

CHAPTER XVII

ASSET ALLOCATION AND PORTFOLIO MANAGEMENT

The Review Chapter points out the benefits of diversification. As noted in Chapter IX, in international markets, those benefits are substantial. Given the low correlations in international markets, international investment is a very important component of a well-diversified portfolio. Investment managers can no longer view foreign markets as an exotic decision, with a minor influence in a domestic portfolio. Investment managers should have a clear view of how to approach global investing.

In this chapter we review the major decisions involved in the asset allocation process and, then, we study how to design performance measures to evaluate those decisions.

I. Introduction to Asset Allocation

There are two main managerial philosophies to investment: the passive approach and the active approach. Investment objectives, data availability, customer preferences, and managerial skills play a role in the selection of the appropriate approach a fund or money manager selects.

1.A Passive approach

Under a passive approach, investors look for the optimal asset allocation assuming *zero forecast ability*. This view has empirical support for stock and exchange rate markets (see Chapters IV and V and Review Chapter). We can also consider the passive approach as an international extension of modern portfolio theory, which claims that market portfolios should be efficient. A fund managed according to a passive approach reproduces a market index of all securities. The Morgan Stanley Capital International (MSCI) world is generally used as a model for equity funds, and the J.P. Morgan international bond index is usually favored for international bond portfolios.

In the U.S. the domestic index-fund approach is supported by extensive empirical evidence of the efficiency of the stock market. In 1999, from all the mutual funds covered by Morningstar, the Standard and Poor's 500 (S&P 500) ranked number 101 out of 1675 on 10-year performance. When the 10-year after tax performance is used to rank the mutual funds, the S&P 500 ranked 52nd. But if the 15-year after tax performance is used as the ranking criteria, the S&P ranks number 8 out of 647. The long-run evidence in favor of the passive approach has been very strong. As a result, similar passive index-fund methods have developed everywhere in the world.

Foreign markets tend to be independent of each other (see Chapter X). This independence, when combined with substantial currency movements, means that different international asset allocations will yield very different performances. Intuitively, this observation suggests that different international portfolios will have very different performances. The relative performance of two international portfolio allocations is compared to the passive benchmark in Table XVII.1.

TABLE XVII.1

Percentage of Actively Managed Foreign Market Funds Outperforming the MSCI Indexes (1987-1997)

| Funds Investing in | 3-year | 5-year | 10-year |
|---------------------|--------|--------|---------|
| Japanese Securities | 62 % | 37% | 25% |
| European Securities | 10% | 26% | 0% |

The average portfolio manager underperformed the passive index in both the five-year and the ten-year periods. In the short-run, portfolio managers can do very well –recall that stock markets resemble a random walk! In the long run, however, stock picking seems less appealing. Using the 15-year after tax performance (1984-1998), as calculated by Morningstar, the MSCI EAFE outperformed all other mutual funds investing in foreign markets. Using the same performance yardstick, among all mutual funds, not just the one investing in foreign equity, the MSCI EAFE ranked 13 overall.

In 1989, U.S. public pension funds had indexed over 40% of their domestic equity investments. U.S. corporate pension funds and UK pension funds had indexed around 25% of their domestic equity investment. The optimal amount of foreign assets is an empirical question in the absence of a complete theory of world market equilibrium. However, we observe that once the size of the foreign position has been determined, there is a trend toward indexing that position. This trend is strongly felt among institutional investors.

There are two important issues:

(1) Deciding on the country weights.

The usual approach to determine the weights in a stock market index is to use market capitalization. This approach, in an international context, translates into using the national market capitalization to decide on the weight of a given country in an international portfolio. Many practitioners have suggested that GDP country weights, instead of market capitalization country weights, provide a better set of portfolio weights. The differences between the two approaches are not trivial. For example, in 1998, the country weight of the U.S. market using stock market capitalization was 48.98%, while the country weight of the U.S. market using GDP was 27.50%. Similarly, for the same year, the weights for China were .84% and 3.10%, respectively. GDP country weights are more stable, since the GDP is usually calculated quarterly. GDP country weights also eliminate accounting problems, like the cross-holding effects, which occur when two companies hold shares in the other one -a common practice in Japan. Historical risk and returns can assist investors in determining the weights.

► GDP weights or Market weights?

The weights in the MSCI EAFE index are based on market weights. During the late 1980s, the Japanese stock market experienced an amazing rise, what many called a speculative bubble. As the prices of Japanese stocks increased, so did the weight of Japan's market as a percentage of the EAFE Index total. Investors who bought an EAFE index fund invested almost two-thirds of their

investment in overpriced Japanese securities. Had the index been weighted according to the relative sizes of the constituent countries' economies --say GDP based weights--, Japanese stocks would have been limited to about one-third of the index. Thus, investing in an index that is market value weighted will not protect an investor from over-investing in precisely those stocks experiencing overvaluations. When the Japanese stock market crashed during the 1990s, investors realized the importance of more stable portfolio weights. ◀

(2) Deciding on hedging strategies.

In a perfect, frictionless world, finance theory suggests that the optimal portfolio is the world market portfolio hedged against currency risk. Investors do not hold the world market portfolio. The simple fact that inflation differs across countries and varies randomly destroys the result that the hedged world market portfolio is efficient. This is not a trivial observation since interest and currency rates are clearly linked to inflation. From another perspective, we have that, sometimes, currency risks lowers the risk of a portfolio.

Example XVII.1: Suppose an U.S. manager holds 15% of her portfolio in foreign assets. This foreign investment provides some diversification with respect to U.S. monetary policy risk. ¶

As a rule of thumb, when the proportion of foreign assets held in a portfolio is small (say 10%), the contribution of currency risk to the total risk of a fund is negligible.

1.B Active approach

Managers using an active approach try to time equity markets and currency markets switching between them to take advantage of what they perceive as investment opportunities. This approach requires high-quality management skills and often lacks a systematic structure.

An active strategy is usually divided into three parts: asset allocation, security selection, and market timing. The manager using an active asset allocation strategy is primarily concerned with determining the proportion of various asset classes in each currency, for example, Canadian equity or Malaysian bonds, needed to optimize the portfolio's expected return-risk trade-off.

There are two approaches to the international investment process: the top-down approach and the bottom-up approach.

A *top-down* manager must choose from among several markets (stocks, bonds, or cash) as well as a variety of currencies. Once these choices have been made, the manager selects the best securities available. The crucial decision in this approach is the choice of markets and currencies.

A *bottom-up* manager studies the fundamentals of many individual stocks from which he/she selects the best securities (no attention is paid to the national origin or currency allocation) to build a portfolio. For example, a manager might be bullish on electronics and buy shares in all of them (Sony, Samsung, Zenith, etc.), regardless of national origin. The product of this allocation is a portfolio with market and currency weights that are more or less a random result of the securities

selected. The manager is more concerned with risk exposure in various sectors than with either market or currency risk exposure.

