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AN EVALUATION OF INTERNATIONALLY DIVERSIFIED MUTUAL FUNDS

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Abstract

This paper compares the risk adjusted performance of three groups of mutual funds: 1) funds that invest in specific regions of the world but not in the United States, 2) funds that invest in foreign securities and in US securities, and 3) funds that restrict their investment to the US over the period from February 1978 to December 1982. Sharpe and Treynor measures are used for performance comparison. Contrary to theory, the funds that invest only in the US outperformed the other two groups of funds. The funds that restricted their investment to a specific region of the world performed worse than the other two groups of funds.

Grubel [1968] developed the first application of portfolio diversification in an international context. Since that time, substantial work has been done to show the gains from international diversification. These gains have been explained as arising from the low correlations that have been found to exist among foreign stock exchanges. One of the most important vehicles for foreign diversification has been provided by mutual funds that either hold portfolios of both domestic and foreign securities or hold only foreign securities.

This paper evaluates the risk-adjusted performance of a sample of internationally diversified mutual funds and compares them to purely domestic mutual funds. The period studied is from February 1978 to December 1982. Two things are worth noting about this period. First, the Interest Equalization Tax was no longer in effect during this period. Second, the international monetary system had changed from a fixed system to a floating rate system.

Three groups of mutual funds are evaluated. The first group was formed by those funds that invested in specific regions of the world but not the US. The second group included those funds that invested in foreign securities and in US securities. Funds that restricted their investments to the US comprised the third group.

Monthly returns for the funds were calculated as the change in the Net Asset Value at the end of the month plus distributions divided by the beginning Net Asset Value. An international market index was constructed as the market value weighted index of fifteen country stock indices. The proxy for the riskless rate of interest is the one month Treasury bill rate. These data were used to calculate both a CAPM beta and standard deviation of returns for each mutual fund.

The Sharpe and Treynor measures of performance were used to evaluate mutual fund performance. Sharpe's reward to variability ratio, the mean excess return on the fund divided by the standard deviation of returns, measures the risk premium per unit of total risk earned by a fund. The Trey-

nor ratio of mean excess return to beta measures the risk premium per unit of systematic risk earned by the mutual fund. One important difference between Treynor's traditional measure and the one used in this study should be mentioned. The beta coefficients were estimated in relation to a world market portfolio instead of a purely domestic market portfolio.

The results of this study indicate that regional funds had more unsystematic risk than either the global or local funds. This result is explained by the fact that the regional funds concentrated investments in specific regions outside the US and thus carried less well diversified portfolios than the global or local funds. The low unsystematic risk of local funds is attributed to the fact that the US market accounted for 60% of the world equity market.

The regional funds tend to have betas less than one and the global and local funds tend to have beta greater than one. It is not clear whether this result represents a characteristic arising from the pattern of diversification followed by each group or whether it is a spurious result due to the small sample size or short period of observation.

A priori one would expect that internationally diversified funds should outperform locally diversified funds because some of the systematic risk of the local market is diversifiable at the international level. The results of this study do not support this hypothesis. With regard to the regional funds, it was found that these funds underperformed the local funds. This is not entirely unexpected because by concentrating their investments in one highly correlated region, these funds carry more unsystematic risk than the other two groups of funds. Of more interest is that the locally diversified funds outperformed both internationally diversified groups. These results are based on rankings of the funds by both the Sharpe and the Treynor indices.

II. LITERATURE REVIEW

The relevant literature on international diversification will be discussed in three parts. The first part deals with researchers attempts to demonstrate the benefits of international diversification. The second section presents some theoretical models and tests of the structure of the international capital market, including the question of integrated versus segmented markets. The last section presents studies that have tested the performance of international mutual funds.

Grubel [1968] first applied Markowitz portfolio analysis in an international context. Using monthly returns for eleven stock indices for the period January 1959 to December 1966, Grubel computed the means, standard deviations, and correlations of the indices. The efficient frontier derived for the eleven indices dominated the United States market alone. Subsequent research supported and expanded Grubel's conclusions. Levy and Sarnat [1970] found that as the number of countries in the available set increased, including less developed countries, the efficient frontier rose as well. Solnik [1974b] extended these results to apply to investors in other countries than the United States. That is, returns to investors in any country would improve by international diversification.

Grubel and Fadner [1971] found that the advantages of international diversification increased as the holding period used increased. Rugman [1977] found that some of the benefits of international diversification could be attained by investing in United States' multinational firms. As the proportion of international sales rose for firms, the firm's beta dropped. Maldonado and Saunders [1981] questioned the

previous studies. They found that correlation coefficients between countries were not stable over periods of time longer than two quarters.

