Treasury Performance Measurement

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The decisions made by corporate treasurers have a potential impact on corporate profits which is often as large as the earnings from operations. In recent years, the sophistication of analytical tools and financial instruments used by corporate treasuries has increased dramatically. The evaluation of treasury performance, however, continues to remain in a primitive state. As a rule, treasury performance evaluation is part of the accounting system of the firm; in fact it is probably no exaggeration to say that the major criterion (whether implicit or otherwise) by which corporate treasurers are judged by headquarters is the measureable effect of their decisions on reported earnings.

By contrast, sophisticated, market-based measurement techniques have long been available for monitoring the performance of investment fund managers. The measures provided by such techniques offer an assessment of a fund manager’s performance relative to some benchmark, and relative to the risks taken to achieve that performance. Moreover, it seems logical that similar performance analysis can (and will someday) be applied to at least some aspects of treasury management. The purpose of this paper is to outline the techniques available for performance measurement and to discuss their application to specific areas of treasury management.

An Introduction to Treasury Performance Appraisal

A corporation has operating assets and liabilities which produce a stream of current and future cash flows. The value of these cash flows, which may be denominated in a variety of currencies, responds to many economic factors such as inflation, interest rates, exchange rates, and commodity prices. The economic value of these cash flows is reflected in the market value of the liabilities used by the corporation to finance its operations.

While no two treasury departments would agree on precisely the objectives that are being pursued, most behave as though they are seeking to accomplish a combination of the following:

- Raise funds as cheaply as possible;
- Invest liquid balances to earn as high a return as possible; and
- Control the risk exposure of the company’s earnings (or equity).

Any particular transaction can have an influence on two or, in some cases, all three of these objectives. Decisions to borrow fixed or floating, for instance, are motivated by both the interest-rate differential between the two types of debt and the relative impact of each on the risk of the company’s equity.

The most difficult aspect of treasury management is the determination of the precise effect of a transaction on the risk of the company’s equity. For instance, is there less risk in borrowing floating or borrowing fixed? Floating-rate borrowing adds less risk to the company if its cash flows, and thus its equity value, tend to be positively related to movements in interest rates. On the whole, this means that a company which believes that its cash flows and equity value will respond positively to unexpected changes in inflation has less equity risk if its borrowing is floating rate.

The goal of a treasury management and performance appraisal system is to produce that set of treasury

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decisions which, given the operating assets and liabilities of the corporation, produces the "best" balance of cost and risk characteristics. If an opportunity to save on borrowing costs is missed, the loss is as costly to the corporation as paying an excessively high interest rate. If the treasury takes a "view" on exchange rates and proves to be correct, the decision will have exposed the corporation to risk. Thus, systems of treasury decision-making and performance appraisal which aim to take advantage of the increasing choices available to reduce borrowing costs and manage risk must be able to focus on opportunities costs and risk measurement. It is these aspects that are lacking in most existing systems.

As suggested above, the overwhelming proportion of treasury management is concerned with the following three functions: (1) borrowing; (2) investment of liquid funds; and (3) foreign exchange exposure. Given that these functions all involve choices among various capital market instruments, a treasury management appraisal system should be governed by the following principles:

**Market Value Measurement.** Prices for most transactions are available in the capital markets. If a particular transaction has no observable market price, a price can be imputed from similar transactions where observed prices are available. Therefore, quantitative performance appraisal should almost always be possible.

**Economic Returns.** The change in value of a capital market instrument is part of the gain or loss to the corporation. Profit and loss systems which do not recognise this fact give an inaccurate picture of the true profitability of the treasury function. An economic accounting system in which changes in the market values of assets and liabilities are included in the measured return is the only consistent basis for performance appraisal.

**Opportunity Gains and Losses.** If interest is earned on liquid balances, not all the income is attributable to the specific choice of investments made by the treasurer. Even a completely passive investment policy would earn interest. The "economic" gain made by the treasury decisions is the extra income relative to that earned by an alternative. This concept of opportunity gain or loss applies to all three areas of treasury management.

**The Benchmark.** A benchmark is required when the firm has two or more mutually exclusive transactions and when the direct and indirect costs of those transactions varies. For example, a benchmark transaction may be based on internal hedging or self-insurance if external insurance markets are more costly than those available internally. But if the company were indifferent between those transactions, then there would be little purpose to choosing one as a benchmark over another. (Indeed, there would be little point to measuring performance at all.)

**Risk Assessment.** Each treasury decision involves a change in the risk to the corporation. Assessment of this risk should be an integral part of the decision. Opportunity gains and losses must be weighed against these risks to provide an accurate picture of treasury performance.

**EXAMPLE: Fixed Income Transactions: A Single Trade**

A corporate treasurer borrows 7-year funds at 12 percent fixed. As an alternative he could have borrowed 7-year floating-rate funds at LIBOR + 75 basis points. (There are several justifications for a corporation choosing a variable rate as a benchmark, one is when variable rates provide the company with a natural hedge against unanticipated inflation.)

At the time of the decision, LIBOR was 10 percent. LIBOR is now (one year later) 11 percent and the 6-year fixed borrowing rate for this corporation is 12.5 percent.

**Quantification of Market Values:** The value of the fixed-rate liability at the end of the year is the present value of a 12 percent coupon 6-year bond at a yield of 12.5 percent. By discounting the cash flows on the bond at the current 6-year rate for such a bond (observed from current market yields), we come up with a value of 98.

**Economic Return from Actual Strategy:**

The cost of the bond issue over the year can be calculated as follows:

\[
\text{Cost} = \frac{\text{Coupon rate} + \text{change in value}}{100} = \frac{12 + (98-100)}{100} = 10\%
\]

Note that the increase in interest rates and the reduction in value of the liability lowers the cost of borrowing.

