

International Diversification

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Abstract

A fundamental ideal of finance is that investors should hold a diversified portfolio. This usually means a diversified portfolio that is Markowitz mean-variance (or standard deviation) efficient. In practical terms, this means the diversified portfolio should contain international investments.

The first phase of this research, which is reported here, uses historic monthly rates of return for ten years from 1997 through 2006 to study four alternative investment categories. The four investment alternatives (portfolios) are

- (1) 30 U.S. firms with minimal international revenue,
- (2) 30 U.S. firms with maximum international revenue,
- (3) 30 closed end country funds and the 30 U.S. firms with minimum international revenue, and
- (4) 30 ADRs and 30 U.S. firms with minimum international revenue.

The 30 firms with minimum international revenue are the benchmark and are the least efficient. The results indicate that portfolio (4), 30 ADRs and 30 U.S. firms with minimum international revenue, has the lowest risk, standard deviation, for a give level of return.

The second phase, which is ongoing, follows the same general procedure as the first phase, but

- (1) Considers additional portfolio groups such as 30 ADRs and 30 U.S. firms with maximum international revenue.
- (2) Creates two categories of ADRs, those with minimum sales outside the home country and those with maximum sales outside the home country.

This research reflects the idea that international diversification should be analyzed using, for instance, sales outside the home country, rather than location of a firm's headquarters.

I. Introduction

For several decades researchers have concluded that the optimum equity portfolio for an investor in the United States should contain international equity securities. These studies indicate that portfolios that combine such international securities can reduce portfolio risk as measured by the standard deviation and increase the portfolio average rates of return (Redman, Gullett and Manakyan, 2000).

These studies investigated various ways to optimize the risk return relationship by incorporating non-U.S. equity securities into a domestic equity portfolio. Some suggest that a domestic portfolio should include stocks of Multinational Corporations (MNCs). In this way, there is sufficient exposure to non-U.S equities to gain the benefits of the "International Diversification Effect. The postulate is that U.S multinationals have a significant portion of revenues and earnings derived from overseas operations; hence, the inclusion of MNCs in a US

domestic portfolio would provide adequate international exposure. Other researchers suggest that the risk-adjusted returns of U.S. multinational stocks are too highly correlated with U.S. domestic portfolios to provide maximum benefits. Others suggest that international funds are the best route in that they are, by definition, comprised solely of international (non-U.S.) securities. Returns of international funds are also more correlated to the returns of international indexes (such as MSCI-EAFE) than the domestic indexes, hence there is more potential for the international diversification effect.

A third alternative for international diversification is the inclusion of American Depositary Receipts (ADR's). ADRs represent foreign securities trading on U.S. markets. ADR returns are more correlated with international stock indexes than with domestic indexes.

II. Objective

This research investigates the mean-variance/standard deviation efficiency of various asset classes for an investor who lives in the United States. The U. S. investor diversifies by investing in the common stock of U.S. corporations that have international operations, purchasing American Depositary Receipts (ADRs), or purchasing closed end international funds. For each asset class five points on the mean-standard deviation efficient frontier are estimated. A "benchmark" asset class contains the common stock of U.S. firms that have minimal international operations.

III. Research Significance

International investing has now become a major financial activity in the U.S., as evidenced by the over \$300 billion investment in foreign equity made each year in the 1990s and early 2000s. Additionally, foreign assets accounted, on average, for only around 25% of the total value of the assets owned by U.S. residents over the period 1990-2004 (Heathcote and Perri, 2007). Most of this investment is channeled either through international funds or through investment in shares of MNCs. Although there are a number of commercial agencies that provide information on the annual returns of funds, information on risk-adjusted returns is inadequate. This study provides an efficient frontier evaluation of the performance of international diversification. U.S. investors can use this information when selecting the best vehicle for diversifying into global markets.