The international asset pricing model was developed by Solnik [1974c]. Solnik's model accounted for foreign exchange risk and the lack of a universal risk-free rate of return. After conducting empirical tests, Solnik [1972a] concluded that stock prices were strongly affected by domestic factors. However, prices were also dependent on international events both directly through the national indices and selectively among stocks. Solnik concluded that the domestic beta of a security could not be taken as the true measure of its risk. The true systematic risk of a stock was much smaller than the domestic systematic risk.

Cohn and Pringle [1973] showed that the risk-premium of securities would drop if barriers to international diversification between otherwise perfect national markets were lifted. This is because the correlation to any single security with the new market portfolio is likely to be less than the correlation with the previous national portfolio.

Stehle [1977] was not able to support the integrated markets hypothesis, although his coefficients did have the hypothesized signs for an integrated market. Lessard [1976] demonstrated that security returns were affected by a world factor but were affected by even stronger country and industry factors.

McDonald [1973] analyzed eight French mutual funds. Using Sharpe and Treynor indices, he found that the funds were able to outperform the French and United States markets. However, because the funds were run by banks that had access to inside information it is not clear if these results are because of superior performance or superior information. Farber [1975] using Solnik's international asset pricing model and Jensen's performance measure, was unable to find superior performance in 27 internationally diversified mutual funds managed in Europe. Results similar to McDonald were found by Handjnicolaou [1980] for the Greek stock market. Although two mutual funds were able to outperform the Greek stock market, they are bank owned.

In summary, the advantages of international diversification are strongly supported both in theory and empirically. However, it is not clear that mutual funds can attain these advantages, without the benefits of inside information. The objective of this study is to measure the performance of mutual funds that are both locally, globally, and regionally diversified.

III. RESEARCH DESIGN

Three groups of mutual funds are evaluated. The first group is formed by those funds that invest in specific regions of the world but not the United States (the regional funds). The second group of funds include those funds that invest in foreign securities and in United States' securities (the global funds). The third group of funds restrict their investment to the United States (the local funds). A total of 17 funds are analyzed.

Monthly returns are calculated as the month end net asset value, NAV(t+1), less the beginning of the month net asset value, NAV(t), plus all dividends, D(t+1), and capital gains, C(t+1), all divided by the beginning of the month net asset value.

$$[NAV(t+1)-NAV(t)+D(t+1)+C(t+1)] /NAV(t) \quad [1]$$

All of the above are in per share amounts. Since monthly data on dividends and capital distributions are not available, estimates of these figures

are used. Annual figures, taken from Investment Companies,[1] are divided by twelve and these amounts are used. Net asset values are taken from various issues of The Wall Street Journal.

In order to construct a world index, monthly returns are used for each of fifteen country stock indices. The returns are calculated by dividing the end of period observation by the beginning of period observation. Dividend yields are not available for these indices and are not included in the returns. Each index is weighted by the market value of the equity in each country and the weighted returns are summed. Market weights are for 1980 which is the mid-point of the observation period and are taken from Ibbotson, Carr, and Robinson [1982]. The country indices are taken from Barron's which quotes them from Capital International Perspective.[2] The fifteen countries composing the world market factor, their weights, the arithmetic means of the monthly returns, standard deviations, and correlations with the United States market index appear in Table 1.[3] All of the means are arithmetic averages and follow McDonald [1973].

The proxy for the risk-free rate of interest used in computing the performance indices is the average of the one month Treasury Bill rates. The selection of the Treasury Bill rate as the risk-free rate follows Sharpe [1966]. Since these are United States based funds, this rate seems to be appropriate. The rates are taken from The Wall Street Journal.

The Sharpe and Treynor measures of performance are used in this paper to evaluate the mutual funds. Sharpe's reward- to-variability ratio, S, is the mean excess return on the fund divided by the standard deviation and measures the risk premium per unit of total risk earned by a fund.

$$S = [r(i)-R]/SD(i) \qquad [2]$$

The average return on the i(th) portfolio is r(i), the average risk-free rate during the period is R, and the standard deviation of returns for the i(th) portfolio is SD(i).

Treynor's ratio of mean excess return to beta, T, measures the risk premium per unit of systematic risk earned by a fund.

$$T = [r(i)-R]/beta(i) \qquad [3]$$

The average return on the i(th) portfolio is r(i), the average risk-free rate during the period isR, and the systematic risk of the i(th) portfolio is beta(i). The Jensen [1968] measure of performance is not used in this study because the omission of dividends in the computation of the world portfolio biases the intercept in the excess returns regressions.

