

Pension Funds
and the Use of International Markets

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I. Introduction

A number of academicians as well as professionals have espoused the advantages of international diversification. In a perfect market with no transaction costs or institutional barriers, international diversification would undoubtedly be advantageous. Yet, investors in the United States hold in aggregate only a miniscule proportion of their portfolios in foreign issues; and for various reasons, this essay will argue that it is unlikely that there will be any marked changes in this proportion over the next several years and possibly beyond despite the theoretical advantages of international diversification. The basic reasons are that United States investors have not yet realized even the full advantages of diversification within the domestic economy and that the "prudent man" rule as well as other factors make investing in foreign issues potentially more expensive and troublesome than in domestic issues. Moreover, most studies of international markets were undertaken before the introduction of flexible exchange rates and thus may have overstated the advantages of such diversification.¹

¹By analyzing periods of fixed exchange rates, many of the studies may have understated the risk of international diversification by not fully capturing the risk of an occasional large change in a currency's value.

II. U.S. Investors

In 1975, institutions held slightly less than half of all common stock held by U.S. investors--a smaller number than the volume of institutional trading would suggest.¹ However, institutions and individuals tend to weight their holdings towards different sectors of the market with individuals being the predominate investors in the smaller issues. In 1975, individuals held 94 percent of all issues traded over the counter which are generally the smaller issues. Since over-the-counter issues represent about a third of all non-intercorporate domestically held stock, individuals are still important investors in the larger issues.

While there may be advantages to international diversification, it does not appear that U.S. institutions have availed themselves of these advantages. According to data collected by the Institutional Investor Study, corporate pension-benefit plans held in 1969 only 1.2 percent of their common stock holdings in foreign issues.² It is highly likely that most of even this small percentage represented foreign issues listed on the New York Stock Exchange. More recent data would, of course, be desirable in assessing the current situation, but this author knows of no such data. Nonetheless, it is unlikely that this percentage would have changed radically. If there were such a radical change, one might have expected some manifestation of the change in, for instance, a noticeable growth in specialized services or institutions to facilitate the investment of funds outside the U.S., but with only a few exceptions such services or institutions have not developed.

¹ Marshall E. Blume and Irwin Friend, The Changing Role of the Individual Investor (New York: John Wiley, 1978). Intercorporate holdings have been excluded in deriving this estimate of the percentage of stock held by institutions.

² This estimate is derived from figures presented in the Institutional Investor Study Report of the Securities and Exchange Commission (Washington: U.S. Government Printing Office, 1971), p. 1060.

As another factor in understanding the current investment posture of U.S. investors, it should be noted that there is a growing disenchantment with professional management and thus an active examination of alternative investment methods. While most institutional funds are still actively managed, there has been a shift of several billion dollars into passively managed index funds. Perhaps, the major reason for this disenchantment is the growing body of evidence which shows that only a small fraction of professionally managed funds have shown superior investment performance.

A large number of academic studies have gone to great lengths in controlling for differences in risk and have shown that no group of investors with the exception of insiders and specialists have consistently outperformed the market. These studies, however, are frequently couched in a highly statistical and mathematical style and thus have probably had much less impact upon corporate attitudes towards professional managers than some very simple studies.

What may have had the greatest impact to creating the growing disenchantment with professional money managers is the widely available empirical evidence, coupled with the poor performance of the stock market in recent years, that only a small fraction of professionally managed stock funds have outperformed the broadly based indexes such as the Standard & Poor's 500. This index consists of 500 stocks, which are selected so as to be representative of those listed on the New York Stock Exchange.¹ Each stock receives a weight

¹The Index now includes some financial over-the-counter stocks which traditionally have been traded on this market even though their size would justify a listing on the New York Stock Exchange.

proportional to the market value of its shares outstanding, and thus the return on this index is a measure of the return realized in aggregate by all investors in these stocks.¹ This type of comparison is obviously subject to criticism since there is no explicit control for differences in risk, but with all of its difficiencies, it has undoubtedly had a major impact. However, the difficiencies are probably not as severe as it might appear at first sight. Institutional investors tend to weight their portfolios towards the larger listed stocks, and this is precisely how the index is weighted.

