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# Global Asset Management and Performance Attribution


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# Global Asset Management and Performance Attribution

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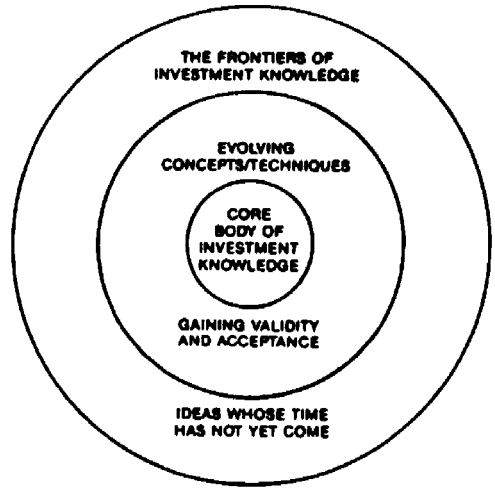


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# Foreword

An increased focus on multicurrency investing has heightened the need for a unified framework for analyzing global asset markets. Global investing is more complex than domestic U.S. investing because vastly different currencies and markets are involved. Most existing attribution models are equipped to dissect returns only in single-country markets. When they are used to analyze global markets, therefore, they often prove to be deficient.

In this monograph, Denis Karnosky, Ph.D., and Brian D. Singer, CFA, comprehensively evaluate other attribution frameworks and identify the pitfalls associated with them. They then introduce an analytical framework designed to overcome the deficiencies of existing attribution models.

The authors recognize the need for a utilitarian approach to performance attribution. Thus, while they adhere to a disciplined theoretical approach, they also present a framework that carefully recognizes all components of portfolio performance. The result is a robust and flexible system that isolates and measures the effects on global portfolios of market allocation, currency management, and security selection. Using the framework will enable the investor to evaluate the separate impacts of each of these key factors. This aspect of the authors' contribution is especially valuable because, in international portfolio management, separate managers are often responsible for the separate functions.

This practical attribution model has strong theoretical underpinnings. The foundation of analysis is the widely accepted axiom that an asset's expected rate of return consists of a real risk-free rate plus a premium to compensate for inflation and a premium to compensate for risk. Recognizing that all investors should demand the same returns to compensate for the risk-free and inflation-premium components, the authors posit that the required future returns from assets will differ only by their respective risk premiums. This approach thus represents an extension of the familiar capital asset pricing model.

Karnosky and Singer continually stress the practical aspects of their

attribution model. They begin with the accepted belief that the primary objective of the investor is to maximize the performance of the entire portfolio. In the global setting, this objective can be achieved only if the investor simultaneously pays attention to currency issues and market or country allocations. The fact that different managers may be responsible for currency, market, and security selections intensifies the need for an attribution system capable of isolating returns from each of these components.

Of particular importance in this monograph is the authors' recognition that, for practical purposes, the market and currency variables must be defined in terms that investors can manage if they choose. Application is the primary focus of this system.

The attribution system begins with a recognized single-country attribution model and adds an application that provides a separate calculation for currency attribution. Specifically, a market attribution component of the model isolates all aspects of the total return contribution of active market decisions, independent of all currency effects. Alternatively, a currency attribution component of the model isolates the full effect of currency decisions, accounting for all effects of spot and forward rates in the portfolio. A combination of the two attribution components accounts for the total return of the portfolio.

The usefulness of the attribution model is validated by its ability to accommodate the plethora of instruments—from swaps to futures to other derivatives—that are increasingly used in the management of multicurrency portfolios. The authors assure understanding of the system by a generous use of examples to explain its application.

The Research Foundation is pleased to sponsor this cutting-edge research. Karnosky and Singer have successfully developed and presented a global attribution model that rests on a solid theoretical foundation and provides useful means for measuring the returns attributable to different key return-generating components. Their work adds considerable maturity to an investment topic in its infancy. Global investors should find this model to be an invaluable tool for evaluating portfolio performance and helping achieve investment objectives. Benefits from this work should accrue to investors for many years to come.

John W. Peavy III, CFA

# Preface

This monograph develops an analytical framework for evaluating global asset markets and uses that framework to construct a performance attribution system that isolates the effects of market allocation, currency management, and security selection on global portfolios. The focus of this presentation is not on deep theoretical issues of asset pricing or optimal investment strategies but, rather, on the issue of developing useful measures of the market and currency components of global asset returns. In adhering to this utilitarian focus, we hope to provide investors and analysts with a general, serviceable framework for analyzing global investment issues.

This work reflects the ongoing efforts within Brinson Partners to address practical issues in the management of global portfolios. The analytical framework and the performance attribution system are integral parts of our investment process, and we believe that open discussion of these tools will enhance general understanding of global investment issues. The analysis provides a consistent framework for all who are involved in the evaluation of investment opportunities, performance, and risks.

This monograph reflects the discussions and research of many Brinson Partners investment managers and analysts, to all of whom we owe a great debt. The presentation benefited particularly from the thoughts and arguments of Gary Brinson, Richard Carr, Khaled Salama, Raymond Chan, and Norman Cumming. Ray Chan was also indispensable in solving the large number of technical issues involved in the performance attribution program. Robert Clarke was instrumental in the early development of the attribution program. We also thank the Research Foundation of the Institute of Chartered Financial Analysts, and AIMR, for their support and encouragement in preparing this monograph.

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# Global Asset Management and Performance Attribution

The management of currencies has received increasing attention as the perspective of pension plan sponsors and investment managers has become increasingly global. As a result, a great deal of analysis is being devoted to such specific issues as whether the benchmark for a global portfolio should be hedged or unhedged, the existence of an optimal or "universal" hedge ratio, and the merits of currency overlay programs. The ability of the investment community to investigate the issues that are presented by global markets would be enhanced, however, if the investigation could be conducted within a consistent, general framework that accounts for the interaction of global asset returns and currency returns. In particular, such a framework would recognize that introducing currency considerations into portfolio analysis has implications for the manner in which the underlying assets are evaluated.

A general framework for analysis of global markets would help greatly in addressing several of the current issues confronting global investors:

- *Portfolio benchmarks and investment policies.* A unified treatment of markets and currencies would provide a consistent framework for evaluating the manner in which markets and currencies interact in the portfolio. It would also aid in understanding the range of alternatives for managing market versus currency exposures. The potential benefits and pitfalls of currency overlay programs, for example, could be clearly seen in an integrated global framework.
- *Global accounting systems.* As investment portfolios have become increasingly global, the need for accounting systems that can handle multicurrency assets and the range of available derivative instruments has become obvious. Development of these systems has been difficult, however, because of the lack of a consistent framework for treating currency exposures and strategies. Such a framework could also enhance the quality of financial legislation and regulations.

- *A common footing for analyzing markets and currencies.* Currency decisions are often based on short-term considerations, while market selection often involves longer horizons. Treating markets and currencies as separate analytical issues typically results in a view that currency management is, at best, a means of adding value through agile short-term positioning or, more usually, something that should be avoided entirely. In a unified analytical framework, the market and currency analyses could be integrated for identical investment horizons. In particular, a general framework would allow long-term, fundamental currency analysis.
- *Performance attribution.* A framework that distinguishes clearly between market and currency returns would provide the means to evaluate the sources of investment returns and risks, allowing accurate comparisons of performance among portfolios.

The investment community has found global investment issues to be difficult within the context of theoretical frameworks that are commonly applied to analysis of domestic markets, such as the capital asset pricing model (CAPM). This difficulty reflects a view that global markets are somehow different from the domestic U.S. market. The primary objective of this monograph is to provide investors and analysts with a unified framework for analyzing global asset markets. This framework gives academics and practitioners the means to communicate ideas and hypotheses involving multicurrency markets and exchange rates.

The approach that is developed here is well grounded theoretically and practically. On the theoretical level, the foundation of the analysis is the notion that an asset's future return should provide a real risk-free rate plus a premium to cover expected inflation and a risk premium to compensate investors for the uncertainty of future real cash flows. Looking forward, investors should require that all assets provide the same risk-free rate and inflation-premium components. Thus, the required future returns from assets would differ only by their respective risk premiums. The framework provided here extends this basic theoretical model to the global capital market. In effect, global asset returns are distinguished by risk premiums, and the remaining components, the global cash returns, incorporate all currency market considerations.

The analysis presented here draws on the authors' earlier work, a version of which was published (in Japanese) in 1991 (Karnosky, Singer, and Taylor 1991). Several authors have explained the nature of the relationships among assets and exchange rates in global portfolios. They have typically cast the problem in terms of hedged versus unhedged exposures (see, for example, Lee 1987, and Eun and Resnick 1988). The framework in this monograph extends that work and develops the general relationships. This approach reduces the

analytical problem to its most basic form, in terms of variables that are common to all global investors. The general framework provides a uniform treatment of global assets and exchange rates. It is universal and identifies the specific market and currency variables that investors can actually manage. It is a basic analytical tool rather than a prescription for formulating and implementing global investment policy.

On the practical level, the framework recognizes that the market and currency variables must be defined in terms that investors can manage if they choose. Also, the framework accommodates the variety of instruments, such as futures, swaps, and other derivative securities, that are increasingly used in the management of multicurrency portfolios. That is, the framework can identify the underlying asset and currency exposures within a portfolio, irrespective of the specific instruments that are used.

Consider, for example, the purchase by a U.S. investor of Japanese equity futures as a means of establishing Japanese market exposure. The return to such a position would be the return on the Nikkei 225 Index less the return on Japanese cash. In other words, the derivative provides an exposure to the Japanese equity market risk premium. If the Japanese equity futures position is not leveraged, however, and the underlying cash is held in U.S. dollars, the position gives market, but not yen, exposure; that is, the Japanese equity position is hedged into U.S. dollars. If the currency strategy called for an unhedged position, purchase of a separate yen-denominated asset is required, involving either converting the cash into yen or entering a yen-denominated forward or currency futures contract. The analytical framework treats this transaction as fundamentally identical to the direct purchase of a Nikkei Index fund, either hedged or unhedged.

Section 1 develops and explains the general analytical framework for distinguishing between the market and currency returns. The central theme is that market and currency returns must reflect the performance of variables that investors can manage when setting portfolio strategy. That practical consideration leads to the conclusion that active currency management is equivalent in all respects to the management of global cash portfolios. This conclusion, in turn, reduces the market analysis to the evaluation of expected market return premiums—that is, the local currency returns of assets relative to the associated local cash returns.

The second section uses this framework to develop a method for performance attribution that identifies the effects of market and currency allocation decisions and the returns that are attributable to security selection within each market. Although some progress has been made recently in improving the ability of attribution systems to measure the effect of currency strategies, the

prevailing approaches continue to misspecify the effects of market selection either in terms of local currencies or in terms of the base currency of the investor. These approaches give misleading results and provide managers with incentives that can be inconsistent with optimal portfolio strategy.

Section 3 applies attribution methodology introduced in Section 2 by using the recent experience of actual global equity and bond portfolios for illustration. These portfolios are used to highlight the relevant issues and are also to demonstrate the pitfalls that plague conventional global analytical and attribution frameworks.

A summary of the issues that investors must address in developing global investment strategies and interpreting attribution results is provided in the fourth section. An actual global balanced portfolio, which involves active management of global equity and bond positions, active currency strategies, and active selection of stocks and fixed-income securities within each market, is the basis for this discussion. This broadly defined portfolio highlights the importance of basing investment analysis on a consistent global framework.

## 1. The General Framework

The primary objective of the investor is to maximize the performance of the entire portfolio. Although the focus of attention in discussions of global markets is often on currency issues, the analytical framework must also account for the market or country allocations so that market and currency strategies can work in concert to achieve optimal joint performance. Optimal market strategy plus optimal currency strategy should produce optimal portfolio performance.

**Defining the Market and Currency Variables.** Table 1 shows that, during the ten years from December 31, 1982, to December 31, 1992, the Australian equity market generated one of the best continuously compounded annual rates of return (17.04 percent) in local-currency terms of several global equity markets. At the same time, the Australian dollar showed one of the most rapid annual rates of depreciation against the U.S. dollar (−3.53 percent). On the surface, these data might suggest that an investment strategy of overweighting Australian stocks and hedging the resulting currency exposure back into U.S. dollars might have been profitable during this period. In fact, however, the opposite would have been true. Despite the strong performance of the Australian market in local currency returns, underweighting of that market would have enhanced the performance of a global equity portfolio for the period. Overweighting of the Australian dollar would have improved the return of a global equity portfolio that used the Morgan Stanley Capital International (MSCI) World Equity Index as a benchmark.

**TABLE 1. Global Equity Returns, December 31, 1982, to December 31, 1992**

| Market | Local Currency Return | Change in Exchange Rate | Dollar Return | Local-Currency Cash Return |
|---|---|---|---|---|
| Australia | 17.04% | −3.53% | 13.51% | 13.56% |
| Canada | 8.31 | −0.31 | 8.00 | 9.73 |
| Germany | 11.02 | 3.84 | 14.86 | 6.37 |
| Japan | 8.70 | 6.31 | 15.01 | 5.78 |
| United Kingdom | 17.12 | −0.66 | 16.46 | 11.09 |
| United States | 14.83 | 0.00 | 14.83 | 9.82 |
| Global index | 12.50 | 1.96 | 14.46 | 7.78 |

*Sources:* MSCI; the *Financial Times*; and Brinson Partners.
*Note:* Continuously compounded annual rates of return. The local currency returns for the global equity index reflect the performance of all the markets that are contained in the MSCI World Equity Index. Cash returns are derived from three-month Eurodeposits denominated in the respective currencies.

Obviously, something that is not captured in local currency returns and/or changes in exchange rates was going on in these markets. That other factor was the relative performance of the U.S. and Australian cash markets, the terms under which currency exposures could have been managed. From the perspective of global investment, annual cash returns of 13.56 percent in Australia during the decade were sufficiently greater than those of the United States, and many other cash markets, to overwhelm both the strong returns from the Australian equity market and the general weakness of the Australian dollar.

The role of relative cash returns in currency markets is well understood by foreign exchange managers. Arbitrage pressure assures that differences in term interest rates among countries dominate the forward rates at which currency exposures are exchanged.[1] The ability to borrow and lend in the various Eurodeposit markets assures a close relationship between, for example, three-month forward discounts/premiums and differentials in the associated three-month Eurodeposit rates. Thus, hedging yen into U.S. dollars during a

[1] The use of forward currency contracts in this analysis is based on "covered interest parity." This choice does not imply that the additional notion of "uncovered interest parity" is assumed to hold. The analysis contains no suggestion that the current forward rates are unbiased forecasts of the future spot exchange rate. Instead, investors are faced with a choice between the known (and often negative) returns that are given by interest rate differentials in the current forward market and the uncertainty of changes in spot exchange rates that can occur in a given period.

three-month period eliminates exposure to changes in the yen:dollar exchange rate in the period and substitutes a forward return that effectively equals the difference between the current three-month Eurodollar and Euroyen rates.

However, these relative cash market conditions also affect the relative market returns that are actually available to investors. This double effect of cash returns—on both the market and available currency returns—is the key to the general framework for analysis of global markets.

The nature of the relationship between the market and currency returns that are available to global investors can be illustrated with a portfolio of three assets denominated in three currencies. For illustration, this example is the portfolio of a U.S. investor who holds assets that are denominated in dollars, yen, and pounds sterling. The total dollar return, $R_\$$, of this portfolio with no currency hedging would be[2]

$$R_\$ = w_\$ r_\$ + w_£(r_£ + \varepsilon_{\$,£}) + w_¥(r_¥ + \varepsilon_{\$,¥}), \tag{1}$$

where

$R_\$$ = total portfolio return, in U.S. dollars,
$r_i$ = local currency return from country $i$ assets,
$\varepsilon_{\$,i}$ = rate of change of the dollar relative to currency $i$, and
$w_i$ = weight of each country asset; $\Sigma w_i = 1$.

The unhedged returns from investments in the United Kingdom and Japan are the joint result of the respective local currency returns, $r_i$, and the rates of change of the associated exchange rates, $\varepsilon_{\$,i}$.

Assume that the investor is comfortable with the market exposures of this portfolio but wants to know whether the total dollar return would be enhanced by altering the currency exposures that result from the market strategy. One alternative would be to hedge the yen and sterling exposure into dollars. In this case, the exchange rate components of the Japanese and U.K. positions would be replaced by the respective forward premiums or discounts, $f_{\$,i}$. The fully hedged return, $HR_\$$, in U.S. dollars, would be

[2] Several simplifying assumptions are made throughout the monograph in order to avoid unnecessary complexity in the presentation of the analysis. First, all returns are initially in continuously compounded terms, which allows simple addition and subtraction of terms. This assumption is relaxed later. Second, the investment objective is the maximization of returns, which allows risk considerations to be ignored. Our focus is on identifying the market and currency variables that are relevant to global investment analysis, not on applying those variables to a specific investment process such as mean–variance optimization. Risk considerations are an implementation issue.

$$HR_{\$} = w_{\$}r_{\$} + w_{£}(r_{£} + f_{\$,£}) + w_{¥}(r_{¥} + f_{\$,¥}). \quad (2)$$

Equations 1 and 2 illustrate that this currency decision (whether or not to hedge) involves comparison of the returns from forward contracts with exchange rates. That is, the investor would hedge into dollars when the current forward return is greater than the expected percentage change in the exchange rate: $f_{\$,£} > \varepsilon_{\$,£}$ and/or $f_{\$,¥} > \varepsilon_{\$,¥}$.

A close look into the relationship between forward exchange rates and the expected changes in spot exchange rates refines the decision, however. Ignoring the typically small transaction costs, arbitrage activity assures that forward returns are effectively equal to the difference between term interest rates, $f_{j,i} = c_j - c_i$. Thus, the currency decision actually involves comparisons of current interest rate differentials with expected changes in exchange rates. In this example, hedging into dollars is attractive to the investor when the difference between U.S. and foreign term interest rates is greater than the expected rate of change in the associated exchange rates; that is, $(c_{\$} - c_{£}) > \varepsilon_{\$,£}$ and $(c_{\$} - c_{¥}) > \varepsilon_{\$,¥}$. These relationships can be simplified, however, through a slight rearrangement of terms, to $c_{\$} > (c_{£} + \varepsilon_{\$,£})$ and $c_{\$} > (c_{¥} + \varepsilon_{\$,¥})$.

Because of the dominance of interest rate differentials in setting forward exchange rates, currency futures prices and currency swaps, the currency decision reduces to a comparison of global cash returns, with all returns expressed in the home currency of the investor.[3] In this example, hedging into the home currency of the investor is a *dollar* strategy that will increase the total returns of the portfolio if and only if the dollar return from Eurodollar deposits is greater than the dollar return from the foreign Eurodeposits.

In fact, the returns that are associated with any currency strategy in any portfolio can be represented by the individual-country Eurodeposit returns converted into the home currency of the investor. This general proposition can be demonstrated by focusing on the Japanese asset and currency components of the portfolio in Equation 1 and considering the full set of alternatives for handling the yen exposure. The investor has three basic currency options: a yen

[3] In practice, forward exchange contracts for a wide range of time periods are available in the market. Determining the optimal maturity of the contract involves analysis of relative yield curves between countries. We assume that the basic forward contract is short term, reflecting differential interest rates on cash equivalents. Extending the term of the contract is thus treated as an active "hedge-selection" decision involving comparisons of total returns from fixed-income securities. Such issues are temporarily ignored, with no loss in generality, and all forward contracts are assumed to reflect differential cash rates. The cash returns, $c_i$, reflect the total returns from rolling short-term Eurodeposits over the investment horizon of the portfolio.

strategy, which maintains the unhedged yen position that results from the market strategy (Equation 3), a dollar strategy, which hedges yen into the dollar (Equation 4), or a sterling strategy, which cross-hedges the yen into a third currency, sterling (Equation 5). The cross-hedge involves the sterling:yen forward premium plus the expected rate of change of the dollar:sterling exchange rate. The dollar returns from applying each of these currency strategies to the Japanese holdings within the portfolio are then

$$R_{\$¥} = r_{¥} + \varepsilon_{\$,¥} \qquad \text{(yen strategy)}, \tag{3}$$

$$HR_{\$¥} = r_{¥} + f_{\$,¥} \qquad \text{(dollar strategy)}, \tag{4}$$

and

$$CR_{\$¥} = r_{¥} + (f_{£,¥} + \varepsilon_{\$,£}) \qquad \text{(sterling strategy)}, \tag{5}$$

where $CR$ is the cross-hedge return.

