CHAPTER 16

International Asset and Currency Allocation

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The focus of this chapter is on the international asset allocation issues that confront U.S. investors. These are:

1. International assets versus domestic assets.
2. International equities versus international fixed income.
3. Foreign currency exposure versus foreign asset exposure.

We will show that, when an investor considers the full opportunity set of all the world's capital markets, both equities and fixed income, his risk/reward preference as revealed by domestic asset allocation choices should also be reflected in international asset allocation choices. In other words, an investor with a balanced domestic portfolio is likely also to prefer a balanced international portfolio.

It will also be shown that, in international investment, it is appropriate to separate long-run asset allocation decisions from long-run currency allocation decisions. This suggests that investors will inevitably enhance their risk/return opportunity set by *separately* making two kinds of international allocation decisions—one concerning asset exposure and one

concerning currency exposure. When these allocations differ, the use of continuously hedged international portfolios is implied.

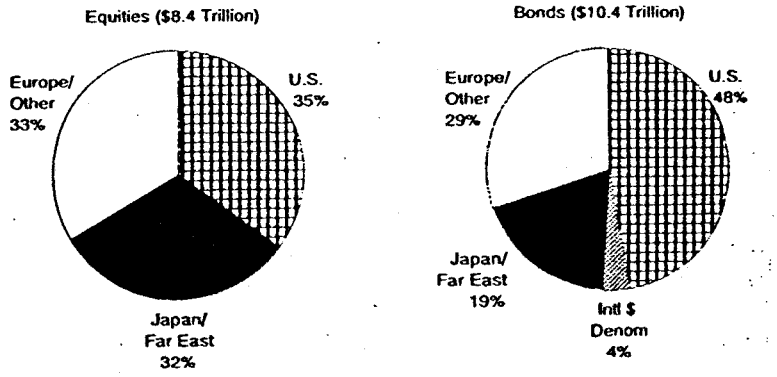
In fact, we will conclude that, in general, it may be more appropriate for a U.S. investor's *normal* international equity and fixed-income portfolios to be defined as fully hedged or partially hedged. Only under perverse assumptions about long-run currency surprises should an international investor's *normal* portfolio be exposed to foreign currency.

We will use the results of the last 13 years to illustrate the effects of these choices in the past and we shall outline a framework for how these decisions can be addressed optimally in the future.

INTERNATIONAL CAPITAL MARKET RETURNS AND RISKS

The world's investable capital markets, excluding cash and real estate, comprise some $19 trillion as of December 1990. This forms the universe for an institutional investor (see Exhibit 1). The world fixed-income

EXHIBIT 1
WORLD CAPITAL MARKETS



Sources: Morgan Stanley Capital International, Salomon Brothers Inc.

markets total some $10.4 trillion, while the world equity markets total $8.4 trillion. The U.S. markets comprise less than half the total of world markets in both the case of fixed-income and equities.

The non-U.S. markets have offered significant opportunities for U.S. investors over the last 13 years. These opportunities can be seen in the form of return enhancement and risk reduction.

RETURN ENHANCEMENT

Exhibits 2 and 3 show the returns in U.S. dollars from investing in international equity and fixed-income markets over the last 13 years. For both equities and fixed-income securities, non-U.S. markets have yielded significantly higher returns than their U.S. equivalents. A market weighted average of all non-U.S. equity markets returned 17.5% per annum in U.S. dollars compared with 12.9% per annum from the U.S.

