HOW DIVERSIFIED ARE EQUITY MUTUAL FUNDS?

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ABSTRACT

The paper investigates the degree to which the domestic equity mutual fund is diversified, and attempts to determine the extent to which any undiversified idiosyncratic risk, i.e. unsystematic or company specific risk is associated with the average fund returns. The sample consists of mutual funds from six investment objective categories, including aggressive growth, small company, growth, growth and income, equity income, and index funds. The results show that, except for the index funds category, the average domestic fund is substantially undiversified. The average idiosyncratic volatility as a percentage of the fund's total volatility ranges from 0.82% for the index funds to 34.28% for the small company category. The explanatory power of the Fama-French-Carhart model declined during the 1986 to 2001 sub period, and then went back up from April 2001 to March 2006.

Key Words: Mutual Funds, Volatility, Idiosyncratic Risk, and Portfolio Diversification

JEL Codes: C13, C23, C25, and G23

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I. INTRODUCTION

Schwert (1989) found that the volatility of the market was stable from 1926 to 1997. Similarly, Campbell, Lattau, Malkiel, and Xu (2001) found that the market and the industry variances were stable from 1962 to 1997. Moreover, Campbell et al. observed an increase in firm level volatility from 1962 to 1997, and they found that correlations among individual stocks and the explanatory power of the market model declined during that period. Thus, even though uncertainty did not change significantly for the market as a whole during the 1962 to 1997 period, it increased significantly at the level of the individual firm. Campbell et al. also found that the explanatory power of the market model for the average firm declined during that period. Further, they observed that the increase in firm level volatility (i.e. idiosyncratic risk) has increased the number of randomly selected stocks needed to achieve a relatively complete portfolio diversification.[2]

The single factor Capital Assets Pricing Model (CAPM) holds that only market risk is priced and that idiosyncratic risk is not relevant because investors can diversify it away. But, as observed by Malkiel and Xu (2002), idiosyncratic risk could also be priced to compensate rational investors that are not able to hold the market portfolio. Malkiel and Xu, relying on a variation of the CAPM, found that idiosyncratic volatility is useful in explaining cross-sectional expected returns because returns from constructed portfolios covary with the idiosyncratic risk of hedging portfolio returns. This finding is in line with Falkenstein (1996) who also found that equity holdings of mutual fund managers are related to idiosyncratic risk. Falkenstein observed that mutual funds generally prefer larger stocks with high visibility and are averse to stocks with low idiosyncratic risk. Malkiel and Xu further noted that actively managed mutual funds and pension funds do not typically hold the market portfolio, even though they are able to, and that institutional investors often deliberately structure their portfolios to accept considerable idiosyncratic risk in an attempt to obtain extraordinary returns.

Moreover, Malkiel and Xu (2002) argued that the vast majority of investors do not hold the market portfolio and therefore idiosyncratic risk is not irrelevant. They point to a recent survey that showed that the average investor owned only 3 stocks and that 15% of individual investors held only one stock. According to Campbell, Lettau, Malkiel, and Xu (2001), a well diversified portfolio must have 40 or more stocks in recent decades because of the increase in idiosyncratic risk. In support of Malkiel and Xu (2002), Goyal and St. Clara (2003) observed that because of the lack of

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[2] Idiosyncratic risk is the portion of the total firm-level volatility that can be eliminated through portfolio diversification, in other words unsystematic risk, or company-specific risk.

diversification, the relevant measure of risk for many investors may be total risk rather than just market risk. They also found that stocks with high idiosyncratic volatility have low returns. Similarly, Ang, Hodrick, Xing, and Zhang (2006) found that stocks with high idiosyncratic volatility have low returns. Tinic and West (1986), Lehmann (1990), and Malkiel and Xu (1997), however, all found that stocks with higher idiosyncratic risk have higher average returns. Other studies that found a significant relation between idiosyncratic risk and returns include Miller and Scholes (1972), Friend, Westerfield, and Granito (1978), Levy (1978), Amihud and Mendelson (1989), and Bali, Cakici, Yan, and Zhang (2005). Further, Malkiel and Xu (2003) have suggested that idiosyncratic volatility of individual stocks is associated with the degree to which their shares are owned by financial institutions, and is positively related to the expected earnings growth.

Although the decline in correlations among stocks over time suggests that the benefit of portfolio diversification has increased, the increase in idiosyncratic risk over time implies that the number of randomly selected stocks needed to diversify a portfolio has also increased. On balance, the effect of these two opposing forces on portfolio diversification is a matter of empirical investigation. The purpose of the present study is to investigate the level of undiversified idiosyncratic risk in the average equity mutual fund and to find out the relation between idiosyncratic risk and average returns on these equity mutual funds. Specifically, this paper examines the extent to which the average equity fund is diversified and whether portfolio diversification has changed over time.