1.C Evidence

The major contribution to the performance of a portfolio is the choice of markets and currencies, not individual securities. This major contribution is based on the fact that securities within a single market tend to move together, but national markets and currencies do not. A variety of surveys and studies have shown that the performance of international money managers is attributable to asset allocation, not security selection. Some institutions have started to offer products that solely capitalize on the asset allocation expertise. The manager decides on the country asset allocation and implements it by using a national index fund for each country.

In 1995, BARRA conducted a survey of 23 U.S. equity money managers to determine new trends in international investing. About 60% of the managers follow market indices when analyzing investment opportunities. The style that two-thirds of the managers use to identify global investment opportunities falls under the broad top-down/passive approach. The remaining third of the managers select stocks within countries.

When asked about the methods used to identify investment opportunities, almost one half mentioned asset allocation. The other half mentioned stock selection and some combination of asset allocation with stock selection.

About 40% of the managers hold stocks that are part of the major global indices -i.e., Morgan Stanley Capital International, Financial Times, etc. In general, these stocks are very liquid.

II. Evaluation of the Asset Allocation Process

To evaluate a portfolio, we need two pieces of information. First, we need a methodology that provides an accurate assessment of the rate of return of a given portfolio. Second, we need an assessment of the risks associated with a given portfolio.

2.A A Note on Optimal Asset Allocation

Briefly, we describe the asset optimizer that is derived for mean-variance optimization theory. An asset allocation is given by a set of weights, ω , attached to different asset types.

Example XVII.2: Reuters every month surveys the asset allocation of the major fund managers. In August 1997, the Reuters survey showed the following U.S. domestic asset allocation:

| Fund Manager | Treasury Bonds | Corporate Bonds | Mortgage Bonds | Equity | Cash | Other |
|-------------------|----------------|-----------------|----------------|--------|------|-------|
| AIM International | 10 | 19 | 0 | 64 | 1 | 5 |
| Bank of America | 20 | 25 | 0 | 55 | 0 | 0 |
| Clark Capital | 20 | 0 | 0 | 80 | 0 | 0 |
| Deutsche MG | 15 | 10 | 10 | 45 | 20 | 0 |
| J. Hancock | 10 | 10 | 15 | 65 | 0 | 0 |
| Scudder | 0 | 0 | 0 | 96 | 4 | 0 |
| VALIC | 14 | 17 | 2 | 62 | 6 | 0 |
| Average | 13 | 12 | 4 | 67 | 4 | 1 |

The higher weight is given to equity, followed, at a distant second, by Treasury bonds. With the exception of the Deutsche MG fund, a very small weight was given to cash and other assets. ¶

A global asset allocation is summarized in a matrix by country (i.e., currency) and asset type. Each cell of the matrix is referred to as an *asset class*. The asset class is referred to A_{ij} . The proportion of the account invested in asset i of country (currency) j is denoted ω_{ij} . The various proportions ω_{ij} add up to 100%.

Example XVII.3: Consider a portfolio with the following asset allocation:

| | Total | Cash | Bonds | Equities |
|-----------|-------|------|-------|----------|
| U.S. | 30.6 | 1.2 | 4.0 | 25.4 |
| Canada | 16.3 | 0.0 | 2.0 | 14.3 |
| Germany | 8.6 | 1.0 | 4.5 | 3.1 |
| U.K. | 10.5 | 3.0 | 3.5 | 4.0 |
| Japan | 16.2 | 6.7 | 0.0 | 10.5 |
| Thailand | 9.8 | 0.1 | 0.0 | 9.7 |
| Australia | 5.2 | 0.0 | 0.0 | 5.2 |
| Brazil | 0.0 | 0.0 | 0.0 | 0.0 |
| Colombia | 2.8 | 0.0 | 0.0 | 2.8 |
| Total | 100.0 | 11.0 | 14.0 | 75.0 |

There are three assets (i) in this asset allocation matrix: cash, bonds, and equities. There are nine countries (j) in which to invest. Each cell represents an asset class. For example, the asset class Canadian equities is denoted as $A_{eq,Can}$. The percentage, $\omega_{eq,j}$, invested in $A_{eq,Can}$ is 14.3%. ¶

One cell of the above matrix is referred to as an *asset class*. The proportion of the account invested in asset i of country (currency) j is denoted ω_{ij} . For example, a percentage (ω_{ij}) could be invested in Canadian (j) stocks (i), which in Example XVII.3 is 14.3%. The various proportions ω_{ij} add up to 100%. The asset class (e.g., German stocks) is referred to A_{ij} .

Some institutions may use an asset allocation matrix in which small markets are grouped by region, (for example, North America, Middle East, South America, etc.).

Futures contracts are implicitly allowed in this matrix. A currency futures contract is equivalent to a short-term borrowing-lending swap in two currencies. For example, a U.S. investor wanting to sell CAD forward can simply borrow CAD short-term, transfer it into USD, and invest it in dollar short-term deposits. Accordingly, selling a currency forward shows up as a negative proportion ω_{ij} for the foreign currency cash investment and an offsetting positive proportion for the domestic cash investment. A similar reasoning applies to other futures on stock indexes or bonds.

The base currency used for the account has been chosen and all rates of returns are calculated in this currency, denoted D .

The forecasted rate of return on asset class A_{ij} is denoted r_{ij} . This is obtained by compounding the forecasted return in local currency by the expected currency movement.

Example XVII.4: If the Canadian stock market is forecasted to provide a return of 25% in CAD (capital gain plus dividend yield), and if the CAD is expected to appreciate by 10% relative to the base currency, the USD, the total forecasted return for a U.S. investor is:

$$r_{ij} = (1+.25)(1+.10) - 1 = .375. \quad (r_{ij} = 37.5\%) \quad \square$$

The return on a bond asset class can be derived from a forecast of changes in market yield by taking into account the average duration of the market. The expected return on the total account is simply written as r . The covariance between returns on two asset classes A_{ij} and A_{kl} is denoted $\sigma_{ij,kl}$. The variance of the total account is simply σ^2 .

Following the work of Markowitz (1959), the objective of an optimal asset allocation is to maximize the expected return, r , while minimizing the risk level, σ^2 . Operationally, this can be done by minimizing the risk level for a given level of expected return.

Investment constraints are often imposed on the asset allocation. These take numerous forms, but are usually expressed as linear combinations of the investment proportions ω_{ij} . The most typical constraints are:

- i. No short sales are allowed on some assets such as stocks and bonds, that is, $\omega_{ij} \geq 0$.
- ii. A cap is placed on asset class, currency or asset type. For example, a typical constraint could be no more than 5% in Brazilian stocks, ($\sum_j \omega_{ij} \leq .05$, where j refers to Brazilian stocks).

iii. Currency short selling cannot exceed the amount of currency-exposed assets held in the portfolio.