Substituting the Eurodeposit interest rate differentials, $c_{\$} - c_{¥}$ and $c_{£} - c_{¥}$, for the respective forward returns ($f_{\$,¥}$ and $f_{£,¥}$) in Equations 4 and 5 and rearranging terms produces

$$R_{\$¥} = (r_{¥} - c_{¥}) + (c_{¥} + \varepsilon_{\$,¥}), \tag{6}$$

$$HR_{\$¥} = (r_{¥} - c_{¥}) + c_{\$}, \tag{7}$$

and

$$CR_{\$¥} = (r_{¥} - c_{¥}) + (c_{£} + \varepsilon_{\$,£}). \tag{8}$$

The differences among the dollar returns from the three currency strategies in Equations 6, 7, and 8 are caused entirely by differences in implied Eurodeposit returns, in dollar terms. By definition, therefore, these Eurodeposit returns are the full measure of the pure currency returns associated with each currency strategy. Repeating this exercise for the U.S. and U.K assets in this example would show that these three Eurodeposit terms define the respective currency strategies in each case. Irrespective of the market strategy in this or any dollar-based portfolio:

- The currency return from a dollar strategy is equal to the return from Eurodollar deposits, $c_{\$}$.
- The currency return from a yen strategy is equal to the dollar return from Euroyen deposits, $c_{¥} + \varepsilon_{\$,¥}$.
- The currency return from a sterling strategy is equal to the dollar return from Eurosterling deposits, $c_{£} + \varepsilon_{\$,£}$.

Because of the unavoidable impact of interest rate differentials in controlling exchange rate exposures, local Eurodeposit returns are an inseparable component of currency returns. Therefore, as shown in Equations 6, 7, and 8, only the portion of local currency returns in excess of local cash returns, $r_{¥} - c_{¥}$, remains in each equation as the measure of Japanese asset returns independent of the associated currency strategy. Similar return premiums define the market returns for the U.K. and U.S. assets in the portfolio. This local return premium, not the total local currency return alone, is the unambiguous measure of the pure market return.[4] The implication is that the investment decision facing this hypothetical U.S. investor involves the allocation of funds among market and currency variables that have the following returns:

| Market Allocation | | Currency Allocation | |
|---|---|---|---|
| Market | Market Return | Currency | Currency Return |
| United States | $r_{\$} - c_{\$}$ | Dollar | $c_{\$}$ |
| Japan | $r_{¥} - c_{¥}$ | Yen | $c_{¥} + \varepsilon_{\$,¥}$ |
| United Kingdom | $r_{£} - c_{£}$ | Sterling | $c_{£} + \varepsilon_{\$,£}$ |

Three distinct market returns and three distinct currency returns need to be evaluated. The market decision involves evaluating the three return premiums, and the currency decision involves a completely separate allocation among the three cash markets.

All combinations of market and currency strategies for any benchmark and any base currency can be constructed within this framework. Whether an investor decides to manage the currency exposure or not is irrelevant in developing the analytical framework; the portion of portfolio return that is attributable to currency must reflect a return that investors *could* actively manage. The relevant question is: How would the total performance of the portfolio have been affected if the investor had managed the currency exposure differently?

The general definition of the return from a global portfolio, in terms of any

[4] The term "return premium" is used, rather than the more familiar "risk premium," in order to make a subtle distinction in the underlying cash return. "Risk premium" refers to the return above the return of a riskless asset, often assumed to be a short-term U.S. Treasury instrument. Because this analysis reflects the premium over Eurodeposit returns, which can, depending on the typical (normal) forward term, have longer maturities, the term "return premium" is used.

base currency, $n$, can be written in terms of separate market and currency components as[5]

$$R_n = \Sigma[w_i(r_i - c_i) + \upsilon_i(k_i - c_i)] + \Sigma\delta_i(c_i + \varepsilon_{n,i}), \tag{9}$$

where the general types of returns are

$r_i$ = return from the noncash assets of country $i$, in local-currency terms,
$c_i$ = return from country $i$ Eurodeposits, in local-currency terms,
$k_i$ = return from country $i$ strategic cash (if held in Eurodeposits, $k_i = c_i$), and
$\varepsilon_{n,i}$ = rate of change in the base currency:currency $i$ exchange rate.

The active decision variables in an unleveraged portfolio are

$w_i$ = weight of country $i$ noncash assets; $0 \leq \Sigma w_i \leq 1$,
$\upsilon_i$ = weight of country $i$ cash held as strategic cash; $\Sigma(w_i + \upsilon_i) = 1$; in a fully invested portfolio, all $\upsilon_i = 0$,
$\delta_i$ = weight of currency $i$; $\delta_i = (w_i + \upsilon_i + h_i)$, and $\Sigma\delta_i = 1$, and
$h_i$ = the portion of the portfolio that is converted (hedged or cross-hedged) to currency $i$; if net short currency positions are prohibited, the following constraint applies: $-(w_i + \upsilon_i) \leq h_i \leq 1$.

In other words, currency strategy is set at the level of the portfolio; the currency exposures are the net result of the market strategy weights, the currencies in which any strategic cash is held, and explicit currency hedging activity. Thus, active currency management can, and often does, involve more than direct hedging or cross-hedging activity. In the end, all that matters is the total currency exposures of the portfolio, regardless of the sources of the exposures. In a balanced portfolio of global stocks, bonds, and cash, this framework also allows the aggregate currency strategy to be evaluated independently of the stock, bond, and cash market decisions. This separation is critical not only for investment analysis but also for performance attribution, as is demonstrated in Section 2.

Equation 9 shows that the problem of evaluating an array of alternative currency strategies can be reduced to analysis of a single vector of Eurodeposit returns, evaluated in terms of the base currency of the investor. This single set of cash returns, $c_i + \varepsilon_{n,i}$, contains all the information that is included in the matrix of all possible forward returns versus changes in exchange rates, $f_{i,j} + \varepsilon_{n,i} - \varepsilon_{n,j}$. Equally important, the returns that are relevant for market or

[5] The detailed derivation of the general framework, including the full effects of strategic holdings of cash as an active market decision, is presented in Appendix A.

country selection are clearly identified as the respective return premiums—that is, the local asset returns relative to local cash returns, $r_i - c_i$.

In the special case in which maximization of returns is the investment objective, the ranking of the market and currency returns that is given by this approach is identical to that which results from the framework proposed by Lee (1987, p. 73) and others, which is based on hedged returns. The equivalence can be demonstrated by adding and subtracting the return from home country $n$ cash ($c_n$), assuming a fully invested portfolio, on the right side of Equation 9:

$$R_n = \Sigma w_i(r_i - c_i) + \Sigma \delta_i(c_i + \varepsilon_{n,i}) + (c_n - c_n). \tag{9a}$$

Because $\Sigma w_i = \Sigma \delta_i = 1.0$, Equation 9a can be rewritten as

$$R_n = w_i[r_i + c_n - c_i] + \Sigma \delta_i[c_i - c_n + \varepsilon_{n,i}] \tag{9b}$$

and

$$R_n = \Sigma w_i[r_i + f_{n,i}] + \Sigma \delta_i[\varepsilon_{n,i} - f_{n,i}]. \tag{9c}$$

The first term on the right of Equation 9c is the vector of hedged returns, in terms of the base currency, $n$. Because the base-currency cash return, $c_n$, appears as a scalar in each hedged return, it has no effect on the relative order of market returns as given in Equation 9. The ranking of hedged returns, $r_i + f_{n,i}$, is identical to that given by the local return premiums, $r_i - c_i$. The second term is the vector of exchange rate versus dollar forward returns. The base-currency cash return also appears as a scalar across the array of currency terms and has no effect on the ranking of the currency terms.

Although these terms can be derived arithmetically from the definition of global returns, they have a strong theoretical foundation. Evaluation of return premiums among global capital markets is an extension of the CAPM, in which risky assets are distinguished by their returns relative to the riskless (cash) asset. With less than full global integration, multiple cash equivalents exist that differ in their currencies of denomination. Because the relevant cash instrument for the U.S. investor, for example, is U.S. cash, the global evaluation process can be thought of as flowing from domestic cash, $c_\$$, to foreign cash, which includes the unavoidable consideration of exchange rates, $c_i + \varepsilon_{\$,i}$, and on to the foreign asset relative to foreign cash, $r_i - c_i$. The first part of that process leads to the currency decision, and the second part encompasses the asset decision. Only in a fully integrated equilibrium environment would comparisons among global cash markets not matter, because exchange rates would then serve a

fully transparent price-equilibrating function. That is, full global integration implies an effective single currency.[6]

This framework is applicable to all benchmarks, whether unhedged, hedged, or partially hedged. When the benchmark is unhedged and explicit hedging is prohibited, the market and currency strategies will be identical, because over- or underweighting of any market will necessarily cause an equal over- or underweighting of the associated currency. In effect, strategy is set on the basis of unhedged returns, which are the sum of the market and currency components. Although the investment manager is unable to act on the market and currency components independently, the framework does distinguish between the contribution of market variables and currency variables to the unhedged return from any market. This consideration is particularly important when hedging, even if allowed, is not feasible. Such would be the case with many emerging markets, where no effective instruments for managing currency exposure exist. The investment decision would necessarily involve both market and currency returns.

**Keeping "Cash" in Perspective.** The framework highlights the significance of cash equivalents, but the distinction between two cash concepts that arise in the framework is important. The first stems from the Eurodeposit rates that dominate the pricing of forward contracts, futures, and swaps that are used in implementing currency strategies. This form of cash enters the analysis, even for portfolios that are fully invested and are holding no explicit strategic cash, because the purchase of any asset—whether equity or fixed income, domestic or foreign—involves implicit exposures to cash and to a return premium over cash. Any decision to hedge involves simply changing the currency denomination of the implicit cash to which the asset's return premium is attached. For example, hedging into U.S. dollars the yen exposure that results from a Japanese equity position involves changing the implicit cash component from Euroyen to Eurodollars. In effect, the Japanese equity return premium is added to the U.S. dollar rather than to the yen Eurodeposit return. Such hedging does not create additional cash; rather, it *substitutes* U.S. dollar cash for non-U.S. cash in the portfolio.

The second cash concept involves holding cash for strategic or operational

[6] For a discussion of the CAPM in a global context, see Karnosky (1993).

purposes, which results in a portfolio that is less than fully invested.[7] This cash can be held in any currency and, if held in Eurodeposits, has a return premium of zero. Conceptually, this type of cash represents a market exposure that is no different from equity or fixed-income assets.

**The Relationship between Market and Currency Returns.** This framework demonstrates that separate currency and market strategies can be implemented within a global portfolio in which a specific currency weight is different from the weight of the associated market.[8] The strategy decisions are interdependent, however, because local Eurodeposit returns affect both expected market and currency returns. Other things being unchanged, an increase in the local Eurodeposit return in a country would increase the attractiveness of that country's currency to all global investors but would also decrease the attractiveness of that country's noncash assets. That is, changes in global cash returns can, independent of current exchange rates and conditions in the underlying asset markets, cause changes in the optimal market and optimal currency strategies.[9]

This link between market and currency returns can be illustrated with an example.[10] Table 2 gives three hypothetical situations involving U.S. and Japanese equity markets. The U.S. dollar is the base currency of the investor.

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[7] Currency management through forwards, futures, or swaps can result, however, in gains and losses during the terms of the contracts. If these gains (losses) are not offset, they create effective net cash exposures (portfolio leverage).

[8] The benchmark portfolio can also be specified with currency weights that differ from the market allocations (Lee 1987). Such is the case with a hedged benchmark, for example, where the weight of the base-currency cash would be 100 percent and all other cash weights would be set to zero. Conceptually, subject only to external restrictions (such as a prohibition against leveraged positions), any combination of market and currency benchmark weights is possible.

[9] This analysis is independent of specific theories about the behavioral relationships among the asset and foreign exchange markets. Economic conditions that change short-term interest rates, for example, could also produce changes in asset returns that result in no change in return premiums. The focus here is on the analytical framework in which particular global capital market theories can be evaluated.

[10] As earlier, risk considerations are ignored, with no loss in generality, and the investment objective is to maximize returns. Mean–variance optimization would involve maximizing the objective function, $E[U] = R_n - (1/T)V[R_n]$, where $R_n$ is the expected return as defined in Equation 9. The constraint set would include $\Sigma(w_i + v_i + h_i) = \Sigma\delta_i = 1$. Restrictions on currency strategies would be imposed on the hedge weights, $h_i$, within the currency weights, $\delta_i$. The covariance matrix would span local return premiums and cash returns expressed in base-currency terms.

The only variables that change among the three cases are the local currency returns from Eurodeposits. For purposes of illustration, the potential behavioral relationships between changes in short-term interest rates and equity returns or exchange rates are ignored.

**TABLE 2. Hypothetical Examples**

| Variable | Case 1 | Case 2 | Case 3 |
|---|---|---|---|
| Yen return on Japanese equity, $r_{¥}$ | 14% | 14% | 14% |
| Dollar return on U.S. equity, $r_{\$}$ | 8 | 8 | 8 |
| Change in dollar:yen exchange rate, $\varepsilon_{\$,¥}$ | −4 | −4 | −4 |
| Yen return on Euroyen deposits, $c_{¥}$ | 9 | 4 | 9 |
| Dollar return on Eurodollar deposits, $c_{\$}$ | 2 | 2 | 4 |
| Return premium | | | |
| United States, $r_{\$} - c_{\$}$ | 6 | 6 | 4 |
| Japan, $r_{¥} - c_{¥}$ | 5 | 10 | 5 |
| Eurodeposit returns (in U.S. dollars) | | | |
| United States, $c_{\$}$ | 2 | 2 | 4 |
| Japan, $c_{¥} + \varepsilon_{\$,¥}$ | 5 | 0 | 5 |
| Optimal market strategy | United States | Japan | Japan |
| Optimal currency strategy | ¥ | $ | ¥ |
| Maximum total return | 11% | 12% | 10% |

In all three cases, Japanese equities offer higher returns in both dollar and local-currency (yen) terms. The yen return from Japanese equity is 14 percent, and the yen is expected to depreciate against the dollar at a 4 percent rate, which implies a 10 percent return in dollars. The dollar return on U.S. equity is 8 percent in each case.

Consider Case 1. The four choices are (1) unhedged Japanese equity, generating a 10 percent dollar return, (2) hedged Japanese equity, generating a 7 percent dollar return, (3) U.S. equity, generating an 8 percent dollar return, and (4) U.S. equity reverse-hedged into yen, generating an 11 percent dollar return. Despite the relatively strong performance of Japanese equity in local-currency and dollar terms in this case, the maximum dollar return is produced by a market strategy that invests in U.S. equity. While the yen depreciates, the optimal currency strategy is a "reverse hedge" into yen, which produces an 11 percent dollar return.

The optimal strategy effectively sacrifices the apparently superior Japanese

equity return in order to take advantage of an even more attractive situation in global cash markets. The best dollar return is produced by combining the weaker equity market and the weaker currency, in terms of local market and exchange rate returns. No net cash exposure in the portfolio results from this strategy, however, and the portfolio is fully invested in equity.

The key consideration is that, although the local currency return of Japanese equity is superior to that of U.S. equity, its performance relative to the local cash return is inferior. In Japan, equity returns a premium of 5 percent over yen cash, while the equity premium is 6 percent in the U.S. market. The dollar return on Eurodollar deposits is only 2 percent, compared with a 5 percent dollar return from Euroyen deposits. Applying the U.S. equity premium of 6 percent to the 5 percent dollar return on Japanese cash gives a total dollar return of 11 percent.

Note that this "extra" return does not result from aggressive management of currencies within the equity portfolio. The additional return is the result of considering a complete set of alternative asset and currency allocations within an unchanged view about exchange rates and equity markets. The information required to achieve the maximum portfolio return is exactly the same as is needed to make the choice between hedging and not hedging, but this framework ensures that the portfolio can make best use of that information.

The simultaneous nature of the market and currency analysis is illustrated by comparing the optimal strategy in Case 1 with the optimal strategies of Cases 2 and 3. In Case 2, lower Euroyen deposit rates reduce the expected yen return from Japanese cash to 4 percent. Although the expected equity and exchange rate returns are unchanged, this lower Japanese cash return implies a portfolio strategy that is the exact opposite of the strategy in Case 1. The optimal portfolio in Case 2 would be fully invested in Japanese equity with a 100 percent hedge into dollars, producing a dollar return of 12 percent.

In Case 2, lower short-term Japanese interest rates imply a larger return premium for Japanese equities, 10 percent versus the 5 percent in Case 1. At this level, the premium over local cash that is offered by Japanese equity is substantially above the 6 percent premium offered by U.S. equity. At the same time, the lower yen return on Japanese cash means that Eurodollar deposits offer the higher dollar return, making exposure to the dollar the better currency strategy.

In Case 3, the narrowed interest spread reflects higher U.S. short-term rates rather than lower Euroyen rates. The expected U.S. cash return of 4 percent produces a U.S. equity return premium of 4 percent. As in Case 2, this situation causes Japan to be a more attractive equity market. In contrast to Case 2, however, the yen is the more attractive currency because Euroyen deposits

offer a 5 percent dollar return, compared with a 4 percent return from Eurodollars. The optimal strategy in this case is an unhedged position in Japanese equity, which gives a dollar return of 10 percent.

A given set of local currency and exchange rate returns can yield a variety of optimal portfolio strategies, depending on the situation in global Eurodeposit markets. Not only are returns from alternative currency strategies affected, but changes in cash returns also affect the premiums that are offered by risky assets. To make the market decisions based on returns from either local currency or the base currency and then try to determine the best currency overlay or strategy given those market exposures is, therefore, inappropriate. In all three cases in this illustration, Japanese equity offers the better local currency and unhedged dollar return. Only in Cases 2 and 3, however, is selection of the Japanese market consistent with achieving a maximum portfolio return. Thus, applying a separate currency overlay onto a portfolio in which the market allocations have already been made *on the basis of either local currency or unhedged asset returns* can be suboptimal. Only if market selection is based on the evaluation of relative local return premiums can separate market and currency decisions be jointly optimal in all cases.

**The Historical Record.** The misleading information that is given by local currency and unhedged returns can be seen in recent historical data for the performance of several global markets. Table 3 repeats the global equity returns that were shown in Table 1 and adds the performance of the associated bond markets. The U.S. dollar returns for each individual market and the indexes are presented on the right. The market and currency components of the dollar returns are presented in both a conventional framework, which focuses on local currency and exchange rate returns, and in terms of local return premiums and cash returns in dollars. The data are shown graphically in Figures 1–3.