II. DATA AND METHODOLOGY

The sample consists of domestic equity mutual funds from the following investment objective categories: Aggressive Growth, Growth, Growth and Income, Equity Income, Small Company, and index funds. Because most of the domestic-equity-mutual funds tend to have substantial holdings of foreign stocks and bonds, only those funds that have at least 50% of their portfolio values invested in domestic stocks and no more than 15% invested in foreign stocks were selected. Funds that have no more than 15% of their portfolio values invested in bonds were also selected. The sample period is April 1986 to March 2006. Monthly mutual fund returns and monthly yields on three-month Treasury bills were obtained from the Morningstar Principia database. Monthly excess return on the market, monthly Fama-French Factors (SML and HMB), and the monthly Momentum Factor (MOM), were obtained from Ken French's Web site: Http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/.

A profile of the sample is shown in Table 1. The average fund holds 171 stocks, and 93% of the value of those holdings is represented by domestic stocks. The average fund has less than 5% of its holdings invested in bonds and foreign stocks

combined. The domestic fund, on average, invests at least 28% of its portfolio in the top ten companies it holds, as indicated by the variable "top-ten." The sample consists of actively managed funds as indicated by the portfolio turnover of about 64%, which suggests that the average fund in this sample, which includes index funds, buys and replaces its assets in about 19 months.

Table 1. Sample Profile of Domestic Equity Mutual Funds (April 1986 – March 2006)

Variable	N	Mean	Std. Dev.
Net Assets ($m)	548	2207.91	5647.00
Holdings	698	170.79	276.40
U.S.Stock (%)	698	92.83	5.68
Foreign Stock (%)	640	4.35	3.83
Bonds (%)	698	0.06	0.56
Top-Ten (%)	698	28.07	17.54
Turnover (%)	698	64.10	49.10

Note: N is the number of mutual funds with non-missing data, and "Std. Dev." is short for standard deviation. Top-Ten is the percentage of the mutual-fund portfolio invested in the top-ten companies held by the mutual fund.

Carhart's (1997) extension of the Fama and French (1993) three factor model is as follows:

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \beta_{j4}MOM_t + \varepsilon_{jt} \tag{1}$$

Where,

r_{jt} = the realized return on security j during time period t;

r_{ft} = the nominal risk-free rate during time period t, represented here by the

monthly yields on three-month Treasury bills.

r_{mt} = the realized return on the market during period t. The series of excess return

on the market, (r_{mt} – r_{ft}), was obtained from Ken French's Website[3]. The

excess return on the market is the value weighted return on all NYSE,

AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury

bill rate.

α_j = the intercept, predicted by the Arbitrage Pricing Model to be equal to zero;

β_{j1} to β_{j4} = slope coefficients on the four risk factors;

ε_{jt} = the residual excess return on portfolio j during time period t;

SMB_t = the difference in returns on small firms versus returns on large firms

during time period t; and

HML_t = the difference in returns of firms with high book-to-market value (B/M)

ratios and the returns of firms with low B/M ratios.

MOM is the momentum factor, i.e. the average return on two high prior return portfolios minus the average return on two low prior return portfolios. That is, the average return on securities with the best return performance during the past year less the average return on securities that had the worst return performance during the same period. This factor was obtained from Ken French's Web.

Undiversified idiosyncratic risk is used in this study as an indicator of the degree to which a portfolio is diversified. The root mean square error (RMSE) obtained from a regression of mutual fund risk premium on the market risk premium, the two Fama and French factors (SMB and HML) and on the momentum factor (MOM), is used as a measure of undiversified idiosyncratic risk.

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[3] Http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/.

III. EMPIRICAL RESULTS

Table 2 shows a breakdown of the sample profile by investment objective. The average index fund has the highest holdings of approximately 620 stocks, and the equity income fund has the lowest holdings of approximately 97 stocks. The index fund is also the most concentrated fund, with 35% of its portfolio invested in the top companies it holds, and has lowest portfolio turnover of 12.67%. Perhaps because an index fund is more diversified, as suggested by its holdings, its idiosyncratic risk of 1.312 is the lowest of any fund category. The aggressive growth and small company categories have the largest idiosyncratic risk of 3.541 and 3.246, respectively, even though they are substantially diversified as judged by their holdings. The average undiversified idiosyncratic risk for the entire sample of 698 mutual funds is 2.291 suggesting that the average domestic fund is not completely diversified. I did not test for statistical differences between categories of funds, therefore I do not know if in fact the differences in these numbers are statistically significant.

Table 2. Portfolio Characteristics of Equity Mutual Funds April 1986 – March 2006.