Mathematically the optimization problem can be written as

$$\min_{\omega} \sum_{ij,kl} \omega_j \omega_k \sigma_{ij,kl}$$

subject to $\sum_{ij} \omega_j r_{ij} = r$ and

the linear constraints on ω_j implied by (i)-(iii).

There are several software packages that can easily solve this problem. These programs can select an optimal asset allocation using standard quadratic programming packages.

► Estimation and Asset Allocation

An accurate estimation of the covariance matrix (i.e., the elements $\sigma_{ij,kl}$) and the rates of return (r_{ij}) for each class is a fundamental prerequisite. Using the techniques discussed in the Review Chapter, expected rate of return and variances and covariances can be estimated. If the estimates of the covariance matrix or expected rates of returns, however, are not very accurate, the allocation might not be very reliable. In practice it is usually found that the estimates of expected returns are not very accurate, while the estimates for the covariance matrix are more accurate. ◀

2.B Performance Analysis in International Markets

The objective of an international performance analysis (IPA) is to measure the rate of return on a portfolio or a portfolio segment on a periodic basis (for example, monthly or quarterly basis). IPA systems also compare performance against certain standards ("tournament evaluation").

Popular standard measures:

- i. MSCI World or MSCI Europe, Australia and Far East (EAFE) Index.
- ii. Goldman Sachs/Financial Times World Index.
- iii. The U.S. S&P 500.
- iv. The mean return of managed portfolios.

More than half of the U.S. money managers surveyed by BARRA in 1995 used Morgan Stanley Capital International benchmarks as the yardstick against which performance is measured. In particular, the MSCI EAFE index was mentioned by 50% of the managers.

► Accounting Valuation and Performance

In international performance analysis, accounting valuation should not be confused with performance measurement. ◀

2.B.1 Calculating the rate of return

This is the first step in an IPA. Rates of returns are easy to calculate if there are no cash inflows or outflows from the evaluated portfolio. The rate of return over a period on a portfolio segment or on a total portfolio is easy to calculate if there are no cash inflows or outflows. Then the rate of return over the period T (r_T) is equal to:

$$r_T = (V_{t+T} - V_t) / V_t,$$

where V_t represents the value of the portfolio at initial time t.

Now, if there are inflows or outflows to a portfolio, the calculation of a rate of returns is a bit more complicated. There are three common methods to measure r_T : time-weighted rate of return (TWR), the internal rate of return (IRR), and the money-weighted rate of return (MWR). These three popular methods do not usually coincide in measuring rates of returns. For example, let's assume that a cash withdrawal, C_t , took place on day t during the period. Let's assume the following situation:

- i. $V_0 = 100$;
- ii. $C_k = 60$, $k = 60$ days; and
- iii. $V_T = 50$, $T = 365$ days.

The change in value over the year is $V_T + C_k - V_0 = 10$. However, methods differ on how to calculate the rate of return. Dividing the change in value by the initial value, V_0 , would be a mistake, since a much smaller capital was invested during most of the year. A common approach is the MWR, which has the following formula:

$$\begin{aligned} \text{MWR} &= (V_T + C_k - V_0) / (V_0 - .5C_k) = \\ &= (50 + 60 - 100) / (100 - 30) = 20.05\% \end{aligned}$$

This approach does not take into account the exact timing of the cash flows: it assumes that they take place in the middle of the period so that their average contribution is half their value. For this, we have the modified MVR or MWR*:

$$\begin{aligned} \text{MWR}^* &= [V_T + C_k - V_0] / [V_0 - ((365-k)/365) \times C_k] = \\ &= [50 + 60 - 100] / [100 - (305/365) \times 50] = 14.28\%. \end{aligned}$$

If several cash flows take place, each is weighted according to the portion of the period for which the funds have been left in the portfolio segment.

The IRR is the discount rate that equals the start-of-period value to the sum of the discounted cash flows including the end-of-period value. In our example,

$$V_0 = [C_k / (1+r)^{(k/365)}] + [V_T / (1+r)].$$

In this example, the IRR=19.75%.

To calculate the IRR a financial calculator is needed. On the other hand, MRW is extremely easy to calculate and, therefore, it is generally used.

The TWR measures the performance per dollar invested. It is calculated independently of cash flows to or from the portfolio segment. TWR measures the performance that would have been realized had the same capital been under management over the period. This method is necessary for comparing performance among managers. The TWR calculation requires knowledge of the value of the portfolio segment, V_t , just before a cash flow takes place.

The first period rate of return, before the first cash withdrawal at time k , r_{t+k-1} is given by:

$$1 + r_{k-1} = (V_{k-1}/V_0).$$

The rate of return for the second period, that is, from $t+k$ to $t+T$, is given by:

$$1 + r_{T-k} = (V_T/(V_{k-1} - C_k)).$$

The total rate of return, r_{t+T} , is:

$$1+r_T = (1+r_{k-1})(1+r_{T-k}).$$

In the above example assume $V_{t-k-1} = 107$, then

$$1 + r_{k-1} = 107/100 = 1.07 \quad (r_{k-1} = 7.00%).$$

$$1 + r_{T-k} = 50/47 = 1.0638 \quad (r_{T-k} = 6.38%).$$

$$1 + r_T = 1.1382 \quad (r_T = 13.82%).$$

Clearly, the various methods of calculating a rate of return yield very different results: from 13.82% to 20.05%.

In general, the TWR is the method used to compare and measure the performance of portfolios. It tends to estimate returns in a more consistent manner than the MWR.

Example XVII.5: Consider a U.S. manager who is restricted to a 10% investment allocation in Brazil. She manages a USD 1 million fund. The manager invests USD 100,000 in the Bovespa stock index. After two weeks the index rises 25%. The manager then transfers USD 25,000 to another market. Over the next two weeks the Bovespa index loses 25%. The following table summarizes the performance of the manager:

| | t=1 | t=15 | t=30 | TWR | MWR |
|-----------|-----|------|-------|--------|--------|
| Index | 100 | 125 | 93.75 | -6.25% | -6.25% |
| Portfolio | 100 | | | | |
| | ... | 100 | 75 | -6.25% | 0% |

The calculations for the portfolio TWR and MWR as shown in the above table are as follows:

$$1 + \text{TWR} = (125/100) \times (75/100) = 0.9375. \quad (\text{TWR} = -6.25\%)$$

$$\text{MWR} = (75 + 25 - 100) / (100 - .5(25)) = 0.$$

It should be clear that the Brazilian index lost 6.25% over the month considered. However, only the TWR method consistently delivers the right answer. ¶

Calculating TWR on the basis of daily data would be optimal, however, it is not easy, especially in global portfolios, given the different currencies, types of investment and differences in national trading procedures to reconcile. Weekly or biweekly computations might be a good compromise.

2.B.2 IPA: Breaking Down Performance

We want to evaluate the performance of a portfolio manager. This portfolio manager might be good in certain areas and not as good in other. An IPA can determine the performance of a portfolio manager in various segments according to type of asset (stocks, bonds, cash, etc.) and currency. Each homogeneous segment (Mexican stocks, European bonds) is valued separately in its local currency.