Notice that the conventional framework indicates that changes in exchange rates accounted for only 1.96 percent of the 14.46 percent dollar return from the global equity index and 1.88 percent of the 11.31 percent dollar return from global bonds. The countries included in Table 3 experienced significant differences in exchange rate returns, however, ranging from a 6.31 percent rate of appreciation of the yen against the U.S. dollar to a 3.53 percent annual rate of depreciation of the Australian dollar against the U.S. dollar. In fact, although the U.K. and Australian equity and bond markets had particularly strong local currency returns, their respective currencies also showed the largest depreciations against the U.S. dollar. Germany and Japan had the strongest currencies

**TABLE 3. Global Market Returns, December 31, 1982, to December 31, 1992**

| Market | Local Currency Return | Dollar Exchange Rate Return | Local-Currency Return Premium | Cash Return in Dollars | Dollar Return |
|---|---|---|---|---|---|
| Equity markets | | | | | |
| Australia | 17.04% | −3.53% | 3.48% | 10.32% | 13.51% |
| Canada | 8.31 | −0.31 | −1.43 | 9.42 | 8.00 |
| Germany | 11.02 | 3.84 | 4.65 | 10.21 | 14.86 |
| Japan | 8.70 | 6.31 | 2.92 | 12.08 | 15.01 |
| United Kingdom | 17.12 | −0.66 | 6.03 | 10.43 | 16.46 |
| United States | 14.83 | 0.00 | 7.01 | 7.82 | 14.83 |
| Global equity index | 12.50 | 1.96 | 4.71 | 9.74 | 14.46 |
| Bond markets | | | | | |
| Australia | 13.67 | −3.53 | 0.20 | 10.03 | 10.22 |
| Canada | 11.66 | −0.31 | 1.93 | 9.42 | 11.35 |
| Germany | 7.35 | 3.84 | 0.98 | 10.21 | 11.19 |
| Japan | 7.06 | 6.31 | 1.29 | 12.08 | 13.38 |
| United Kingdom | 11.23 | −0.66 | 0.14 | 10.43 | 10.57 |
| United States | 10.22 | 0.00 | 2.40 | 7.82 | 10.22 |
| Global bond index | 9.43 | 1.88 | 1.71 | 9.59 | 11.31 |

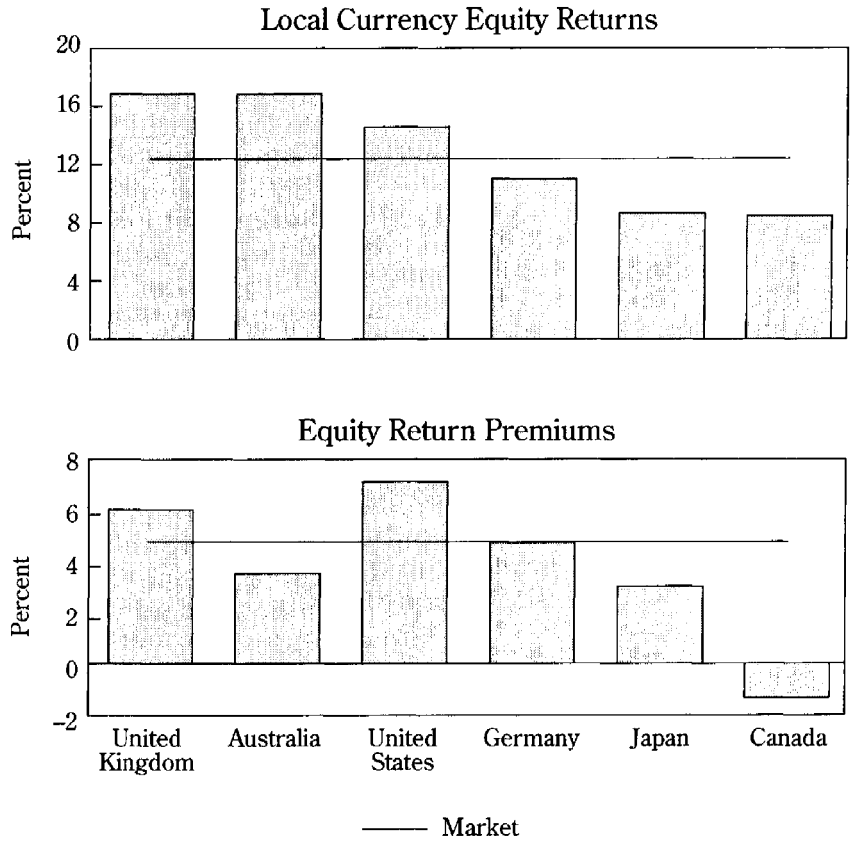
*Sources:* MSCI; Salomon Brothers; the Financial Times; and Brinson Partners.
*Note:* Continuously compounded annual rates of return. The local currency returns for the global equity index are based on the full set of markets that are contained in the MSCI World Equity Index, and the global bond index reflects the performance of the full set of markets contained in the Salomon Brothers World Government Bond Index. Cash returns reflect the performance of the respective three-month Eurodeposits.

relative to the dollar, but the local currency returns from their equity and bond markets were below the respective indexes.

The upper panels of Figures 1 and 2 show the local currency returns from each market relative to the local currency returns from the respective global indexes. Figure 1 shows that the local currency returns from the Australian, U.K., and U.S. equity markets exceeded the index during this ten-year period. Figure 2 shows that the bond markets of these three countries plus Canada provided local currency returns above the index of global bond markets.

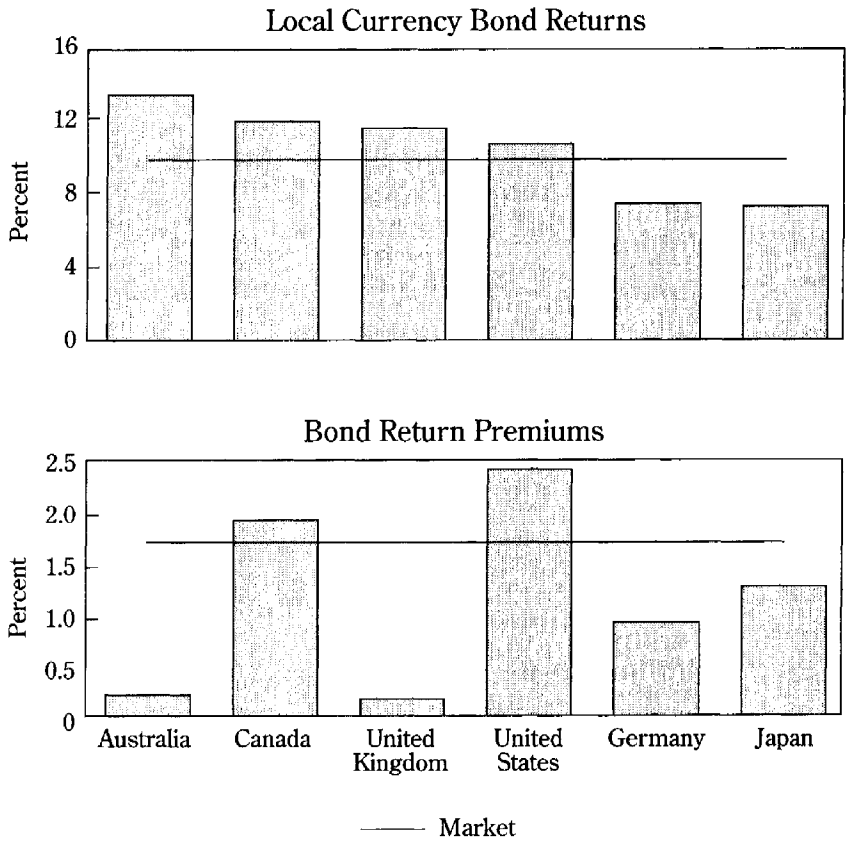
The upper panel of Figure 3 shows the annual rates of change of each exchange rate relative to the weighted average of the exchange rates for the global equity and bond indexes. Only the mark and the yen exceeded the index.

**FIGURE 1. Global Equity Markets, December 31, 1982, to December 31, 1992**



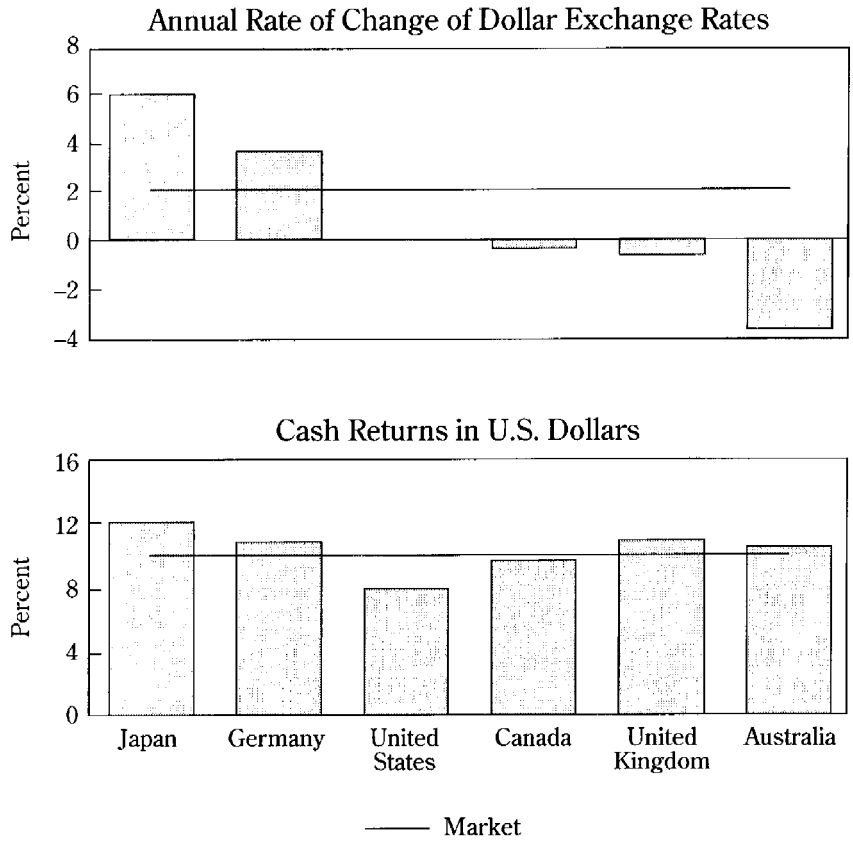

As demonstrated, however, the relative local currency and exchange rate returns have no necessary relevance for investment strategy because they do not account for the practical issues involved in the management of currency exposures. The market and currency returns that were actually available to global investors are measured by the local return premiums and the associated cash returns in dollars. In those terms, the global equity index generated an average market return that was 4.71 percent above global cash, and the global bond market produced an average 1.71 percent premium over cash. From this perspective, the United Kingdom and the United States provided above-average equity market returns, as shown in the lower panel of Figure 1, and

**FIGURE 2. Global Bond Markets, December 31, 1982, to December 31, 1992**




only Canadian and U.S. bond market return premiums were superior to the bond index, as shown in Figure 2. The dollar was the poorest performing currency for global investors during the decade, with U.S. cash producing a dollar return of 7.82 percent, compared with index returns of slightly less than 10 percent. In fact, all other currencies in Table 3 had returns greater than the cash return, in dollars, from the index. Note that although the Australian dollar showed the largest depreciation against the U.S. dollar among these currencies, the 10.03 percent dollar return from Australian cash was above the market average and was among the highest returns.

**FIGURE 3. Global Currency Markets, December 31, 1982, to December 31, 1992**




**Summary.** The ability to account consistently for the various factors that influence portfolio performance is critical in investment management. Global portfolios complicate the task by introducing exposures to changes in exchange rates. Recognizing that cash markets are an inseparable part of currency analysis, however, provides the means for handling exchange rate considerations consistently within established asset valuation techniques.

Equally important is the fact that the proper treatment of currencies has implications for the manner in which global asset or market returns are evaluated. Because local cash returns are an inseparable part of the currency returns that can be managed by the investor, the implicit cash portion of asset

returns is not relevant to market analysis. Only the return premiums of assets, relative to local cash, distinguish among assets and markets. Failure to exclude local cash from the market returns confounds the market and currency effects and can generate misleading analyses of the market returns that are available to the investor.

Although the range of currency returns is made explicit in the investment process, this framework does not imply that investment managers should manage currency more actively than in the past. Rather, it allows a more informed and consistent treatment of investment alternatives in global portfolios than has been possible. Recasting the global asset management problem into this framework has the merit of both rigor and simplicity. It involves the minimum number of distinct variables that must be evaluated, in terms of risk and return, and allows investment managers to determine optimal market allocations and currency strategies as distinct but interdependent decisions.

The framework for analysis of global asset returns that has been presented in this section gives an unambiguously correct distinction between market and currency returns. It provides, therefore, a consistent, general means for evaluating global investment alternatives in terms of expected market and currency returns. Although investors cannot avoid the risks inherent in acting on uncertain views about future returns, this framework allows the investor's best estimates, however faulty, to be evaluated rationally. Because this analytical approach provides an accurate view of the relative market and currency returns that are perceived by the investor, it also provides the basis for an *ex post* evaluation of resulting investment performance. The next section provides details of a performance attribution system for global portfolios.

## 2. Global Performance Attribution

This section develops the methodology for global performance attribution that is based on the analytical framework presented in the first section. This attribution approach provides unambiguous measures of the returns that result from market and currency decisions. The method applies to portfolios with unhedged, partially hedged, or hedged benchmarks.

**Pitfalls in Performance Attribution.** The following example has been constructed with an eye toward highlighting the pitfalls in conventional systems of global performance attribution and the perverse investment incentives that

these systems can create.[11] Although this example is hypothetical, similar relative returns are common in the actual performance record of global equity and bond markets, as was shown in Table 3.

Table 4 provides a set of passive weight and return data for performance evaluation from the perspective of a U.S. investor. These four assets are assumed to represent the market and have equal weights in the market index.

**TABLE 4. Global Security Returns**

| Market | Index Weights | Local Currency Returns | Exchange Rate Returns | U.S. Dollar Returns | Local Eurodeposit Returns |
|---|---|---|---|---|---|
| Germany | 25.00% | 7.00% | 1.00% | 8.00% | 5.00% |
| United Kingdom | 25.00 | 10.50 | −3.00 | 7.50 | 11.25 |
| Japan | 25.00 | 9.50 | −1.00 | 8.50 | 9.00 |
| United States | 25.00 | 8.40 | 0.00 | 8.40 | 7.50 |
| Index | 100.00 | 8.85 | −0.75 | 8.10 | 8.19 |

*Note:* Continuously compounded rates of return.

Among these four markets, the U.K. offers the best local currency return, but the pound sterling shows the largest depreciation against the dollar. The German mark (deutsche mark, DM) shows the largest appreciation against the dollar, but the German asset market has the lowest local currency return. The best unhedged dollar return is provided by Japanese securities.

Table 5 specifies the total dollar return provided by each of the 16 combinations of market and currency exposures that can be created from the 4 markets and 4 currencies. Unhedged dollar returns are read along the diagonal; hedged dollar returns are in the last column on the right. All other currency strategies involve cross-hedging. The hedged and cross-hedged returns reflect the forward premiums and discounts that are implied by the Eurodeposit rates in Table 4. The market/currency combinations that have a dollar return greater than the 8.10 percent dollar return of the equally weighted market index (in Table 4) are shown in boldface in Table 5.

[11] "Conventional" refers to the majority of attribution methods currently in use. Other approaches have recently been proposed, but although they address the problems of accounting for currency, they provide only partial solutions. Typically, the methods for measuring the effects of market selection remain flawed. For example, see Allen (1991) and Ankrim and Hensel (1992).

**TABLE 5. Dollar Returns from All Combinations of Market and Currency Strategies**

| | Currency Strategy | | | |
|---|---|---|---|---|
| Market Strategy | DM | Sterling | Yen | U.S. Dollars |
| Germany | 8.00% | **10.25%** | **10.00%** | **9.50%** |
| United Kingdom | 5.25 | 7.50 | 7.25 | 6.75 |
| Japan | 6.50 | **8.75** | **8.50** | 8.00 |
| United States | 6.90 | **9.15** | **8.90** | **8.40** |

*Note:* Continuously compounded rates of return. Boldface indicates market/currency combinations that have a dollar return greater than the 8.1 percent dollar return of the equally weighted market index in Table 4.

Looking down each column in Table 5 reveals that German securities provide the highest dollar returns for each currency strategy. Looking across each row shows that a sterling currency strategy gives the highest dollar return regardless of the market strategy. In terms of maximizing returns, the German market is unambiguously the best market and sterling is unambiguously the best currency exposure. The portfolio that offers the highest dollar return would be invested completely in German securities cross-hedged into sterling. From the data in Table 4, the resulting 10.25 percent dollar return of that portfolio reflects the 7 percent DM return from German securities, the 6.25 percent sterling return from selling DM forward into British pounds (11.25 percent Eurosterling return–5.00 percent EuroDM return), and the 3 percent loss from depreciation of sterling against the dollar.

The ranking of market and currency strategies in Table 5 is unambiguous. Not only does the German market strategy give the highest dollar return in each column, a U.S. strategy gives the next best return, irrespective of the currency exposure, followed in each case by Japan. Investments in U.K. assets show the lowest return for all currency strategies. Similarly, a yen exposure shows the second highest return in each row, followed in turn by U.S. dollar and DM strategies.

These rankings of market and currency returns are independent of the home currency of the investor. If all returns were converted to yen or marks, for example, the rankings (but not the returns) would be the same as those facing an investor whose base currency is the U.S. dollar.

Because a market strategy of overweighting German securities shows the highest dollar return regardless of the associated currency strategy, the performance attribution system should show a positive contribution from an

overweight of the German market. Notice in Table 4, however, that German securities have both local currency and unhedged returns that are inferior to the associated index returns. The equally weighted index of local currency returns for these four markets is 8.85 percent, versus 7 percent for Germany; the index of unhedged dollar returns is 8.1 percent, versus 8 percent for Germany. If either local currency or unhedged returns were used as the basis for evaluating alternative market allocations, an overweight of German securities would appear to have detracted from the performance of the portfolio relative to the index. In other words, using either of those returns as the criterion in a global attribution system would have given the investment manager an incentive to avoid the German market, in this example, to the detriment of total portfolio performance.

In fact, judging alternative market strategies on the basis of local currency returns would have given the manager an incentive to invest in U.K. and Japanese securities, which are the only markets in Table 4 that gave local currency returns—10.5 percent and 9.5 percent, respectively—that were superior to the 8.85 percent local currency return of the index. Table 5 indicates, however, that investment in U.K. securities would have produced the worst dollar return regardless of the associated currency strategy. No currency strategy associated with investment in U.K. securities would have even matched the 8.1 percent dollar return from the passive index. Using unhedged dollar returns as the criterion would have led the manager to invest in the Japanese and U.S. markets. That is, the second and third best markets would have been recommended, while the best choice, Germany, would have again been shunned.

Using the relative attractiveness of markets that is indicated solely by local currency or unhedged returns can lead to nonsensical performance attributions and decisions. Consider, for example, an investor whose policy is to use an investment manager who invests fully in the most attractive market and to use another manager who will apply a currency overlay to gain the best currency exposure. Based on Table 4, using local currency returns to evaluate markets would have caused the perceptive market manager to invest the portfolio totally in U.K. securities. Given that market allocation decision, the correct strategy for the overlay manager would have been to do nothing, leaving the sterling position unhedged. Unfortunately, Table 5 shows that combination of market and currency strategies producing a 7.5 percent dollar return for the portfolio, 60 basis points less than the passive index.

Which decision, market or currency choice, would then account for the underperformance of the portfolio? Using local currency returns to evaluate the market decision would indicate that the market manager made the correct

choice, because U.K. securities offer the highest local currency return, 165 basis points better than the local currency return of the index. The currency decision would also appear to be correct, however, because the currency manager could show that applying any other currency strategy—hedging into dollars or cross-hedging into German marks or yen—would have produced even worse dollar returns. The investor is left with the nonsensical conclusion that both the market and currency managers adopted the best strategies but, nevertheless, the portfolio underperformed the passive benchmark.

The problem has nothing to do with the basic policy decision to use an active currency overlay program. The problem is entirely the result of the misleading information and investment incentives that were given to the market manager by the focus on the local currency returns. As shown previously, development of distinct market and currency returns that allow a separate treatment of market and currency strategies must account for the effect of *cash returns* on both market and currency alternatives.

The analysis in Section 1 indicated that local-currency return premiums and Eurodeposit returns in base-currency terms give unambiguously correct rankings of the returns from the various market and currency strategies. From the data presented in Table 4, the local return premiums and Eurodeposit returns in dollars for each of the four countries are as shown in Table 6. The rank of the local return premiums is identical to the rank of returns from the market strategies in Table 5, with the German market showing the highest return premium, followed by the United States, Japan, and the United Kingdom, regardless of the currency strategy. Not only are the German and U.S. markets unambiguously the most attractive, but they are also the only markets offering return premiums in excess of the index premium of 0.66 percent. The implication is that the portfolio's return would be enhanced by market strategies

**TABLE 6. Global Security Returns**

| Market | Local Return Premium | Eurodeposit Return in U.S. Dollars | U.S. Dollar Returns |
|---|---|---|---|
| Germany | 2.00% | 6.00% | 8.00% |
| United Kingdom | −0.75 | 8.25 | 7.50 |
| Japan | 0.50 | 8.00 | 8.50 |
| United States | 0.90 | 7.50 | 8.40 |
| Index | 0.66 | 7.44 | 8.10 |

*Note:* Continuously compounded rates of return.

that favor German and U.S. assets and underweight the U.K. and Japanese markets.

The rank of dollar returns from the various Eurodeposit markets is also identical to the rank of dollar returns from the various currency strategies in Table 5 regardless of the market strategy. Among the currency alternatives, sterling, yen, and/or dollar cash offer dollar returns above the 7.44 percent Eurodeposit return for the index, in U.S. dollars.

These data would have given the market manager in the prior example the incentive to invest fully in Germany, and the overlay manager would then have converted the resulting German mark exposure into sterling. The total effect would have been a 10.25 percent dollar return for the portfolio, 215 basis points better than the dollar return of the benchmark. Because no other combination of market and currency strategies would have given a better return, the optimal market and currency strategies clearly would have resulted in the optimal portfolio return.