**Opportunity Cost or Gain:** One alternative for this company would have been to issue a 7-year floating-rate note. Assuming that the price of this note would not have changed over the year, its cost for the year would have been 10.75 percent. The opportunity gain can be calculated as follows:
[Arbitrage] transactions offer opportunity gains with little or no risk. As such, they represent the most unambiguous contribution of the treasury function to the profitability of the corporation.

Opportunity gain = Cost of issued bond
- Cost of alternative
= 10% - 10.75% = -0.75%

In this case the issuance of the fixed-rate bond resulted in an opportunity gain of 75 basis points on the issue over the year.

Risk Assessment: In this case, rates moved favourably for the fixed-rate issuer and a gain was made. Even if the issuer forecast this move, there was a chance that the forecast would turn out to be wrong. The transaction therefore involved risk. The risk of a financial asset or liability is commonly measured by the uncertainty about its value. This is most often quoted as a volatility in percent per annum. Based on observation over a 55-year period, the average volatility of a 7-year fixed-rate bond has been estimated to be about 6 percent. This means that such bonds typically experience unexpected value changes of about 6 percent per annum. By borrowing long, as in this case, the treasurer exposed the corporation to the risk that the value of its liability would rise by 6 percent over the year.

Overall Performance Appraisal: As we have seen, the transaction resulted in an opportunity gain of 0.75 percent; and the expected variation of this return, based on historical experience, was roughly 6 percent. The final step in such an analysis is to determine whether the potential gains were adequate to justify the risks taken. We shall return to this question later.

Identifying the Sources of Gains and Losses

The gains and losses resulting from treasury decisions must be weighed against the risks taken to achieve them. In some cases these risks are small, as in a swap transaction designed to lower a borrowing rate. In other cases, such as leaving a foreign exchange risk uncovered, the risks are much larger.

Apart from the size of the risk involved, there is also an important distinction between those risks that are reflected (and thus compensated for) in rates offered in the market place, and those that are not. If liquid balances, for instance, are moved into lower-grade paper, there is an increase in risk and an increase in promised return. If, however, the treasurer chooses to leave a foreign exchange exposure uncovered, there is no explicit risk premium offered in the market place to compensate for the risk involved.

To highlight the relationship between the gains and losses made and the risks taken, we shall categorise all transactions as one of four types:

1. "Arbitrage" Transactions. These transactions offer opportunity gains with little or no risk. As such, they represent the most unambiguous contribution of the treasury function to the profitability of the corporation.

   Some examples are financial leasing rather than borrowing, currency swaps, and tax-arbitrage in bond markets. In each case, the expertise of the treasurer results in an opportunity gain relative to a particular alternative transaction with little or no increase in risk. Choosing a vehicle for foreign exchange cover that minimises transaction costs (in the form of the bankers' spread) is also an "arbitrage" transaction in the sense that it does not involve risk.

2. Spread-motivated Transactions. Other transactions are motivated, at least in part, by differences in rates offered on similar but not identical instruments. In fixed-income markets these spreads may reflect differences in the maturity, default risk, liquidity, and currency denomination of the securities. For instance, a shift of liquid assets into lower-quality paper gives a yield gain. This yield gain, however, is simply the market's compensation for the extra risk involved.

   In evaluating the opportunity gain from such transactions, it must be recognised that the price of this gain was the extra risk which made the yield spread necessary. This comparison can be achieved by first identifying the source of the yield spread (that is, whether liquidity, maturity, quality, or currency) and then measuring the extent of the risk involved. Examples of transactions which fall into this category are buying illiquid or low-quality money market instruments and borrowing long rather than short.

3. Hedging Transactions. A large proportion of treasury transactions, particularly in corporations with a relatively passive treasury function, are directed at reducing the risk facing the corporation. While performance measurement of such transactions might seem redundant, this is frequently not the case. Whenever a risk is hedged, it may be necessary to take a relatively unfavourable rate or to pay a spread to the intermediary providing the hedging instrument. If the hedge is, for instance, a long-term forward contract, the rate obtained will include a substantial bid/ask spread.

   In such a case, the relevant question is this: Is
Because a decision not to hedge a known exposure is tantamount to speculation, speculative decisions need not involve an actual transaction. Indeed, all treasury decisions, with the possible exception of those motivated by arbitrage, involve some element of speculation.

the size of the risk being hedged sufficiently large to warrant paying the spread? For example, we may believe the risk has simply been mispriced in the market (and there is convincing evidence, for example, that non-traded options on equities were severely overpriced before the establishment of a traded options market). Alternatively, if the spread contains a component for transactions costs, it may be that the company has lower transaction costs than the market-makers (perhaps because the company has more information about its own risks). Risk analysis in such cases therefore involves measuring the size of the risk and assessing it against the effective cost of the hedging instrument. This analysis again involves the quantification of the two elements of any final decision: opportunity cost and risk.

In this case, however, there is a problem in deciding how to measure the effective cost of the transaction. In the case of the long-term forward rate, the effective cost to the corporation is equivalent to half of the bid/ask spread charged by the bank. Our reasoning is simply that because the opening and closing of a long-term forward position will incur the full spread, each half of the transaction can be viewed as having an effective cost equal to half of the spread.

Apart from forward cover, other treasury decisions motivated by hedging are foreign currency borrowing, matching the maturity of borrowings to asset maturity, and hedging commitments with interest rate futures.

4. Speculative Transactions. The final category of treasury decisions involves speculation based on a particular forecast of interest rates or exchange rates. Because a decision not to hedge a known exposure is tantamount to speculation, speculative decisions need not involve an actual transaction. Indeed, all treasury decisions, with the possible exception of those motivated by arbitrage, involve some element of speculation. For example, spread-motivated transactions will expose the corporation to a speculative risk if there is a possibility that rates can move unfavourably and wipe out the gain being sought through the spread. If the returns on spread-motivated transactions are uncorrelated, however, then a sufficiently large number will reduce these speculative (or specific) risks.