The base currency rate of return is easily derived by translating all prices into the base currency D at exchange rate S_j :

$$r_{jD} = (P_j^t S_j^t + D_j^t S_j^t - P_j^{t-1} S_j^{t-1}) / (P_j^{t-1} S_j^{t-1}),$$

where

P_j : value of the portfolio segment, j , in local currency.

D_j : dividends paid during the period.

Let p_j , d_j and s_j be the rate of change (percent) of P_j , D_j and S_j , respectively. Then, after some algebra, we can write,

$$r_{jD} = p_j + d_j + s_j(1 + p_j + d_j) = p_j + d_j + c_j.$$

| | | | | | | |
|------------------|---|---------|---|-----------|---|------------|
| Total return | | Capital | | Yield | | Currency |
| in base currency | = | yield | + | component | + | component. |

Note the currency component, c_j , is equal to zero if the exchange rate, S_j , does not move, but differs from s_j because of the cross terms (price and dividends cross effects).

Over period t , the total return on account r is computed in the base currency as follows:

$$r = \sum_j \omega_j r_{jD} = \sum_j \omega_j (p_j + d_j + c_j) =$$

$$= \sum_j \omega_j p_j + \sum_j \omega_j d_j + \sum_j \omega_j c_j.$$

$$= \text{Capital gain component} + \text{Yield component} + \text{Currency component}.$$

Example XVII.6: Table XVII.2 breaks down the total return of the asset allocation of a portfolio (15.20%) into capital gains in the local currency (12.45%), yield (0.72%) and exchange rate gains (2.03%).

TABLE XVII.2
Breakdown of a Portfolio's Total Return

| | | | |
|------------------------|-------------------------|-------|-------|
| Total Return | | | 15.20 |
| Capital gains (losses) | | | 12.45 |
| | Bond | 1.25 | |
| | Equity | 11.20 | |
| | Market return | 8.55 | |
| | Indiv. stocks selection | 2.65 | |
| Currency movements | | | 2.03 |
| | Bonds | 1.12 | |
| | Equity | 0.91 | |
| Yield | | | 0.72 |
| | Bonds | 0.33 | |
| | Equity | 0.39 | |

In general, the relative performance of a manager may be measured by evaluating his/her performance in three areas: security selection, asset allocation, and market timing.

2.B.2.i Security Selection

A manager's security selection ability is determined by isolating the local market return of his/her account. Let call I_j the return in local currency, of the market index corresponding to segment j (for example, the Mexican Stock Market index).

$$r_{jD} = I_j + (p_j - I_j) + d_j + c_j.$$

The total portfolio return may be written as:

$$r = \sum_j \omega_j I_j + \sum_j \omega_j (p_j - I_j) + \sum_j \omega_j d_j + \sum_j \omega_j c_j =$$

$$= \begin{array}{cccc} \text{Market} & & \text{Security} & & \text{Yield} & & \text{Currency} \\ \text{return} & + & \text{selection} & + & \text{component} & + & \text{component} \\ \text{component} & & \text{component} & & & & \end{array}$$

The first term measures the performance the manager would have achieved had he or she invested in a local market index instead of individual securities. This contribution is calculated net of currency movements, which are picked up by the last term in the formula. The second term measures the contribution made by the manager's individual security selection.

Example XVII.7: Example XVII.6 breaks down the performance of a portfolio's equity investment. The 11.20% capital gain in equity is divided into a 8.55% market index return and a 2.65% individual stock selection contribution. The currency component contributes 2.03% to the total portfolio's return. The majority of the return is explained by capital gains in local markets (12.45%). ¶

2.B.2.ii Asset Allocation

A manager's performance is evaluated relative to a standard. This comparison is usually made with respect to the return I^* on an international index such as the MSCI EAFE or World Index. The objective is to measure $(r - I^*)$.

Let call I_{jD} , the return on market index j , translated into base currency D .

$$I_{jD} = I_j + E_j,$$

where E_j is the currency component of the index return in base currency. That is,

$$E_j = s_j (1 + I_j).$$

Let call ω_j^* the weight of market j in the international index chosen as a standard (these weights are known). In base currency, the return on this international index equals

$$I^* = \sum \omega_j^* I_{jD}.$$

Now, we can write r as:

$$r = \sum \omega_j^* I_{jD} + \sum (\omega_j - \omega_j^*) I_j + \sum (\omega_j c_j - \omega_j^* E_j) + \sum \omega_j d_j + \sum \omega_j (p_j - I_j)$$

$$= \begin{array}{cccccc} \text{International} & & \text{Market} & & \text{Currency} & & \text{Yield} & & \text{Security} \\ \text{index} & + & \text{allocation} & + & \text{allocation} & + & \text{component} & + & \text{selection} \\ \text{return} & & \text{contribution} & & \text{contribution} & & & & \text{contrib.} \end{array}$$

This breakdown allow us to estimate the contribution to total performance of any deviation from the standard asset allocation $(\omega_j - \omega_j^*)$.

The word *contribution* in this context indicates performance relative to a selected index, while the word component refers to a breakdown of the portfolio's total return.

The relative performance of a manager, $r-I^*$, is the result of two factors:

(1) An asset allocation different from that of the index. This is a source of positive performance or the manager who overweights the best-performing markets ($\omega_j > \omega_j^*$) and underweights the poorest performing markets. This factor can be decomposed into market and currency contributions. So it is possible for a manager to have chosen his/her markets effectively (positive market allocation) but be penalized by currency movements (negative currency allocation contribution).

(2) Superior security selection.

This breakdown of relative performance is the simplest of many possibilities. IPA services use a variety of similar approaches. Popular IPA services are provided by Frank Russell, Intersec Research Co., and Wood McKenzie.

2.B.2.iii Market Timing

Asset allocation changes over time. Thus, over a given performance period, there is a contribution made by *timing the market*. This contribution is made by time-variation in ω_j . Precise information on the weights over time is necessary to do market timing evaluation.

III. Risk-Adjustment Performance of Portfolios

In the previous section we have only focused on returns. Now, we want to focus on the the risks taken by the portfolio manager. The total risk of a portfolio is measured by the standard deviation of its rate of return. To get reliable estimates of the standard deviation we need at least four years of frequently sampled data. Monthly data would give us 48 observations. Annual or quarterly data would give us few observations and the estimates would not be very reliable.