EXHIBIT 2
INTERNATIONAL EQUITY MARKETS
RETURNS IN U.S. DOLLARS 1978–1990

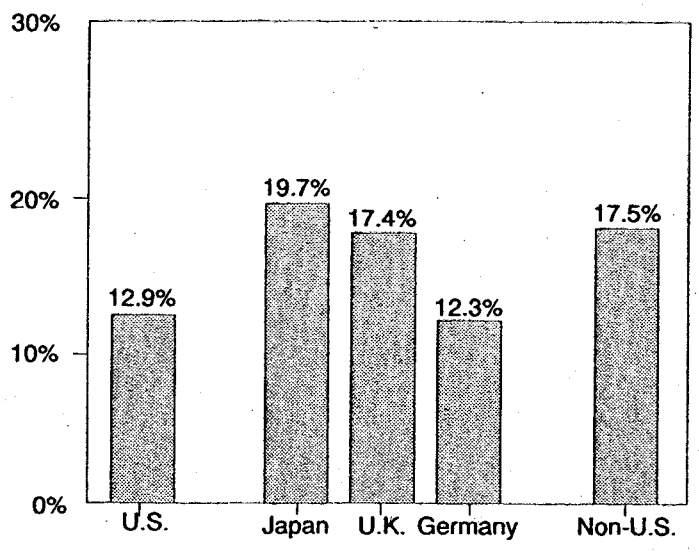
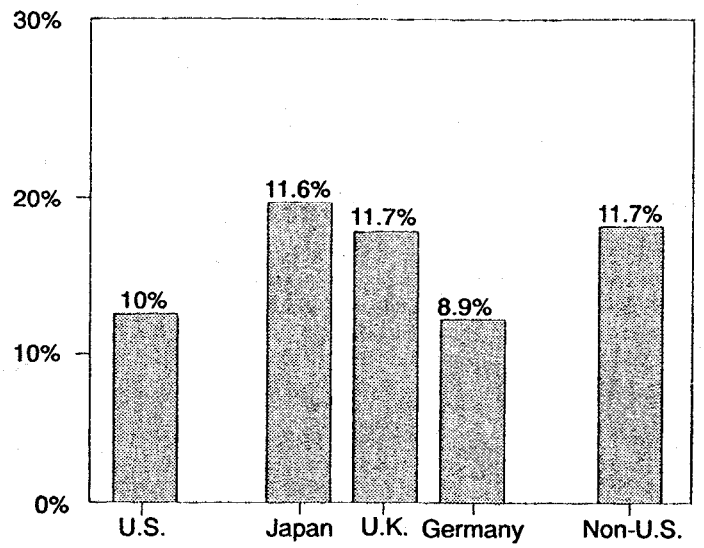


EXHIBIT 3
INTERNATIONAL FIXED-INCOME MARKETS
RETURNS IN U.S. DOLLARS 1978–1990



equity market. Similarly, non-U.S. fixed-income markets returned 11.7% compared to the U.S. fixed-income return of 10.0%.

RISK REDUCTION

While the non-U.S. capital markets offered the U.S. investor significant return opportunities, they did so without increasing risk. In fact, the U.S. investor's total portfolio risk was reduced through the use of non-U.S. markets. Exhibits 4 and 5 show the annualized standard deviation of U.S. dollar return from the international markets over the period 1978–1990. While individual international equity and fixed-income markets are significantly more risky than their U.S. equivalent, a diversified portfolio of non-U.S. equities or non-U.S. fixed-income securities is not significantly more risky than the equivalent domestic market. For example, a market weighted average of non-U.S. equity markets had an annual standard deviation of dollar return of 19.5% per annum compared with 16.2% per annum for the U.S. equity market.

EXHIBIT 4
INTERNATIONAL EQUITY MARKETS
STANDARD DEVIATION OF RETURNS IN U.S. DOLLARS 1978–1990

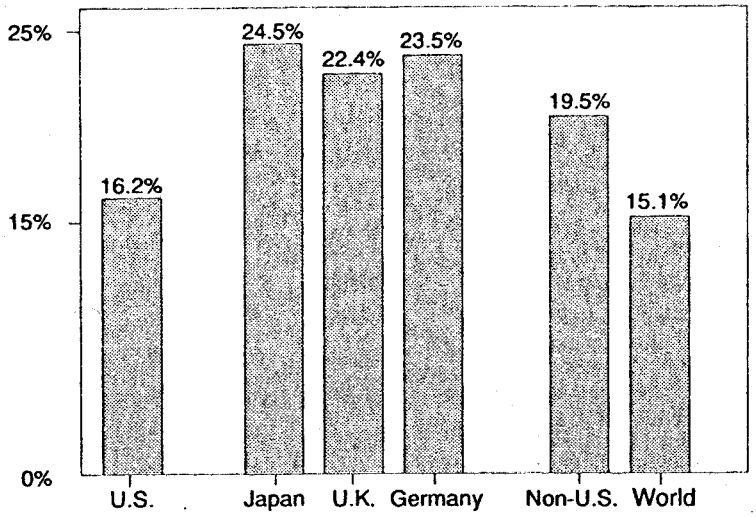
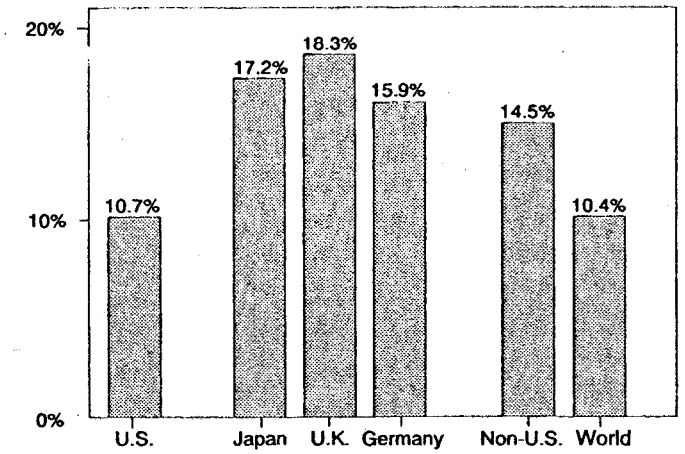


EXHIBIT 5
INTERNATIONAL FIXED-INCOME MARKETS
STANDARD DEVIATION OF RETURNS IN U.S. DOLLARS 1978–1990



This diversification *between* international markets is significant for both equities and fixed-income securities. It is important to bear in mind that international investment for any investor, U.S. or otherwise, always offers two tiers of diversification: first, diversification out of the domestic market; second, diversification across the many markets outside the domestic market.