The natural way to classify speculative transactions is by the underlying source of the speculation. Transactions depending upon the movement of a particular interest rate form one group, those depending upon a particular exchange rate form another, and so on. The most typical kinds of speculative transactions in treasury management are, therefore, decisions not to hedge exchange exposures and decisions to lengthen maturities of borrowings or investments.

**EXAMPLE: Sources of Opportunity Gain:**

**Liquidity Management**

Transaction: Purchase of $500,000 6-month commercial paper

Benchmark: 3-month high-grade certificates of deposit (CD's)

Rates at date of transaction:

- 3-month CD 10%
- 6-month CD 11%
- 6-month commercial paper 11.5%

Rate after 3 months:

- 3-month CD 9%
- 3-month commercial paper 9.5%

**Economic Return over Six Months on Actual Policy:**

\[(1.115)^{1/2} - 1 = 0.59\%

**Economic Return on Benchmark:**

\[4.64\% - \frac{500 \times (1.10)^{1/4} \times (1.09)^{1/4} - 0}{1 + R} = 0.0464\%

Oppportunity Gain:

\[(5.59\% - 4.64\%) = 0.95\% \times 500,000 = 4750\]

**Components of Gain:**

Maturity spread = 11\% 6mo. CD - 10\% 3mo. CD

\[(1.11/1.10)^{1/2} - 1 = 0.45\%\]

Liquidity spread = 11.5\% 6mo. commercial paper - 11\% 6mo. CD

\[(1.115/1.11)^{1/2} - 1 = 0.22\%\]

Speculative gain = 0.95\% - 0.45\% - 0.22\%

= 0.28\%

**Discussion:** The three components of the gain should be viewed differently. The maturity spread was gained from the market-determined difference between the three-month and six-month rates. This is a combination of the market's expectation concerning the movement in interest rates over the next three months, and a maturity premium. To achieve this gain, the treasurer took a risk amounting to a speculation on interest rates. On the other hand, the liquidity spread is the market's price for not being able to trade the asset easily. If the treasurer was certain that the funds would not be needed at short notice, he would not value liquidity as much as the mar-
TABLE 1
Treasury Transactions: Classification

<table>
<thead>
<tr>
<th>Transactions</th>
<th>Opportunity</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbitrage</td>
<td>Yield Spread</td>
<td>Low</td>
</tr>
<tr>
<td>—Lease vs Borrow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>—Swaps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>—Round Tripping</td>
<td></td>
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</tr>
<tr>
<td>Spreads</td>
<td>Yield Spread</td>
<td>Default Risk</td>
</tr>
<tr>
<td>—Hold Liquid Balances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in Lower Grade Paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>—Hold Liquid Balances</td>
<td>Yield Spread</td>
<td>Illiquidity</td>
</tr>
<tr>
<td>in Less Liquid Paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>—Borrow Long/Lend Long</td>
<td>Term Premium</td>
<td>Interest Rate</td>
</tr>
<tr>
<td>Hedging</td>
<td>Bid/Ask Spread</td>
<td>Volatility</td>
</tr>
<tr>
<td>—Currency Forward</td>
<td></td>
<td>Currency Volatility</td>
</tr>
<tr>
<td>Hedge</td>
<td>(Cost)</td>
<td>(Reduction in Exposure)</td>
</tr>
<tr>
<td>Speculation</td>
<td>Actual Rate Gained</td>
<td>Interest Rate</td>
</tr>
<tr>
<td>—Borrow Long/Lend Long</td>
<td>Relative to Short Rate</td>
<td>Volatility</td>
</tr>
<tr>
<td>—Leave Exposure</td>
<td>Actual Rate Gained</td>
<td>Currency Volatility</td>
</tr>
<tr>
<td>Uncovered</td>
<td>Relative to Forward Rate</td>
<td></td>
</tr>
</tbody>
</table>

ketplace, and this could be viewed as an "arbitrage" gain relative to the benchmark.

In Table 1 we have classified treasury transactions with an estimate of their respective opportunity costs and risks.

Measurement of Asset/Liability Values

Before the economic return from a treasury decision can be measured, the values of assets and liabilities extant at the beginning and end of the performance appraisal period must be estimated. In the areas of treasury involvement this requires the valuation of currency forward, futures, and spot contracts, as well as the valuation of various debt instruments in various currencies issued and held by the corporation.

When these assets and liabilities are traded in liquid markets, the valuation problem involves simply revaluing the asset or liability at the current market rate at the end of the performance appraisal period. In the case where the assets and liabilities are illiquid or non-standard, the valuation must be performed by reference to the most similar securities traded in relatively liquid markets.

EXAMPLE: Valuation of a Forward Contract Prior to Maturity

On 1 December, three-month forward cover at $1.35/£ was taken on £300,000. The two-month forward rate on 31 December is $1.38/£. The dollar interest rate is 10 percent.

The company is short forward sterling at $1.35. It could liquidate this position at $1.38, resulting in a gain of $9,000 on 1 March of the next year. The present value of this strategy on 31 December is $9,000 discounted for two months at an annual rate of 10 percent. This gives an economic value of $8,858.30 on 31 December.

Economic Returns

In almost all areas where financial performance measurement is applied, there is a controversy over whether returns should be measured by accounting profits, economic returns, or some other standard. In some cases, such as short-term foreign exchange hedging, this controversy is empty because both accounting profit and economic profit will be the same for transactions that are opened and closed within the performance measurement period.

In other cases, such as long-term debt instruments, the difference can be substantial and centers on the valuation of long-term assets and liabilities at the end of the performance measurement period. Quite simply, the difference is that economic return measurement revalues assets and liabilities at current market rates whereas accounting profit meas-
A belief that accrued accounting values represent the fundamental value of a security more closely than market values would imply a staggeringly powerful ability to speculate against the market.

Accounting revalues them according to a particular set of accounting accrual rules which may or (more likely) may not be similar to market values.