IV. Literature Review

Since the 1980's there have been a number of studies extolling the benefits of diversifying U.S. investment portfolios on an international scale. Even on a risk adjusted basis, it has been demonstrated that investments spread over different countries have shown both higher returns and lower risk when compared with the Standard and Poor's 500 Index of stock prices in the U.S. For the average U.S. based investor, there are several ways to diversify an investment portfolio globally: invest in an international mutual fund, purchase American Depositary Receipts (ADRs) and purchase shares of U. S. based Multinational corporations (hereafter, MNCs). Starting with Bruno Solnik (1974) and Gary Bergstrom (1975), economists have confirmed the benefits of international investing. Their main thrusts related to the fact that the stock indexes of many foreign countries exhibited very low correlations with the returns of the S&P 500. Hence they could be combined with U. S. portfolios to lower overall portfolio risk without proportionately reducing returns. Some of the studies in support of the positive portfolio

benefits of global diversification included the following: Cumby and Glen (1990) who studied the risk-adjusted performance of 15 international mutual funds compared with that of the S&P 500 and the Morgan Stanley World Index using a period of 1982-1988, they found that U.S. mutual funds did not outperform the World Index. Eun, Kolodny & Resnick (1991) who used 19 funds for the period of 1977-1986, found that the majority of international funds outperformed the S&P 500. However, Droms and Walker (1994) studied four international funds over a period of 20 years and 30 funds over a six-year period. Their performance was compared with the S&P 500 and the MSCI EAFE who used a sample of 30 funds. They found that the international funds did not outperform either index.

The overall support for the use of international diversification continued to the late 1990's with various recommendations as to how to best accomplish maximum portfolio benefits. Some indicated the use of a diversified domestic portfolio along with international mutual funds as the route to accomplish optimum results. The benefits of diversification via ADRs has been investigated by Wahab and Khandwala (1993). This study focused on the relative merits of diversification via international mutual funds, multinationals and/or ADRs with domestic portfolios and also tested whether the slowdown in the 1990's is a temporary or a longer-term phenomenon. Rowland and Tesar (1998) in another study, found that combining a portfolio of large MNC's with the domestic portfolio provided the biggest diversification benefit versus international funds and ADR's.

Cai and Warnock (2006) imply that international diversification should look at where a firm has its operations rather than where its headquarters is located. For instance, in 2005, Nokia, with headquarters in Finland, generated more than 25 percent of its revenue in China and the United States.

V. Methodology

The efficient frontier optimization model (Markowitz, 1952 and Bodie, Kane, and Marcus, 1993) used in this research considers only a set of risky assets (that is, there are no risk free assets) and does not allow for short sales. Exhibit 1 (all Exhibits are at the end of the paper) contains the mathematical formulation of the model. The objective of the optimization model is to find the weights (percentages) for each risky asset that gives the minimum portfolio standard deviation (risk measure) subject to the constraints that the weights add to one (all funds are invested), each weight is greater than or equal to zero (no short sales) and the expected rate of return on the portfolio is a stated percentage (1, 2, 3, 4, or 5 percent).

The approach used is to calculate the efficient frontier values for four investment strategies. They are

1. Data Set 1: 30 U.S. equity stocks in the S&P 500 Index that have minimal international operations. This can be considered the benchmark asset class. That is, this asset class should have minimal international diversification. Exhibit 2 contains an alphabetical list of these firms.
2. Data Set 2: 30 U.S. equity stocks in the S&P 500 Index that have extensive international operations. Exhibit 3 contains an alphabetical list of these firms.

3. Data Set 3: Data Set 1 plus 30 Closed End International Funds. Exhibit 4 contains an alphabetical list of the 30 closed end international funds.
4. Data Set 4: Data Set 1 plus 30 ADRs. Exhibit 5 contains an alphabetical list of the 30 ADRs.

VI. Data

The 2006 version of Compustat (Research Insight) was used to obtain the list of firms in the S&P 500 index, the most recent annual revenue and the most recent annual foreign revenue. These revenue values are used to determine the list of 30 firms for Data Sets 1 and 2. More than 200 S&P 500 firms did not have a figure for most recent annual foreign revenue. The 30 largest firms (by market capitalization) that did not have a value for foreign revenue and did have five years of return data form Data Set 1 (list of firms with minimal international operations). Likewise, the 30 largest firms (by market capitalization) with the largest percentage for foreign revenue and with five years of return data form Data Set 2 (list of firms with maximum international operations).

The international closed end equity funds was obtained from an early December 2006 issue of *Barron's*. Only those funds that had 10 years of return data are used. Exhibit 4 lists the 30 closed end funds used.

The ADRs used are a subset of all ADRs (adr.com) Those ADRs with the largest institutional holding and five years of return data are used. Exhibit 5 lists the 30 ADRs used.

For each U.S. firm, closed end fund, or ADR used there are 120 historic monthly rates of return (including dividends). These monthly rates of return begin in January 1997 and end in December 2006. CRSP (Center for Research in Stock Prices) was the source of these rates of return.