**The Global Attribution Framework.** Brinson *et al.* (1986, 1991) have presented a framework for separating the total portfolio return into components that are ascribable to active asset allocation strategies and components ascribable to security-selection activity. Active asset allocation reflects the setting of asset class weights within the portfolio relative to the benchmark weights. Security selection involves the specific investment choices within each asset class. Brinson *et al.* applied their framework to a portfolio of domestic assets and measured the portion of extra return that is attributable to the market allocation decisions:

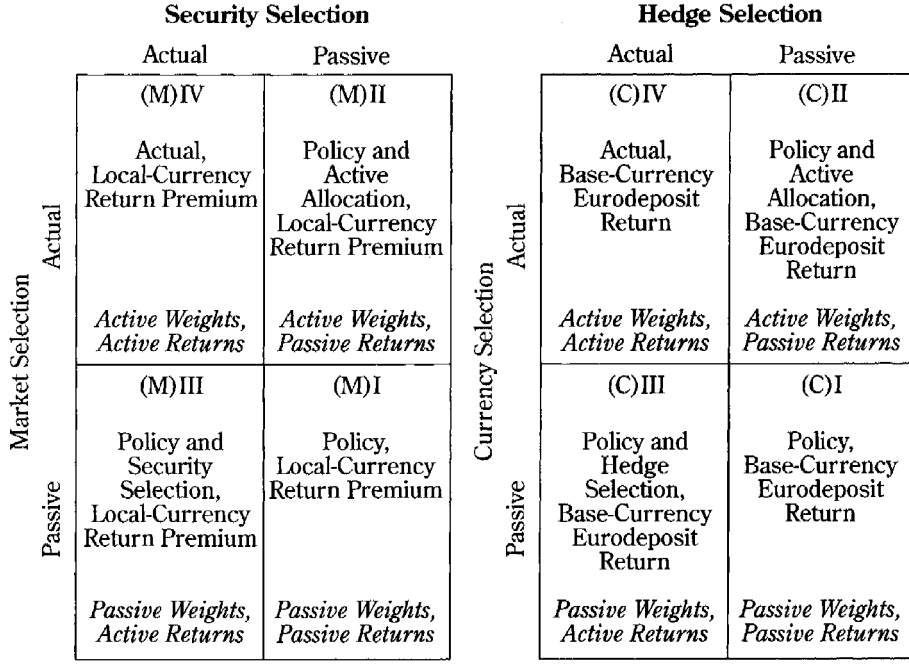
$$\begin{matrix}\text{Market}\\ \text{allocation}\\ \text{return}\end{matrix} = \begin{pmatrix}\text{Active}\\ \text{market}\\ \text{weight}\end{pmatrix} - \begin{pmatrix}\text{Passive}\\ \text{market}\\ \text{weight}\end{pmatrix} \times \begin{pmatrix}\text{Passive}\\ \text{market}\\ \text{return}\end{pmatrix} - \begin{pmatrix}\text{Index}\\ \text{market}\\ \text{return}\end{pmatrix}.$$

The framework presented in Section 1 allows this attribution approach to be applied to global portfolios, providing unambiguous measures of the returns that are attributable to market and currency strategies. This application involves only adding a separate calculation for currency attribution, which is identical in concept to the calculation that is used to account for market strategy:

$$\begin{matrix}\text{Currency}\\ \text{allocation}\\ \text{return}\end{matrix} = \begin{pmatrix}\text{Active}\\ \text{currency}\\ \text{weight}\end{pmatrix} - \begin{pmatrix}\text{Passive}\\ \text{currency}\\ \text{weight}\end{pmatrix} \times \begin{pmatrix}\text{Passive}\\ \text{currency}\\ \text{return}\end{pmatrix} - \begin{pmatrix}\text{Index}\\ \text{currency}\\ \text{return}\end{pmatrix}$$

Following the Brinson *et al.* approach, Figure 4 shows the currency-related decisions in a grid that is separate from, but parallel to, market-related calculations. The market attribution grid isolates all aspects of the total return contribution of active market decisions, independent of all exchange rate effects. The currency attribution grid isolates the full effect of currency

**FIGURE 4. A Framework for Global Portfolio Return Accountability**




Active market returns ascribable to:

| | |
|---|---|
| Market selection | M(II) – M(I) |
| Security selection | M(III) – M(I) |
| Other | M(IV) – M(III) – M(II) + M(I) |
| Total | M(IV) – M(I) |

Active currency returns ascribable to:

| | |
|---|---|
| Currency selection | C(II) – C(I) |
| Hedge selection | C(III) – C(I) |
| Other | C(IV) – C(III) – C(II) + C(I) |
| Total | C(IV) – C(I) |

decisions, accounting for all effects of spot and forward exchange rates in the portfolio. Combining the two grids accounts for the total return of the portfolio. The framework that was presented in Section 1 yields measures of market and currency returns that can be applied directly to the Brinson *et al.* approach.

- *Market strategy attribution.* The market attribution grid accounts for the return contribution of active decisions across and within asset markets and is based on local-currency return premiums. Quadrant M[arket](I) contains the passive (index) return premium; Quadrant M(IV) gives the active (portfolio) return premium. The difference between Quadrant M(IV) and Quadrant M(I) is the total contribution from all active market decisions, both active market allocation and active security selection within the markets. The contribution from active market allocation only is computed by subtracting the Quadrant M(I) return premium from the Quadrant M(II) return premium. The contribution ascribed to security selection is the difference between Quadrant M(III) and Quadrant M(I).
- *Currency strategy attribution.* The currency attribution follows the same approach. Quadrant C[urrency](I) of the currency attribution grid measures the passive Eurodeposit return for the index, in the base currency of the investor. For an unhedged benchmark, the passive currency weights are the market weights of the benchmark. A fully hedged benchmark would be specified by a 100 percent base-currency allocation with zero allocations to all other currencies. Quadrant C(IV) measures the active (portfolio) Eurodeposit return in base-currency terms. As with market attribution, the contribution of all active currency management is given by the difference between Quadrants C(IV) and C(I). Like the market allocation effect, the total currency effect can be segmented into two active decisions—active currency allocations and active hedge selection. Equation 9 showed that currency allocations can result from noncash asset exposures, $w_i$; strategic cash exposures, $v_i$; and/or currency hedges, $h_i$. The difference between Quadrants C(II) and C(I) is the contribution of active currency allocation.

Quadrant C(III) provides the base-currency Eurodeposit return that is achieved through hedge selection only. An example of hedge selection is the return that is achieved by entering forward transactions for a term that is different from the maturity of the normal forward term and also, therefore, different from the benchmark Eurodeposit instrument. The use of a three-month Eurodeposit benchmark defines a three-month currency hedge as the benchmark forward transaction. Any decision to hedge for a term shorter or longer than the benchmark Eurodeposit maturity would then be an active hedge decision. Thus, hedge selection reflects a yield-curve strategy relative to the Eurodeposit benchmark against which performance is measured. The value

added by hedge selection, therefore, is the difference between the Eurodeposit returns of Quadrant C(III) and Quadrant C(I).

The portion of the portfolio's added value that can be attributed to each market allocation is thus computed as

$$\begin{matrix}\text{Market}\\ \text{allocation}\\ \text{return}\end{matrix} = \left(\begin{matrix}\text{Active}\\ \text{market}\\ \text{weight}\end{matrix} - \begin{matrix}\text{Passive}\\ \text{market}\\ \text{weight}\end{matrix}\right) \times \left(\begin{matrix}\text{Passive}\\ \text{market}\\ \text{return}\\ \text{premium}\end{matrix} - \begin{matrix}\text{Index}\\ \text{market}\\ \text{return}\\ \text{premium}\end{matrix}\right)$$

The value added by each specific currency allocation is computed as

$$\begin{matrix}\text{Currency}\\ \text{allocation}\\ \text{return}\end{matrix} = \left(\begin{matrix}\text{Active}\\ \text{currency}\\ \text{weight}\end{matrix} - \begin{matrix}\text{Passive}\\ \text{currency}\\ \text{weight}\end{matrix}\right) \times \left(\begin{matrix}\text{Passive}\\ \text{Eurodeposit}\\ \text{return}\\ \text{in U.S.}\\ \text{dollars}\end{matrix} - \begin{matrix}\text{Index}\\ \text{Eurodeposit}\\ \text{return}\\ \text{in U.S.}\\ \text{dollars}\end{matrix}\right)$$

The value added by security selection within the various markets is measured as

$$\begin{matrix}\text{Market}\\ \text{security}\\ \text{selection}\end{matrix} = \begin{matrix}\text{Passive}\\ \text{market}\\ \text{weight}\end{matrix} \times \left(\begin{matrix}\text{Active}\\ \text{market}\\ \text{return}\\ \text{premium}\end{matrix} - \begin{matrix}\text{Passive}\\ \text{market}\\ \text{return}\\ \text{premium}\end{matrix}\right)$$

The portion attributable to hedge selection within the various currency exposures is

$$\begin{matrix}\text{Currency}\\ \text{hedge}\\ \text{selection}\end{matrix} = \begin{matrix}\text{Passive}\\ \text{currency}\\ \text{weight}\end{matrix} \times \left(\begin{matrix}\text{Active}\\ \text{Eurodeposit}\\ \text{return}\\ \text{in base currency}\end{matrix} - \begin{matrix}\text{Passive}\\ \text{Eurodeposit}\\ \text{return}\\ \text{in base currency}\end{matrix}\right)$$

Table 7 provides a summary of the detailed formulas for determining the contribution of active management to the total performance of a global

**TABLE 7. Summary of Calculations in Global Performance Attribution**

| Return from | Calculation | Market Quadrant Differences |
|---|---|---|
| *A. Market attribution* | | |
| Active market selection | $\sum_i \left\{ [w_i - \bar{w}_i] \left[ (\bar{r}_i - \bar{c}_i) - RP \right] \right\} + \sum_i \left[ (v_i - \bar{v}_i) RP \right]$ | Quadrant M(II) − Quadrant M(I) |
| Security selection | $\sum_i \left[ \bar{w}_i (r_i - \bar{c}_i) - \bar{w}_i (\bar{r}_i - \bar{c}_i) \right] + \sum_i \left[ \bar{v}_i (k_i - \bar{c}_i) - \bar{v}_i (\bar{c}_i - \bar{c}_i) \right]$ | Quadrant M(III) − Quadrant M(I) |
| | $= \sum_i \left[ \bar{w}_i (r_i - \bar{r}_i) \right] + \sum_i \left[ \bar{v}_i (k_i - \bar{c}_i) \right]$ | |
| Market cross-product | $\sum_i \left\{ [w_i - \bar{w}_i] \left[ (r_i - \bar{c}_i) - (\bar{r}_i - \bar{c}_i) \right] \right\} + \sum_i \left\{ [v_i - \bar{v}_i] \left[ (k_i - \bar{c}_i) - (\bar{c}_i - \bar{c}_i) \right] \right\}$ | Quadrant M(IV) − [Quadrant M(II) + Quadrant M(III)] + Quadrant M(I) |
| | $= \sum_i \left[ (w_i - \bar{w}_i)(r_i - \bar{r}_i) \right] + \sum_i \left[ (v_i - \bar{v}_i)(k_i - \bar{c}_i) \right]$ | |
| Market total | $\sum_i \left\{ \left[ w_i (r - \bar{c}_i) + v_i (k_i - \bar{c}_i) \right] - \left[ \bar{w}_i (\bar{r}_i - \bar{c}_i) \right] \right\}$ | Quadrant M(IV) − Quadrant M(I) |
| *B. Currency attribution* | | |
| Active currency selection | $\sum_i \left\{ \left[ (w_i + v_i + h_i) - (\bar{w}_i + \bar{v}_i + \bar{h}_i) \right] \left[ (\bar{c}_i + \bar{\varepsilon}_i) - c \right] \right\}$ | Quadrant C(II) − Quadrant C(I) |
| Hedge selection | $\sum_i \left\{ \left[ (\bar{w}_i + \bar{v}_i + \bar{h}_i)(c_i + \bar{\varepsilon}_i) \right] - \left[ (\bar{w}_i + \bar{v}_i + \bar{h}_i)(\bar{c}_i + \bar{\varepsilon}_i) \right] \right\}$ | Quadrant C(III) − Quadrant C(I) |
| | $= \sum_i \left[ (\bar{w}_i + \bar{v}_i + \bar{h}_i)(c_i - \bar{c}_i) \right]$ | |

**TABLE 7.** (continued)

| Return from | Calculation | Market Quadrant Differences |
|---|---|---|
| *B. Currency attribution (continued)* | | |
| Currency cross-product | $\sum_i \left\{ \left[ (w_i + v_i + h_i) - (\bar{w}_i + \bar{v}_i + \bar{h}_i) \right] \left[ (c_i + \tilde{\varepsilon}_i) - (\bar{c}_i + \bar{\varepsilon}_i) \right] \right\}$ | Quadrant C(IV) − [Quadrant C(II) + Quadrant C(III)] + Quadrant C(I) |
| | $= \sum_i \left\{ \left[ (w_i + v_i + h_i) - (\bar{w}_i + \bar{v}_i + \bar{h}_i) \right] (c_i - \bar{c}_i) \right\}$ | |
| Currency total | $\sum_i \left\{ \left[ (w_i + v_i + h_i)(c_i + \tilde{\varepsilon}_i) \right] - \left[ (\bar{w}_i + \bar{v}_i + \bar{h}_i)(\bar{c}_i + \bar{\varepsilon}_i) \right] \right\}$ | Quadrant C(IV) − Quadrant C(I) |

*Note:* Plain lower-case letters indicate portfolio weights and returns; letters with a bar over them indicate passive benchmark weights and returns.

$w_i$ = weight of country $i$ noncash assets,
$v_i$ = weight of country $i$ strategic cash assets,
$h_i$ = portion of portfolio hedged into (positive) or out of (negative) currency $i$,
$RP$ = aggregate passive benchmark local-currency return premium,
$C$ = aggregate passive benchmark Eurodeposit return, in base-currency terms,
$r_i$ = return from the noncash assets of country $i$, in local-currency terms,
$c_i$ = return from country $i$ Eurodeposits, in local-currency terms,
$\tilde{\varepsilon}_i$ = rate of change in the base currency:currency $i$ exchange rate, and
$k_i$ = return from actively managed strategic cash in country $i$, where the passive return is assumed to be the passive return from country $i$ Eurodeposits, $\bar{c}_i$.

portfolio.[12] The formulas represent differences in the quadrants defined in Figure 4. The active contributions from both market and currency management are composed of active allocation, security/hedge selection, and a cross-product that measures the interaction of the active allocation and selection decisions. Actual portfolio returns and weights are identified by plain lower-case letters, and passive benchmark returns and weights are lower-case letters with bars over them.

From Equation 9, the attribution framework treats strategic cash as part of the market allocation decision; the currency exposure that is associated with that cash is incorporated in the currency attribution. Because cash equivalents have passive return premiums at or near zero, any strategic market allocation to cash assets can enhance returns only when the passive return premium provided by the aggregate global benchmark is negative (below the cash-equivalent passive return premium).[13]

**A Comparison of Global Attribution Frameworks.** Consider a U.S.-dollar-based portfolio with an unhedged benchmark that has been invested in the markets indicated in Table 4. Table 8 summarizes the active market and currency positions of this portfolio. The portfolio overweights cash and the German market and underweights all other markets. Although the portfolio overweights the German market, it underweights German marks. The opposite is true for the U.K. equity market and sterling. Even though the Japanese market is strategically underweighted, the allocation to the yen is neutral—that is, equal to the benchmark allocation. The yen underweight that results from the market strategy is offset by hedges into yen. The active dollar weight of 10 percent is below that of the index, reflecting the net effect of an underweight of

[12] The segmentation of market and currency management ignores a relatively small term that reflects the interaction of these decisions. This term is $(1 + \varepsilon_{\$,i})(r_i - c_i) - [(1 + r_i)/(1 + c_i) - 1]$, where $r_i$ = local currency return for the portfolio, $c_i$ = local currency Eurodeposit return, and $\varepsilon_{\$,i}$ = portfolio exchange rate return. The portion of the attribution residual accounted for by this interaction is $\{[(1 + \varepsilon_{\$,i}(r_i - c_i)] - [(1 + r_i)/(1 + c_i) - 1]\} - \{[(1 + \bar{\varepsilon}_{\$,i}(\bar{r}_i - \bar{c}_i)] - [(1 + \bar{r}_i)/(1 + \bar{c}_i) - 1]\}$, where plain lower-case letters indicate portfolio returns and letters with a bar over them indicate benchmark returns. In continuously compounded terms, the interaction term reduces to $\varepsilon_{\$,i}(r_i - c_i)$, and the residual accounted for by this term is $\varepsilon_{\$,i}(r_i - c_i) - \bar{\varepsilon}_{\$,i}(\bar{r}_i - \bar{c}_i)$.

[13] This presentation generally assumes that the passive strategic cash return in any country equals the passive Eurodeposit return. The assumption is a matter of convenience and does not limit the flexibility of the proposed attribution framework. A portfolio could just as easily incorporate a Treasury bill as the strategic cash benchmark in the United States. The result would be a slightly negative strategic cash passive return premium (the T-bill return would be below the Eurodollar return).

**TABLE 8. Summary of Global Portfolio Strategy**

| | Market Strategy | | | Currency Strategy | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Country | Index Weight, $\bar{w}_i$ | Active Weight, $w_i$ | Over/ Under | Active Market Weight, $w_i$ | + | Active Cash Weight, $v_i$ | + Currency Hedge, $h_i$ | = | Currency Weight, $w_i + v_i + h_i$ | Over/ Under |
| Germany | 25.0% | 60.0% | 35.0% | 60.0% | | 0.0% | −50.0% | | 10.0% | −15.0% |
| United Kingdom | 25.0 | 10.0 | −15.0 | 10.0 | | 0.0 | 45.0 | | 55.0 | 30.0 |
| Japan | 25.0 | 10.0 | −15.0 | 10.0 | | 0.0 | 15.0 | | 25.0 | 0.0 |
| United States | 25.0 | 15.0 | −10.0 | 15.0 | | 5.0 | −10.0 | | 10.0 | −15.0 |
| Cash | 0.0 | 5.0 | 5.0 | NA | | NA | NA | | NA | NA |
| Benchmark/ portfolio | 100.0% | 100.0% | 0.0% | 95.0% | + | 5.0% | + 0.0% | = | 100.0% | 0.0% |

NA = not applicable.

the U.S. market, a small active allocation to U.S. cash, and a forward sale of dollars.

The "Currency Hedging" column indicates the currency hedge positions. This hedging information is incidental, however, because only the net cash allocations, not the sources of currency exposure, are relevant.

Table 9 summarizes the passive returns provided by the portfolio benchmark and the actual returns earned by the portfolio. The table indicates that security selection in the U.K., Japanese, and U.S. markets added value, producing local-currency market returns and return premiums in excess of the respective passive country indexes. To simplify the discussion, assume no active hedge management, such as the use of long-term forward contracts or options. Thus, the passive and actual Eurodeposit returns in U.S. dollars are equal.

The chosen portfolio strategy produced a total dollar return of 9.47 percent, 137 basis points above the benchmark.[14] This performance was the joint result of market and currency allocation strategies and security selection within each market.

Conventional global portfolio performance attribution evaluates market selection according to local market returns and currency selection in accordance with exchange rate returns. In that framework, the 8.1 percent U.S. dollar return of the benchmark can be segmented into the local currency return of 8.85 percent and the exchange rate return of −0.75 percent. Table 10 provides the results of a performance attribution of this simple portfolio based on the conventional approach.

Recall from Table 5 that Germany was the best available market alternative. Thus, overweighting of the German market should have contributed positively to portfolio performance. The conventional attribution indicates, however, that the German market strategy *reduced* the portfolio return by 0.65 percent. In fact, the data in Table 10 indicate that the total market strategy reduced returns by 1.01 percent relative to the benchmark, with only the U.S. underweight providing a positive contribution. The total currency strategy is also shown to have reduced returns, by 1.05 percent relative to the benchmark. Again from Table 5, U.K. sterling was the best currency alternative, and thus the attribution would be expected to show a positive currency contribution from the

[14] Equation 9 indicated that the portfolio return can be computed by summing the active local-currency return premiums and the active Eurodeposit returns expressed in base-currency terms. The "market return" of this portfolio would be $\Sigma[w_i(r_i - c_i) + v_i(k_i - c_i)]$, or 1.58 percent. The "currency return" would be $\Sigma[(w_i + v_i + h_i)(c_i + \varepsilon_{n,i})]$, or 7.89 percent. Adding these two continuously compounded components of the global portfolio's return provides the total portfolio return of 9.47 percent.