One common argument for using accounting accrual rules is that market values are not available. This is clearly not the case for the capital market transactions involved in treasury management. In most cases, market values that can be used for revaluation are readily available. When they are not, benchmark rates on similar securities can be used as the basis of the revaluation.

A second argument cited against using economic returns and market values is that market values are subject to random, transitory fluctuation and, therefore, provide a distorted picture of “true” value changes. This view flies in the face of all the evidence on the behaviour of security market prices. In fact, a belief that accrued accounting values represent the fundamental value of a security more closely than market values would imply a staggeringly powerful ability to speculate against the market. Few people believe this is the case.

The other arguments in favour of using accounting profit as a performance measure tend to be pragmatic. Existing controls systems, reporting systems, and tax systems tend to incorporate a large element of accrual accounting rather than market-value measurement. Therefore, it is argued, performance measurement systems should be based on the same conventions. However, there are other sectors, such as fund management, where performance appraisal is based entirely upon economic returns despite the necessity of providing reports based upon accounting rules for other purposes.

In general, therefore, treasury management satisfies the principal necessary condition for using a measurement system based on economic returns: the availability of market prices to revalue assets and liabilities at the beginning and end of the performance appraisal period.

**Example: Economic Return vs. Accounting Profit**

At the beginning of the year the corporation issued a five year straight Eurodollar bond of $50 million at a coupon rate of 12.5 percent. Rates on four-year comparable Euros at the end of the year are now 11 percent. (Once again, we shall defer discussion of whether fixed or floating rates provide the appropriate benchmark here, and focus solely on the issue of economic versus accounting profit.)

**Accounting cost:** The annual accounting cost of the bond is the 12.5 percent coupon payment, or $6.25 million.

**Economic Cost:** The liability extant at the end of the year has a market price per $100 face value equal to the present value at 11 percent of the remaining coupon and principal payments. This value can be calculated as follows:

\[
(12.5 \times 11\% \times 4\text{-year Annuity Factor}) + (100 \times \text{Discount Rate for year 4 at } 11\%) = (12.5 \times 3.102) + (100 \times 0.6588) = 104.66
\]

The total cost of the issue over the year has been:

\[
\text{(Coupon rate + Value change) Starting value} = 12.5\% + 4.66\% = 17.16\%
\]

**Discussion:** The economic cost recognises that the decision to issue the bond has already resulted in a substantial loss to the corporation. The payments promised to the holders of the bond could now, at the end of the year, be used to service a bond issue of $52.35 million.

**Opportunity Gains and Losses**

The economic returns from treasury decisions must be compared with a benchmark alternative to show the “net” return of the decisions. This net return is the opportunity gain or loss.

The general notion of evaluating the gain or loss relative to a benchmark is widely accepted in performance measurement. The choice of a specific benchmark is sometimes problematic, however, and thus a source of controversy. In foreign exchange hedging, for instance, a policy of full forward cover provides a useful benchmark—one which would be achieved by a passive treasury department. In the case of evaluating debt policy, on the other hand, there appears to be no such obvious passive benchmark. The appropriate, non-speculative maturity structure for borrowing will depend upon the particular funding requirements of the corporation. The benchmark will also depend critically on the sensitivity of operating cash flows to movements in interest rates: for example, an interest-rate sensitive firm would be better off with a fixed-rate benchmark whereas an interest insensitive firm would be best served with a floating-rate benchmark.
The fact that we observe large-scale hedging of risks by corporations should suggest that some hedging is desirable (although it is an interesting, and as yet unanswered, question as to what is the optimal amount of hedging).

Some possible benchmarks are the following:
- Foreign exchange: Full forward cover
- Liquidity: Short-term, high-grade liquid paper
- Debt: Floating-rate borrowing

These benchmarks have the common characteristic that they minimise the exposure of the corporation to the sources of treasury risk: exchange rate risk, default and liquidity risk, and, in the case of interest-insensitive firms, long-term interest rate variation. In so doing, they minimise the risk exposure of the holders of the equity of the company.

The measurement of the opportunity gain or loss for a particular transaction is then quite straightforward:

\[ \text{Opportunity gain} = \text{Economic return earned on transaction} - \text{Economic return on benchmark} \]

Similarly, the risk of the transaction is measured as the extra risk resulting from the actual transaction compared with the benchmark.

**EXAMPLE: Opportunity gain: Liquidity Management**

Transaction: Purchase of 6-month commercial paper.

Benchmark: 3-month high grade CD’s.

Rates at date of transaction:
- 3-month CD 10%
- 6-month commercial paper 11.5%

Rate after 3 months
- 3-month CD 9%

**Economic Return:** Return on commercial paper over 6 months:
\[ (1.115)^{1/2} = 1.0559 \]
Return = 5.59%

**Benchmark Return:**

Return on 3-month CD rolled over:
\[ (1.10)^{1/4} \times (1.09)^{1/4} = 1.0464 \]
Return = 4.64%

**Opportunity gain:** Return on actual transaction – Return on benchmark
\[ = 5.59\% - 4.64\% = 0.95\% \]

**Discussion:** The opportunity gain has been generated partly by the spread of low-grade commercial paper over high grade CD’s and partly by a speculative gain resulting from lengthening the maturity and experiencing a favourable move in interest rates.

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**Choosing the Proper Benchmark**

The first question is, why do we need a benchmark at all? The simple answer is that we can only evaluate a transaction if we know the opportunity cost, and that opportunity cost implies an alternative transaction. For example, a benchmark transaction may be chosen because it has lower transaction costs than other transactions. Or the best benchmark might be the transaction that has least risk.

However, if those risks are properly priced by the market and the transaction costs of hedging are zero or insignificant, then the firm should be indifferent between taking one risk position and another. A belief in this proposition would suggest that all forms of hedging are unnecessary. After all, shareholders are diversified and can always hedge corporate risks by changing the risk of their own investment portfolios. Nonetheless, the fact that we observe large-scale hedging of risks by corporations should suggest that some hedging is desirable (although it is an interesting, and as yet unanswered question as to what is the optimal amount of hedging for a corporation).