In assessing the risk of international investment, the relevant measure is not total risk of the international markets, but their contribution to the overall risk of the investor's portfolio. From this perspective, international investment offers risk *reduction* in addition to the return opportunities described above. For both international equities and fixed-income securities, a capitalization weighted world portfolio of U.S. and non-U.S. markets is less risky than the U.S. market alone. This shows that diversification into international markets in fact reduces a U.S. investor's total portfolio risk.

INTERNATIONAL ASSET ALLOCATION

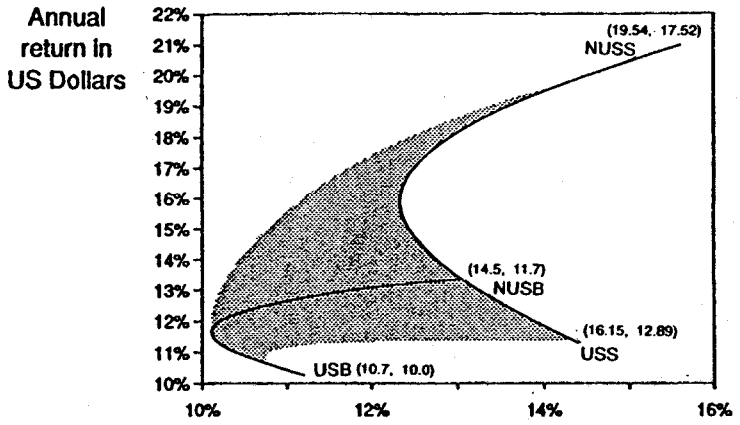
Exhibit 6 illustrates the returns and risks to various asset allocation decisions over the period 1978–1990. The line joining USS and NUSS shows returns and risks to a portfolio ranging from 100% U.S. equities up to 100% non-U.S. equities. The line USB, NUSB shows portfolios ranging from 100% U.S. fixed-income to 100% non-U.S. fixed-income. The line NUSB, NUSS shows all combinations of international fixed-income securities and international equities.

Exhibit 6 shows (1) that international equities and fixed-income securities add value when compared with their domestic counterparts, and (2) that they offer diversification among themselves (see frontier of the shaded area). This is the third tier of international diversification – across international equity and fixed-income.

From an asset allocation perspective, it is appropriate to consider the full spectrum of all international assets simultaneously when identifying an investor's portfolio risk/reward tradeoff. In other words, the more traditional domestic/international allocation question is more appropriately addressed in the context of simultaneous allocations across all four asset classes – U.S. equities, U.S. fixed-income, international equities and international fixed-income securities.

Of critical importance to this asset allocation problem is the correlation of diversification characteristics of all asset classes simultaneously. Exhibit 6 also gives these correlations for the period 1978–1990.

EXHIBIT 6
INTERNATIONAL EQUITY AND BOND MARKETS
RETURNS AND RISK 1978–1990



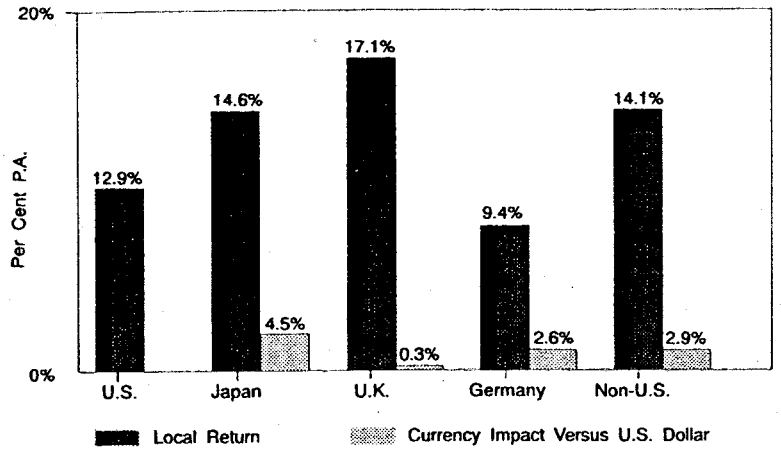
Correlations

U.S. stocks (USS)	1.00			
U.S. bonds (USB)	.33	1.00		
Non-U.S. stocks (NUSS)	.38	.22	1.00	
Non-U.S. bonds (NUSB)	.04	.36	.68	1.00