Example XVII.8: A portfolio is compared with several indexes, where risk estimates are computed from daily returns. All risk and return estimates are reported on an annual basis (1994-1998).

| | Total Return (%) | Risk | Correlation with Portfolio |
|---------------|------------------|-------|----------------------------|
| Portfolio | 15.40 | 26.67 | 1.00 |
| S&P 500 | 18.86 | 15.43 | 0.54 |
| Pacific Index | -10.23 | 17.30 | 0.23 |
| Europe Index | 18.33 | 15.21 | 0.46 |

Note that by diversifying into the other indexes would reduce the risk faced by an investor who buys the above-mentioned portfolio. ¶

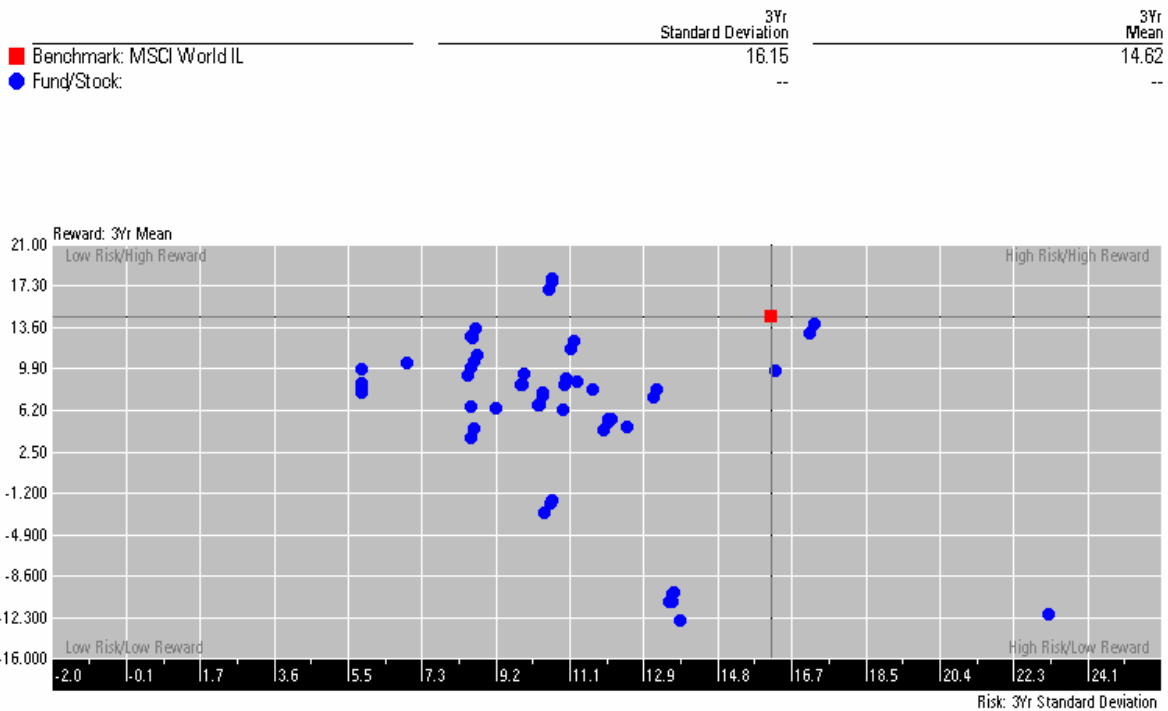
As discussed in the Review Chapter, the total risk (SD) of a portfolio is not the only relevant measure of risk. Investors who are interested in diversification typically spread their investments among several funds. Calculating the correlation of indexes reveals whether the benefits of diversification have been achieved. For example, a low correlation between a domestic portfolio and a foreign portfolio means that there are great benefits of diversification. Some investment services compute betas rather than correlation coefficient to derive how closely our portfolio moves with other international markets.

IPA services display risk-return performance comparisons for the universe of managers they evaluate. Graph XVII.1 presents the 3-year risk/return performance (1995-1998) of 56 mutual funds that have an international hybrid style, as defined by Morningstar. While looking at this graph, think of the benefits of diversification as allowing a manager to move to the efficient frontier.

Example XVII.9: In Graph XVII.1 take the Templeton Growth and Income I fund. Suppose you are the manager of this mutual fund, with a 3-year mean return of 8.01% and standard deviation of 13.19%. The mean of your portfolio was average, however, by diversifying into another portfolio, you could have substantially increased the mean of your portfolio for the same level of risk or for the same level of return you could have decreased your risk. ¶

GRAPH XVII.1
Risk/Reward Profile: Mean against SD

3 Year Risk/Reward Scatterplot



Source: Morningstar.

3.A Simple ratios

It seems attractive to use a single number that takes into account both performance and risk. This is often done using a measure called the Sharpe Ratio. William Sharpe, in a paper published in the Journal of Business, in 1966, used total risk ($SD=\sigma$) to create an index of portfolio performance. The Sharpe Ratio measures the reward to risk. The Sharpe Ratio or *reward to variability* ratio (mean excess return over the risk-free rate divided by the standard deviation of returns) can be calculated as follows:

$$RVAR_i = (r_i - r_f) / \sigma_i.$$

The higher the value of $RVAR_i$, the better the performance of portfolio or asset i , that is, the higher is the risk premium per unit of total risk. The value of $RVAR_i$ represents the price per unit of total risk.

The Sharpe ratio is appropriate when total risk matters; that is, when most of an investor's wealth is invested in asset i . When the asset is only a small part of a large, diversified portfolio, measuring risk by total volatility is inappropriate. J. Treynor, in a paper published in the Harvard Business Review, in 1965, proposed a modification of the Sharpe Ratio, emphasizing systematic risk. This measure is the *reward to volatility* ratio (mean excess return over the risk-free rate divided by the beta), or Treynor Ratio, and can be calculated by

$$RVOL_i = (r_i - r_f) / \beta_i.$$

RVOL measures the risk premium per unit of systematic risk, under the CAPM.

These ratios provide a comparable index by which several portfolios can be assessed and ranked. For example, the higher the RVOL the better off is the portfolio performance and the more likely is its inclusion in an investment portfolio. In practice both measures give similar rankings of portfolios.

Example XVII.10: Mr. Krang, a U.S. investor, has a domestic portfolio that tracks the U.S. market perfectly. He is considering investing in the following foreign stock markets:

| Market | r_i | σ_i | β_{WORLD} | RVAR | RVOL |
|--------|-------|------------|------------------------|-------|-------|
| France | .07 | 1.02 | 0.89 | .0196 | .0225 |
| Panama | .15 | 2.20 | 0.55 | .0454 | .1818 |
| Korea | .13 | 1.44 | 0.51 | .0556 | .1569 |
| U.S. | .10 | 1.08 | 1.02 | .0463 | .0490 |
| WORLD | .12 | 1.01 | 1.00 | .0693 | .0700 |
| r_F | .05 | | | | |

r_F is the U.S. one-year Treasury Bill rate, that is, the risk free rate. β_{WORLD} is the beta of the foreign market with the World Index.