Why, then, should firms choose to hedge at all? Put another way, why do firms choose low- or minimum-risk positions as benchmarks? One answer is that high-risk positions increase the probability of financial distress or insolvency. If such distress creates costs by diverting management time, postponing profitable projects, or forcing the unprofitable sale of assets in illiquid markets, then there can be a strong incentive to hedge.

A second motive for hedging may be tax. The U.S. tax system, like most others, is asymmetrical. That is, if the corporation makes taxable profits it pays taxes; but if taxable losses arise, tax benefits can be obtained only by carrying losses forward and offsetting them against future taxable profits. As a result the present value benefits of a dollar of tax losses is less than the tax cost of a dollar of taxable profits.

A third reason for hedging may be that it provides an efficient mechanism for having risks monitored and processed by outside experts. Indeed, some creditors may demand that some risks be hedged which the corporation has little control over or no skills in estimating or monitoring.

In sum, then, the case for corporate hedging of financial risks may come down to this: Corporations may not wish to bear certain risks (a) which are not
There are now well-developed techniques for measuring risk in financial markets.

part of its business activities, (b) for which it is not fully compensated by capital markets for bearing, and (c) which may impose significant tax disadvantages.

The Criteria

To return to our search for the appropriate benchmark, the following represents a tentative set of criteria for choosing such a benchmark:

1. Does the benchmark represent a policy that could actually have been followed?
2. Could the benchmark have been specified at the beginning of the performance period?
3. Does the benchmark provide a lower-cost strategy than some of the alternative transactions?

A traditional view of treasury management is that all significant risks should be hedged using the lowest-cost instrument. This view ignores the possibility that shareholders, by holding a diversified portfolio of securities, avoid exposure to many of these risks. It also presupposes that the cost of the hedging is outweighed by the benefits of risk-reduction. Furthermore, it ignores the possibility of self-insurance. Self-insurance involves leaving risks open which, in aggregate and when combined with the entire activity of the company, are effectively diversified.

An alternative view is that because financial risks are properly priced in financial markets from the point of view of diversified shareholders, all risks should be left open. In such circumstances any transaction costs incurred to hedge such risks would represent a net loss to shareholders.

An intermediate view is that the risk and cost of treasury transactions should be measured. One purpose of this measurement is to determine whether the cheapest available instrument is being used to hedge risk. The other is to measure the ratio of the cost being paid for hedging to the risk reduction achieved. An emphasis on the former would suggest a benchmark which is the lowest-cost form of hedging. The benchmark in the second case is not undertaking hedging transactions—that is, self-insurance.

Some Examples of Possible Benchmarks

Transaction: Purchase of fixed-interest rate bonds
Benchmark: Long-term fixed-rate bonds
Alternative transactions: Short- or medium-term bonds

Motive for the benchmark: Long-term interest rates contain a term premium and the company has little or no need for liquidity. Also, the firm's operating cashflows are negatively affected by unexpected increases in interest rate movements (and vice versa), thus making fixed rates a natural hedge.

Transaction: Hedging foreign exchange risks
Benchmark: Costs of hedging foreign exchange risks internally
Alternative transactions: Hedging foreign exchange risk in the financial markets
Motive for the benchmark: Buy-sell spreads in the financial market reflect larger transaction costs than internal hedging.

Transaction: Insuring fixed assets against fire, accident risks, etc.
Benchmark: Costs of self-insurance
Alternative transactions: Purchase of insurance in external markets
Motive for the benchmark: Lower costs of processing information on risks internally compared with external insurers.

We shall now review some of these examples in more detail.

A Benchmark for Cash Management

The manager of the liquid balances of a corporation faces the following problem. On any date he knows the amount of liquid balances on hand, and he has forecasts of how these will be increased or depleted in the future. The accuracy of these forecasts diminishes with their horizon. He knows what the balances are currently invested in, and he knows the current rates on all relevant securities that provide alternative investment opportunities.

His goal is to earn the highest rate of return possible, while retaining the balances in a sufficiently liquid form to be available when needed. There will also be a tax consequence of the decisions (which we will ignore here, though the reader is referred to the Appendix). The three dimensions of the cash management decisions are as follows: (1) rate of return; (2) risk; and (3) liquidity (or ease of realisation).

One possible benchmark against which to measure his performance could be the policy of
holding all the balances in very short-term deposits or short-term government paper. This will be the strategy with the lowest risk and the highest liquidity since the markets for these securities are the most heavily traded. This benchmark will also offer considerable opportunities for superior performance. To the extent that the treasurer can forecast that part of the balances which will not be needed for longer periods of time, he will be able to pick up a term premium without increasing risk or reducing liquidity in any way that matters.

If the manager knew precisely the future inflows and outflows to the liquidity pool, he could pursue a policy of matching precisely the maturity of the instruments held with the cash requirements of the corporation. The benchmark strategy would then consist of holding government securities with maturities matching the maturity profile of the cash requirements.

The treasurer will deviate from these benchmark policies if he feels that the extra return he can earn on some alternative investment is sufficient compensation for the increased risk and reduced liquidity. Some of these switches will be unambiguous gains, such as switching to overnight deposits when the overnight rate is sufficiently high. Some will be speculative, such as moving to longer-term instruments when he expects rates to fall. Others will be increases in return offset by higher risk or lower liquidity, such as moving into lower-quality paper when he feels that the yield gain is high enough.

The details of the performance measurement will then require the following:

- Agreement on the benchmark
- Government paper
- Government paper matched to the maturity profile of cash requirements
- Rates on the benchmark investment.
- Actual investments held.
- Rates earned on actual investments.
- Market revaluations of benchmark investments and actual investments at the end of performance evaluation period.