When an investor considers these four asset classes simultaneously in an optimization context, it is likely that his risk preference, as revealed by his domestic stock/bond allocation, will also be reflected in his international stock/bond allocation. In other words, say that in the absence of international investment, an investor was prepared to accept a target risk level of 12% as revealed by a 60/40 stock bond allocation; then, when international assets are allowed into the universe, the optimal portfolio at the same risk level will include both international stocks and bonds. A balanced U.S. investor is likely also to be a balanced international investor.

The exact proportions of such optimal portfolios will inevitably depend on the future expectations for risk, return and covariance. Examples

EXHIBIT 7
INTERNATIONAL EQUITY MARKETS
LOCAL AND CURRENCY RETURNS 1978–1990



of such optimal portfolios using *ex ante* equilibrium assumptions are discussed at a later stage.

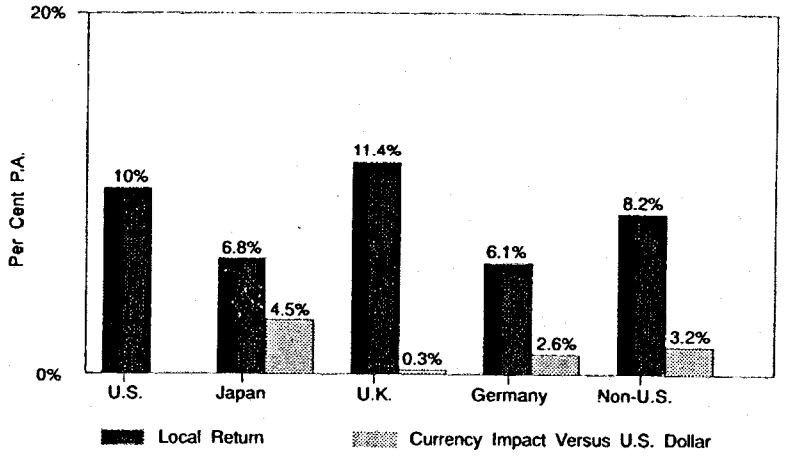
U.S. investors considering such asset allocation issues are often concerned with the relatively high correlation between international equity and international fixed income. This high correlation results from both asset classes sharing very similar currency exposure – a Japanese equity and a Japanese bond imply identical exposure to the Yen.

In order to appropriately identify asset allocation policies in global investment, it is important first to separate international asset allocation issues from international currency allocation. Indeed, we shall show in the next section that the risk/reward opportunity set for a U.S. investor is greatly enhanced by considering these allocations separately, and that the high correlations of international equities and bonds can be greatly reduced when asset and currency decisions are separated.

SEPARATION OF ASSETS AND CURRENCIES – HEDGED INTERNATIONAL PORTFOLIOS

Returns to a U.S. investor in international markets derive from two separate sources of return – local asset return and currency appreciation (depreciation) versus the U.S. dollar. The local and currency returns to U.S. investment in international equities and fixed-income securities are shown in Exhibits 7 and 8.

EXHIBIT 8
INTERNATIONAL FIXED-INCOME MARKETS
LOCAL AND CURRENCY RETURNS 1978–1990



The contribution of currency return to total return has been unsystematic; for some markets it has been positive and for others negative; for diversified portfolios or non-U.S. markets it has been small.

In contrast, however, the contribution of currencies to investment risk is significant and systematically positive. Exhibits 9 and 10 separate the total risk (standard deviation of return) of international equities and fixed-income markets into risk from local return volatility and currency volatility versus the U.S. dollar. Total risk is given by the outlined bar, and component risks are given by the inner bars. It can be seen that currency risk is approximately equal to 70% of the local risk of equity markets and more than 200% of the risk of local fixed-income markets. The total risk as indicated by the outlined bar is not equal to the addition of the two component risks, because standard deviations are not additive, due to the correlations of local asset and currency returns. These correlations are indicated also in Exhibits 9 and 10.