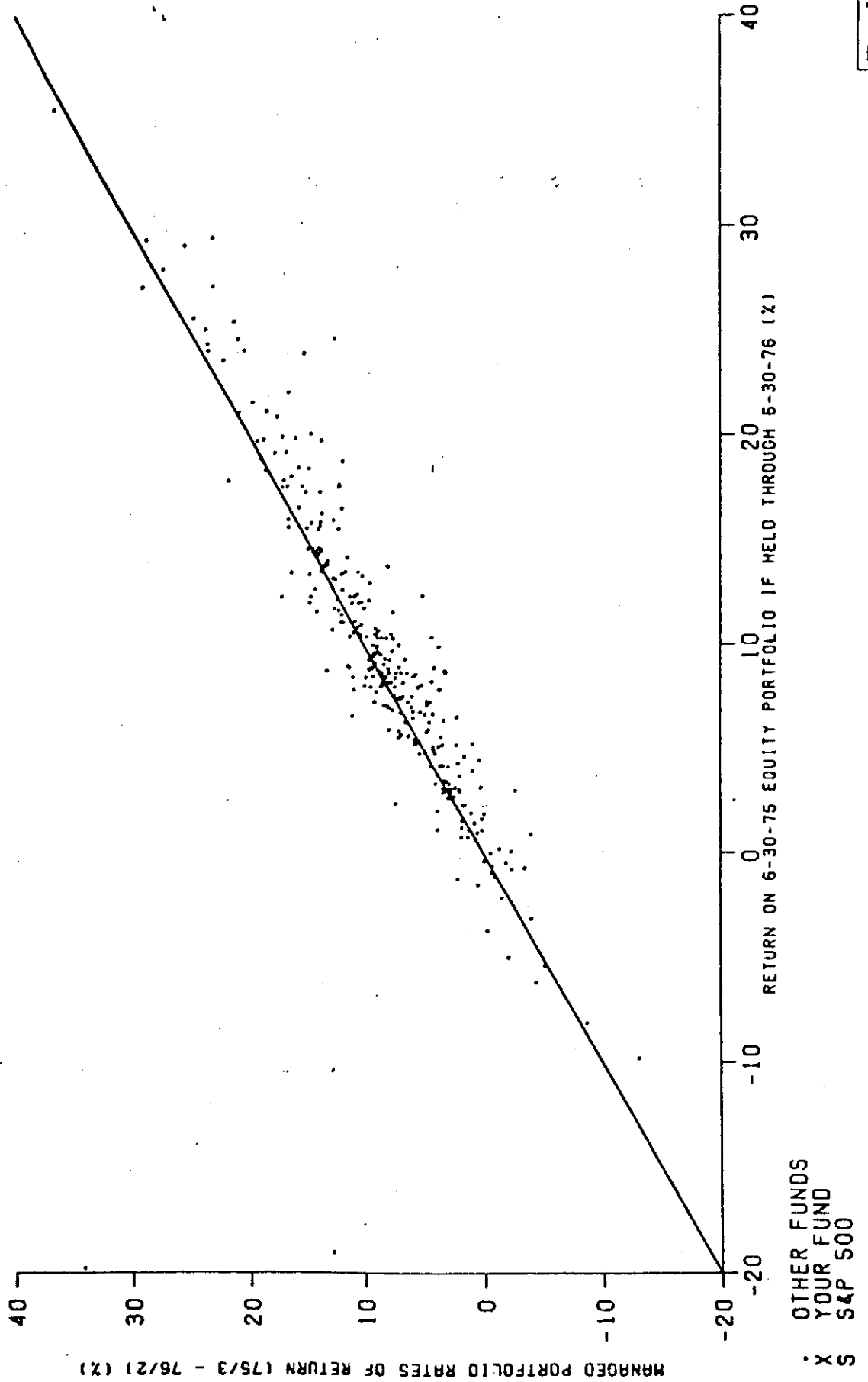
A.G. Becker, a brokerage house providing performance measurement services, has included in some of its reports a chart which illustrates in a dramatic way the type of data which corporate officials are constantly seeing (Chart I). This chart plots the returns which actually occurred on all the managed stock portfolios in the Becker data base² against the returns which would have been realized on these same portfolios if no stocks had been bought or sold over the year -- an essentially unmanaged portfolio. If professional management contributed to performance, the majority of the data points should fall above the line; if not, below the line. A quick glance reveals that most fall below the line -- a surprising result if the market is efficient. In an efficient market, it should be fully as difficult to turn in consistently poor performance as good performance. Perhaps, the