Based on a risk-adjusted performance measure (RVAR and RVOL), Mr. Krang ranks the performance of the four markets as follows.

| Rank | RVAR | RVOL |
|------|--------|--------|
| 1 | Korea | Panama |
| 2 | U.S. | Korea |
| 3 | Panama | U.S. |
| 4 | France | France |

Although it is not common, we can see that RVAR and RVOL can give different rankings. ¶

3.A.1 Formation of Optimal Portfolios

The calculation of an optimal portfolio, using the standard Markowitz approach, can be greatly simplified by assuming a single-index model (for example, the CAPM). Assuming such a single-index model, Elton and Gruber, in Modern Portfolio Theory and Investment Analysis, present a set of very simple rules to include assets in a portfolio. Using the RVOL to rank assets, Elton and Gruber derive a number C^* , a cut-off rate, that determines whether an asset belongs to an optimal portfolio or not. That is, the rules discussed in Elton and Gruber are very simple:

- i) Rank assets according to their RVOL from highest to lowest.
- ii) The optimal portfolio consists of investing in all stock for which $RVOL_i > C^*$.

C^* is the unique cut-off rate that determines which assets are included based on their RVOL. So far, we have not talked about the main issue: the calculation of C^* . Suppose we have a value for C^* , C_i . We assume that i securities belong to the optimal portfolio and calculate C_i . Since assets are ranked from highest RVOL to lowest, if a particular asset belongs to the optimal portfolio, all higher ranked assets also belong in the optimal portfolio. It can be shown that for a portfolio of i asset C_i is given by:

$$C_i = C_{num} / C_{den},$$

$$C_{num} = \sigma_m^2 \sum_{j=1}^i (r_j - r_f) (\beta_j / \sigma_{\epsilon_j}^2),$$

$$C_{den} = 1 + \sigma_m^2 \sum_{j=1}^i (\beta_j^2 / \sigma_{\epsilon_j}^2),$$

where σ_m^2 is the variance of the market index and $\sigma_{\epsilon_j}^2$ is the asset unsystematic risk.

We calculate values of C_i as if the first ranked asset was in the optimal portfolio ($i=1$). Then, the first and second ranked assets were in the optimal portfolio ($i=2$), then the first, second, and third ($i=3$) ranked assets were in the optimal portfolio ($i=3$), and so forth. We know we have found the optimal C_i , when all assets used in the calculation of C_i have a higher RVOL than C_i and all assets not used in the calculation of C_i have a lower RVOL than C_i . Therefore, the cut-off rate C^* is equal to that particular C_i .

Example XVII.11: Reconsider Example XVII.10. Mr. Krang, is considering investing in the following foreign stock markets. He wants to form an optimal portfolio:

| Market | $(r_i - r_f)$ | β_{WORLD} | RVOL | $\sigma_{\epsilon_i}^2$ | $(r_i - r_f)\beta_i / \sigma_{\epsilon_i}^2$ | $\sigma_m^2 \beta_i^2 / \sigma_{\epsilon_i}^2$ | C_i |
|--------|---------------|-----------------|-------|-------------------------|--|--|-------|
| Panama | .10 | .55 | .1818 | 4.5314 | .01214 | 0.06810 | 0.012 |
| Korea | .08 | .51 | .1569 | 1.8083 | .02256 | 0.14674 | 0.029 |
| U.S. | .05 | 1.02 | .0490 | 0.1051 | .48525 | 10.09812 | 0.047 |
| France | .02 | .89 | .0225 | 0.2324 | .07659 | 3.47686 | 0.041 |

Some calculations for Korea:

A. $\sigma_{\epsilon, Kor}^2$

From the Review Chapter, recall that $\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma_{\epsilon_i}^2$.

$$\sigma_{\epsilon, Kor}^2 = (1.44)^2 - (.51)^2 (1.01)^2 = 1.8083.$$

B. C_{Kor}

$$C_{\text{Kor}} = (1.01)^2 [.01214 + .02256]/[1 + (0.06810 + 0.14674)] = 0.029.$$

Now, we compare the C_i coefficients with the RVOL_i . That is,

$$\begin{aligned} \text{RVOL}_{\text{Pan}} = .1818 > C_{\text{Pan}} = 0.012 & \quad (\text{Panama should be included}). \\ \text{RVOL}_{\text{Kor}} = .1569 > C_{\text{Kor}} = 0.029 & \quad (\text{Korea should be included}). \\ \text{RVOL}_{\text{US}} = .0490 > C_{\text{US}} = 0.047 & \quad (\text{U.S. should be included}). \\ \text{RVOL}_{\text{Fra}} = .0225 < C_{\text{Fra}} = 0.041 & \quad (\text{France should not be included}). \end{aligned}$$

From the above calculations, $C^* = C_{\text{US}} = .047$. Then, Mr. Krang portfolio will include Panama, Korea, and the U.S. ¶

Once the assets that are contained in the optimal portfolio are determined, it remains to calculate the proportion invested in each asset. The proportion (%) invested in each asset is ω_i , where the ω 's are determined by:

$$\omega_i = Z_i / \sum_j Z_j,$$

$$\text{where } Z_i = (\beta_i / \sigma_{\epsilon_i}^2) (\text{RVOL}_i - C^*).$$

Example XVII.12: Reconsider Example XVII.11. We want to calculate the Z_j for Korea. Using the above formula, we have:

$$Z_{\text{Kor}} = (\beta_{\text{Kor}} / \sigma_{\epsilon, \text{Kor}}^2) (\text{RVOL}_{\text{Kor}} - C^*) = (.51 / 1.8083) \times (.1569 - .047) = 0.03099541. ¶$$

Exercise XVII.3 asks you to apply the above formula to determine the weights for the markets selected in Example XI.11.

3.B Bankers Trust's risk adjustment method

Bankers Trust uses a modification of RVAR to evaluate the performance of its managers. They use the so-called risk-adjusted return on capital (RAROC) system. RAROC adjusts returns taking into account the capital at risk, which is defined as the amount of capital needed to cover 99 percent of the maximum expected loss over a year. The one-year horizon is used for all RAROC comparisons, regardless of the actual holding period. Thus, all traders can be compared using the same measure.

Example XVII.13: Bankers Trust has two traders dealing in different markets. One trader deals in the futures stock index market and reports an annualized profit of USD 3.3 million. The other trader deals in the foreign exchange market and reports an annualized profit of USD 3 million. Assume that the nominal face value of the futures index contract was USD 45 million, while the nominal amount of the foreign exchange contracts was USD 58 million. The volatility of futures stock indices is 21% annually, while the volatility of foreign exchange is 14%.

Bankers Trust needs to hold enough cash to cover 99% of possible losses. Assuming a normal distribution, Bankers Trust knows that the 1% lower tail of the distribution lies 2.33 standard deviations below the mean.