The correlations are consistently small especially for international equities. This observation, combined with the fact that currency risk is

EXHIBIT 9
INTERNATIONAL EQUITY MARKETS
LOCAL AND CURRENCY RISKS 1978–1990

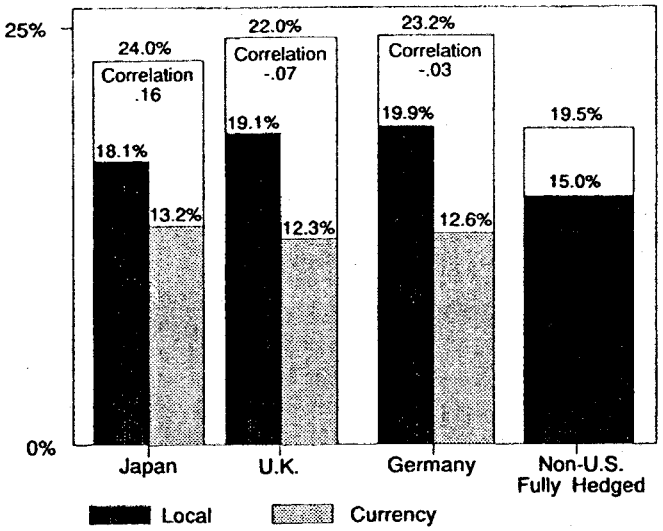
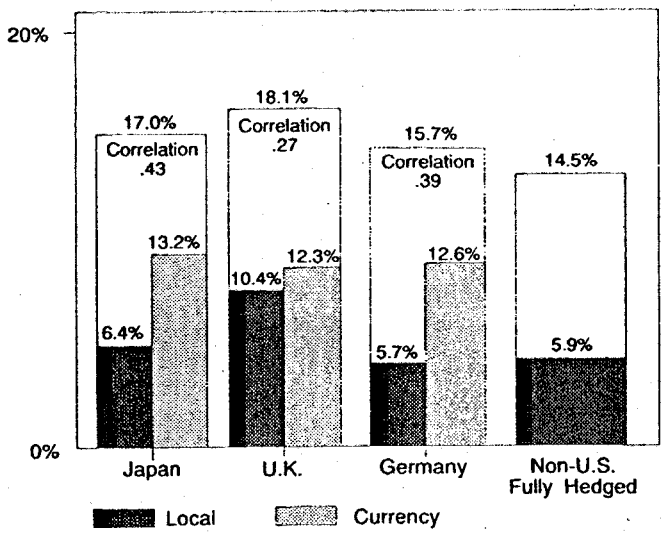


EXHIBIT 10
INTERNATIONAL FIXED-INCOME MARKETS
LOCAL AND CURRENCY RISKS 1978–1990



a significant source of investment risk in international portfolios, suggests:

1. Currency risk should be managed and not simply assumed in international investment.
2. Currency exposure decisions should be managed separately from asset exposure decisions.

HEDGED INTERNATIONAL INVESTMENT

International portfolios that have exposure only to local asset return can be constructed by hedging the currency exposure of the underlying foreign asset back into the dollar. The risks of such hedged portfolios of all non-U.S. markets is also given in Exhibits 9 and 10. These risks show that hedged portfolios, with only exposures to international assets and not currencies, can avoid the significant currency risks associated with international investment.

Return to a fully hedged foreign investment is equal to:

local asset return + forward premium/discount[1]

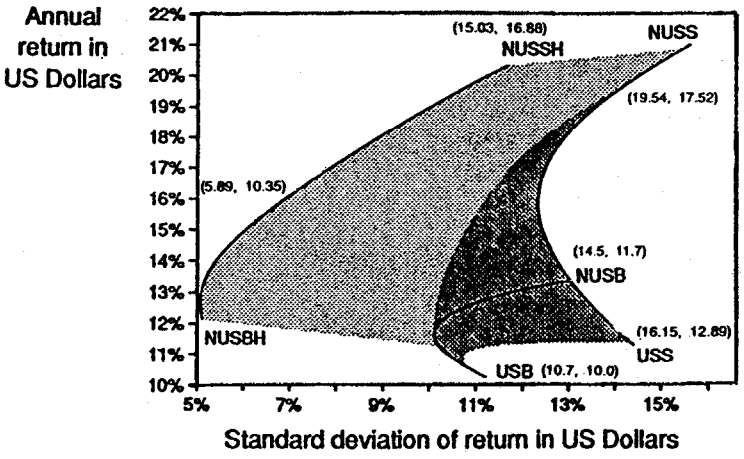
Exhibit 11 plots the risks and returns to the full spectrum of asset and currency allocation choice over the period 1978–1990 – U.S. stocks, U.S. bonds, non-U.S. stocks, non-U.S. bonds, non-U.S. stocks fully hedged and non-U.S. bonds fully hedged.

It can be seen that the returns to fully hedged international equities and bonds for the period 1978–1990 were roughly equivalent to their dollar-adjusted equivalent. *Ex post* the hedged and unhedged returns will differ by the "surprise currency" depreciation beyond that anticipated in the forward premium. In other words, unhedged investment will outperform hedged investment only if currency appreciation is greater than that anticipated by the forward premium.