¹The Dow-Jones Index of 30 Industrials is better known, but it covers only a limited number of stocks and is peculiarly weighted. In practice, professional managers do not use this index as a performance criterion, but only as a loose guide in describing day-to-day movements in the market.

²The Becker data base includes performance results on all funds subscribing to the Becker performance evaluation services. While exact figures are not available, the Becker data base is an extensive, if not the most extensive, data base on the performance of professionally managed funds.

Chart 1

MANAGED VS. UNMANAGED EQUITIES PORTFOLIO RATES OF RETURN



reason that more funds appear below the line is that the returns on the managed funds are measured after trading and commission costs while those of the unmanaged portfolios include none of these costs. Both returns are measured before management fees.

A final factor of importance in assessing the future for professionally managed funds in the U.S. is the so-called "prudent man" rule. Developed in the context of personal trust law, this rule states in essence that a trustee should be prudent in the management of a portfolio. This standard of prudence has been interpreted to apply to each and every investment separately and not to the entire portfolio. It is therefore antithetical to the concepts of modern portfolio theory which holds that risk should be judged in terms of the overall portfolio and not by the total risk of each of the individual assets separately. It is easy to construct examples of well diversified and conservative portfolios which would contain some assets of extreme risk if risk were assessed in isolation from the rest of the portfolio. Under the prudent man rule it is possible for a manager to be surcharged for losses on such assets even if the performance on the total portfolio was clearly superior.

Pension funds and most other types of institutional funds are not personal trusts, and it is unclear to what extent the principles of the prudent man rule would apply to these types of funds. Complicating the issue is the new pension fund bill, known as ERISA, which clearly states that a pension fund should be diversified. This provision could be interpreted as mandating the inclusion of some assets for purposes of diversification which would clearly be unacceptable under the prudent man rule. Thus, there may well

be an inconsistency in the law which will at some point be resolved in the courts.

Since no corporation would wish to be a test case, even if management believed that its defense were compelling, the effect of this possible inconsistency in the law has made management very conservative in undertaking new types of investments. As a case in point, even those corporations which have decided to place money in index funds have generally undertaken some perfunctory type of security analysis on each stock in the index and, on the basis of this analysis, have excluded a limited number of very small issues-- often ten or so in number. This exclusion of a limited number of very small issues through traditional security analysis, though perfunctorily applied, is obviously an attempt to be in formal compliance with the prudent man rule without affecting the overall objective of replicating the returns on index.

III. The Future

Because of the historical interest in comparisons to the Standard & Poor's Index, it was natural that those investors who became disenchanted with professional money management would turn to funds designed to replicate the returns on this index. Some of these investors are now questioning whether the S&P index is the index to replicate. If these investors decide to go beyond this index, they would have the choice of expanding into foreign issues or into other domestic types of investment.

There are potential costs associated with either of these tacks which must be carefully weighed against the potential benefits of further diversification. Expanding into other domestic assets, if not done carefully, may produce a conflict with the prudent man rule resulting in potential legal costs. For instance, a seemingly natural expansion into smaller over-the-counter stocks, frequently highly speculative in nature, would seem to be in clear violation of the prudent man rule. However, there are other types of domestic assets, such as non-speculative real estate investment, in which a pension fund could invest without violating the prudent man rule.