Therefore, using a normal distribution, Bankers Trust easily determines the worst possible loss for both traders (see Review Chapter):

Futures stock index: $2.33 \times 0.21 \times \text{USD } 45,000,000 = \text{USD } 22,018,500.$

Foreign exchange: $2.33 \times 0.14 \times \text{USD } 58,000,000 = \text{USD } 18,919,600.$

Now, Bankers Trust calculates RAROC. That is,

Futures stock index: $\text{RAROC} = \text{USD } 3,300,000 / \text{USD } 22,018,500 = .1499.$

Foreign exchange: $\text{RAROC} = \text{USD } 3,000,000 / \text{USD } 18,919,600 = .1586.$

The reward-to-risk, measured by RAROC, of the futures stock index trader is 14.99%, while the reward-to-risk of the foreign exchange trader is 15.86%. Therefore, once adjusted for capital-at-risk, the foreign exchange trader provided a better return. ¶

3.C The Jensen measure

Another popular measure is the *Jensen' alpha measure*. This measure is based on the mean-variance efficiency of the Market portfolio. Recall that under the CAPM, expected excess return for asset i are proportional to expected excess market returns. That is,

$$E[(r_i - r_f)] = \beta_i E[(r_m - r_f)],$$

where r_i represents the rate or rate of asset i and r_m represents the return of a well-defined market portfolio. It is common to test the CAPM using the following market-model regression:

$$(r_i - r_f) = \alpha_i + \beta_i (r_m - r_f) + \varepsilon_i.$$

Under the CAPM, α_i is equal to zero. If α_i is greater than zero, the asset i is outperforming the CAPM's expected return.

Suppose we want to measure the performance of the managed fund i , which has a rate or rate r_i . Then, the performance of a managed fund may be based on a regression estimate of α_i , which is what we call *Jensen's alpha*. In order to see if α_i is significantly different than zero, a t-test on α_i is performed.

If α_i is positive and significantly different than zero, then the managed fund has a superior risk-adjusted performance than the market. If α_i is negative and significantly different than zero, then the managed fund has an inferior risk-adjusted performance than the market.

The Jensen's alpha measure reflects the selectivity ability of a manager. However, it has been shown that it does not measure correctly the timing skills of the manager. This measure, in fact, can be negative if the manager has superior timing information. Selectivity refers to the ability of a manager to buy or sell a specific asset. Timing refers to the ability of a manager to buy or sell at a specific moment in time.

There is another measure of portfolio performance called Positive Period Weighing Measure (PPW). This measure is not dependent on timing skills and it is a good measure of selectivity skills. One advantage of the PPW measure is that it does not require the knowledge of the composition of the managed portfolio. However, in practical applications to international portfolios, the Jensen's alpha and the PPW measure give similar results. PPW measures are cumbersome to estimate. Therefore, we will concentrate on the Jensen's alpha measure.

Sometimes, the market regression is augmented to introduce other factors besides the market portfolio that supposedly can explain abnormal returns for security (in this case, managed portfolio) *i*. In this case, we have a *multi-factor market model*. For example, in the case of international portfolios, it is usual to include a portfolio of riskless assets denominated in each currency on the portfolio, with a return of r_c ,

$$(r_i - r_f) = \alpha_i + \beta_{im} (r_m - r_f) + \beta_{ic} (r_c - r_f) + \varepsilon_i.$$

Example XVII.14: Table XVII.3 presents the Jensen measure for the market model (second column) and the extended market model (third column) for 14 U.S. international managed portfolios from January 1982 to June 1988. r_m is measured by the returns of the Morgan Stanley Capital Investment World Index and r_c is measured by the returns on an equally weighted portfolio of Eurocurrency Deposits.

TABLE XVII.3
Jensen's alpha measures (α_i) and Tests of Mutual Fund Performance

| Variables in the regression: | r_m | r_m & r_c | r_m & D_{87} |
|------------------------------|-------------------|-------------------|-------------------------|
| Alliance | -0.191 (.476) | -0.191 (.480) | 0.123 (0.308) |
| GT Pacific | -0.476 (.536) | -0.465 (.536) | 0.005 (0.009) |
| Kemper | -0.182 (.471) | -0.184 (.486) | 0.208 (.563) |
| Keystone | -0.389 (1.420) | -0.390 (1.465) | -0.280 (.990) |
| Merrill | 0.042 (.088) | 0.040 (.085) | 0.407 (.862) |
| Oppenheimer | -0.486 (1.240) | -0.486 (1.232) | -0.164 (.424) |
| Price | -.083 (.259) | -0.085 (.277) | 0.132 (.410) |
| Putnam | -0.030 (.110) | -0.030 (.112) | 0.129 (.467) |
| Scudder | -0.150 (.453) | -0.151 (.468) | 0.192 (.694) |
| Sogen | 0.198 (.849) | 0.199 (.869) | 0.484 (2.285) |
| Templeton Global | -0.054 (.124) | -0.050 (.164) | 0.392 (1.211) |
| Transatlantic | -0.543 (1.378) | -0.544 (1.446) | -0.308 (.771) |
| United | 0.095 (.419) | 0.094 (.416) | 0.297 (1.351) |
| Vanguard | 0.281 (.756) | 0.278 (.782) | 0.387 (1.005) |

Note: absolute value of the t-statistics in parenthesis.

The results are very simple. According to the Jensen's alpha measure, none of the managed portfolios fared very well (the t-statistics are smaller than two). Moreover, even the signs are wrong: the majority of the estimates are negative (though not significant). Note that including in the market model the portfolio of riskless assets in local currencies, r_c , does not make a difference in both the estimates of α_i and the test-statistics. ¶

The poor performance is surprising. A possible explanation might be related to the inclusion in the sample of a big negative observation ("outlier"), the Crash of October 1987. If mutual funds merely provide investors with diversification services, then their performance during this month should mimic that of the overall market. Conversely, if managers have superior information and market timing, then this should be reflected at this time as well.

One approach to separate the effects of a specific outlier (in this case, the crash of October 1987) on the performance of mutual funds is to include in the market model regression a Dummy variable. Dummy variables are variables that take a value of zero or one.

Example XVII.15: For the mutual funds in Example XVII.13, we ran the following regression,

$$(r_i - r_f) = \alpha_i + \beta_{im} (r_m - r_f) + \delta_i D_{87} + \varepsilon_i.$$

where D_{87} represents the October 1987 dummy variable, which takes a value equal to one during the month of October 1987 and a value equal to zero for all the other observations. An estimate of δ_i will measure of the effect of the Crash of October 1987 for each portfolio. A t-test on δ_i is necessary to evaluate the significance of the Crash of October 1987.

The third column of Table XVII.3 reports the Jensen measure - estimate of α_i - when the above regression is estimated, and the Jensen test in parenthesis. When the dummy variable is included, only three Mutual funds have a negative estimate of α_i , and one is significantly different than one (Sogen). ¶

Taken together, the results suggest that active management of the funds does not yield superior performance, but much of the poor performance is associated with relatively large holdings of assets that did relatively poorly in October 1987.

Interesting reading:

International Investments, by Bruno Solnik. (Sections of this Chapter are based on this Chapter.)

Modern Portfolio Theory and Investment Analysis, 4th Edition, by Edwin Elton and Martin Gruber, published by John Wiley. New York.

Portfolio Selection, by Harry M. Markowitz, 1959, published by John Wiley. New York.