Including fully hedged portfolios in the universe of choice greatly enhanced the risk/reward opportunity set to the U.S. investor. In fact, hedged international equities and bonds dominated their unhedged equivalents in terms of return and risk; this is so because hedged portfolios had similar returns to unhedged portfolios but significantly reduced risks.

[1] Forward premium = U.S. short-term rate – foreign short-term rate.

EXHIBIT 11
INTERNATIONAL EQUITY AND BOND MARKETS
RETURNS AND RISK 1978–1990



Correlations

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Non-U.S. stocks (NUSS)	.38	.22	1.00			
Non-U.S. bonds (NUSB)	.04	.36	.68	1.00		
Non-U.S. stocks hedged (NUSSH)	.53	.14	.80	.17	1.00	
Non-U.S. bonds hedged (NUSBH)	.22	.51	.48	.67	.36	1.00

Also, and importantly, hedged international equities and bonds are significantly less correlated than their unhedged counterparts, –.36 versus .75, thus improving diversification between international equities and bonds. This addresses the concern raised earlier of the relatively high correlation between international bonds and equities, due to their shared currency exposure.

Hedged international portfolios have equivalent diversification characteristics to unhedged portfolios, as can be seen from the correlations of returns in Exhibit 11.

Currency exposure in international portfolios is not itself the source of international diversification. It can be shown that diversification of unhedged international investment, as measured by correlation of domestic asset return with combined return of foreign local asset and currency, can be broken down as follows:

$$R_{a+c,u} = \left(R_{a,u}\frac{S_a}{S_{a+c}}\right) + \left(R_{c,u}\frac{S_c}{S_{a+c}}\right)$$

a = foreign asset local returns
c = foreign currency returns
u = domestic asset returns
R = correlation coefficient
S = standard deviation (risk)

This says that the unhedged correlation is the weighted average of local asset correlation with the domestic asset and the correlation of the foreign currency with the domestic asset. The weights are given by the respective ratios of asset risk and currency risk to total risk.

It can be shown that hedging will not reduce diversification unless

$$\frac{R_{c,u}}{R_{a,u}} < \frac{S_{a+c} - S_a}{S_c}$$

In other words, unless $R_{c,u}$ is small and the increase in risk associated with currency exposure is large, hedging will not reduce diversification. Empirically the impact of hedging on diversification has been minimal.

However, the appropriate way to evaluate the impact of hedging is by examining its effect on total portfolio risk, i.e., its marginal impact on the risk of a portfolio of U.S. and international assets. The chapter appendix shows the condition under which hedged international investment will reduce total portfolio risk when compared with unhedged international investment. *The combined impact of diversification and international risk reduction associated with hedging has always been to reduce total portfolio risk for a U.S. investor.*

LONG-RUN INTERNATIONAL ASSET ALLOCATION – A FRAMEWORK FOR A GENERALIZED SOLUTION

In order to identify appropriate optimal asset allocation strategies, the asset allocation problem should be separated into *domestic assets, hedged foreign assets* and *currency*. Solutions to optimal allocations should then be sought simultaneously with all assets: In this context, currency can be thought of as a separate asset class or exposure and uncoupled from its traditional overlap with international assets. Conceptually, optimal currency exposure can be less than, or indeed greater than, international asset allocations.

Optimization theory would suggest allocations to foreign currency in proportion to its expected return and inversely proportional to its variance and covariance with all other assets. (See Appendix B for theoretical framework).

In this framework of *hedged assets* and *currency,* "expected currency return" refers to currency appreciation in excess of the forward premium. This we refer to as "currency surprise." The expected currency return should also be adjusted in practice by the transaction cost required to hedge currency exposure. Appendix C outlines the sources of transaction costs and estimates for each source.

Exhibits 12 and 13 show optimal asset and currency exposure and the associated hedge ratios for a range of assumptions, allocations and risk levels. It was assumed that hedged international assets return the equivalent of their domestic counterpart and historical risks and covariances over the last 13 years were used.

A range of transaction costs were used and three alternative assumptions for surprise currency return are given.

a. Zero expected currency returns. This is equivalent to assuming that currency markets are "efficient": the expected future spot rate equals the current forward rate.
b. Zero compound returns. This is equivalent to a zero long-run return assumption and implies a positive expected arithmetic return equal to half the variance of currency. It is also consistent with Seigel's paradox as it applies to currency. This refers to the fact that the return to a U.S. investor and foreign investor in any given scenario never sum to zero because of the way spot rates are expressed. See Appendix D for an example of this.