VII. Efficient Frontier Calculation

All Efficient Frontier calculations are done using Excel 2007. Excel's COV and OFFSET functions are used to obtain the variance/covariance matrix. The MMULT function is used for the optimization model's objective functions and the rate of return constraint. The solver feature in Excel 2007 is used to solve the quadratic optimization problem (Benninga). Most calculations were checked using various initial positions (that is values for the weights-amount to invest in each risky asset).

VIII. Results

Exhibit 6 contains the results of the Efficient Frontier calculations. For each of the four data sets the portfolio minimum standard deviation is calculated for five monthly rate of return values, 1%, 2%, 3%, 4%, and 5%. For each data set and for each of the five monthly rates of return there is the minimum standard deviation value and the number of securities in the optimum portfolio. Additionally, for Data Sets 3 and 4 the percentage of each optimum portfolio invested in closed end international funds or ADRs is provided.

The results contain one outlier. The number of securities in the optimum portfolio is 35 when the rate of return is 4 percent and the data set includes ADRs (Data Set 4). This efficient frontier calculation was checked twice (using different initial conditions). All three calculations gave the same optimum solution (to two places to the right of the decimal point).

If we consider the 1, 2, and 3 percent rate of return calculations the most efficient is portfolio/Data Set 4, which consists of the 30 U.S. firms with minimal international sales and 30 ADRs. The optimum standard deviation values are 2.6, 2.6, and 4.0.

When the monthly rate of return is set at 4 or 5 percent the optimum portfolio standard deviation seems to be sensitive to what happened to a few stocks. For instance, when the rate of return is 5 percent the number of risky assets in the optimum portfolio ranges from 4 assets for Data Set 3 to 6 assets for Data Set 4.

When comparing the results of Data Set 3 (30 U.S. firms with minimal international sales and 30 closed end international funds) and Data Set 4, Data Set 3 has a higher standard deviation at all rate of return levels (except rate of return of 4%). Additionally, the percentage of the optimum portfolio for Data Set 3 has some investment in closed end funds only when the rate of return value is 1 and 2 percent.

The primary implication of this research is that the benefits of international diversification seem to be greatest when investing in ADRs (the stocks of non-U.S. firms) rather than international funds.

Exhibit 1: Markowitz Minimization Model for Efficient Frontier Calculation

$$\text{min portfolio risk/standard deviation} = \text{min } \sigma_p = \text{min } \sqrt{\sum_{i=1}^N \sum_{j=1}^N x_i x_j \sigma_{ij}}$$

subject to

$$E(r_p) = \sum_{i=1}^n x_i E(r_i) = b$$

$b =$ values 1, 2, 3, 4, 5,

$$\sum_{i=1}^N x_i = 1 \text{ and } x_i \geq 0,$$

$i = 1, \dots, N$

$x_i =$ weight of each risky asset in the portfolio,

$i = 1, \dots, N$ is the asset identifier,

$E(r_p) =$ expected rate of return for portfolio p,

$E(r_i) =$ expected rate of return for risky asset i,

$\sigma_p =$ risk/sigma/standard deviation for portfolio p,

$\sigma_{ij} =$ covariance between risky asset i and j.

Exhibit 2: 30 S&P 500 Firms with Minimum International Revenue

Number	Name of Firm	Ticker Symbol	Number	Name of Firm	Ticker Symbol
1	Allstate	ALL	16	Lowe	LOW
2	AOL Time Warner	AOL	17	MBNA	KRB
3	Bank of America	BAC	18	Morgan Stanley	MWD
4	Bank of New York	BK	19	National City	NCC
5	Bank One	ONE	20	Schlumberger	SLB
6	Citigroup	C	21	Southern	SO
7	Colgate-Palmolive	CL	22	Sun Trust Banks	STI
8	Comcast	CMCSK	23	Sysco	SYU
9	Dow Chemical	DOW	24	Target	TGT
10	Federal Home Loan Mortgage	FRE	25	Tenet Healthcare	THC
11	Fifth Third Bancorp	FITB	26	US Bancorp	USB
12	Fleet Boston	FBF	27	United Health Group	UNH
13	HCA	HCA	28	Walgreen	WAG
14	J P Morgan	JPM	29	Washington Mutual	WM
15	Kohl	KSS	30	Wells Fargo	WFC