A major expansion into foreign assets would be a radical course for most pension funds. The compatibility of such an investment philosophy to the prudent rule would be uncertain. There is, for instance, the risk of expropriation by the foreign government. In a well-diversified portfolio, this risk may be acceptable, but, in terms of an individual asset (the standard traditionally used in the prudent man rule), the risk may be unacceptable. There is even some uncertainty about the prudence of investing in bonds guaranteed by stable foreign governments in that the provisions of

such bonds cannot be enforced in U.S. courts. Finally, the costs of investing in foreign issues are probably greater than the costs of investing in comparable domestic issues.

Despite these disadvantages of investing in foreign issues, a domestic investor might still invest outside the United States if the advantages were sufficiently great. Most studies of international diversification have used data preceding the period of floating exchange rates which might be dated from the beginning of 1973 when the dollar was devalued relative to the Snake. It is quite possible that these studies did not fully capture the risk of potential currency fluctuations which were often masked by the fixed exchange rate regime.

The risks associated with currency fluctuations can be substantial. Table 1 shows the annual percentage change in currency values relative to the dollar from 1974 through 1976. For comparison purposes, the table also contains the returns on the S&P Composite Index. The fluctuations in the changes in currency rates are less than those in the stock index but are still pronounced. Assuming the same level of risk among different stock markets in terms of the home currency, the effect of the risk associated with currency fluctuations would be to make the magnitude of the potential fluctuations of investment in a foreign market greater than in the domestic market.

In order to visualize the impact of currency exchange risk on the potential for international diversification, this study simulated potential ten-year returns under various assumptions as to the mix between investments

Table 1

Annual Rates of Change in Currency Rates
and S&P Composite Index

1974-1976

Year Ending	France	Germany	Italy	Japan	U.K.	S&P Composite*
1976	-10.6%	10.0%	-21.3%	3.7%	-17.0%	19.1%
1975	1.4	-6.5	-3.5	-1.7	-13.2	31.5
1974	1.6	8.5	-7.8	-6.7	0.5	-29.7

*Not adjusted for dividends.

in the domestic market, designated country 1, and the foreign market, designated country 2. It was assumed that, before exchange risk, the annual returns of the markets in the two countries were each normally distributed with expected values of 10 percent and standard deviation of 15 percent. The correlation of returns before exchange risk was varied from 0.0 to 0.75 in steps of 0.25. The annual changes in currency rates were assumed independent of the returns in the two countries and normally distributed with an expected change of 0.0 and a standard deviation of 10 percent.

The results of these simulations are tabulated in Tables 2-9.¹ For instance, allowing for exchange risk, these tables show that there is a 9.6 percent chance that the value of one dollar initially invested equally between the domestic and foreign country would be \$1.50 or less after 10 years when the correlation between the two markets before exchange risk is 0.0 (Table 2). If there were no exchange risk, the corresponding percentage would be 5.8 percent (Table 3). These investment results assume that the portfolio is rebalanced yearly to the initial proportions.

Before allowing for exchange risk, it is seen that the potential advantages of international diversification hinge on the size of the correlation coefficient, with the advantages decreasing rapidly as this coefficient increases. The incorporation of exchange risk changes the picture substantially. At a

¹For each correlation level, 10 year returns for both countries were simulated for each of 500 times before exchange risk. Exchange risk fluctuations were then superimposed upon these returns. Thus, the tabulations for each level of correlation are based upon the same simulated numbers which preserves comparability among the different portfolio mixes.