**TABLE 9. Summary of Global Portfolio Returns**

| | Passive Returns | | | | | Actual Returns | | |
|---|---|---|---|---|---|---|---|---|
| Country | Local Market Return | Local Eurodeposit Return | Exchange Rate Return | Local-Market Return Premium | Eurodeposit Return in U.S. Dollars | Local Market Return | Local-Market Return Premium | Eurodeposit Return in U.S. Dollars |
| Germany | 7.00% | 5.00% | 1.00% | 2.00% | 6.00% | 6.80% | 1.80% | 6.00% |
| United Kingdom | 10.50 | 11.25 | −3.00 | −0.75 | 8.25 | 12.25 | 1.00 | 8.25 |
| Japan | 9.50 | 9.00 | −1.00 | 0.50 | 8.00 | 10.50 | 1.50 | 8.00 |
| United States | 8.40 | 7.50 | 0.00 | 0.90 | 7.50 | 9.00 | 1.50 | 7.50 |
| U.S. cash | 7.50 | 7.50 | 0.00 | 0.00 | 7.50 | 8.00 | 0.50 | 7.50 |
| Benchmark/ portfolio | 8.85 | 8.19 | −0.75 | 0.66 | 7.44 | 8.11 | 1.58 | 7.89 |

*Note:* Continuously compounded rates of return.

**TABLE 10. Conventional Value-Added Performance Attribution**
(percents)

| Country | Market Selection | Currency Selection | Security Selection | Total |
|---|---|---|---|---|
| Germany | −0.65 | −0.26 | −0.12 | −1.03 |
| | (0.60 − 0.25)(7.00% − 8.85%) | (0.10 − 0.25)[1.00% − (−0.75%)] | 0.60(6.80% −7.00%) | |
| United Kingdom | −0.25 | −0.68 | 0.18 | −0.75 |
| | (0.10 − 0.25)(10.50% − 8.85%) | (0.55 − 0.25)[− 3.00% − (− 0.75%)] | 0.10(12.25% − 10.50%) | |
| Japan | −0.10 | 0.00 | 0.10 | 0.00 |
| | (0.10 − 0.25)(9.50% − 8.85%) | (0.25 − 0.25)[− 1.00% − (−0.75%)] | 0.10(10.50% − 9.50%) | |
| United States | 0.05 | −0.11 | 0.09 | 0.02 |
| | (0.15 − 0.25)(8.40% − 8.85%) | (0.10 − 0.25)[0.00% − (−0.75%)] | 0.15(9.00% − 8.40%) | |
| U.S. cash | −0.07 | NA | 0.03 | −0.04 |
| | (0.05 − 0.00)(7.50% − 8.85%) | | 0.05(8.00% − 7.50%) | |
| Unexplained | NA | NA | NA | 3.16 |
| Total | −1.01 | −1.05 | 0.27 | 1.37 |

*Note:* Continuously compounded rates of return. Totals may not sum because of rounding.

NA = not applicable.

sterling overweight. The conventional attribution computes a *negative* contribution, however, of 0.68 percent. Security selection does show a positive effect, a contribution of 0.27 percent extra return.[15] In summary, the incentive provided by the conventional attribution framework would have been to invest in the worst market and the worst currency.

In fact, the superior performance of this portfolio relative to the benchmark is unexplained by the conventional framework, which cannot account for 3.16 percent of the return of the portfolio relative to the benchmark. The magnitude of the unexplained term reflects the effect of hedging marks into sterling and yen. The unexplained portion of the added value attribution can be computed by weighting each Eurodeposit rate with the respective hedge weight: 3.16 percent = [−0.50(5.00 percent) + 0.45(11.25 percent) + 0.15(9.00 percent) − 0.10(7.50 percent)]. The portfolio maintained a 50 percent hedge out of marks (giving up the local cash return of 5 percent), hedged 45 percent into sterling and 15 percent into yen (gaining the higher local cash returns of 11.25 percent and 9 percent, respectively), and hedged 10 percent out of the dollar (giving up the 7.5 percent cash return).

Use of a currency benchmark that is different from the market benchmark presents a similar and systematic problem of unaccountable performance. A common but extreme example would involve a fully hedged benchmark. In effect, market and currency benchmark differences involve passive forward positions. The conventional attribution framework simply forces these passive forward hedges into the residual. Because the proposed methodology considers currency exposures to be exposures to global cash markets, it accounts for passive forward hedges naturally.

The perverse results of conventional attribution result from focusing on local currency and exchange rate returns while ignoring the interest rate differentials that were actually responsible for a significant portion of the active performance.

The proposed methodology eliminates the unexplained term by accounting for the Eurodeposit returns underlying forward exchange rates as an explicit factor in the currency-selection process and removing that effect from the market-selection process. Table 11 provides the results of the proposed attribution procedure according to the formulas provided in Table 7.

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[15] In the conventional and proposed attribution systems, we have used a common convention of combining security selection and the market cross-product. The resulting computation involves the actual market weight rather than the passive weight. This procedure is trivial with respect to the comparison of attribution approaches because the security selections and cross-products are identical.

**TABLE 11. Proposed Value-Added Performance Attribution**
(percents)

| Country | Market Selection | Currency Selection | Security Selection | Total |
|---|---|---|---|---|
| Germany | 0.47 | 0.22 | −0.12% | 0.56% |
| | (0.60 − 0.25)(2.00% − 0.66%) | (0.10 − 0.25)(6.00% − 7.44%) | 0.60(1.80% − 2.00%) | |
| United Kingdom | 0.21 | 0.24 | 0.18 | 0.63 |
| | (0.10 − 0.25)(−0.75% − 0.66%) | (0.55 − 0.25)(8.25% − 7.44%) | 0.10(1.00% + 0.75%) | |
| Japan | 0.02 | 0.00 | 0.10 | 0.12 |
| | (0.10 − 0.25)(0.50% − 0.66%) | (0.25 − 0.25)(8.00% − 7.44%) | 0.10(1.50% − 0.50%) | |
| United States | −0.02 | −0.01 | 0.09 | 0.06 |
| | (0.15 − 0.25)(0.90% − 0.66%) | (0.10 − 0.25)(7.50% − 7.44%) | 0.15(1.50% − 0.90%) | |
| U.S. cash | −0.03 | NA | 0.03 | −0.01 |
| | (0.05 − 0.00)(0.00% − 0.66%) | | 0.05(0.50% − 0.00%) | |
| Unexplained | NA | NA | NA | 0.00 |
| Total | 0.65 | 0.45 | 0.27 | 1.37 |

*Note:* Continuously compounded rates of return. Totals may not sum because of rounding.

NA = not applicable.

The contribution from market allocation is indicated to be positive, adding 65 basis points to the portfolio return. The positive effects of the decisions to overweight Germany and underweight the United Kingdom are captured, consistently with the data in Table 5. The same observations can be made about the German mark underweight and sterling overweight. The absence of a residual indicates that this system accounts for the effects of all of the decisions that combined to produce the portfolio return of 9.47 percent.

Although the framework is designed to account for currency exposures within global portfolios, perhaps the most interesting results are with regard to the market allocation decision. Correct attribution of the performance contribution of currency allocations places crucial but identifiable constraints on the attribution to market decisions.

The conventional and proposed attribution systems indicate that considering global returns in terms of local currency and exchange rate returns does not provide an adequate basis for market and currency strategy decisions that will jointly produce optimal performance.[16] Existing systems of market and currency performance attribution are potentially perverse in this regard. The proposed attribution system focuses on the return components that provide an accurate distinction between market and currency alternatives.

**Summary.** This section has presented a general methodology for performance attribution. The approach corrects the remaining problems in the attribution literature by providing unambiguous measures of both market and currency returns in global portfolios. In particular, the attribution shows clearly the dangers inherent in using either local currency or unhedged return in evaluating market returns that are available to investors.

The proposed framework offers several advantages over attribution systems that are currently in use. First, the framework is conceptually valid, which allows a pure segmented evaluation of market and currency decisions according to variables that managers can, in fact, control. Second, it applies to any

[16] Allen (1991) recognized the important impact that forward contracts have on performance attribution. Although his approach accounts for the impact of both passive and active hedge decisions, it does so only at the portfolio level because of the perceived complexity of forward currency transactions. Also, his system confounds market and currency effects by using unhedged returns to measure the effects of market selection. An unhedged market-selection criterion, as we demonstrated in Section 1, can lead to suboptimal market decisions and suboptimal portfolio returns. Ankrim and Hensel (1992) had similar problems in specifying a market effect that is free of currency influences. Like Allen, however, they specified the currency effect correctly.

benchmark currency position, whether unhedged, partially hedged, or fully hedged. Third, it can be applied to portfolios in any base currency. Fourth, by breaking returns into elemental components, it allows attribution for portfolios that use derivatives and synthetics. Finally, and most importantly, it provides the correct incentives to the market and currency managers, thereby assuring that the decisions of each can work in concert to maximize the performance of the portfolio.

This section considered a performance attribution for a single period for a hypothetical portfolio, in order to demonstrate the methodology and to highlight some of the pitfalls of conventional attribution procedures. Sections 3 and 4 apply the attribution framework to actual global equity, global bond, and global balanced portfolios.

## 3. Interpretation of Global Performance Attributions

This section contains evaluations of the performance of two global portfolios. It involves a detailed analysis of inputs and a thorough interpretation of the attribution results. To clarify the appropriateness of the proposed performance attribution framework, the results are contrasted with those generated by conventional attribution methods.

**A Global Equity Portfolio, 1989.** This example considers the performance of a U.S.-dollar-based global equity portfolio during a period when direct hedging in the portfolio was minimal but active currency management was nevertheless significant.

Table 12 shows the performance attribution results for the calendar year of 1989. The output is divided into two sections; Part A is a summary of returns attributable to the components of the portfolio return, and Part B presents the detailed data for the specific markets and currencies that were used in the attribution.

The benchmark for this portfolio was the MSCI World Equity (Free) Index. The individual market returns have been adjusted for the withholding taxes that are appropriate for a U.S.-based investor. The base currency was the U.S. dollar. The benchmark total return was 16.97 percent. The portfolio earned a total return of 24.63 percent, producing 7.66 percent of added value through active management.

Of this added value, market selection cost 75 basis points, primarily reflecting a negative contribution from a strategic cash position. Currency selection added 563 basis points, largely through an underweighting of the Japanese yen and overweighting of the U.S. dollar. Stock selection within the various markets contributed 165 basis points. Differences between the ex-

**TABLE 12. Global Equity Portfolio, 1989**
(base currency = U.S. dollar)

| | | |
|---|---|---|
| *A. Portfolio performance summary* | | |
| MSCI Global Equity Index | | 16.97% |
| Market selection | −0.75% | |
| Currency selection | 5.63 | |
| Security selection | 1.65 | |
| Exchange rate differences | −0.03 | |
| Intramonth effect | 1.16 | |
| Total value added | | 7.66% |
| Global equity portfolio | | 24.63% |

*B. Attribution of added value (basis points)*

| Country | Market Selection | Currency Selection | Security Selection | Total |
|---|---|---|---|---|
| Australia | −8 | 11 | 19 | 22 |
| Austria | −6 | −2 | 0 | −8 |
| Belgium | −16 | 19 | 2 | 5 |
| Canada | −8 | 19 | 5 | 16 |
| Denmark | −3 | −4 | 0 | −7 |
| Finland | 1 | −1 | 0 | 0 |
| France | −5 | −9 | 20 | 6 |
| Germany | 29 | 22 | 6 | 57 |
| Hong Kong | 3 | −1 | −7 | −6 |
| Italy | 17 | −21 | 0 | −4 |
| Japan | 89 | 297 | 25 | 411 |
| Netherlands | 14 | 14 | 11 | 39 |
| New Zealand | −34 | 4 | 13 | −17 |
| Norway | −3 | −2 | 0 | −5 |
| Singapore | 2 | 1 | −5 | −2 |
| Spain | −25 | 22 | 19 | 16 |
| Sweden | −3 | −3 | 0 | −7 |
| Switzerland | 16 | 18 | −8 | 26 |
| United Kingdom | 21 | 4 | 22 | 47 |
| United States | 30 | 173 | 43 | 246 |
| Cash | −185 | NA | 0 | −185 |
| Subtotal | −75 | 563 | 165 | 653 |
| Exchange rate differences | | | | −3 |
| Intramonth effect | | | | 116 |
| Total active contribution | | | | 766 |

*Note:* Totals may not sum because of rounding.

NA = not applicable.

change rates used by MSCI to compute index returns and those used to value the portfolio generated a 3-basis-point discrepancy, a transitory valuation factor that is beyond the manager's control. Finally, a residual of 116 basis points reflects primarily the impact of intramonth changes in market and currency allocations. The intramonth residual arises because the specific timing of intramonth changes in strategies was ignored and beginning-of-month weights were used to reflect asset allocations throughout the month. These aggregate contributions reflect the combined effect of active strategies applied among and within individual markets and among currencies.[17]

Table 13 summarizes the average active market and currency strategies for the year. This information is useful for identifying the basic structure of the strategies that produced the performance shown in Table 12. Average weights and returns across multiple valuation periods can be misleading, however, by masking active market and currency changes that occurred during the period. Thus, these summary data should be viewed as only a rough indication of portfolio strategy during the period; they become more tenuous as the attribution horizon lengthens.

The market and currency strategies are specified as deviations from the normal investment policy, as given by the benchmark weights. This specification is a generally accepted interpretation of market strategies but is often not applied to the evaluation of currency strategies. Instead, many incorrectly assume that active currency management is synonymous with currency hedging. This portfolio maintained a significant underweight in Japanese yen relative to the benchmark, however, and a significant overweight in U.S. dollars, even though currency hedging was relatively insignificant. Notice, for example, that the active currency weights are similar to the market strategy weights; an explicit decision was made to accept the currency over- and underweights that resulted from the market strategy. As in the hypothetical portfolio in Section 2, a neutral yen strategy would have required hedging into the yen to offset the underweight that was derived from holding a below-benchmark allocation to Japanese equities. In summary, the lack of currency hedging in this portfolio resulted in active currency strategies.

Table 14 shows the average hedge positions maintained in this global equity portfolio for the year. The small hedge from yen into U.S. dollars reflects a

[17] As indicated in the first section, a manager can allocate among currencies and, by using different forward terms, add value through hedge selection. Because active hedge selection was not a major consideration in the management of this portfolio (or the global bond portfolio that follows), we have simplified the attribution by assuming that passive currency hedges were used. Thus, the attribution results have no accounting for active hedge selection.

**TABLE 13. Global Equity Portfolio: Average Market and Currency Strategies, 1989**
(base currency = U.S. dollar)

| | Market-Selection Summary | | | | | | Currency-Selection Summary | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Market Weight | | | Return Premium | | | Average Currency Weight | | | Eurodeposit Return in U.S. Dollars |
| Country | Passive | Active | Difference | Passive | Active | Difference | Passive | Active | Difference | (passive) |
| Australia | 1.44% | 2.09% | 0.65% | 0.98% | 8.82% | 7.85% | 1.44% | 2.09% | 0.65% | 9.11% |
| Austria | 0.13 | 0.00 | −0.13 | 82.16 | NA | NA | 0.13 | 0.00 | −0.13 | 12.53 |
| Belgium | 0.64 | 2.14 | 1.50 | 3.27 | 4.31 | 1.04 | 0.64 | 2.14 | 1.50 | 13.94 |
| Canada | 2.70 | 3.83 | 1.13 | 7.89 | 10.15 | 2.26 | 2.70 | 3.83 | 1.13 | 15.56 |
| Denmark | 0.33 | 0.00 | −0.33 | 26.92 | NA | NA | 0.33 | 0.00 | −0.33 | 13.68 |
| Finland | 0.05 | 0.00 | −0.05 | −1.46 | NA | NA | 0.05 | 0.00 | −0.05 | 15.09 |
| France | 2.75 | 2.51 | −0.24 | 19.31 | 26.15 | 6.84 | 2.75 | 2.51 | −0.24 | 14.25 |
| Germany | 2.97 | 4.94 | 1.97 | 30.96 | 33.31 | 2.35 | 2.97 | 5.10 | 2.13 | 11.93 |
| Hong Kong | 0.77 | 0.59 | −0.18 | −1.48 | −12.08 | −10.60 | 0.77 | 0.59 | −0.18 | 10.01 |
| Italy | 1.49 | 0.00 | −1.49 | 3.29 | NA | NA | 1.49 | 0.00 | −1.49 | 15.84 |
| Japan | 41.96 | 14.86 | −27.10 | 11.46 | 13.66 | 2.20 | 41.96 | 12.77 | −29.19 | −8.75 |
| Netherlands | 1.40 | 3.00 | 1.61 | 21.57 | 25.67 | 4.10 | 1.40 | 3.01 | 1.61 | 12.12 |
| New Zealand | 0.16 | 1.61 | 1.45 | 4.01 | 11.06 | 7.05 | 0.16 | 1.61 | 1.45 | 7.43 |
| Norway | 0.24 | 0.00 | −0.24 | 31.46 | NA | NA | 0.24 | 0.00 | −0.24 | 11.13 |
| Singapore | 0.58 | 0.33 | −0.25 | 31.13 | 22.11 | −9.02 | 0.58 | 0.33 | −0.25 | 8.47 |
| Spain | 0.99 | 2.18 | 1.19 | −6.79 | 2.71 | 9.50 | 0.99 | 2.18 | 1.19 | 17.76 |
| Sweden | 0.39 | 0.00 | −0.39 | 26.92 | NA | NA | 0.39 | 0.00 | −0.39 | 10.27 |
| Switzerland | 1.14 | 2.78 | 1.64 | 23.36 | 19.58 | −3.78 | 1.14 | 3.53 | 2.38 | 3.66 |
| United Kingdom | 8.26 | 10.20 | 1.94 | 20.31 | 22.50 | 2.19 | 8.26 | 10.40 | 2.14 | 1.66 |
| United States | 31.61 | 35.13 | 3.52 | 19.69 | 21.51 | 1.82 | 31.61 | 49.91 | 18.30 | 9.76 |
| Cash | 0.00 | 13.79 | 13.79 | 0.00 | 0.00 | 0.00 | NA | NA | NA | NA |
| Benchmark/portfolio | 100.00% | 100.00% | 0.00% | 15.20% | 16.31% | 1.11% | 100.00% | 100.00% | 0.00% | 1.38% |

*Note:* Totals may not sum because of rounding.
NA = not applicable.

**TABLE 14. The Global Equity Portfolio's Average Currency Hedges, 1989**

| Country | Currency Hedges |
|---|---|
| Australia | 0.00% |
| Austria | 0.00 |
| Belgium | 0.00 |
| Canada | 0.00 |
| Denmark | 0.00 |
| Finland | 0.00 |
| France | 0.00 |
| Germany | 0.00 |
| Hong Kong | 0.00 |
| Italy | 0.00 |
| Japan | −2.57 |
| Netherlands | 0.00 |
| New Zealand | 0.00 |
| Norway | 0.00 |
| Singapore | 0.00 |
| Spain | 0.00 |
| Sweden | 0.00 |
| Switzerland | 0.00 |
| United Kingdom | 0.00 |
| United States | 2.57 |
| Total | 0.00% |

range forward that was executed with options on futures contracts. As profits (losses) were realized on the option positions, U.S. dollar cash was realized in the margin account and reflected as an increase (decrease) in the portfolio's cash allocation. Other differences between the active market weights and active currency weights reflect strategic allocations to cash in each currency.

The hedges shown in Table 14 are provided to aid in the interpretation of the attribution data; they are not necessary for attribution purposes. As Equation 9 showed, only the total currency weights in Table 13 are relevant.

Interpretation of the market-selection contribution to this portfolio's performance is based on the efficacy of relative return-premium allocations. The return premium of the MSCI World Equity benchmark was an extraordinary 15.2 percent, computed as the weighted-average local-currency total return of each market above the local three-month Eurodeposit return. An active overweight (underweight) in any equity market that had a passive return

premium greater (less) than 15.2 percent added value to the global equity portfolio. Conversely, an overweight (underweight) in any market that had a passive return premium less (greater) than the passive benchmark return premium of 15.2 percent detracted from the portfolio's performance. Summing all of the contributions from each individual market strategy shows that the total contribution from market selection was negative 75 basis points.

