 million reflects the value of productive capacity — future earnings. Because future earnings enjoy a longer lead time price adjustment may be more complete. We assume that this adjustment potential implies price increases of 90% to offset any increases in inflation. Therefore, only 10% of this market value is at risk.

We have assumed here that the market value of the sterling debt re-
EXHIBIT 3A
AGGREGATE MARKET VALUE EXPOSURE COEFFICIENT:
FINANCIAL AND ECONOMIC DATA
British Subsidiary of International Manufacturing (£00,000)

<table>
<thead>
<tr>
<th>Individual Exposure Coefficient (I-m£)</th>
<th>Book Value</th>
<th>Market Value</th>
<th>Market-Value Weights (V/MVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>£10</td>
<td>£11</td>
<td>.07</td>
</tr>
<tr>
<td>Accounts Receivable</td>
<td>1.0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Inventories</td>
<td>.6</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td>Net Fixed Assets</td>
<td>.1</td>
<td>53</td>
<td>150</td>
</tr>
<tr>
<td>Total Assets</td>
<td>1.0</td>
<td>£100</td>
<td>£200</td>
</tr>
<tr>
<td>Total Debt</td>
<td>(1.0)</td>
<td>£50</td>
<td>£50</td>
</tr>
<tr>
<td>Net Worth</td>
<td>0</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Total Liabilities and Net Worth</td>
<td>£100</td>
<td>£200</td>
<td></td>
</tr>
</tbody>
</table>

AGGREGATE MARKET VALUE EXPOSURE COEFFICIENT

\[
AEC = (1 \times 0.07) + (1 \times 0.11) + (0.6 \times 0.15) + (0.1 \times 1.0) - (1.0 \times 0.33) = 0.04
\]

remains unchanged with British inflation. This assumption implies an exposure coefficient of negative unity for the debt.

The aggregate exposure coefficient is the weighted sum of the individual exposure coefficients. The weights reflect the contribution of each asset and liability component to total value.

To compute the weighted average exposure coefficient, one first computes the exposure coefficient for each asset category and then weights each of these coefficients by its proportion of the market value of equity. These value-weighted coefficients are then added up to obtain the value weighted average. Exhibit 3A gives the formula summarizing this computation procedure. Exhibit 3B provides an illustrative computation.

Calculations following this equation produce a single exposure coefficient which quantifies the sensitivity of the aggregate market value to foreign exchange rate variability. The aggregate coefficient reflects the exchange rate sensitivities of individual streams as well as the relative importance of each stream in aggregate value. This average sensitivity is .04 for International’s British subsidiary so that £6 million (4% of the equity value) is effectively at risk. This exchange risk is identical in size and character to the exchange risk of a £6 million investment in government securities.

ACCOUNTING AND MARKET VALUE EXPOSURE COEFFICIENTS: A COMPARISON

The framework described above is a useful tool for the estimation of market value exposure and can be used to compare market value exposure to accounting exposure implied by accounting standards such as

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4. This overly strict assumption is offered for simplicity; in fact the value of the debt is likely to decline with increased inflation and concomitantly higher interest rates. See Hekman [7] for a detailed approach to more realistic measurement.
FASB-52. The application of this approach to accounting exposure emphasizes two important assumptions hidden in the accounting standards: 1) accounting standards assume book value rather than market value weights and 2) polar case values of either zero or unity are assumed for individual exposure coefficients. For example, an exposure coefficient value of unity is assumed for accounts which are translated at current exchange rates. For these accounts the exposure coefficient, \((1 - m^f)\), would equal unity. In contrast, values of zero are assumed for accounts translated at historic exchange rates.

Exhibit 4 shows the individual and aggregate exposure coefficients which are implied when accounting standards are used to measure exposure. Under FASB-8, accounts receivable and foreign currency debt are treated as fully exposed and carry exposure coefficients of unity. Inventory and net fixed asset accounts carry exposure coefficients of zero.

All asset and liability accounts are translated at current rates under FASB-52 rules so that all individual coefficients as well as the weighted aggregate coefficient are unity.

Overall, FASB-8 implies an aggregate exposure coefficient of -0.44. FASB-52 implies a coefficient of 1.0 and the market value method implies a coefficient of 0.04 for the British subsidiary. The three exposure coefficients are summarized in Exhibit 5.

Differences in weighting schemes and in the component coefficients place the market-value exposure between the two accounting extremes. Of course, the example is only hypothetical. It is, however, a good representation of the situation faced by many international manufacturing concerns.

The accounting measures of exposure represent extremes because weighting schemes based on book value weights neglect any excess of market value over book value. Further, this excess is normally substantial and is usually concentrated in net fixed assets and inventories assumed under FASB-8 to be unexposed. As a result, the relatively heavy weighting of foreign currency debt in the accounting convention generates a large liability exposure coefficient.