TABLE 2

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.0
WITH FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

COUNTRY#1	COUNTRY#2	\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00	EXPECTED VALUE	STU DEV
0	100	4.0%	8.4%	22.8%	40.4%	56.4%	72.8%	88.0%	94.4%	96.4%	2.59	1.50
10	90	0.8%	5.0%	19.4%	36.4%	55.8%	70.8%	86.8%	95.6%	97.0%	2.59	1.54
20	80	0.6%	5.4%	18.4%	35.2%	55.4%	70.8%	88.6%	95.8%	98.0%	2.59	1.20
30	70	<0.1%	1.2%	14.2%	30.6%	50.2%	70.8%	91.2%	96.4%	99.0%	2.59	1.06
40	60	<0.1%	0.2%	11.2%	27.4%	52.6%	71.8%	91.8%	97.6%	99.4%	2.60	0.99
50	50	<0.1%	0.4%	9.6%	26.8%	52.2%	70.8%	93.2%	98.0%	99.4%	2.60	0.93
60	40	<0.1%	0.4%	8.0%	27.2%	50.6%	70.0%	92.8%	98.6%	99.4%	2.60	0.91
70	30	<0.1%	0.8%	8.0%	29.4%	52.4%	69.6%	92.4%	98.6%	99.2%	2.60	0.95
80	20	0.2%	0.6%	11.0%	30.4%	53.0%	69.8%	90.4%	98.2%	99.4%	2.60	0.96
90	10	0.4%	1.0%	13.0%	33.2%	53.4%	68.6%	88.8%	97.2%	99.4%	2.60	1.06
100	0	0.8%	1.8%	17.4%	35.4%	54.2%	69.0%	87.4%	96.0%	98.2%	2.60	1.17

Table 3

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.0
WITHOUT FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE COLLAR IS LESS THAN

COUNTRY#1	COUNTRY#2	\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00	EXPECTED VALUE	STD DEV
0	100	1.0%	3.6%	16.3%	34.6%	54.2%	71.6%	89.0%	95.6%	96.2%	2.59	1.20
10	90	0.2%	2.4%	13.6%	31.2%	51.8%	72.0%	90.4%	96.0%	99.2%	2.59	1.08
20	80	0.2%	1.2%	10.5%	28.2%	52.6%	72.0%	91.2%	97.6%	99.4%	2.59	0.97
30	70	0.2%	0.4%	9.0%	26.6%	52.0%	73.2%	92.0%	98.6%	99.6%	2.59	0.89
40	60	0.2%	0.4%	7.6%	25.2%	50.8%	71.6%	93.6%	99.4%	99.8%	2.59	0.84
50	50	<0.1%	0.4%	5.8%	26.0%	51.6%	72.0%	95.0%	99.0%	99.6%	2.59	0.82
60	40	<0.1%	0.6%	5.6%	25.8%	50.4%	71.2%	95.2%	98.8%	99.6%	2.59	0.84
70	30	0.2%	0.8%	7.2%	25.4%	52.6%	71.0%	92.8%	98.8%	99.4%	2.59	0.80
80	20	0.4%	0.6%	9.0%	30.6%	53.0%	70.4%	90.6%	98.0%	99.4%	2.60	0.96
90	10	0.4%	0.8%	13.0%	32.8%	53.6%	68.6%	88.8%	97.4%	99.4%	2.60	1.05
100	0	0.8%	1.8%	17.4%	35.4%	54.2%	69.0%	87.4%	96.0%	98.2%	2.60	1.17

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.25
WITH FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