Table 12 suggests that the primary market-selection contribution to portfolio performance came from the allocation to the Japanese market. Table 13 shows that a large (27.1 percent) underweight of Japanese equities, which had a passive return premium of 11.46 percent, resulted in this contribution. Although the Japanese return premium was only slightly below that of the benchmark, the magnitude of the underweight produced a large contribution to the differential between portfolio and benchmark total returns.

This added value was more than offset, however, by the effect of a large overweight (13.79 percent) of cash. The passive cash return premium of zero was significantly below that of the benchmark for the portfolio. The benchmark for cash in this portfolio was the return to three-month Eurodeposits. Therefore, and by definition, the passive cash return premium is zero.

Although the interpretation of the effect of the total market allocation is relatively straightforward, the interpretation of the individual market contributions can become complicated. In this example, should the Japanese equity underweight be interpreted as a positive contributor to performance? What if the manager had a negative view toward Japan but no strong views on any other markets? Underweighting of Japan requires overweighting of some other markets. To the extent, for example, that this global equity portfolio maintained the cash overweight as a substitute for Japanese equities, would the appropriate interpretation be that the Japanese equity decision, reflecting the combined negative contribution of the cash overweight and positive effect of the Japanese equity underweights, was a hindrance to portfolio performance?

The point is that an underweight of one market requires the overweight of another market. The individual market contributions, even though they are directly calculable, are inseparable portfolio decisions.[18] In the final analysis, at the level of the individual markets, interpretation of performance attribution requires an understanding of the motivation behind each of the active market allocations. Typically, only the investment manager has that information; others should be wary of interpretating attributions to individual markets.

[18] Section 4 addresses some of the difficulties that arise in interpreting these individual market contributions by establishing a tiered attribution framework.

The column of currency-selection contributions in Table 12 is based on a comparison of each country's passive three-month Eurodeposit return in U.S. dollars with the 1.38 percent passive U.S.-dollar-denominated three-month Eurodeposit return of the benchmark. The benchmark Eurodeposit return is computed by applying the passive currency (market) weights to the U.S. dollar Eurodeposit returns in each country. The only Eurodeposit return in Table 13 that was below that of the benchmark was Japan (–8.75 percent). Thus, a productive portfolio currency strategy would have involved an underweight of the Japanese yen and overweights of any other currency. In fact, this portfolio did maintain its largest currency underweight in yen; although other small underweights existed, each paled in comparison with the yen underweight. The largest currency overweight was in the U.S. dollar.

Keeping in mind the reservations about interpreting individual effects, Table 12 indicates that the underweight of yen and the U.S. dollar overweight were largely responsible for the positive effect of currency strategy. Summing the contributions of each active currency decision indicates a total currency-selection contribution of 563 basis points. Even though explicit currency hedging was minimal in this portfolio, active currency selection was the largest contributor to portfolio performance. Currency hedges per se are not the sole indicators of active currency decisions. Net currency over- and underweights relative to the benchmark are active decisions regardless of their source.

Security selection is based on the difference between the active return premium in each country and the passive return premium specified by the benchmark in each country. Because the Eurodeposit returns underlying the active and passive return-premium computations are identical, however, the computation of the returns from security selection using local currency returns is equivalent to using return premiums.[19]

The interpretation of security selection within markets is no different for global than it is for domestic portfolios. Selection of securities in any market that results in above-benchmark performance during the evaluation period adds to the value of the portfolio. As explained in the second section, the cross-product of market- and security-selection decisions is combined into the security-selection effect through the use of active market weights in determining the

[19] The computations reflect periodic rather than continuously compounded returns; therefore, the differences in return premiums do not quite equal the differences in local currency returns. The discrepancy is small, however, and has no meaningful impact on the interpretation of attribution results.

contribution of security selection to the portfolio. Security selection added value in almost every market in this global equity portfolio.

This example demonstrates that the proposed framework applies to any multicurrency portfolio regardless of whether hedging is used. If hedging is prohibited, however, independent market and currency strategies are not possible. Instead, the market and currency strategies will be identical and the currency effects will become an integral part of the market decision. The combined market allocation effect is identical to the method outlined by Brinson and Fachler (1985). Without authority to hedge, the consideration of exchange rates and short-term interest rates becomes irrelevant and the analysis can be completed in base-currency terms. In that regard, segmentation of market and currency effects as shown in Table 12 would indicate the opportunity cost of a policy to restrict hedging.

**A Global Bond Portfolio, 1992.** Unlike the example global equity portfolio, this attribution example considers the performance of a portfolio for which hedging activity and active currency strategy were significant throughout the evaluation period.

Table 15 shows performance attribution results for a global bond portfolio for the 1992 calendar year. The portfolio outperformed the Salomon Brothers World Government Bond Index benchmark's total return of 5.53 percent by 3.56 percent, producing a total return of 9.09 percent. The portfolio benefited from positive contributions from market, currency, and security selection. Exchange rate differences between the exchange rates within the Salomon Index and those used to value the global bond portfolio reduced the portfolio total return relative to the benchmark by 16 basis points for the year. Finally, the intramonth effect was −0.09 percent.

Table 15 shows the contributions from active strategies among and within individual markets and among currencies. The average active market and currency strategies for the year are summarized in Table 16. On average, above-normal allocations to markets with return premiums above the 3.77 percent return premium of the benchmark would have added value to the portfolio. Note, however, that market and currency strategies changed significantly during 1992 and, therefore, the summary data can be misleading. Table 16 masks the month-to-month market allocations that added to the portfolio total return.

Canada is a case in point. Given the relatively low average return premium for the Canadian bond market during the year (2.47 percent versus 3.77 percent for the benchmark), overweighting the Canadian bond market would appear to have been a deterrent to portfolio performance. In fact, however, an over-

**TABLE 15. Global Bond Portfolio, 1992**
(base currency = U.S. dollar)

*A. Portfolio performance summary*

| | | |
|---|---|---|
| Salomon Brothers World Government Bond Index | | 5.53% |
| Market selection | 0.24% | |
| Currency selection | 3.09 | |
| Security selection | 0.48 | |
| Exchange rate differences | −0.16 | |
| Intramonth effect | −0.09 | |
| Total value added | | 3.56% |
| Global bond portfolio | | 9.09% |

*B. Attribution of added value (basis points)*

| Country | Market Selection | Currency Selection | Security Selection | Total |
|---|---|---|---|---|
| Australia | 1 | 5 | 0 | 6 |
| Belgium | −7 | 14 | 1 | 9 |
| Canada | 39 | 1 | −10 | 31 |
| Denmark | −14 | 18 | 9 | 14 |
| France | −1 | 16 | −24 | −9 |
| Germany | 17 | 33 | 18 | 68 |
| Italy | −5 | 47 | 0 | 41 |
| Japan | −23 | −16 | −14 | −53 |
| Netherlands | 13 | 6 | 7 | 26 |
| Spain | −5 | −28 | 2 | −31 |
| Sweden | −4 | 23 | 0 | 19 |
| Switzerland | 1 | −3 | 0 | −2 |
| United Kingdom | −10 | 68 | 4 | 62 |
| United States | 19 | 124 | 53 | 196 |
| Cash | 3 | NA | 0 | 3 |
| Subtotal | 24 | 309 | 48 | 381 |
| Exchange rate differences | | | | −16 |
| Intramonth effect | | | | −9 |
| Total active contribution | | | | 356 |

*Note:* Totals may not sum because of rounding.

NA = not applicable.

**TABLE 16. Global Bond Portfolio: Average Market and Currency Strategies, 1992**
(base currency = U.S. dollar)

| | Market-Selection Summary | | | | | | Currency-Selection Summary | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Market Weight | | | Return Premiums | | | Average Currency Weight | | | Eurodeposit Returns in U.S. Dollars |
| Country | Passive | Active | Difference | Passive | Active | Difference | Passive | Active | Difference | (passive) |
| Australia | 0.79% | 0.00% | −0.79% | 2.82% | NA | NA | 0.79% | 0.00% | −0.79% | −3.25% |
| Belgium | 0.87 | 0.55 | −0.32 | −4.07 | −3.67 | 0.41 | 0.87 | 0.55 | −0.32 | 3.52 |
| Canada | 3.82 | 5.44 | 1.62 | 2.47 | 3.91 | 1.44 | 3.82 | 7.33 | 3.51 | −2.81 |
| Denmark | 1.36 | 3.44 | 2.08 | −2.53 | −1.79 | 0.74 | 1.36 | 0.74 | −0.62 | 4.29 |
| France | 6.03 | 10.41 | 4.38 | 0.23 | −1.79 | −2.02 | 6.03 | 5.27 | −0.76 | 3.88 |
| Germany | 10.04 | 16.02 | 5.98 | 2.52 | 3.62 | 1.10 | 10.04 | 6.89 | −3.15 | 3.27 |
| Italy | 1.49 | 0.00 | −1.49 | −7.04 | NA | NA | 1.49 | 0.00 | −1.49 | −10.87 |
| Japan | 18.31 | 6.50 | −11.81 | 5.60 | 3.86 | −1.75 | 18.31 | 8.82 | −9.50 | 5.00 |
| Netherlands | 3.89 | 11.61 | 7.72 | 4.63 | 5.19 | 0.56 | 3.89 | 3.77 | −0.13 | 3.60 |
| Spain | 0.35 | 1.60 | 1.25 | −6.49 | −8.49 | −2.00 | 0.35 | 0.49 | 0.14 | −3.94 |
| Sweden | 0.31 | 0.00 | −0.31 | −4.36 | NA | NA | 0.31 | 0.00 | −0.31 | −10.63 |
| Switzerland | 0.18 | 0.00 | −0.18 | 2.34 | NA | NA | 0.18 | 0.00 | −0.18 | 0.54 |
| United Kingdom | 5.67 | 2.07 | −3.60 | 6.87 | 5.79 | −1.08 | 5.67 | 1.38 | −4.30 | −10.20 |
| United States | 46.89 | 42.43 | −4.46 | 3.00 | 4.09 | 1.10 | 46.89 | 64.78 | 17.89 | 4.09 |
| Cash | 0.00 | −0.07 | −0.07 | 0.00 | 0.00 | 0.00 | NA | NA | NA | NA |
| Total portfolio | 100.00% | 100.00% | 0.00% | 3.77% | 4.52% | 0.75% | 100.00% | 100.00% | 0.00% | 1.79% |

*Note:* Totals may not sum because of rounding.

NA = not applicable.

weight early in 1992 and an underweight later in the year captured an early high return premium and avoided poor performance in late 1992. Consequently, the Canadian bond market strategy added 39 basis points to the value of the portfolio. Even though these types of summary data are commonly reported and are useful, they are not a substitute for a comprehensive report of active portfolio strategies and implementation. The *aggregate* effects of market, currency, and security selection, however, are unambiguous.

Among the market allocation decisions, positive contributors included the active overweighting then underweighting of Canada, the (essentially) neutral weighting in the beginning of the year followed by a late-year overweighting of Germany, the consistent overweighting of the Netherlands, and the early neutral weighting then late underweighting of the United States. Consistent underweighting of the Japan and U.K. markets detracted from performance.

A small net short cash position at the year-end valuation date added three basis points to the value of the portfolio. This cash position resulted from small forward-contract losses that generated an unrealizable "negative cash" allocation. Any forward-contract gains outstanding at the time of portfolio valuation would be unrealizable gains reflected as a "positive cash" holding. The previously discussed global equity portfolio attribution had no unrealizable gains or losses because that portfolio's currency hedges were implemented through options on futures. Futures and options on futures are marked to market daily, so gains and losses are realized daily and either reinvested or met through a margin call.

Table 17 shows the average hedge positions maintained in this global bond portfolio during the year. The active currency strategy resulted from the bond market allocations combined with these portfolio currency hedges. Even though the portfolio was overweighted in many continental European bond markets, it was underweighted in all of these currencies except the Spanish peseta. Also, hedges into the U.S. dollar totaling 22.34 percent transformed a moderate currency underweight implied by the U.S. bond market strategy into the significant average overweight, 17.89 percent, shown in Table 16.

In contrast to the global equity portfolio presented earlier, currency hedges were a means of achieving desired currency strategy in this global bond portfolio. During the year, the magnitudes of these hedges were increased as U.S. dollar cash became increasingly undervalued relative to European cash in U.S. dollar terms. When the Exchange Rate Mechanism stumbled in September 1992, major currency realignments, involving the pound sterling in particular, generated significant portfolio gains relative to the benchmark. The aggregate currency strategy added 309 basis points to the portfolio's return during the year.

**TABLE 17. The Global Bond Portfolio's Average Currency Hedges, 1992**

| Country | Currency Hedges |
|---|---|
| Australia | 0.00% |
| Belgium | 0.00 |
| Canada | 1.89 |
| Denmark | −2.70 |
| France | −5.14 |
| Germany | −9.13 |
| Italy | 0.00 |
| Japan | 2.31 |
| Netherlands | −7.84 |
| Spain | −1.11 |
| Sweden | 0.00 |
| Switzerland | 0.00 |
| United Kingdom | −0.69 |
| United States | 22.34 |
| Total | −0.07% |

Finally, value added through security selection is based on active yield-curve, quality, and sector strategies within the various markets. The active return premiums of the portfolio's U.S. component provided most of the positive security-selection effect. The dominance of the U.S. market's security-selection contribution is a function of that component's superior performance and the large weighting, 42.43 percent, of the active U.S. bond market.

This portfolio example indicates the importance of using the correct attribution framework when large currency hedges are in place. An attribution based on the conventional framework not only gave misleading information on market and currency effects but also resulted in a –173-basis-point residual, over 48 percent of the total added value provided by active portfolio management.

The conventional attribution framework creates an incentive to invest in countries with high short-term interest rates and to hedge the resulting currency exposures. This problem can be especially important in attributing added value to emerging markets, which tend to offer high market and cash returns to offset the ravages of relatively high inflation. Conventional attribution frameworks, by overstating the available market returns, would have shown strong market-selection incentives for investing in countries such as Mexico in the early 1980s and Eastern Europe in the early 1990s. Moreover, hedging

against the depreciation of the currencies of such countries would also appear advantageous in the conventional framework, whereas in reality, the high cost of hedging that results from high local short-term interest rates would largely offset the apparent benefits.

**Summary.** Portfolio performance attributions require a framework that parallels the investment decision-making process by allocating responsibility for performance among factors that can be controlled by the investment manager. Currency strategy can be isolated from the market strategy, but only when controllable and separable variables are used to represent each decision. The basic element underlying market decisions and, therefore, market-selection attributions are the return premiums of each market relative to the return premium of the benchmark. The bases for attributions to currency decisions and currency selection are global Eurodeposit returns expressed in the investor's base currency.

Because of the importance of investment policy mandates and the dynamic nature of market and currency allocations, the interpretation of attribution results requires a thorough understanding of the strategies in use during the period in question and the motivation for those strategies.

## 4. Global Balanced Portfolios

Broadly based global balanced portfolios that include multicurrency investments in stocks, bonds, and cash are the ultimate test of a global analytical framework. A number of critical issues that are not always evident in the analysis of global equity or global bond portfolios become prominent when equity and bonds are combined in the portfolio. For example, active market and currency strategies are ultimately relevant only at the level of the aggregate portfolio. Bond and equity management are often separated among different managers, however, and the effect on the portfolio of active decisions at the component level may not be evident. Performance attribution that separates the effects of the asset allocation decision—that is, separates the portions of the portfolio that are assigned to various managers—from the effects of the investment expertise of each manager within each specific assignment is clearly necessary.

Currency management in global balanced portfolios can be particularly challenging. Currency exposures are affected by market and currency decisions within the non-U.S.-equity and non-U.S.-bond components as well as by asset allocation decisions that affect the portfolio's exposure to the broad classes of foreign assets. This section addresses these unique issues that arise in the management and performance evaluation of global balanced portfolios.

**The Multiple-Asset Problem.** A common approach to asset allocation within global balanced portfolios is first to allocate funds among broad U.S.-equity, non-U.S.-equity, U.S.-bond and non-U.S.-bond asset classes. Subsequent allocations within each of these asset classes reflect relative valuations within the markets of the various countries. While this approach can produce optimal strategies within each asset class, it can lead to unintended and even perverse market and currency strategies for the total global portfolio.

Consider a global balanced portfolio that has normal allocations to U.S. equities of 50 percent, non-U.S. equities of 17 percent, U.S. bonds of 20 percent, non-U.S. bonds of 8 percent, and U.S.-dollar-denominated cash equivalents of 5 percent. Assume that the portfolio strategically underweights global equities and overweights global bonds and cash to provide the following asset-class strategy:

| | *Normal* | *Portfolio* | *Strategy* |
|---|---|---|---|
| U.S. equity | 50.0% | 25.0% | −25.0% |
| Non-U.S. equity | 17.0 | 6.0 | −11.0 |
| U.S. bonds | 20.0 | 34.0 | +14.0 |
| Non-U.S. bonds | 8.0 | 25.0 | +17.0 |
| Cash | 5.0 | 10.0 | +5.0 |

The portfolio strategy involves a large non-U.S.-equity underweight and a large non-U.S.-bond overweight. The non-U.S.-equity manager is provided with 6 percent of the aggregate portfolio to manage against a non-U.S.-equity benchmark; the non-U.S.-bond manager is provided with 25 percent of the portfolio to manage against a non-U.S.-bond benchmark. Both of the non-U.S. managers are charged with and perform in a manner that is consistent with beating their individual benchmarks.

The non-U.S.-equity manager is particularly attracted to the U.K. equity market and allocates 60 percent of the non-U.S.-equity portfolio to that market, roughly twice its weight in a benchmark such as the MSCI Non-U.S. Equity Index. Although the U.K. equity market may outperform the non-U.S.-equity index (in terms of return premiums), the aggregate portfolio may be detrimentally affected by the U.K.-equity-market strategy. To see why, one must view the portfolio in its entirety.

The normal allocation to U.K. equities within the total portfolio is 5.1 percent, which reflects the combined effect of the normal non-U.S.-equity weight of 17 percent and the 30 percent U.K.-equity-market weight within the non-U.S.-equity index. The actual U.K. equity weight at the aggregate portfolio level is obtained by multiplying the actual U.K. allocation of 60 percent within

the non-U.S. component by the 6 percent allocation to non-U.S. equities. Even though the equity manager considers the U.K. equity market to be attractive relative to other non-U.S. equities, the actual U.K. weight is only 3.6 percent of the total portfolio, below the normal allocation of 5.1 percent.

The outcome is potentially, but not necessarily, perverse. If the underweighting of the non-U.S.-equity asset class takes into account the relative unattractiveness of non-U.S. equities in general, then the U.K.-equity underweight may be appropriate at the portfolio level even if the U.K. market proves to be the top performing non-U.S. equity market. The key is whether the U.K. equity market offers returns that are superior to the passive return of the total portfolio. The investment process as well as the attribution program must be able to handle the joint asset allocation decision involving the asset-class decision and the market allocation within the asset class.

Now consider the non-U.S.-bond manager's strategy when the U.K. bond market is considered to be unattractive. The non-U.S.-bond manager allocates only 10 percent to U.K. bonds, or about half of the Salomon Brothers Non-U.S. Government Bond Index market capitalization. For an aggregate portfolio, the normal U.K.-bond allocation is 1.6 percent, but the actual allocation is 2.5 percent. Again, both allocations are computed by multiplying the asset-class weights by the market weights within the asset class. Although the non-U.S.-bond manager anticipates underperformance of the U.K. bond market, such a development could detract from overall portfolio performance.

The confluence of decision making at two levels—the asset-class level and the market level—can lead to the unintended market allocations. Unless these decisions are coordinated, the potential for perverse market allocations exists. To the extent that the decisions are separated, performance attribution analysis should provide accurate feedback on the decisions involving both asset allocation and individual market selection.

Currency management is equally complicated. Because global balanced portfolios contain global or non-U.S.-equity and global or non-U.S.-bond components, thinking of currency exposures within each component might seem to be appropriate. Such thinking is misguided at the level of the total portfolio, however, and can produce unintended currency strategies.

For example, relative currency exposures can be eliminated within each component of a global securities portfolio, but the aggregate portfolio may nevertheless incur significant relative currency exposures. This conundrum would arise when currency allocation strategies are set at the asset-class level.