EXHIBIT 12
OPTIMAL CURRENCY EXPOSURE AS % OF PORTFOLIO

10% International Equity Allocation

		Overall Equity Allocation					
		40%		*60%*		*70%*	
	Transaction Costs	*% Currency*	*Hedge Ratio*	*% Currency*	*Hedge Ratio*	*% Currency*	*Hedge Ratio*
Zero expected currency return	0%	−16	100	−14	100	−13	100
	.05%	−15	100	−13	100	−12	100
	.10%	−14	100	−12	100	−10	100
	.15%	−13	100	−10	100	−8	100
Zero compound currency return	0%	−2	100	4	60	10	0
	.05%	−1	100	5	50	11	0
	.10%	0	100	6	40	13	0
	.15%	0	100	7	30	15	0
Tactical expectation +2% pa	0%	16	0	40	0	50	0
	.05%	16	0	41	0	51	0
	.10%	16	0	41	0	51	0
	.15%	17	0	42	0	52	0
−2% pa	0%	−51	100	−64	100	−71	100
	.05%	−51	100	−64	100	−70	100
	.10%	−51	100	−65	100	−70	100
	.15%	−51	100	−65	100	−70	100

EXHIBIT 13
OPTIMAL CURRENCY EXPOSURE AS % OF PORTFOLIO

10% International Equity, 10% International Bonds

		Overall Equity Allocation					
		40%		*60%*		*70%*	
	Transaction Costs	*% Currency*	*Hedge Ratio*	*% Currency*	*Hedge Ratio*	*% Currency*	*Hedge Ratio*
Zero expected currency return	0%	−17	100	−15	100	−14	100
	.05%	−16	100	−13	100	−12	100
	.10%	−15	100	−12	100	−11	100
	.15%	−14	100	−11	100	−9	100
Zero compound currency return	0%	−3	100	4	80	10	50
	.05%	−2	100	5	75	12	40
	.10%	−1	100	7	66	13	35
	.15%	0	100	8	60	14	30
Tactical expectation +2% pa	0%	16	20	35	0	50	0
	.05%	16	20	36	0	50	0
	.10%	17	15	36	0	50	0
	.15%	17	15	36	0	50	0
−2% pa	0%	−50	100	−70	100	−80	100
	.05%	−50	100	−70	100	−80	100
	.10%	−50	100	−70	100	−80	100
	.15%	−50	100	−70	100	−80	100

c. Tactical expectation. While it may appear theoretically and empirically that the long run currency return is zero, it has been true that currency returns have often been persistently positive or negative through extended periods of time. In other words, currency can be tactically forecasted and managed.

The results in Exhibits 12 and 13 suggest several conclusions about optimal asset and currency allocations.

1. Optimal currency allocation is rarely if ever equal to optimal international asset allocation. Nor is optimal currency exposure related to the size of international allocations.
2. Therefore, no one optimal hedge ratio exists. The optimal hedge ratio depends on the risk preference of the investor, overall asset allocation and the size of the international asset allocation, the last factor suggesting that hedge ratios should be higher the higher the international allocation.
3. If currency is assumed to have a zero expected arithmetic return, then optimal currency exposure is in fact negative and 100% hedged international investment is appropriate at all levels of transaction costs. This negative exposure exists because of currency's positive covariance with other assets, particularly U.S. bonds.
4. If currency is expected to have a zero compound return, then optimal currency exposure is higher for more aggressive plans (about 10%) and lower for less aggressive plans (0%). For a typical plan, optimal currency exposure may be about 6%, suggesting a 40% hedge ratio for 10% international associations, a 60% hedge ratio for a 20% international allocation.
5. Optimal hedge ratios in an overall plan context are very sensitive to tactical expectations. A plus or minus 2% expectation changes the hedge ratio forecast 0% to 100%. This reinforces the need for tactical currency management.

SUMMARY AND CONCLUSIONS

On the basis of past data and optimization of *ex ante* expectations, we can conclude:

1. Investment in both international equities and fixed income in significant percentages will raise returns and reduce risks for U.S. investors.

2. There are significant benefits to separating long run international asset allocation decisions from long run currency decisions.
3. International investment may be more appropriately defined as being on a fully hedged or partially hedged basis, and the hedge ratio should be identical to the context of overall asset allocation.

APPENDIX A

The appropriate question in evaluating the case for hedged international investment is whether or not the risk of a diversified portfolio using hedged foreign securities is lower than that of a diversified portfolio using unhedged foreign investment.