COUNTRY#1	COUNTRY#2	\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00	EXPECTED VALUE	STD DEV, %
0	100	2.2%	5.6%	22.2%	39.0%	57.8%	69.8%	84.8%	93.6%	96.0%	2.61	1.49
10	90	1.4%	5.0%	20.0%	36.0%	56.4%	67.4%	85.0%	94.8%	97.5%	2.61	1.55
20	80	0.8%	3.6%	17.4%	34.6%	53.4%	64.0%	86.2%	95.2%	98.4%	2.62	1.24
30	70	0.4%	1.6%	15.2%	33.2%	54.4%	66.4%	86.4%	96.0%	98.6%	2.62	1.15
40	60	<0.1%	1.2%	13.2%	31.6%	53.4%	68.0%	87.4%	96.0%	98.6%	2.62	1.06
50	50	<0.1%	0.6%	12.0%	31.2%	53.4%	68.8%	89.8%	97.0%	99.0%	2.62	1.04
60	40	<0.1%	0.4%	10.8%	31.0%	51.4%	68.2%	89.8%	97.0%	99.4%	2.62	1.02
70	30	<0.1%	0.4%	11.8%	30.6%	51.0%	69.0%	89.2%	97.6%	99.4%	2.62	1.02
80	20	<0.1%	0.2%	12.4%	31.6%	52.0%	68.8%	88.8%	97.0%	99.4%	2.63	1.05
90	10	0.4%	0.8%	13.6%	33.6%	53.2%	68.2%	87.8%	96.2%	99.2%	2.65	1.11
100	0	0.4%	2.2%	15.2%	34.8%	54.6%	67.2%	86.8%	95.2%	99.0%	2.62	1.18

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.25

WITHOUT FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

PERCENT COUNTRY#1	COUNTRY#2	\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00	EXPECTED VALUE	STU DEV
0	100	1.0%	4.2%	15.0%	32.4%	53.6%	72.4%	89.4%	95.6%	99.0%	2.55	1.15
10	90	0.2%	3.4%	13.6%	30.6%	51.0%	70.8%	90.6%	96.0%	99.4%	2.60	1.05
20	80	0.2%	1.0%	12.2%	29.8%	50.2%	69.6%	90.8%	97.6%	99.6%	2.60	0.98
30	70	<0.1%	1.0%	10.6%	28.4%	50.0%	69.4%	92.0%	98.2%	99.8%	2.60	0.94
40	60	<0.1%	0.6%	9.0%	28.2%	49.0%	68.6%	93.6%	93.6%	99.8%	2.60	0.91
50	50	<0.1%	0.2%	8.4%	26.4%	49.8%	69.4%	93.6%	98.4%	99.6%	2.61	0.90
60	40	<0.1%	0.4%	9.0%	28.2%	50.0%	70.0%	92.2%	98.2%	99.8%	2.61	0.92
70	30	<0.1%	0.4%	10.4%	28.0%	50.6%	69.4%	90.2%	97.8%	99.6%	2.61	0.90
80	20	0.2%	0.4%	11.4%	31.6%	51.6%	69.2%	99.6%	97.8%	99.4%	2.62	1.02
90	10	0.4%	1.0%	13.2%	32.8%	52.8%	69.4%	87.8%	97.2%	99.2%	2.62	1.09
100	0	0.4%	2.2%	15.2%	34.8%	54.6%	69.2%	86.6%	95.2%	99.0%	2.62	1.10

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.50
WITH FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

PERCENT COUNTRY#1	COUNTRY#2	PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN										EXPECTED VALUE	STD DEV
		\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00			
0	100	2.6%	6.8%	22.4%	40.2%	56.2%	68.8%	80.4%	92.8%	96.4%	2.65	1.50	
10	90	1.6%	5.4%	19.8%	37.8%	54.8%	69.2%	86.0%	93.8%	97.2%	2.65	1.39	
20	80	0.8%	3.8%	17.6%	36.8%	53.4%	69.2%	87.2%	94.0%	97.8%	2.65	1.31	
30	70	0.6%	2.2%	16.0%	34.6%	52.0%	69.8%	87.4%	95.0%	97.6%	2.65	1.23	
40	60	0.2%	1.8%	14.2%	34.4%	52.4%	70.4%	87.2%	95.2%	98.0%	2.65	1.18	
50	50	<0.1%	1.6%	14.2%	32.8%	53.2%	68.6%	87.4%	95.6%	98.4%	2.65	1.14	
60	40	<0.1%	1.0%	13.4%	33.6%	53.0%	67.6%	87.2%	95.8%	99.0%	2.64	1.11	
70	30	<0.1%	0.6%	14.0%	34.0%	52.2%	68.6%	87.8%	95.8%	99.2%	2.64	1.11	
80	20	<0.1%	0.6%	14.8%	32.8%	52.4%	68.2%	87.8%	96.0%	99.0%	2.64	1.13	
90	10	<0.1%	1.0%	14.4%	33.2%	53.8%	68.8%	88.4%	96.0%	98.8%	2.63	1.16	
100	0	<0.1%	2.2%	15.4%	34.4%	54.4%	68.6%	87.6%	95.6%	98.4%	2.63	1.20	