Returning to the actual global balanced portfolio, the allocation strategy overweights non-U.S. bonds by 17 percent and underweights non-U.S. equities by 11 percent. Assume that the weights for the Japanese markets within the

equity and the bond components are neutral, equal to the respective asset classes' market capitalizations of 40 percent and 35 percent. In this instance, in the absence of any currency hedging, the yen weights are also neutral within both the non-U.S.-equity and -bond components.

The aggregate portfolio's normal exposure to yen is 9.6 percent, which is the combined normal allocation in the equity and bond components, 0.17(0.40) + 0.08(0.35). Even though the relative currency exposure has been eliminated within each component, the actual yen exposure for the entire portfolio is 11.15 percent, an overweight of 1.55 percent. The actual yen allocation is computed by combining the non-U.S.-bond and non-U.S.-equity strategic yen allocations, 0.06(0.40) + 0.25(0.35). The entire portfolio is strategically overweighted in yen even though the actual yen exposure in each of the components is neutral.

The explanation for this counterintuitive outcome is that, through its allocation to the various asset classes, the portfolio is actually buying a small portion of the "equity-based" yen weight and a large portion of the "bond-based" yen weight. Because the overweight of the non-U.S.-bond asset class is significantly greater than the non-U.S.-equity underweight, the portfolio ends up with an above-normal exposure to the yen. Appendix B provides a full accounting of the strategy's interactions and their impact.

Equally glaring is the 6 percent underweight of the U.S. dollar that is implied by this asset allocation strategy in the absence of any hedges into the dollar by the non-U.S.-equity and -bond managers. The normal allocation to non-U.S. assets is 25 percent, but the active allocation strategy has increased the non-U.S. exposure to 31 percent. Such active over- and underweights of the dollar are often the largest active currency allocation decisions in globally diversified pension plans, and although plan sponsors spend a lot of time in setting optimal hedge ratios within the non-U.S. components of their portfolios, such simple active allocations may go unmanaged, even unnoticed.

Global portfolios cannot be managed as a collection of asset classes; they require careful evaluation of interactions among and within asset classes. Nowhere is this necessity so clear as in the management of currencies. Market and currency strategies are often set at the non-U.S.-component level, but the aggregate strategy is all that matters to aggregate portfolio performance.

Currency overlays are one way to deal with the need to set currency strategy at the aggregate portfolio level. Using overlays, however, places specific requirements on the means by which the global assets are to be managed. Because an overlay involves the explicit, and appropriate, separation of market and currency strategies, when overlays are used, the market managers must manage against a return premium or, equivalently, a hedged benchmark. Also, even though these managers may or may not be allowed to

hedge currency exposures, their performance must be evaluated in terms of return premiums. If they are measured against a local currency or unhedged benchmark, then as demonstrated in Section 1, their decisions could be suboptimal.

**A Global Balanced Portfolio.** This example addresses several difficulties that arise in performance attribution for actively managed global balanced portfolios. First, the common practice of segmenting portfolios into U.S. equity, non-U.S. equity, U.S. bonds, non-U.S. bonds, and perhaps cash suggests that attributing performance from two perspectives would be useful. One perspective would explicitly recognize that the allocation among asset classes is the primary decision and that selection of markets within asset classes follows. The other approach would assume that, ultimately, performance is determined by specific market over- and underweights, regardless of whether a two-stage decision process is being used.

The second difficulty is the clear need to separate currency strategy from market strategy. To evaluate separate non-U.S.-equity and non-U.S.-bond currency strategies within an aggregate portfolio makes no sense.

Third, a method is needed to present the performance of the non-U.S. components that excludes the contributions of currency management to portfolio performance. This difficulty is particularly relevant in light of the performance presentation standards developed by AIMR for international portfolio carve-outs (AIMR 1993).

Table 18 shows performance attribution for an actual global balanced portfolio for the 1992 calendar year. The normal or benchmark weights reflect the Brinson Partners' Global Securities Market Index, which is designed to take into account the risk tolerance of the average U.S. pension plan. On average, the portfolio overweighted U.S. and non-U.S. bonds, underweighted U.S. and non-U.S. equities, and overweighted cash as follows:

| | *Normal* | *Active Weights* | *Strategy* |
|---|---|---|---|
| U.S. equity | 50.0% | 22.0% | −28.0% |
| Non-U.S. equity | 17.0 | 5.2 | −11.8 |
| U.S. bonds | 20.0 | 45.6 | +25.6 |
| Non-U.S. bonds | 8.0 | 15.0 | +7.0 |
| Cash | 5.0 | 12.2 | +7.2 |

The attribution of total return performance in Table 18 indicates positive contributions from market, currency, and security selection. The total value added during the year was 460 basis points above the benchmark return of 4.48

**TABLE 18. Global Balanced Portfolio: Nontiered Market-Selection Attribution, 1992**
(base currency = U.S. dollar)

| | | |
|---|---|---|
| *A. Portfolio performance summary* | | |
| Global balanced index | | 4.48% |
| Market selection | 1.67% | |
| Currency selection | 1.23 | |
| Security selection | 1.52 | |
| Exchange rate differences | −0.04 | |
| Intramonth effect | 0.21 | |
| Total value added | | 4.60% |
| Global balanced portfolio | | 9.08% |

*B. Attribution of added value: Market selection (basis points)*

| Market | Market Selection | Security Selection |
|---|---|---|
| Equity | | |
| United States | −102 | 112 |
| Australia | 1 | −1 |
| Austria | 1 | 0 |
| Belgium | 0 | 2 |
| Canada | 4 | 2 |
| Denmark | 5 | 0 |
| Finland | 0 | 0 |
| France | 3 | −1 |
| Germany | 14 | 0 |
| Hong Kong | −7 | 0 |
| Italy | 5 | 0 |
| Japan | 182 | 1 |
| Netherlands | 1 | 0 |
| New Zealand | 0 | −1 |
| Norway | 1 | 0 |
| Singapore | −1 | 0 |
| Spain | 4 | 0 |
| Sweden | 0 | 0 |
| Switzerland | −6 | 0 |
| United Kingdom | −11 | 3 |
| Bond | | |
| United States | 56 | 20 |
| Australia | 0 | 0 |
| Belgium | 0 | 1 |
| Canada | 16 | 3 |
| Denmark | −5 | 0 |

**TABLE 18.** (continued)

*B. Attribution of added value: Market selection (basis points) (continued)*

| Market | Market Selection | Security Selection |
|---|---|---|
| Bond (*continued*) | | |
| France | −2 | −2 |
| Germany | 6 | 3 |
| Italy | 2 | 0 |
| Japan | 3 | 1 |
| Netherlands | 7 | 2 |
| Spain | −2 | 1 |
| Sweden | 0 | 0 |
| Switzerland | 0 | 0 |
| United Kingdom | −2 | −1 |
| Cash | −6 | 7 |
| Subtotal | 167 | 152 |

*C. Attribution of added value: Currency selection (basis points)*

| Currency | Currency Selection |
|---|---|
| Australia | 3 |
| Austria | 0 |
| Belgium | −2 |
| Canada | −5 |
| Denmark | 5 |
| Finland | 0 |
| France | −1 |
| Germany | 21 |
| Hong Kong | 0 |
| Italy | 11 |
| Japan | −1 |
| Netherlands | 6 |
| New Zealand | 0 |
| Norway | 0 |
| Singapore | 0 |
| Spain | 3 |
| Sweden | 6 |
| Switzerland | 3 |
| United Kingdom | 52 |
| United States | 21 |
| Total | 124 |

*Note:* Totals may not sum because of rounding.

percent. Market allocation accounted for 167 basis points, currency management contributed 123 basis points, and total security selection added 152 basis points. The intramonth effects amounted to only 21 basis points.

Detailed interpretation of the contributions from decisions about individual markets depends, as was discussed in Section 2, on the underlying decision-making process that was used in managing this portfolio. The basic market allocation might have been made on a market-by-market basis, as was done in the allocation process for the global equity and bond portfolios in Section 2. Such an approach would imply that the German bond overweight, for example, is as likely to offset explicitly a Japanese equity underweight within the total portfolio as it is to offset an underweight of Japanese bonds within the non-U.S.-bond component. From this perspective, the decision process would have been totally disaggregated, with each individual equity and bond market being treated as a distinct asset class.

On that basis, the U.S. equity underweight clearly detracted from performance, while the U.S. bond overweight clearly added to portfolio value. The cash allocation was a small deterrent to portfolio performance. Clearly also, the Japanese equity underweight made a substantial contribution to the total performance of the portfolio.

Alternatively, the investment decision process might have followed a sequential approach, with the allocation strategy being set across the broad asset classes of U.S. and non-U.S. equity and U.S. and non-U.S. bond markets. Such would be the case, for example, if the portfolio accounted for an entire pension plan's assets and was divided among various managers. From this perspective, the individual market weights would reflect the joint effect of the general asset allocation decision and the subsequent market allocations within each asset class. Thus, the overweight of German bonds would be the result of the general decision to overweight non-U.S. bonds—a decision by the plan sponsor—and/or an explicit decision by the non-U.S.-bond manager to overweight the German market within the non-U.S.-bond component. The attribution program should be able to distinguish between these decisions that are made at different levels.

Table 19 summarizes the average market strategy weights for this portfolio. The information is divided into three columns: The first shows the broad asset-class weights. The second shows the individual market weights within the non-U.S.-equity and non-U.S.-bond components. The third column shows the individual market allocations as a percentage of the total portfolio. Finally, the table summarizes the average return premiums for the benchmark and the portfolio.

Conceptually, the analysis required to provide information that is relevant for a sequential decision process is simple. The decision to underweight non-U.S.

## TABLE 19. Global Balanced Portfolio: Average Market Strategy, 1992

| | Passive Weight | | | Active Weight | | | Difference | | | Market Return Premiums | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Market | Asset Class | Market within Asset Class | As Percent of Portfolio | Asset Class | Market within Asset Class | As Percent of Portfolio | Asset Class | Market within Asset Class | As Percent of Portfolio | Passive Return Premium | Active Return Premium | Return Premium Difference |
| U.S. equity | 50.00% | | 50.00% | 22.02% | | 22.02% | −27.98% | | −27.98% | 4.70% | 11.60% | 6.90% |
| Non-U.S. equity | 17.00 | | | 5.21 | | | −11.79 | | | −12.46 | NA | NA |
| Australia | | 2.71% | 0.46 | | 6.45% | 0.34 | | 3.73% | −0.13 | −7.46 | 10.57 | 18.03 |
| Austria | | 0.50 | 0.09 | | 0.00 | 0.00 | | −0.50 | −0.09 | −13.55 | NA | NA |
| Belgium | | 1.22 | 0.21 | | 3.86 | 0.20 | | 2.64 | −0.01 | −4.57 | 1.89 | 6.46 |
| Canada | | 4.40 | 0.75 | | 8.12 | 0.42 | | 3.72 | −0.33 | −9.37 | −4.53 | 4.84 |
| Denmark | | 0.77 | 0.13 | | 0.00 | 0.00 | | −0.77 | −0.13 | −31.20 | NA | NA |
| Finland | | 0.04 | 0.01 | | 0.00 | 0.00 | | −0.04 | −0.01 | −2.93 | NA | NA |
| France | | 6.38 | 1.09 | | 6.64 | 0.35 | | 0.26 | −0.74 | −1.13 | −3.32 | −2.19 |
| Germany | | 6.88 | 1.17 | | 9.80 | 0.51 | | 2.93 | −0.66 | −13.03 | −11.91 | 1.12 |
| Hong Kong | | 2.69 | 0.46 | | 0.54 | 0.03 | | −2.15 | −0.43 | 26.63 | 17.86 | −8.77 |
| Italy | | 2.12 | 0.36 | | 2.08 | 0.11 | | −0.04 | −0.25 | −12.22 | −18.52 | −6.30 |
| Japan | | 41.53 | 7.06 | | 24.35 | 1.27 | | −17.18 | −5.79 | −25.18 | −23.16 | 2.02 |
| Netherlands | | 3.16 | 0.54 | | 4.99 | 0.26 | | 1.82 | −0.28 | −1.08 | −2.67 | −1.59 |
| New Zealand | | 0.30 | 0.05 | | 2.67 | 0.14 | | 2.37 | 0.09 | −1.95 | −7.52 | −5.57 |
| Norway | | 0.31 | 0.05 | | 0.00 | 0.00 | | −0.31 | −0.05 | −14.93 | NA | NA |
| Singapore | | 1.32 | 0.22 | | 0.00 | 0.00 | | −1.32 | −0.22 | 4.04 | NA | NA |
| Spain | | 2.14 | 0.36 | | 3.97 | 0.21 | | 1.83 | −0.16 | −18.21 | −18.30 | −0.09 |
| Sweden | | 0.96 | 0.16 | | 0.00 | 0.00 | | −0.96 | −0.16 | 5.82 | NA | NA |
| Switzerland | | 3.57 | 0.61 | | 2.73 | 0.14 | | −0.84 | −0.46 | 17.16 | 16.44 | −0.72 |
| United Kingdom | | 18.98 | 3.23 | | 23.76 | 1.24 | | 4.78 | −1.99% | 7.52 | 10.70 | 3.18 |
| Subtotal | | 100.00% | | | 100.00 | | | 0.0% | | | | |

**TABLE 19.** (continued)

| Market | Passive Weight | | | Active Weight | | | Difference | | | Market Return Premiums | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Asset Class | Market within Asset Class | As Percent of Portfolio | Asset Class | Market within Asset Class | As Percent of Portfolio | Asset Class | Market within Asset Class | As Percent of Portfolio | Passive Return Premium | Active Return Premium | Return Premium Difference |
| U.S. bond | 20.00 | | 20.00 | 45.62 | | 45.62 | 25.62 | | 25.62 | 3.43 | 3.87 | 0.44 |
| Non-U.S. bond | 8.00 | | | 14.95 | | | 6.95 | | | 4.06 | NA | NA |
| Australia | | 1.50 | 0.12 | | 0.00 | 0.00 | | −1.50 | −0.12 | 2.82 | NA | NA |
| Belgium | | 1.49 | 0.12 | | 1.38 | 0.21 | | −0.11 | 0.09 | −4.07 | −3.06 | 1.01 |
| Canada | | 7.25 | 0.58 | | 8.82 | 1.32 | | 1.57 | 0.74 | 2.47 | 2.44 | −0.03 |
| Denmark | | 2.56 | 0.20 | | 4.13 | 0.62 | | 1.57 | 0.41 | −2.53 | −2.35 | 0.18 |
| France | | 11.39 | 0.91 | | 17.03 | 2.55 | | 5.63 | 1.63 | 0.23 | −0.36 | −0.59 |
| Germany | | 18.97 | 1.52 | | 25.01 | 3.74 | | 6.04 | 2.22 | 2.52 | 3.19 | 0.67 |
| Italy | | 2.55 | 0.20 | | 0.00 | 0.00 | | −2.55 | −0.20 | −7.04 | NA | NA |
| Japan | | 34.67 | 2.77 | | 19.11 | 2.86 | | −15.56 | 0.08 | 5.60 | 5.93 | 0.33 |
| Netherlands | | 7.36 | 0.59 | | 17.71 | 2.65 | | 10.35 | 2.06 | 4.63 | 5.56 | 0.93 |
| Spain | | 0.60 | 0.05 | | 1.84 | 0.28 | | 1.24 | 0.23 | −6.49 | −5.73 | 0.76 |
| Sweden | | 0.54 | 0.04 | | 0.00 | 0.00 | | −0.54 | −0.04 | −4.36 | NA | NA |
| Switzerland | | 0.35 | 0.03 | | 0.00 | 0.00 | | −0.35 | −0.03 | 2.34 | NA | NA |
| United Kingdom | | 10.75 | 0.86 | | 4.97 | 0.74 | | −5.78 | −0.12 | 6.87 | 3.50 | −3.37 |
| Subtotal | | 100.00% | | | 100.00 | | | 0.00% | | | | |
| Cash | 5.00 | | 5.00 | 12.22 | | 12.22 | 7.22 | | 7.22 | −0.59 | 0.00 | 0.59 |
| Total | 100.0% | | 100.00% | 100.00% | | 100.00% | 0.00% | | 0.00% | 1.15% | NA | NA |

*Note:* Totals may not sum because of rounding.

NA = not applicable.

equities can be determined to have added value only if the benchmark return premium offered by non-U.S. equities exceeded the return premium of the global balanced benchmark. The passive non-U.S.-equity return premium was −12.46 percent in 1992, substantially below the benchmark return premium of 1.15 percent. Thus, the non-U.S.-equity asset-class underweight added value.

The subsequent lower level decision to underweight Japan within the non-U.S.-equity component can also be shown to have added value, but the contribution is somewhat less than indicated by the detailed attribution shown in Table 18. The Japanese equity return premium of −25.18 percent was below that of the non-U.S.-equity benchmark, while the Japanese equity weight within the non-U.S.-equity component was 24.35 percent, versus the index weight of 41.53 percent. Thus, the Japanese equity underweight within the non-U.S.-equity component added value.

The questions are:

- How much value was added by the underweight of the non-U.S.-equity asset class?
- How much value was added by underweighting Japan within the non-U.S.-equity asset class?

Table 20 gives the performance attribution for a sequential or tiered decision-making process in allocating among markets. Notice that the total market allocation effect (+167 basis points) is unchanged from Table 18. Only the sources of that added return are altered.

Table 20 indicates that the allocation among asset classes dominated the market-selection contribution. Active asset allocations among U.S. and non-U.S. equities and U.S. and non-U.S. bonds added 140 basis points to portfolio value. Market selection within the non-U.S.-equity component accounted for 27 basis points, and non-U.S.-bond market selection added 1 basis point.

Notice that in Table 20 the underweight of Japan within the non-U.S.-equity component added only 17 basis points to aggregate portfolio performance, compared with the 182-basis-point contribution that was indicated in Table 18. The difference reflects the alternative decision process that might have been used. Under a sequential process, the higher-level asset allocation decision to underweight the non-U.S.-equity asset class would account for the bulk of the Japanese equity underweight. That decision would actually account for 165 of the 182-basis-point effect shown in Table 18. The subsequent decision to underweight the Japanese market further within the non-U.S.-equity component added the remaining 17 basis points. Excluding the large Japanese equity underweight, the other market selections within the non-U.S.-equity component added 10 basis points to total portfolio return.

**TABLE 20. Global Balanced Portfolio: Tiered Market-Selection Attribution, 1992**
(base currency = U.S. dollar)

| *A. Portfolio performance summary* | | |
|---|---|---|
| Global balanced index | | 4.48% |
| Market selection | 1.67% | |
| Currency selection | 1.24 | |
| Security selection | 1.52 | |
| Exchange rate differences | −0.04 | |
| Intramonth effect | 0.21 | |
| Total value added | | 4.60% |
| Global balanced portfolio | | 9.08% |

*B. Attribution of added value: Market selection (basis points)*

| Market | Total | = | Asset Class | + | Market |
|---|---|---|---|---|---|
| Equity | | | | | |
| United States | −102 | | −102 | | NA |
| Non-U.S. | 196 | | 170 | | NA |
| Australia | | | | | 1 |
| Austria | | | | | 0 |
| Belgium | | | | | 1 |
| Canada | | | | | 1 |
| Denmark | | | | | 1 |
| Finland | | | | | 0 |
| France | | | | | 1 |
| Germany | | | | | 3 |
| Hong Kong | | | | | −3 |
| Italy | | | | | 0 |
| Japan | | | | | 17 |
| Netherlands | | | | | 1 |
| New Zealand | | | | | 1 |
| Norway | | | | | 0 |
| Singapore | | | | | −1 |
| Spain | | | | | 0 |
| Sweden | | | | | −1 |
| Switzerland | | | | | −1 |
| United Kingdom | | | | | 6 |
| Total | | | | | 27 |

**TABLE 20.** (continued)

| | | | | | |
|---|---|---|---|---|---|
| Bond | | | | | |
| United States | 57 | | 57 | | NA |
| Non-U.S. | 22 | | 21 | | NA |
| Australia | | | | | 0 |
| Belgium | | | | | 0 |
| Canada | | | | | 12 |
| Denmark | | | | | −2 |
| France | | | | | −3 |
| Germany | | | | | −1 |
| Italy | | | | | 0 |
| Japan | | | | | −4 |
| Netherlands | | | | | 1 |
| Spain | | | | | −2 |
| Sweden | | | | | −1 |
| Switzerland | | | | | 0 |
| United Kingdom | | | | | −2 |
| Total | | | | | 1 |
| Cash | −6 | | −6 | | NA |
| Total | 167 | = | 140 | + | 27 |

*Note:* Totals may not sum because of rounding and compounding at aggregate, rather than market, level.