One important difference between Treynor's traditional measure and the one used in this study must by mentioned. The beta coefficients of funds are estimated in relation to a world market index instead of a purely domestic market index. Treynor [1965] used characteristic lines to estimate betas. These characteristic lines were derived using simple regressions between mutual fund returns and the returns on a domestic market index, e.g. the S&P 500. In this study, the market index used is composed of a world index.

The international asset pricing model was proposed by Solnik [1974]. The risk premium of a security over it's national risk-free rate is proportional to it's international systematic risk.

$$E[R(i)]-R(f)=beta(i)[E(R(m))-R(fm)] \qquad [4]$$

where

E[R(i)] - the expected return on the i(th) security (in local currency)

R(f) - the risk-free rate in the country of the i(th) security (in local currency)

E(R(m)) - the expected return on the world market portfolio (where each component is expressed in its own currency with market value weights)

R(fm) - the average interest rate in the world with the same weights as the world market portfolio

beta(i) - the international systematic risk of the i(th) security.

Because the expectations for Equation [4] are unobservable, realized returns are used for ex post analysis. Using realized returns and making the standard assumptions about the distributions of the error terms, the following regressions are run.[4]

$$r(it)=alpha(i)+beta(i)[r(mt)]+e(it) \qquad [5]$$

where

r(it) - the monthly realized returns on the i(th) fund for the t(th) month

alpha(i) - the intercept for the i(th) fund

beta(i) - the systematic risk measure for the i(th) fund

r(mt) - the monthly return on the world portfolio

e(it) - the random disturbance term.

This model is taken from Solnik [1973, chapter 7].

Two time periods are analyzed, February 23, 1978 to December 22, 1982 and May 24, 1979 to December 22, 1982. This shorter period is used in order to increase the sample of global and regional funds from six to nine since full data are not available for three funds for the longer period. Similar tests are run with a longer time period, February 23, 1978 to December 22, 1982, but with three regional funds, two global funds, and eight local funds. The results are the same as those for the shorter time period with sixteen funds. All of the tests are replicated for the long and the short term period using the natural logarithms of the wealth relatives with similar results. Only one set of results are reported here.

IV. EMPIRICAL RESULTS

The results of this study will be discussed in two parts - first, the performance during the shorter period will be discussed and then the three statistical tests comparing the performance measures across types of funds will be discussed.

Table 2 contains the beta, R^2, F-ratio, average return, and standard deviation of return for each of the sixteen funds in the shorter time period. The average R^2 for the regional funds, which represents the proportion of the variation in mutual fund's returns explained by the world portfolio, is 0.3482 with a range of 0.2547 to 0.5065. This compared with an average R^2 for the global funds of 0.6755 with a range of 0.3075 to 0.8593. For the local funds, the average R^2 is 0.7239 with a range of 0.3291 to 0.8656. It would appear that regional funds are less related to the world index than the global or local funds. Because the regional funds restricted their investments to specific areas, their portfolios are less well diversified which reduced their relationship with the world index.

The average beta for the regional funds is 0.9986 with a range of 0.8002 to 1.3890. This group of funds is less systematically related to the world index. The global funds had average betas of 1.0216 with a range from 0.7725 to 1.2375. The local funds had average betas of 1.2691 with a range from 0.9182 to 1.6918. It would appear that the regional funds are less

aggressive than the global funds which are less aggressive than the local funds.

Table 3 shows the name, the area of investment, the Sharpe index (with rankings), and the Treynor index (with rankings) for each fund. The rankings by the Sharpe and Treynor indices are very similar, the Spearman Correlation Coefficient is very high, 0.9951 (significant at the 0.01 level). The regional funds Canadian, G.T. Pacific, Merrill Lynch, and Scudder International ranked in the bottom. Locally diversified funds again clustered at the top of the scale outperforming all the other funds except Sogen and Templeton.

In this section, significance tests will be performed for differences in performance measures. Since the results for both periods are similar, the significance tests discussed in this section will be for the May 1979 to December 1982 period.

The first hypothesis tested is that the mean performance of the mutual funds are not all equal.

H[0] : mu(r) = mu(g) = mu(l)

H[1] : at least one mean is different.

This hypothesis is tested using analysis of variance. Since the results of the analysis of variance do not allow the analyst to determine which mean is different, multiple comparisons will be performed using the Scheffe technique.[5]

In addition to the analysis of variance and Scheffe tests, two non-parametric tests are performed because they have less stringent assumptions. The underlying population distributions need not be normal, and since it is not clear whether the performance measures are properly distributed or that the central limit theorem is applicable, the use of non-parametric tests seems appropriate.