The performance measure would then be the return on the actual policy relative to the rate of return on the benchmark. If extra risk or lower liquidity had been taken to achieve a higher rate of return, it would be reflected in the average yield spread between securities held and the benchmark securities. The performance measure could be adjusted for this yield spread to give a risk- and liquidity-adjusted performance measure.

### A Benchmark for Debt

The problems of choosing a benchmark for borrowing are very similar to those of choosing the liquidity management benchmark. The treasurer is faced with a forecast of the cash needs of the corporation and rates on various instruments. To measure whether his actual borrowing strategy is successful we need a benchmark. Here again, one natural benchmark is a policy of always using floating-rate or short-maturity instruments. If he chooses to borrow fixed rate for a particular maturity, this would be considered a speculation that interest rates will rise. The net borrowing cost could then be compared with the all-in cost of a floating-rate note of the same maturity. The information required would be as follows:

- The rate and characteristics of any actual borrowing.
- The all-in rate on floating-rate notes matched to any actual borrowing; and
- A valuation at current market interest rates of all debt outstanding at the beginning and at the end of the performance measurement period.

The performance measure would then be the difference between the economic return on the actual debt issued and the economic return on the benchmark floating-rate note policy.

### A Benchmark for Managing Currency Exposure

The sequence of events for foreign exchange hedging by corporate treasurers is this:

- Exposure is identified
- Exposure arises
- Exposure is liquidated

For instance, an exposure on receivables is identified when a potential sale in a foreign currency is identified. When the sale is made, the exposure is taken into the books; and when the receivable matures, the exposure is liquidated.

The natural strategy for some commercial and industrial corporations is to fully hedge all foreign exchange exposure, using either the forward market or foreign currency borrowing. This is the benchmark strategy against which the management...
of foreign exchange risk by the corporate treasurer could be measured.\(^1\)

When the identified exposure is certain to arise, the benchmark strategy would consist of fully hedging forward as soon as the exposure is identified. A treasurer who chose not to do this would be viewed as speculating on the currency movement relative to the forward rate at the time the exposure is identified.

To measure performance in this case, we would require the following information:

- **Forward rate for cover at the time the exposure is identified.**
- **Whether or not the exposure was covered at that time.**
- **If the exposure was left open, the rate at which it was subsequently covered. If it was not covered, the rate at which it was liquidated.**
- **Rates for valuation of forward contracts and uncovered exposures at the beginning and end of the performance appraisal period.**

If the identified exposure will not arise with certainty, the benchmark strategy must be carefully defined. Suppose that a UK company identifies a potential sale in dollars, on which it fixes a dollar price. It is still not certain, however, that the sale will actually be made. There is now no perfect hedging strategy available. In such a case, we would have to let the corporate treasurer specify his own normal benchmark strategy, and then measure him relative to that strategy. Although this might appear to give too much discretion to the treasurer whose performance is being measured, as long as the general benchmark policy to be pursued on such occasions is specified before the fact, the treasurer will be less able to manipulate the benchmarks in the light of actual market movements.

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**Risk and Treasury Performance**

Each treasury transaction involves a change in the risk facing the corporation. Frequently, the transaction will reduce the overall risk, as in the case of foreign exchange hedging transactions. In some cases the transaction will result in an increase in risk as, for instance, when liquid assets are shifted into low-quality paper or when borrowing maturities are lengthened to take advantage of a forecast rise in interest rates. Thus, there are two components to risk measurement when appraising decisions: (1) measuring the size of the risk involved and (2) deciding whether the transaction reduced or increased the level of risk. In many cases, the first of these tasks can be performed more easily than the second.

There are now well-developed techniques for measuring risk in financial markets. Risk is typically measured as the level of price volatility of an asset where price reflects the risk involved. So if, for instance, the risk involved is that of dollar-sterling exchange rate fluctuations, such risk would be measured by the variability of the dollar-pound spot exchange rate.

It has even become a convention to quote these risk measures in terms of annual equivalent standard deviations or "volatilities." (Using a single measure of volatility is possible because most financial markets exhibit two common features: variation of prices is almost random and the distribution of price changes is approximately normal.) Typical figures for the volatilities of particular instruments are as follows:

- **Typical common stock:** 30% annual standard deviation
- **Typical exchange rate:** 10% annual standard deviation
- **Typical long-term bond:** 10% annual standard deviation

It is also possible to give fairly precise interpretations of these measures. A volatility of 10 percent annual standard deviation means that the price of the asset in question has about a two-thirds chance of being within 10 percent of its current value after one year. Thus, if the dollar-pound starts the year at $1.40/$, there is a two-thirds chance that it will be between $1.26 and $1.54 at the end of the year.

It is also possible to convert the annual volatility to an equivalent volatility over a shorter or longer period of time. This conversion is complicated slightly because volatility does not increase one for one with the length of time involved. For example, volatility over six months is not half the volatility over a year. In fact, the correct conversion is to multiply the volatility by the square root of the amount of time.

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\(^1\) In this section, we focus only on transaction exposures. In fact, economic operating exposures may well be just as important. For a discussion of foreign exchange exposure, see the articles by Donald Leonard, "Finance and Global Competition: Exploiting Financial Scope and Coping with Volatile Exchange Rates," Midland Corporate Finance Journal, Vol. 4, No. 5, Fall 1986, and Bradford Cornell and Alan Shapiro, "The Managing of Foreign Exchange Risk," Midland Corporate Finance Journal, Vol. 1, No. 5, Fall 1988.
involved. So the six-month volatility of an asset with an annual volatility of 10 percent can be calculated as follows:

\[
\text{Annual volatility} \times \text{square root of time} \\
= 10\% \times \sqrt{0.5} = 7.1\%
\]

This means that in the case of an asset with an annual volatility of 10 percent, there is a two-thirds chance that the price at the end of the six months will be within about 7 percent of the starting price.