Similarly, the coefficient implied by FASB-52 is also based on book-value weights, but fixed assets and inventories are designated as fully exposed. As a result, FASB-52 assumptions usually imply a substantial asset exposure.

Foreign currency debt receives a much smaller weight in the market value exposure coefficient calculation and inventory and fixed asset components are moderating factors. For these accounts, the individual exposure coefficients usually fall between the extremes of zero and unity.

For most companies it appears that exposure implied by the FASB-8 rules are somewhat closer than FASB-52 exposure to market value exposure. Of course, this conclusion depends on the weighting scheme implied by the asset structure and, more importantly, on the values of
EXHIBIT 4
THE CALCULATION OF THE AGGREGATE ACCOUNTING EXPOSURE COEFFICIENT FOR THE BRITISH SUBSIDIARY OF INTERNATIONAL MARKETING COMPANY

<table>
<thead>
<tr>
<th>INVESTMENT</th>
<th>Book Value Weights</th>
<th>Exposure Coefficient</th>
<th>Weighted Value</th>
<th>Exposure Coefficient</th>
<th>Weighted Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASH</td>
<td>.22</td>
<td>1.0</td>
<td>.22</td>
<td>1.0</td>
<td>.22</td>
</tr>
<tr>
<td>ACCOUNTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECEIVABLE</td>
<td>.34</td>
<td>1.0</td>
<td>.34</td>
<td>1.0</td>
<td>.34</td>
</tr>
<tr>
<td>INVENTORIES</td>
<td>.38</td>
<td>0</td>
<td>.00</td>
<td>1.0</td>
<td>.38</td>
</tr>
<tr>
<td>NET FIXED ASSETS</td>
<td>1.06</td>
<td>0</td>
<td>.00</td>
<td>1.0</td>
<td>1.06</td>
</tr>
<tr>
<td>TOTAL DEBT</td>
<td>1.00</td>
<td>(1.0)</td>
<td>(1.0)</td>
<td>(1.0)</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>

AGGREGATE ACCOUNTING EXPOSURE COEFFICIENT

- .44

1.00

the individual coefficients assigned to each asset.

CONCLUSION

The measurement of foreign exchange exposure is the first and most important step in exchange risk management. This article has described and compared three methods of exposure measurement.

Because each method implies a different corporate objective, the choice of measurement method should be consistent with corporate goals. The options offered here assumed objectives of either market-value maximization or book-value maximization.

Whichever is chosen as a basis of management, it is important to understand and to measure the alternative definition of exposure. Those who manage exchange risk and investment on an "economic" or market-value basis find the task greatly simplified if accounting definitions are considered simultaneously. Unrealistic accounting disclosures may be explained to the public on this basis.

Those who manage foreign exchange exposure based on accounting definitions should consider the costs of this choice. Clearly, a major component of these costs is the size of the difference between accounting and market-value exposure.

Differences in accounting and market value exposures are summarized in Exhibit 6 and company characteristics that determine the size of this difference are summarized in Exhibit 2. For investments with characteristics falling under the "High Exposure" category, market value and FASB-52 measures of exposure will be more similar. In contrast, naturally hedged investments, as characterized in the second column of the exhibit, will generate markedly different measures of exposure. For these companies, FASB-8 may have been a preferred accounting system to FASB-52 which in turn may differ quite substantially from market value exposure.

REFERENCES


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**EXHIBIT 5**

**A COMPARISON OF ALTERNATIVE MEASURES OF FOREIGN EXCHANGE EXPOSURE**

<table>
<thead>
<tr>
<th>Component</th>
<th>Market-Value</th>
<th>FASB-8</th>
<th>FASB-52</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEC</td>
<td>= .04</td>
<td>= - .44</td>
<td>= 1.0</td>
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</tbody>
</table>

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**EXHIBIT 6**

**A SUMMARY COMPARISON OF ACCOUNTING AND MARKET VALUE APPROACHES TO EXPOSURE MEASUREMENT**

<table>
<thead>
<tr>
<th>Component</th>
<th>Cash and Receivables</th>
<th>Inventories</th>
<th>Net Fixed Assets</th>
<th>Bias Relative to Market-Value Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Component Weighting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FASB-8 APPROACH</td>
<td>Book value weights</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FASB-52 APPROACH</td>
<td>Book value weights</td>
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<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>MARKET-VALUE APPROACH</td>
<td>Market value weights</td>
<td>1.0</td>
<td>Between 0 and 1.0</td>
<td>Between 0 and 1.0</td>
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</tbody>
</table>