The hypothesis that the medians of all three groups of funds are equal is tested with the Kruskal-Wallis test.

H[0] : M(r) = M(g) = M(l)

H[1] : at least one of the medians is different.

Table 4 shows the results of the performance comparisons. The analysis of variance F-ratio for differences in at least one mean is 3.82. This is significant at the 0.05 level and would allow the rejection of the null hypothesis of equal means. At least one of the groups' performance is statistically different from the other two.

The Scheffe method of multiple comparisons is designed to be used after the null hypothesis of no differences among the means in an ANOVA has been rejected. The purpose of the procedure is to determine which of the means are different. None of the differences are statistically significantly different at the 0.05 level of significance but the difference between the local and regional funds are statistically different at the 0.10 level.

The Kruskal-Wallis method is a non-parametric test analogous to the analysis of variance F-test but requiring less stringent assumptions with respect to normality. The test statistic is calculated as follows:

$$H=[12/[n(n+1)]x[SUM[T^2]/n(i)]-3(n+1)$$

where,

n - the total number of observations over the sample, 17 in this case

c - the number of samples, 3 in this case

T^2 - the square of the sum of the ranks assigned to the i(th) sample.

The calculated H is equal to 8.31 and is

significant at the 0.05 level. The null hypothesis of equal means is rejected.

The Wilcoxon Rank Sum Test is a non-parametric procedure to measure differences between group medians.[6] To calculate this statistic, the observations in the sample of regional and local funds are replaced with their combined ranks such that rank one is given to the smallest of the combined observations, rank two is given to the second smallest, and so forth. The Wilcoxon statistic is the summation of the ranks given to the observations in the smaller sample (the regional group).

$$W(i) = [SUM(Rank(i)]$$

The calculated value for the Wilcoxon statistic is T(r)=10 and is significant at the 0.01 level with n(r)=4 and n(l)=8. For the comparison of the global and local medians, the Wilcoxon test statistic is T(g)=21 which is significant at the 0.10 level. The null hypothesis of equality of medians is rejected. These results are the same for both the Treynor and the Sharpe indices. They indicate that the regional funds performed worse than the global funds and that the global funds performed worse than the local funds.

A priori, one would expect that internationally diversified funds that invested in the United States and other countries should outperform locally diversified funds because of the portfolio effect. The results obtained in this study did not reveal any significant difference between these two groups of funds. However, it must be stressed that the sample of global funds is very small and the proportion of funds invested in the United States by the global funds is not known.

The regional funds underperformed the local funds. This is not an entirely unexpected result because, by concentrating their investments in one highly correlated region, these funds carried more unsystematic risk than the other two groups. Hence, their portfolios are less efficiently diversified. The local funds also invest regionally, the United States. However, this country represents 60% of the world equity market and may provide substantial diversification compared to other countries or regions.

V. CONCLUSIONS

This paper evaluated the risk-adjusted performance of three groups of mutual funds - regional, global, and local for the periods February 1978 to December 1982 and May 1979 to December 1982. The results of this research reveal that the regional funds have higher levels of both unsystematic and systematic risk than either the global or local funds. These results are explained by noting that regional funds concentrated their investments in specific regions outside the United States and invested in less efficiently diversified portfolios. The low unsystematic risk of the local funds is attributable to the fact that the United States accounted for 60% of the world equity market during the periods studied.

Risk adjusted performance of the three groups of funds are compared using the Sharpe and Treynor performance measures. For the periods analyzed, the rankings by both measures are similar. Statistical analysis of the means and medians of the sample groups revealed that the performance of the global and local funds was superior to the performance of the regional funds. The global and local funds are not statistically different in performance.

Table 1
Countries Used in Constructing the International Index

Name, Weight, Mean, Standard Deviation, and Correlation with the United States Index

Name	Weight	Mean*	SD#	R^2(@)
Australia	0.025	0.0095	0.0628	0.65325(a)
Belgium	0.004	0.0012	0.0459	0.25245
Canada	0.050	0.0124	0.0514	0.65772(a)
Denmark	0.002	0.0104	0.0475	0.24323
France	0.020	0.0097	0.0625	0.17068
West Germany	0.030	-0.0002	0.0301	0.42017(a)
Hong Kong	0.020	0.0170	0.1069	0.25868(b)
Italy	0.010	0.0227	0.1026	0.15957
Japan	0.150	0.0091	0.0335	0.28476(b)
Netherlands	0.010	0.0061	0.0482	0.55371(a)
Norway	0.001	0.0117	0.0747	0.35036(a)
Sweden	0.005	0.0209	0.0695	0.27305(b)
Switzerland	0.020	-0.0005	0.0318	0.64843(a)
United Kingdom	0.053	0.0120	0.0497	0.44540(a)
United States	0.600	0.0061	0.0489	1.00000