For an individual treasury transaction, we can divide the process of assigning a risk measure into four steps:

1. Identify the source of the risk.
2. Measure the annual volatility for that risk.
3. Convert the annual volatility to a risk measure appropriate to the duration of the exposure.
4. Decide whether the transaction was a hedge (i.e., it reduced risk) or a speculation (it increased risk).

The most common sources of risk for treasury transactions are the fluctuations of exchange rates and interest rates. A treasury risk-monitoring system could simply monitor the volatility of the relevant exchange rates and interest rates (or bond prices) to provide the basis of a risk score for each potential or actual treasury transaction.

The basic information for measuring volatility comes from two sources: (1) actual price movements and (2) the volatility forecasts implicit in option prices. These two measures of volatility will be different because they use different information. If, for instance, a foreign exchange exposure was left uncovered for the first two months of 1985, the risk of this decision could be measured by calculating (from the daily exchange rate moves over that period) the volatility of the relevant exchange rate during the time that the exposure was left uncovered. Such a procedure, however, although it correctly measures the actual risk that resulted, may be unfair in that it uses information that would not have been available to the decision-maker at the time of the decision.

An alternative that avoids this problem is to use as a measure of risk the volatility forecast that was being employed by the options market at the beginning of the two-month period. This number is known to option specialists as the "implied standard deviation" (ISD), and it represents the market consensus volatility forecast that has been traded into the option price. In this case, the appropriate option to use to compute the implied volatility would be an option on the particular currency in question, trading at the beginning of January 1985, when the hedging decision was made.

**EXAMPLE: Risk Assessment of Foreign Exchange Hedging Transaction**

An exposure is identified long $500,000 in three months. The company is sterling-based. At the time the exposure is identified, the spot rate is $1.40/£ and the three-month forward is $1.38/£.

The exposure is left uncovered for one month and then closed at $1.36/£ two-month forward.

**Opportunity Gain:**

- Actual value – Value of alternative
  - $500,000/1.36 – $500,000/1.38
  - $5,328

**Risk Measures (Annual Volatilities):**

Implied annual standard deviation at beginning of month of exposure = 12%
Actual annual volatility over month of exposure = 16%

**Risk of Transaction (% Standard Deviation over Life of Exposure):**

Equivalent one-month standard deviation:
Actual volatility: 16\% \times \sqrt{1/12} = 4.6\%
Implied volatility: 12\% \times \sqrt{1/12} = 3.5\%

**Size of Exposure (Money Amounts):**

- £362,319 \times 4.6\% = 16,667
- £362,319 \times 3.5\% = 12,681

5. **Discussion:** As a benchmark in judging whether a particular risk-return tradeoff is acceptable, a commonly used reference is the equity market. This has historically provided an annual return of about 8% in excess of the interest rate. In exchange for an annual volatility of about 20%. Thus a ratio of gain to risk of about 0.4 might be viewed as "normal" in this context.

**Analysing the Components of Aggregate Opportunity Gains and Risks**

As we have suggested, the gains resulting from treasury transactions can be classified according to
whether they are gains from arbitrage, spreads, hedging, or speculation. They can also be split into the separate components of the risks involved—that is, those associated with movements in a particular exchange rate or interest rate.

All transactions that depend upon the same source of risk (movements in the yen/sterling, for example) can first be aggregated to give an overall picture of performance with respect to that component of risk. The total opportunity gain on this group of transactions can then be measured and split into components according to whether they result from one of the four categories mentioned above: arbitrage, spreads, hedging, or speculation. The risks resulting from the hedging and speculation can also be measured.

To aggregate all transactions that depend upon a common interest rate or exchange rate, the performance of each transaction must be measured in dollar (or other currency) amounts rather than percentages. If measured in this way, the opportunity gains and losses can simply be added to give an overall opportunity gain from that particular kind of transaction.

Fortunately, the risks, as measured by the standard deviation or volatility expressed in dollars, can also be added to give the overall volatility figure. This is the case when the risks being aggregated all depend on a common source, such as the dollar/DM exchange rate. If performance is aggregated across different sources of risk, then constructing the appropriate risk depends on the level of intercorrelation between the different sources of risk.

Table 2 gives a possible framework for the presentation of overall performance. Performance from foreign exchange transactions involving the dollar-sterling exchange rate resulted in two types of gain—with two associated risks. Hedging transactions had an opportunity cost of $0.4 million, but reduced risk to the corporation by an amount equivalent to a standard deviation of $8.3 million. Speculative transactions, on the other hand, resulted in an opportunity gain of $1.4 million, with an associated increase of risk equivalent to a standard deviation of $3.7 million.

Figure 1 gives a diagrammatic presentation of the same information. On the vertical axis we plot opportunity costs or gains of a transaction in dollars. On the horizontal axis we plot the risk of the transaction. Notice that transactions in the lower left-hand quadrant reduce the risk of the company, but there is an opportunity cost to that risk reduction. At this point, management is in a position to weigh the returns against the risks associated with each transaction.

### How Might We Measure Abnormal Performance

We have explained in some detail how opportunity gains and losses from Treasury transactions can be measured, with consequent changes in risks. In
Figure 1 we sketched out how those incremental returns and risks might be presented. But we have left it for management to trade off those risks and returns in order to decide if the transaction was worth undertaking. In other words, management must calculate the "abnormal" or economic returns on the transaction.

Of course if the transaction is riskless (for example, an arbitrage), then the abnormal return is simply the opportunity gain since there is no risk to consider. For risky transactions, however, we require a model of risk and return. One obvious one is the Capital Asset Pricing Model (CAPM). In this case, estimates from past data suggest that the equity market has provided an annual return of about 8 percent in excess of the interest rate in exchange for an annual volatility of about 20 percent. Thus, a ratio of gain to risk of about 0.4 may be a useful way of determining if a transaction’s opportunity gain is worth accepting or not. A word of warning, however: the CAPM assumes that certain risks can be diversified away by shareholders and, therefore, that corporate diversification is unnecessary to achieve such risk reduction. But, if some risks are better diversified away or hedged by corporations rather than by shareholders, then following the prescriptions suggested by the CAPM may not be the best policy.