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.50
WITHOUT FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

COUNTRY#1	COUNTRY#2	\$ 0.75	\$ 1.00	\$ 1.20	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00	EXPECTED VALUE	STD DEV
0	100	0.0%	4.5%	15.0%	32.0%	51.6%	69.6%	88.6%	95.3%	99.0%	2.60	1.11
10	90	0.4%	2.9%	14.3%	31.6%	51.8%	69.2%	89.4%	96.6%	99.4%	2.60	1.10
20	80	0.4%	2.2%	13.3%	31.2%	51.6%	69.0%	90.4%	97.4%	99.6%	2.61	1.03
30	70	<0.1%	1.0%	13.0%	31.0%	50.6%	68.0%	92.0%	97.6%	99.6%	2.61	1.00
40	60	<0.1%	0.3%	12.2%	30.4%	50.4%	68.0%	91.6%	97.8%	99.4%	2.61	0.99
50	50	<0.1%	0.6%	11.5%	30.6%	50.0%	68.0%	91.6%	93.2%	99.4%	2.62	1.01
60	40	<0.1%	0.6%	13.0%	31.6%	50.4%	68.6%	90.8%	97.6%	99.0%	2.62	1.02
70	30	<0.1%	0.6%	13.6%	31.2%	50.6%	68.2%	90.0%	96.8%	99.0%	2.62	1.00
80	20	<0.1%	0.3%	14.0%	32.0%	51.6%	68.0%	89.4%	95.4%	99.0%	2.63	1.01
90	10	<0.1%	1.0%	14.6%	33.4%	53.8%	69.2%	88.0%	96.2%	98.8%	2.63	1.14
100	0	<0.1%	2.2%	15.4%	34.4%	54.4%	68.6%	87.6%	95.6%	96.4%	2.63	1.21

TABLE 8

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.70
WITH FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

COUNTRY#	PERCENT	\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 5.00	EXPECTED VALUE	STD DEV
0	100	4.2%	7.0%	22.0%	40.5%	50.4%	65.8%	85.2%	92.6%	95.6%	2.65	1.54
10	90	1.0%	4.0%	20.2%	37.4%	55.0%	68.0%	85.6%	93.2%	95.9%	2.00	1.40
20	80	1.2%	4.2%	16.6%	30.2%	55.4%	68.0%	85.4%	93.6%	97.2%	2.65	1.59
30	70	0.8%	3.4%	17.0%	37.2%	52.2%	68.0%	85.8%	93.6%	96.0%	2.85	1.55
40	60	0.6%	4.0%	18.0%	36.4%	51.8%	67.4%	85.8%	93.8%	97.6%	2.85	1.20
50	50	50.1%	2.0%	16.8%	33.8%	52.2%	67.2%	86.0%	94.0%	98.2%	2.65	1.24
60	40	50.1%	1.8%	15.4%	33.4%	51.8%	68.0%	86.8%	95.8%	98.8%	2.65	1.21
70	30	50.1%	1.6%	13.4%	30.2%	51.2%	66.4%	87.4%	96.0%	98.4%	2.64	1.20
80	20	50.1%	1.4%	13.8%	33.8%	50.4%	68.8%	88.8%	95.6%	98.4%	2.64	1.17
90	10	50.1%	1.6%	10.8%	33.8%	51.0%	68.8%	87.8%	95.8%	98.4%	2.64	1.20
100	0	50.1%	4.2%	10.0%	34.8%	50.2%	67.6%	88.8%	98.0%	98.2%	2.64	1.22