Exhibit 3: 30 S&P 500 Firms with Maximum International Revenue

Number	Name of Firm	Ticker Symbol	Number	Name of Firm	Ticker Symbol
1	3M	MMM	16	International Flavors & Fragrances	IFF
2	AES	AES	17	McDermott International	MDR
3	Altera	ALTR	18	McDonald	MCD
4	Applied Materials	AMAT	19	Motorola	MOT
5	Avon Products	AVP	20	National Semiconductor	NSM
6	Bausch & Lomb	BOL	21	Pall	PLL
7	Baxter International	BAX	22	Parametric Technology	PMTI
8	Cisco Systems	CSCO	23	PerkinElmer	PKI
9	Coca Cola	KO	24	Qlogic	ALGC
10	Eastman Kodak	EK	25	Rohm & Haas	ROH
11	Gillette	G	26	Solectron	SLR
12	Halliburton	HAL	27	Sun Microsystems	SUNW
13	Hewlett-Packard	HWP	28	Teradyne	TER
14	Intel	INTC	29	Unisys	UIS
15	IBM	IBM	30	Wrigley	WWY

Exhibit 4: 30 Closed End International Funds

Number	Name of Firm	Ticker Symbol	Number	Name of Firm	Ticker Symbol
1	Brazil Equity	BZF	16	Korea Equity	kef
2	Asia Pacific Fund	APB	17	Korea	KF
3	Asia Tiger	GRR	18	Latin America Equity	LAQ
4	Chile	CH	19	Malaysia	MF
5	China	CHN	20	Mexico Equity and Income	MXE
6	Central European Equity	CEE	21	Morgan Stanley Asia-Pacific	APF
7	Europe Fund	EF	22	Morgan Stanley India	IIF
8	First Isreal	ISL	23	New Ireland	IRL
9	First Philippine	FPF	24	Scudder New Asia	SAF
10	France Growth	FRF	25	Spain	SNF
11	Germany Fund	GCHGER	26	Templeton China	TCH
12	Greater China	IFNGCH	27	Templeton Dragon	TDH
13	India Fund	ITAIFN	28	Templeton Emerging Market	EMF
14	Italy	ITA	29	Templeton Russia and Eastern Europe	TRF
15	Japan Equity	JEQ	30	Turkish Investment	TKF

Exhibit 5: 30 American Depository Receipts (ADRs)

Number	Name of Firm	Ticker Symbol	Number	Name of Firm	Ticker Symbol
1	Aegon	AEG	16	Matsushita	MC
2	Akzo	AKZOY	17	News Corp	NWS
3	ASML	ASML	18	Nokia	NOK
4	AstraZeneca	AZN	19	NTT	NTT
5	Aventis	AVE	20	POSCO	PKX
6	BPPLC	BP	21	Repsol	REP
7	Diageo	DEO	22	Rio Tinto	RTP
8	Elan	ELN	23	Royal Dutch Shell	RD
9	ENI	ENI	24	SK Telecom	SKM
10	GlaxoSmithKline	GSK	25	Sony	SNE
11	Grupo Televisa	TV	26	Telefonica	TEF
12	Gucci	GUC	27	TelMex	TMX
13	Hitachi	HIT	28	Total Fina	TOT
14	KEPCO	KEP	29	Unilever	UN
15	Luxottica	LUX	30	Vodafone	VOD

Exhibit 6: Efficient Frontier Results

Efficient Frontier Portfolio Standard Deviation				
	Data Set 1	Data Set 2	Data Set 3	Data Set 4
			30 U.S. Firms with Minimal International Sales and 30 Closed End International Funds	30 US Firms with Minimal International Sales and 30 American Depository Receipts, ADRs
Portfolio Monthly Rate of Return (%)	30 U.S. Firms with Minimal International Sales	30 U.S. Firms with Maximum International Sales		
1	4.3	3.7	3.3	2.6
2	4.3	4.2	3.0	2.6
3	4.5	5.4	4.2	4.0
4	7.8	7.9	7.8	8.2
5	12.3	10.8	12.1	11.4
Number of risky securities in minimum standard deviation portfolio.				
1	9	11	12	15
2	12	11	15	16
3	8	7	9	11
4	6	5	6	35
5	5	5	4	6
			Percentage in Closed End Funds	Percentage in ADRs
1			32.5	45.7
2			11.3	39.6
3			0	23.6
4			0	22.5
5			0	20.4

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