Assume the diversified portfolio is split $w\%$ domestic, $1 - w\%$ foreign. The risk of a hedged diversified portfolio is given by:

$$\text{VAR}\left(\frac{u}{w} + \frac{a}{1-w}\right) \tag{1}$$

Risk of unhedged diversification is given by:

$$\text{VAR}\left(\frac{u}{w} + \frac{a+c}{1-w}\right) \tag{2}$$

Total portfolio risk reduction is given by:

$$\text{VAR}\left(\frac{u}{w} + \frac{a+c}{1-w}\right) - \text{VAR}\left(\frac{u}{w} + \frac{a}{1-w}\right) \tag{3}$$

$$= \frac{\text{VAR}(u)}{w^2} + \frac{\text{VAR}(a+c)}{(1-w)^2} + \frac{2\,\text{COV}(u,a+c)}{w(1-w)}$$

$$- \left[\frac{\text{VAR}(u)}{w^2} + \frac{\text{VAR}(a)}{(1-w)^2} + \frac{2\,\text{COV}(u,a)}{w(1-w)}\right]$$

$$= \frac{1}{(1-w)^2}\left[\text{VAR}(a) + \text{VAR}(c) + 2\,\text{COV}(a,c)\right] +$$

$$\frac{2}{w(1-w)}\left[\text{COV}(u,a) + \text{COV}(u,c)\right] - \frac{\text{VAR}(a)}{(1-w)^2} - \frac{2\,\text{COV}(u,a)}{w(1-w)}$$

$$= \frac{1}{(1-w)^2}\left[\text{VAR}(c) + 2\,\text{COV}(a,c)\right] + \frac{2}{w(1-w)}\,\text{COV}(u,c)$$

$$= \frac{1}{(1-w)^2}\left[S_c^2 + 2R_{a,c}\,S_a\,S_c\right] + \frac{2}{w(1-w)}\,R_{u,c}\,S_u\,S$$

> 0, unless $R_{c,a}$ or $R_{u,c}$ are significantly negative.

Unless there is a significantly *negative* correlation between currency appreciation and the local or domestic asset, hedged foreign investment reduces total portfolio risk over unhedged investment.

Historically, these correlations have been consistently non-negative. For U.S. and Japanese equities for 1970–1986, the empirical results are as follows, where $w = .5$. from equation (1):

$$= \frac{(.108)^2}{4} + \frac{1}{2} \times .108\,[.197 \times .08 + .158 \times .04]$$

$$= .016$$

or hedging reduced the standard deviation of the diversified portfolio from 19% to 14.2% per annum.

How negative do these correlations have to be to justify unhedged investment on a risk equivalent basis?

Using the data for 1970–1986 again and assuming the correlation between local asset and currency is zero, then the yen should have a –.34 correlation with the U.S. equity market. The equivalent number for bonds is –.57.

APPENDIX B

Optimal Currency Exposure

- Markowitz optimization theory suggests that optimal currency exposure, in general is given by:

$$\mu' v_c^{-1} (\mu' v^{-1} \mu)^{-1}$$

Where v_c^{-1} is the column of the inverse covariance matrix relating to the covariance of currency with all assets,

μ is the vector of expected returns of all assets, and

v is the covariance matrix of all assets and currency.

- An interesting example of the general solution is where currency is uncorrelated with all assets. In this case optimal currency exposure is given by:

$$\frac{\text{Expected Return to Currency}}{\text{Variance of Currency}} \times \frac{\text{Portfolio Variance}}{\text{Portfolio Expected Return}}$$

APPENDIX C

Transaction Costs for Passive Hedging

- Sources of transactions cost include:
  a. Spot spread on initial hedge,
  b. Forward spread on rollovers,
  c. Cash flow-related transaction cost at rollover, and
  d. Market impact.
- Estimates for normal trading volumes:
  a. 3.5 – 6.0 basis points once off
  b. 10.0 – 15.0 basis points per annum for monthly rollover,
     3.0 – 7.0 basis points per annum for semi-annual rollover
  c. Depends on cash management approach, rollover periodicity, and opportunity costs. Is probably zero if overall net cash flow to investor is positive, or if a cash balance is held and futures are purchased to regain asset exposure.
     Monthly rebalancing with a zero cash balance implies 14 basis points per annum.
     Quarterly rebalancing with a zero cash balance implies 8 basis points per annum.
  d. Should be minimal.

APPENDIX D

Seigels Paradox and Equilibrium Currency Returns

$$\text{Currency return U.S. investor} = \frac{S_t}{S_{t+1}} - 1 = R_t - 1$$

$$\text{Currency return NON-U.S. investor} = \frac{S_{t+1}}{S_t} - 1 = \frac{1}{R_t} - 1$$

$$\text{Aggregate currency return} = R_t + \frac{1}{R_t} - 2$$

$$\text{But, } E\left(\frac{1}{R_t}\right) > \frac{1}{E(R_t)}, \text{ iff Var}(R_t) > 0$$

Therefore, aggregate currency return > 0

An example:

	U.S. Currency Return	*Foreign Return*	*Currency Aggregate*
Currency Appreciation	+10%	−9.09%	0.91%
Currency Depreciation	−10	11.11	1.11
Expected Return	0	1.01	—