NA = not applicable.

Similar analysis is appropriate for the non-U.S.-bond component of the portfolio. With a sequential decision process, the attribution shown in Table 20 is relevant; it indicates that the overweighting of the non-U.S.-bond asset class accounted for almost all of the market-selection contribution from this component. As in the case of non-U.S. equities, the relatively small allocation to the asset class does not give the non-U.S.-bond manager much latitude to add value through individual market selection.

The level of tiering need not start or stop at the non-U.S. level. In this portfolio, the underweight of Japan in the non-U.S.-equity component dictated an overweight in all other non-U.S. equity markets. A proportional overweight of all the other non-U.S. equity markets would have added 16 basis points to performance. In actuality, however, active market selection within those markets cost 6 basis points, resulting in the 10-basis-point contribution.

Ankrim (1992) provided a crude method for expanding the added value that is attributed to a single market allocation decision to account for the associated impact of that decision on all other market weights. The tiering approach

discussed here is conceptually similar to that methodology, but tiering permits a focus on market decisions independent of currency decisions and increases flexibility by increasing the extent to which the tiers can be expanded.

The currency returns and the average strategy for the global balanced portfolio are shown in Table 21. The currency strategy in this portfolio was set at the portfolio level. That is, the desired currency exposures were set relative to the normal weights of each currency in the total portfolio. Thus, direct hedging activity was used only when the currency exposures that resulted from the combined equity, bond, and cash market decisions were different from the desired strategic currency weights for the entire portfolio. No hedging was done within the non-U.S.-equity or -bond components: Based on Equation 9 in Section 1, only the net currency exposures at the total portfolio level are relevant for performance; the sources of the exposures are meaningless.

Implementation can become a tricky issue, however, when multiple managers are involved in managing non-U.S. components within a portfolio. One approach would allow the individual managers to set currency strategies within the components and then have a separate currency overlay program achieve the desired aggregate currency exposures. In that case, currency decisions would be made at both the aggregate portfolio level and within the components of the portfolio. As with the sequential market strategies discussed previously, this approach creates a special problem for the performance attribution system, namely, to isolate the effects of the separate currency decisions.

This problem can be avoided by holding the non-U.S.-asset managers accountable for their market-selection activity only and managing the assets against a return premium or fully hedged benchmark. The market managers would not actually have to hedge their currency positions, because the currency exposures resulting from the market allocation decisions would be the responsibility of the currency manager at the aggregate portfolio level. The market managers would be accountable only for the portion of their returns that resulted from market selection, as measured by the return premiums.

Security selection for a global balanced portfolio is no different from what it is for purely domestic portfolios or the global equity and bond portfolios that were evaluated in Section 3. In the portfolio analyzed in this section, security selection within all markets contributed 152 basis points to total portfolio performance. Added value within either the non-U.S.-equity or non-U.S.-bond component can be determined by summing across all markets within each component. Non-U.S.-equity security selection added 4 basis points, and non-U.S. bonds added 9 basis points.

**TABLE 21. Global Balanced Portfolio: Average Currency Strategy, 1992**

| | Currency Weight | | | Eurodeposit Return | | |
|---|---|---|---|---|---|---|
| Country | Passive | Active | Difference | Local-Currency Cash Return | Dollar Exchange Rate Return | Cash Return in U.S. Dollars |
| Australia | 0.58% | 0.10% | −0.48% | 6.90% | −9.49% | −3.25% |
| Austria | 0.09 | 0.00 | −0.09 | 10.08 | −5.93 | 3.56 |
| Belgium | 0.33 | 0.37 | 0.04 | 10.14 | −6.02 | 3.52 |
| Canada | 1.33 | 2.52 | 1.20 | 6.86 | −9.04 | −2.81 |
| Denmark | 0.34 | 0.18 | −0.16 | 10.78 | −5.86 | 4.29 |
| Finland | 0.01 | 0.00 | −0.01 | 14.10 | −20.94 | −9.79 |
| France | 2.00 | 2.01 | 0.02 | 10.75 | −6.20 | 3.88 |
| Germany | 2.69 | 2.52 | −0.16 | 10.25 | −6.33 | 3.27 |
| Hong Kong | 0.46 | 0.03 | −0.43 | 3.91 | 0.48 | 4.42 |
| Italy | 0.57 | 0.12 | −0.45 | 14.29 | −22.02 | −10.87 |
| Japan | 9.83 | 5.05 | −4.78 | 4.91 | 0.08 | 5.00 |
| Netherlands | 1.13 | 1.37 | 0.24 | 10.27 | −6.05 | 3.60 |
| New Zealand | 0.05 | 0.14 | 0.09 | 6.55 | −4.87 | 1.36 |
| Norway | 0.05 | 0.00 | −0.05 | 11.84 | −13.77 | −3.56 |
| Singapore | 0.22 | 0.00 | −0.22 | 3.45 | −1.25 | 2.15 |
| Spain | 0.41 | 0.18 | −0.23 | 13.79 | −15.58 | −3.94 |
| Sweden | 0.21 | 0.00 | −0.21 | 14.03 | −21.63 | −10.63 |
| Switzerland | 0.63 | 0.14 | −0.50 | 8.74 | −7.54 | 0.54 |
| United Kingdom | 4.09 | 1.08 | −3.01 | 10.97 | −19.08 | −10.20 |
| United States | 75.00 | 84.19 | 9.19 | 4.09 | 0.00 | 4.09 |
| Benchmark total | 100.00% | 100.00% | 0.00% | 5.06% | −1.65% | 3.31% |

*Note:* Totals may not sum because of rounding.

**Carve-Out Performance.** What if a manager or consultant wants information on the performance of one of the asset classes within a global balanced portfolio? For the U.S. equity and U.S. bond components, this information is a straightforward display of the performance of domestic components. All deviations between component portfolio and benchmark performance are attributable to security selection.

When currency is managed at the aggregate level, the carve-out performance of the non-U.S. components of a global balanced portfolio must exclude the impact of currency management. Why? Because currency strategies exist only at the portfolio level and have no relevance within either non-U.S.

component.[20] A global balanced portfolio contains no equity currencies or bond currencies. Therefore, the non-U.S. component of the portfolio returns should reflect only the value added by market- and security-selection decisions. The asset-class benchmark and the returns for the global balanced portfolio, in U.S. dollars, for calendar 1992 were as follows:

| | |
|---|---|
| U.S.-equity benchmark | 8.98% |
| U.S.-equity portfolio component | 16.16 |
| Non-U.S.-equity benchmark | −11.99 |
| Non-U.S.-equity portfolio component (excluding currency management) | −5.93 |
| U.S.-bond benchmark | 7.66 |
| U.S.-bond portfolio component | 8.12 |
| Non-U.S.-bond benchmark | 4.77 |
| Non-U.S.-bond portfolio component (excluding currency management) | 5.42 |

Although these returns are derived from monthly computations, annual data from Tables 19 and 20 can be used to demonstrate how the returns are calculated. The non-U.S.-equity manager's subbenchmark is the MSCI Non-U.S. Equity (Free) Index adjusted for the withholding taxes of a U.S.-based investor. The benchmark U.S. dollar return was −11.99 percent in 1992. The non-U.S.-equity manager's performance, reflecting only market and security selections, was computed from the following formula:

$$\text{Component return} = \text{Benchmark return} + \frac{(\text{Component market selection} + \text{Component security selection})}{\text{Active component weight}}$$

Using the average summary data for the year,

$$\text{Non-U.S.-equity component return} = -0.1199 + \frac{(0.0027 + 0.0004)}{0.0521}$$

$$= -6.04 \text{ percent.}$$

Compounded monthly returns would generate the −5.93 percent return.

The non-U.S.-bond component return, given a non-U.S.-bond benchmark return (in U.S. dollars) of 4.98 percent, is

[20] Only if each non-U.S. manager is asked to manage currency exposure separately can currency management be included in the non-U.S. carve-out. Such management would require a currency overlay of the aggregate portfolio, however.

$$\text{Non-U.S.-bond component return} = 0.0477 + \frac{(0.0001 + 0.0009)}{0.1495}$$

$$= 5.44 \text{ percent.}$$

Again, compounded monthly returns would generate the 5.42 percent return presented.

These non-U.S.-component returns are the U.S. dollar returns that would have been achieved if each non-U.S.-component portfolio manager made only market- and security-selection decisions and if the currency strategy were held neutral to the benchmark. In other words, currency strategies are assumed not to have occurred and, therefore, not to have affected the components' performance.

If clients, consultants, and the managers themselves want information on total component returns, these considerations are crucial. They also provide a means of presenting carve-out performance in accordance with the objectives of the 1993 AIMR performance presentation standards.

## Conclusion

Currency issues make the management of global portfolios more complex, but not necessarily more difficult than managing domestic portfolios. Particular care is needed when the portfolio uses separate managers for the U.S. and non-U.S. asset classes as well as for currency management.

The global asset evaluation and attribution framework presented in Sections 1 and 2 provide a robust and flexible system for handling these complexities. The framework offers plan sponsors, investment managers, and consultants an accurate means for determining and attributing returns to market, currency, and security selections regardless of the decision process that is used in the management of the aggregate portfolio.

As an extension of the familiar CAPM, the framework calls for evaluation of all global asset returns in terms of local-currency return premiums. All currency considerations are based on cash returns—typically, Eurodeposit returns—expressed in the base currency of the investor. Recognizing the variables that are actually controllable by investors leads to the conclusion that implementing active currency strategy involves nothing more than global cash management.

The framework for analysis of global asset returns presented in Section 1 is comprehensive but simple. It allows a clear distinction to be made between the market and currency returns that are available to investors and provides a direct method of treating market and currency strategy options consistently in the investor's decision-making process. The framework is general, applicable to any base currency and any currency benchmark. It is also flexible, in that it handles

all types of derivative instruments that might be used in the management of a global portfolio.

A rigorous global performance attribution system can be a powerful tool for investment management by providing a means for critical review of the decision process. Isolation of the effects of market, currency, and security strategies supplies valuable information about the sources of investment returns. The attribution framework presented in Section 2 provides a comprehensive and flexible foundation for such analysis.

Sections 3 and 4 used actual global portfolios to demonstrate the application of the analytical framework to the task of performance attribution for global portfolios. The attribution system identified unambiguously the contributions of aggregate market and currency strategy to portfolio returns. The examples also highlighted, however, the care that must be taken in interpreting the market and currency effects on a country-by-country basis. The general decision process used in the management of the aggregate portfolio significantly influences the manner in which the components of the market and currency effects are presented.

Global balanced portfolios provide the strongest test of the global investment process. The typical sequential approach of first allocating among broad asset classes such as non-U.S. equities and bonds and then selecting markets within these asset classes can lead to unintended and possibly perverse exposures for the aggregate portfolio. The decision process must recognize the implications of such a layered allocation process, and the performance attribution system must be able to account for the effects of each layer of decisions.

The attribution framework that has been presented here can be structured to provide information at all levels of decision making and reveal their ultimate contributions to aggregate portfolio performance. That flexibility applies to the setting of both market and currency strategies for global portfolios.

# Appendix A

The general definition of the return from a portfolio of global assets for an investor with a base currency $n$ can be derived by considering the base-currency return from investments in country $i$. Equation A1 specifies this return in terms of each of the potential returns and strategy weights:

$$R_{n,i} = w_i r_i + \upsilon_i k_i + (w_i + \upsilon_i)\varepsilon_{n,i} + \sum_j h_{i,j}(f_{i,j} + \varepsilon_{n,i} - \varepsilon_{n,j}). \qquad \text{(A1)}$$

Five general types of returns can be involved in such a global portfolio:

$R_{n,i}$ = return from all assets, including cash, of country $i$, in terms of the base currency, $n$,
$r_i$ = return from the noncash assets of country $i$, in local-currency terms,
$k_i$ = return from the explicitly held cash assets of country $i$, in local-currency terms,
$c_i$ = return from country $i$ Eurodeposits, in local-currency terms,
$\varepsilon_{n,i}$ = rate of change in the base currency:currency $i$ exchange rate, and
$f_{i,j}$ = forward premium of currency $j$ in terms of currency $i$; $f_{i,j} = c_i - c_j$.

The active decision variables are

$w_i$ = weight of country $i$ noncash assets; $0 \leq \Sigma w_i \leq 1$,
$\upsilon_i$ = weight of country $i$ cash that is held as strategic cash; in a fully invested portfolio, all $\upsilon_i = 0$, and
$h_{i,j}$ = portion of the portfolio that is hedged (or cross-hedged) to currency $i$ from currency $j$; $-(w_i + \upsilon_i) \leq h_i \leq 1$ for portfolios that prohibit net short currency positions.

Substituting for $f_{i,j}$ in Equation A1 and rearranging terms gives

$$R_{n,i} = w_i(r_i - c_i) + \upsilon_i(k_i - c_i) + (w_i + \upsilon_i)(c_i + \varepsilon_{n,i}) + \sum_j h_{i,j}(c_i - c_j + \varepsilon_{n,i} - \varepsilon_{n,j}). \qquad \text{(A2)}$$

Because $\sum_j h_{i,j} = h_i$,

$$R_{n,i} = w_i(r_i - c_i) + \upsilon_i(k_i - c_i) + (w_i + \upsilon_i + h_i)(c_i + \varepsilon_{n,i}) - \sum_j h_{i,j}(c_j + \varepsilon_{n,j}). \quad \text{(A3)}$$

The last term in Equation A3 reflects the currency exposures that are eliminated in favor of currency $i$.

Because the hedge weights, $h_i$, must sum to zero, the summation across all $i$ gives the total portfolio return as

$$R_n = \Sigma[w_i(r_i - c_i) + \upsilon_i(k_i - c_i)] + \Sigma[(w_i + \upsilon_i + h_i)(c_i + \varepsilon_{n,i})]. \quad \text{(A4)}$$

The exposure to changes in exchange rates is the net effect of three strategic decisions: (1) The market decision to invest in the noncash assets of the various countries, as reflected in the $w_i$ weights; (2) a decision to hold some portion of the portfolio in cash, which could be denominated in any currency and is reflected in the $\upsilon_i$ weights; and (3) decisions to buy and sell currency exposures forward, as reflected in the hedge weights, $h_i$. In this form, the emphasis is on the portfolio's total exposure to each currency rather than on the specific sources of that exposure. In the absence of differential transaction costs, the means by which currency exposure enters the portfolio is irrelevant.

Thus, the base-currency return from a global portfolio (Equation 9) can be written in terms of separate market and currency components as

$$R_n = \Sigma[w_i(r_i - c_i) + \upsilon_i(k_i - c_i)] + \Sigma\delta_i(c_i + \varepsilon_{n,i}), \quad \text{(A5)}$$

where

$$\delta_i = w_i + \upsilon_i + h_i$$

and

$$\Sigma(w_i + \upsilon_i + h_i) = \Sigma\delta_i = 1.$$

# Appendix B

The following formulas account for the potential perversity of strategy interactions:

Let: $\bar{\delta}_i$ = benchmark currency $i$ weight in the portfolio,
$\bar{w}_e$ = benchmark non-U.S.-equity asset-class weight,
$\bar{w}_b$ = benchmark non-U.S.-bond asset-class weight,
$\bar{\delta}_{ei}$ = benchmark currency $i$ weight in the non-U.S.-equity component,
$\bar{\delta}_{bi}$ = benchmark currency $i$ weight in the non-U.S.-bond component,
$\delta_i$ = actual currency $i$ weight in the portfolio,
$w_e$ = actual non-U.S.-equity asset-class weight,
$w_b$ = actual non-U.S.-bond asset-class weight,
$\delta_{ei}$ = actual market and currency $i$ weight in the non-U.S.-equity component, and
$\delta_{bi}$ = actual market and currency $i$ weight in the non-U.S.-bond component.

Let each of the actual market weights equal the benchmark weight plus an active strategy, $w_e = \bar{w}_e + \Delta\bar{w}_e$. Thus, the actual weight in currency $i$ is

$$\delta_i = (\bar{w}_e\bar{\delta}_{ei} + \Delta\bar{w}_e\bar{\delta}_{ei} + \bar{w}_e\Delta\bar{\delta}_{ei} + \Delta\bar{w}_e\Delta\bar{\delta}_{ei}) + (\bar{w}_b\bar{\delta}_{bi} + \Delta\bar{w}_b\bar{\delta}_{bi} + \bar{w}_b\Delta\bar{\delta}_{bi} + \Delta\bar{w}_b\Delta\bar{\delta}_{bi}) \quad \text{(B1)}$$

Setting the actual weight of currency $i$ equal to its normal weight in both the equity and bond components implies

$$\Delta\bar{\delta}_{ei} = \Delta\bar{\delta}_{bi} = 0.0 \text{ percent.}$$

Thus, Equation B1 can be rewritten as

$$\delta_i = (\bar{w}_e\bar{\delta}_{ei} + \bar{w}_b\bar{\delta}_{bi}) + \Delta\bar{w}_e\bar{\delta}_{ei} + \Delta\bar{w}_b\bar{\delta}_{bi}. \quad \text{(B2)}$$

Equivalently,

$$\delta_i = \bar{\delta}_i + \Delta\bar{w}_e\bar{\delta}_{ei} + \Delta\bar{w}_b\bar{\delta}_{bi}.$$

Even with the currency weights set equal to the normal weights within each component, the total portfolio contains a strategic over/underweight of currency $i$ equal to

$$\delta_i - \bar{\delta}_i = \Delta\bar{w}_e\bar{\delta}_{ei} + \Delta\bar{w}_b\bar{\delta}_{bi},$$

which reflects the effect on currency exposure of the asset allocation decision to alter the weights of non-U.S. equities and non-U.S. bonds within the portfolio—i.e., $\Delta\bar{w}_e$ and $\Delta\bar{w}_b$ .

According to Equation B2, in the example in Section 3, the strategic weight for yen in the portfolio is

$$\delta_i = [(0.17)(0.4) + (0.08)(0.35)] + (-0.11)(0.4) + (0.17)(0.35)$$
$$\delta_i = [(0.068) + (0.028)] + (-0.044) + 0.0595$$
$$\delta_i = [0.096] - 0.044 + 0.0595$$
$$\delta_i = 11.15 \text{ percent.}$$

The bracketed calculations indicate, as one might expect intuitively, that the strategic yen weight is equal to the benchmark yen weight of 9.6 percent. Intuition fails to recognize the cross-products, however, that arise from the *interaction* of the non-U.S.-equity and non-U.S.-bond strategies and the yen strategy within each component.

# References


AIMR. 1993. *Performance Presentation Standards* (Charlottesville, Va.: Association for Investment Management and Research).

Allen, G.C. 1992. "Performance Attribution for Global Equity Portfolios." *The Journal of Portfolio Management* (Fall).

Ankrim, E.M. 1993. "The Japanese Weighting Decision in International Equity Portfolios: Measuring the Impact." *Russell Research Commentary* (June).

Ankrim, E.M., and C.R. Hensel. 1992. "Multicurrency Performance Attribution." *Russell Research Commentary* (November).

Brinson, G.P., and Nimrod Fachler. 1985. "Measuring Non-U.S. Equity Portfolio Performance." *The Journal of Portfolio Management* (Spring).

Brinson, G.P., R. Hood, and G.L. Beebower. 1986. "Determinants of Portfolio Performance." *Financial Analysts Journal* (July/August):39–44.

Brinson, G.P., B.D. Singer, and G.L. Beebower. 1991. "Determinants of Portfolio Performance II: An Update." *Financial Analysts Journal* (May/June):40–48.

Eun, C.S., and B.G. Resnick. 1988. "Exchange Rate Uncertainty, Forward Contracts and International Portfolio Selection." *The Journal of Finance* (March):197–215.

Karnosky, D.S. 1993. "Global Investment in a CAPM Framework." *The CAPM Controversy: Policy and Strategy Implications for Investment Management.* Charlottesville, Va.: Association for Investment Management and Research:56–61.

Karnosky, D.S., B.D. Singer, and J.G. Taylor. 1991. "The General Framework for Global Asset Analysis." *Security Analysts Journal,* vol. 29 (March):42–51.

Lee, A.F. 1987. "International Asset and Currency Allocation." *The Journal of Portfolio Management* (Fall):68–73.