Exercises:

1. A Costa Rican mutual fund manager wants to invest CRC 20 million in Mexican stocks (CRC = Costa Rican colon). She is considering two alternatives: (1) investing in an index fund tracking the IPC Mexican index and (2) giving the money to an active Mexican manager. The Costa Rican manager studies the past history of the active manager. The active manager turns the portfolios over three a year. The transaction costs are around 0.70%. The active manager charges 0.60% in annual management fee, and the indexer charges 0.25%. By how much should the active manager outperform the index to cover the extra costs?

2. An investor is considering adding a Swiss fund to his U.S. portfolio. Is the Swiss fund attractive? Should the investor add it to his U.S. portfolio.

| | Portfolio weights (%) | Total Return (USD) | SD of Returns | Correlation with U.S. Index |
|------------|-----------------------|--------------------|---------------|-----------------------------|
| U.S. | 90 | 10 | 15 | 0.99 |
| Swiss fund | 10 | 11 | 20 | -0.10 |

3. Go back to Example XVII.10. Assume Mr. Krang adds to his U.S. portfolio, which tracks the World market, all markets with a higher RVOL than the U.S. RVOL. Mr. Krang gives a weight of 20% to each foreign market in your expanded portfolio.

- i. What is the risk of your expanded portfolio?
- ii. Is the risk of your expanded portfolio lower than before?
- iii. Under the excess return approach of Elton and Gruber, the optimal portfolio consists of securities for which $RVOL > C^*$.

Recall that once the assets that are contained in the optimal portfolio are determined, it remains to calculate the percent invested in each asset. The percent invested in each asset is

$$\omega_i = Z_i / \sum_j Z_j,$$

where $Z_i = (\beta_i / \sigma_{\epsilon_i}^2) \times (RVOL_i - C^*)$.

Using this approach, how should Mr. Krang restructure his portfolio?

4. Mr. Rensenbrik, a U.S. investor, has a domestic portfolio that tracks the U.S. market perfectly. He is considering investing in Spain, Hong Kong, the U.K., and Peru. Mr. Rensenbrik has the following information:

| Market | r_i (%) | β_i | σ_i | ρ_{WORLD} |
|-----------|-----------|-----------|------------|-----------------------|
| World | 24.7 | 1.00 | 18.2 | 1.00 |
| U.S. | 34.7 | 0.78 | 17.0 | 0.83 |
| Spain | 26.0 | 0.26 | 20.9 | 0.23 |
| Hong Kong | 18.2 | 0.34 | 45.5 | 0.15 |
| U.K. | 17.2 | 0.63 | 24.4 | 0.45 |
| Peru | 65.7 | 0.04 | 66.5 | 0.01 |

In addition, Mr. Rensenbrik estimates that $r_F = 6.5\%$.

r_i is the return in USD of market i , r_F is the U.S. one-year Treasury Bill rate, that is, the risk free rate, ρ_{WORLD} is the correlation between market i and the World Index, and β_{WORLD} is the beta of the foreign market with the World Index.

Mr. Rensenbrik wants to form an optimal portfolio. Determine the weights for Mr. Rensenbrik's optimal portfolio.

5. Suppose First Bank has three dealers in different markets. The first dealer trades in Latin American Brady bonds and reports an annualized profit of USD 5 million. The second dealer trades in Japanese government bond (JGB) market and reports an annualized profit of USD 2 million. The third dealer trades in the GBP/USD market and reports an annualized profit of USD 1.5 million. Assume that the nominal face value of the Brady bonds was USD 20 million, the nominal amount of the JGB contracts was USD 50 million, and the nominal amount of the GBP/USD contracts was USD 15 million. The volatility of Latin American Brady Bonds is 32% annually, the volatility of the JGBs is 12%, and the volatility of the USD/GBP was 15%.

Which trader provided the best risk-adjusted trade-off? Use RAROC and RVAR to compare the performance of the three dealers. Assume the risk-free rate is 6.5%.

6. Mr. Splinter is a foreign investor with an account with a Cayman Islands bank. He does not pay taxes on his account. The Cayman Island bank assigned an officer to manage his account. Now, Mr. Splinter wants to measure the performance of the manager of his account. He is using the USD as his reference currency.

Mr. Splinter is looking at the two most-recent valuation monthly reports, which are given in Table E.1 and wonders how to compute the performance. He knows that the MSCI World Index has risen by 2% this month (in USD). Mr. Splinter is looking for an answer to the following questions:

- (1) What is the total return on his portfolio?
- (2) What are the sources of this return (capital appreciation, yield, and currency movements)?

TABLE E.1

Account Valuation for Mr. Splinter, December 31, 2002.

| Security | Number of securities or nominal. | Market Price | Accrued interest | Total (USD) |
|------------------|----------------------------------|--------------|------------------|-------------|
| Equity | | | | |
| U.S. | | | | (29.8%) |
| AMAX (USD) | 1,000 | 24.50 | | |
| AGCO (USD) | 500 | 37.25 | | 43,125 |
| Japan | | | | (43.0%) |
| Hitachi (JPY) | 10,000 | 800 | | |
| TDK (JPY) | 1000 | 6,500 | | 62,205 |
| Sweden | | | | (12.7%) |
| Ericson (SKK) | 200 | 770 | | 18,326 |
| Bonds | | | | (14.5%) |
| Gov. 6% 02 (JPY) | 2,000,000 | 91% | 0.52% | |
| EIB 8% 03 (JPY) | 3,000,000 | 98.5 | 3.47% | 20,976 |
| Total | | | | 144,632 |

JPY= .00912 dollars

SKK= .119 dollars

U.S. Index = 100

Japan Index = 100

Swedish Index = 100

JPY Bond Index = 100

World Index = 100

TABLE E.1 (continuation)

Account Valuation for Mr. Splinter, January 31, 2003.

| Security | Number of securities or nominal. | Market Price | Accrued interest | Total (USD) |
|------------------|----------------------------------|--------------|------------------|-------------|
| Equity | | | | |
| U.S. | | | | (28.8%) |
| AMAX (USD) | 1,000 | 23.50 | | |
| AGCO (USD) | 500 | 38.00 | | 42,500 |
| Japan | | | | (43.5%) |
| Hitachi (JPY) | 10,000 | 820 | | |
| TDK (JPY) | 1000 | 6,100 | | 64,350 |
| Sweden | | | | (12.9%) |
| Ericson (SKK) | 200 | 870 | | 19,140 |
| Bonds | | | | (14.8%) |
| Gov. 6% 02 (JPY) | 2,000,000 | 90.0% | 1.04% | |
| EIB 8% 03 (JPY) | 3,000,000 | 96.9% | 4.16% | 21,837 |
| Total | | | | 147,827 |

JPY= .0095 dollars

SKK= .110 dollars

U.S. Index = 102.5

Japan Index = 98

Swedish Index = 108

JPY Bond Index = 99