SIMULATED INVESTMENT RESULTS FOR 10 YEARS
WITH CORRELATION COEFFICIENT OF 0.75

WITHOUT FOREIGN EXCHANGE RISK

PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN

PERCENT COUNTRY#1	COUNTRY#2	PROBABILITY THAT THE TERMINAL VALUE OF ONE DOLLAR IS LESS THAN										EXPECTED VALUE	STL DEV
		\$ 0.75	\$ 1.00	\$ 1.50	\$ 2.00	\$ 2.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.00			
0	100	0.6%	5.2%	15.4%	32.6%	50.6%	68.2%	88.0%	99.4%	99.4%	2.61	1.12	
10	90	0.4%	2.6%	14.8%	32.6%	50.6%	68.0%	89.4%	99.2%	99.2%	2.61	1.16	
20	80	0.4%	2.0%	14.4%	33.2%	51.0%	68.0%	90.4%	99.0%	99.0%	2.62	1.09	
30	70	0.2%	2.0%	14.0%	35.8%	51.2%	66.6%	89.8%	99.0%	99.0%	2.62	1.00	
40	60	0.2%	1.6%	15.0%	33.8%	50.6%	67.0%	90.0%	99.0%	99.0%	2.62	1.05	
50	50	<0.1%	1.2%	14.6%	34.2%	50.0%	66.2%	90.4%	99.0%	99.0%	2.62	1.00	
60	40	<0.1%	1.2%	14.6%	34.0%	49.6%	63.4%	89.4%	99.0%	99.0%	2.63	1.11	
70	30	<0.1%	1.2%	15.0%	34.4%	50.0%	69.4%	88.8%	96.0%	96.0%	2.63	1.13	
80	20	<0.1%	1.4%	15.4%	35.2%	50.2%	69.0%	88.6%	96.0%	96.0%	2.63	1.11	
90	10	<0.1%	1.6%	16.8%	35.4%	51.4%	69.2%	88.8%	95.8%	95.8%	2.64	1.18	
100	0	<0.1%	2.2%	19.0%	34.8%	53.2%	69.6%	88.6%	96.2%	96.2%	2.64	1.24	

correlation of 0.0, the optimal amount to invest in the foreign country would be about 40 percent. At a correlation of 0.75, the optimal amount is only about 20 percent;¹ moreover, when the correlation is high as in this last case, the advantages of international diversification are not great. For instance, if the portfolio were fully invested in the domestic market, there would be an 18.0 percent chance the value of an initial investment of \$1.00 after ten years would be less than \$1.50. This 18.0-percent figure decrease only 15.8 percent for the optimally diversified international portfolio.

This analysis is, of course, based upon only two countries, but could easily be extended to more countries. The quantitative results would change, but the qualitative results would remain unchanged.

¹These optimal proportions were determined analytically and may differ slightly from those implied by the simulation results.

IV. Conclusion

Many of those investors who have recently placed money in index funds designed to replicate the returns on the Standard & Poor's Index, or who are contemplating such a move, are asking whether this index is the index to match. The spirit of modern portfolio theory would clearly call for a broader based index covering virtually every asset possible.

One option for these investors would be to expand into other types of domestic assets such as real estate or smaller OTC stocks. Another option would be to expand into investments in foreign countries. Possible fluctuations in currency values and other risks tend to reduce the advantages of such international diversification. Simulations prepared for this study quantify the effect of currency fluctuations upon the advantages of international diversification. The costs of international diversification and the uncertain legal foundations with respect to the prudent man rule and other laws suggest that U.S. pension plans, if they increase their commitment to foreign investments at all, would increase their commitment at a very slow and moderate rate.