* - Arithmetic mean of monthly returns for the period February 23, 1978 to December 22, 1982.
# - Standard Deviation
@ - Correlations with the United States market for February 23, 1978 to December 22, 1982.
(a) - significant at the 0.01 level
(b) - significant at the 0.05 level

Table 2
Results of Regressions of Mutual Fund Returns
and the World Index
May 24, 1979 to December 22, 1982

Regional Funds	beta	R^2	F	Return	SD
Canadian Fund	1.0017	0.5065	42.08	0.0086	0.0568
G.T. Pacific	0.8866	0.3211	19.40	0.0053	0.0632
Merrill Lynch Pac.	0.9159	0.2897	16.73	0.0101	0.0687
Scudder Intnl	0.8002	0.3693	24.10	0.0080	0.0532
Global Funds					
Keystone Intnl	1.1136	0.8593	250.60	0.0100	0.0480
Putnam Intnl	0.9630	0.6871	90.05	0.0108	0.0469
Sogen	0.7725	0.3075	18.21	0.0199	0.0562
Templeton World	1.2375	0.8483	229.35	0.0146	0.0542
Local Funds					
American Mutual	1.0861	0.6472	75.24	0.0171	0.0545
NEL Growth	1.3916	0.3291	20.12	0.0323	0.0979
Oppenheimer	1.6918	0.7860	150.59	0.0151	0.0770
Pioneer	1.3408	0.8269	195.95	0.0132	0.0595
Scudder Common	1.2975	0.7929	156.98	0.0154	0.0588
Travelers Equities	1.1754	0.8273	196.52	0.0161	0.0522
United Continental	0.9182	0.7164	103.60	0.0127	0.0438
Vanguard Index	1.2514	0.8656	264.06	0.0137	0.0543

Summary Statistics

Group	Average R^2	Average Beta	Average Return	Average SD
Regional	0.3717	0.9011	0.0080	0.0472
Global	0.6755	1.0216	0.0138	0.0513
Local	0.7239	1.2691	0.0195	0.1218
World Portfolio	1.0000	1.0000	0.0077	0.040
Treasury Bills	-	-	0.0093	-

Table 3
Sharpe and Treynor Rankings for Mutual Funds

Fund Name	Area of Investment	Sharpe Index	Treynor Index
Canadian Fund	Canada	-0.0123(15)	-0.0007(15)
G.T. Pacific	Far East	-0.0632(17)	-0.0045(17)
Merrill Lynch Pac.	Far East/West Pac	0.0116(14)	0.0008(13)
Scudder Intnl	Foreign Sec.	-0.0244(16)	-0.0016(16)
Keystone Intnl	US & Foreign	0.0146(13)	0.0006(14)
Putnam Intnl	US & Foreign	0.0319(12)	0.0015(12)
Sogen	US & Foreign	0.1886(3)	0.0137(3)
Templeton World	US & Foreign	0.0978(7)	0.0043(7)
American Mutual	US	0.1431(4)	0.0072(4)
NEL Growth	US	0.2349(2)	0.0165(2)
Oppenheimer	US	0.0753(10)	0.0034(10)
Pioneer	US	0.0655(11)	0.0029(11)
Scudder Common	US	0.1037(6)	0.0047(6)
Travelers Equities	US	0.1302(5)	0.0057(5)
United Continental	US	0.0776(9)	0.0037(8)
Vanguard Index	US	0.0810(8)	0.0035(9)

Table 4
Analysis of Variance for Regional, Global, and Local Funds

Source of Variance	Sum of Squares*	Degrees of Freedom	Mean Sum of Squares*	F-Ratio
Between Groups	1.5529	2	0.7765	3.82321
Within Groups	2.6409	13	0.2031	
Total	4.1938	15		

* times 1/1000
# significant at the 0.05 level

FOOTNOTES

1. Investment Companies is published by Arthur Wisenberger Services, Inc.

2. Capital International Perspective is published by Capital International, S.A., Geneva. The base year for all indices is January 1, 1970 and equals one hundred.

3. All of the means are arithmetic averages and follow McDonald [1973].

4. The assumptions about the regression error terms are that they are independent and normally distributed with mean zero and standard deviation sigma.

5. For a discussion of the Scheffe multiple comparison technique see Glass and Stanley [1970].

6. For a discussion of the Wilcoxon Rank Sum Test see Bradley [1968].

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