Summary
The overwhelming proportion of treasury management is concerned with foreign exchange, debt, and liquidity decisions. These decisions are choices among various capital market alternatives. They all involve hedging risks or taking risks.

Performance measurement of treasury decisions should be based upon measurement of opportunity gains and losses together with consideration of the risks involved. Opportunity gains and losses should be measured as economic returns on the actual policy pursued, relative to the return on a viable benchmark. Economic return measurement should be based upon market values of treasury assets and liabilities.

The benchmark policy used to measure the opportunity gain should represent a policy that could be specified a priori and actually followed. Likely benchmarks include full forward cover for evaluating exchange risk management, floating-rate debt for evaluating corporate borrowing, and short-term government paper for evaluating cash management. Different circumstances may dictate other choices.

Risk can be measured in two ways. Measurement of the actual variability of exchange rates and interest rates gives an indication of the actual risks taken. Measurement of implied volatility from option markets gives an indication of the risk forecast available at the time of the decision.

The opportunity gain or loss and risk of each transaction should be measured in dollars (or other base currency) and classified in two ways. Classification by type of transaction (that is, whether as arbitrage, yield spreads, hedging, or speculation) gives an indication of the activeness of the treasury policy. Classification by source of risk gives an indication of the major sources of exposure in the decisions taken. Both classifications aid in diagnosing the causes of treasury performance and in controlling future activity.
APPENDIX: Tax and Treasury Performance Management

The impact of tax on treasury behavior is very complex. Complexities arise because of differential actual or effective tax rates over time, differential treatment of gains and losses, of income and capital, of domestic and foreign income, and particular detailed tax laws such as those on zero coupon bonds, and holdings of government debt. To fully incorporate all these details into a decision model is practically impossible, since the comparisons to be made are so heavily dependent upon specific tax laws. Each decision, such as the choice between issuing a low-coupon bond and a high-coupon bond requires analysis based upon the particular tax rules that apply to that choice.

A general concept that can be applied to treasury decisions affected by tax is as follows: given two transactions with the same maturity, liquidity, and risk, choose the one with the most favourable after-tax rate of return. Thus a lease will be desirable if it has a lower all-in, after-tax cost than the all-in, after-tax cost of an equivalent secured term loan. Even this simple rule may, however, be misleading in certain cases where the difference in after-tax rates of return is not directly equivalent to a difference in present values.

Where tax rates are different over future years, the problem of after-tax benchmarks for comparison becomes even more complex. Consider the situation in the UK. In 1984 it was known that the corporate tax rate would fall in the subsequent two years. Year 84/85 85/86 86/87 Rate 45% 40% 35%

For a corporation whose tax year ends at a date other than April 15, the rate in each year is a weighted average.

The corporation is confronted by different pretax borrowing rates for different maturities. The after-tax borrowing cost for a particular maturity depends on the pretax borrowing rate and the tax deductions resulting from the borrowing. These deductions depend upon the tax year in which the interest is paid or accrued, and so the after-tax borrowing cost for a particular maturity will vary during the year.

If the corporation is currently not paying taxes, it faces a series of “effective” tax rates that depend upon the date at which it expects to resume paying corporation tax. For instance, if the corporation expects to resume paying tax in 86/87, its “effective” rates are roughly:

<table>
<thead>
<tr>
<th>Year</th>
<th>84/85</th>
<th>85/86</th>
<th>86/87</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Rate</td>
<td>28%</td>
<td>31%</td>
<td>35%</td>
</tr>
</tbody>
</table>

The tax rates in the early years are equivalent to the tax rate at the resumption date discounted back to the date in question. Interest payments in 85/86, for instance, will result in a tax saving in 86/87 at a rate of 35 percent so their present value benefit in 85/86 is 35 percent discounted by one year.

More subtle questions of tax timing arise, in most circumstances, because tax accrued in a particular tax year is paid with a delay. Sophisticated lease evaluation systems, for instance, keep a daily calendar of tax accruals and payments, so that the optimal lease rental pattern can be chosen for a company with a particular tax position.

This might make it seem hopeless even to try to build a general after-tax performance measurement system. In fact, it would not be intellectually demanding, just extremely tedious, to put in the correct tax rules and make sure that every actual decision was compared with an appropriate alternative.

For instance, consider a corporation that uses a benchmark of the all-in, after-tax cost of floating-rate debt. When it enters into a fixed-rate leasing transaction, we know that the lease should be compared with fixed-rate secured borrowing of the same maturity as the lease. The performance of the leasing transaction, therefore, consists of two parts:

Lease spread = After-tax cost of fixed rate borrowing - after-tax cost of lease Fixed/floating spread = After-tax cost of floating rate term borrowing - after-tax cost of fixed-rate borrowing

In this case, the lease is causing the corporation to deviate from its normal passive borrowing strategy to pick up the spread available in the fixed-rate leasing market.

How should one analyze this transaction in terms of its performance? One might argue that the deviation from the FRN strategy is unavoidable, and therefore should be ignored in measuring the performance of the transaction. Then one would just use the spread between the lease and fixed-rate borrowing. But what if a floating rate lease is available, as is probably the case? Other comparisons are then possible:
The equity market has historically provided an annual return of about 8 percent in excess of the interest rate in exchange for an annual volatility of about 20 percent.

An alternative view would be that the decision consists of two parts: the decision to lease, as measured by spread C, and the decision to use fixed-rate borrowing, as measured by spread B.

This seems to be a more natural way of thinking about the problem, in that it views the decision to deviate from the floating-rate policy as an explicit rather than an implicit decision. The only problem is that the market for floating-rate leases may be relatively thin, so that the only way to pick up the full benefits of leasing may be to use fixed-rate leases.

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