Category	Holdings	Top-Ten	U. S. Stock	Turnover	Id.Risk	R_{im}	RV (%)
AG	147.261	24.179	93.283	92.043	3.541	0.86	27.72
SC	178.116	20.196	93.056	67.402	3.246	0.79	34.28
G	103.016	29.514	92.152	74.757	2.324	0.89	17.86
EI	97.409	28.900	92.450	61.523	2.074	0.83	28.89
GI	116.469	28.316	91.811	60.366	1.825	0.89	16.99
Index	619.814	34.685	97.561	12.671	1.312	0.95	0.82
All	170.794	28.074	92.825	64.096	2.291	0.88	19.43

Note: Holdings is the number of stocks held by the average fund; Top-Ten is the percentage of the portfolio invested in the top-ten companies held by the mutual fund; U.S. stock is percentage of the portfolio represented by domestic stocks; Id. Risk is the idiosyncratic risk measured by the root mean squared error (RMSE) that is obtained (in a pooled cross-sectional regression) when portfolio excess returns are regressed on market excess returns using the CAPM based regression model; and R_{im} is the correlation between the mutual fund portfolio and the market portfolio. "RV (%)" is the average undiversified risk as a percentage of the total portfolio variance. The categories are Aggressive Growth (AG), Small Company (SC), Growth (G), Equity Income (EI), Growth and Income (GI), and Index (Index) funds.

According to portfolio theory, one can measure the extent to which a portfolio is diversified by measuring the correlation between the portfolio and the market portfolio, assuming of course that the market portfolio is completely diversified. In other words, if the market portfolio is completely diversified and therefore has zero idiosyncratic risk, another completely diversified portfolio should be perfectly correlated with it. Table 2 shows the correlations (R_{im}) between the proxy of the Market Portfolio (i.e. the value weighted return on all NYSE, Amex, and NASDAQ stocks) and the average domestic equity fund. The lowest correlation is 0.79, and in all other cases, the correlation coefficient is above 0.80 but well below 1.0, indicating that the average fund is well diversified although it is still not completely diversified. The correlation for the entire sample is also well below 1.0, supporting the finding that some diversifiable risk remains in mutual fund's portfolio. To present a better picture of the magnitude of the undiversified idiosyncratic risk that remains in the portfolio, I calculated the undiversified idiosyncratic risk as a percentage of the total portfolio volatility. From the market model, the total variance of a portfolio, σ_p^2, can be described as:

$$\sigma_p^2 = \beta_p^2 \ \sigma_m^2 \ + \frac{1}{n}\sigma_{ep}^2, \qquad (2)$$

and the undiversified idiosyncratic volatility as a fraction of the total portfolio volatility can be calculated as,

$$RV = 1 - \frac{(\beta_p^2 \ \sigma_m^2 \ )}{\sigma_p^2}, \qquad (3)$$

Where, β_p is the measure of the portfolio's systematic risk; σ_m^2, is the variance of the market portfolio; σ_p^2, is portfolio p's total variance; and σ_{ep}^2 is portfolio p's residual variance.

The last column in Table 2 shows the average undiversified risk for each fund category as percentage of the total portfolio volatility. As shown in the Table, the average undiversified idiosyncratic risk varies from 0.82% for the index funds category, to 34.28% for the small company category. Thus, except for the index funds, the average domestic mutual fund is significantly undiversified.

Table 3 shows the regressions of portfolio excess returns on four regressors—excess return on the market, the two Fama and French factors, and a momentum factor as recommended by Carhart (1997). Undiversified Idiosyncratic risk, measured by the root mean squared error (RMSE) obtained from the regressions are shown in the Table. The measured Idiosyncratic risk ranges from 1.737 to 3.611, supporting earlier findings that the average domestic mutual fund is not completely diversified. The explanatory

power of the Fama-french-Carhart (1997) regression equation was high during the April 1986 to March 1991 sub-period, as judged by the R^2 of 84.5%, but declined substantially during the next two sub-periods, in support of Campbell, et al. (2001) who found that the explanatory power of the market model declined from 1962 to 1997. But as is shown in Table 3, the explanatory power of the Fama-French-Carhart four factor model went back up in the subsequent sub-period from April 2001 to March 2006. For the entire sample period, April 1986 to March 2006, R^2 was 72.8%.

Table 3. Regression of Excess Fund Returns on Fama-French-Carhart Factors

(April 1986 – March 2006)

Period	Intercept	Market	SMB	HML	MOM	RMSE	R²
4/86-3/91	0.113	0.921	0.184	-0.177	-0.042	2.207	0.845
	(7.16)*	(264.11)*	(27.71)*	(-19.74)*	(-8.06)*		
4/91–3/96	0.006	1.004	0.243	-0.045	0.040	1.737	0.707
	(0.56)	(250.01)*	(53.53)*	(-10.21)*	(8.79)*		
4/96-3/01	-0.020	1.037	0.105	0.202	0.012	3.611	0.641
	(-1.07)	(216.52)*	(23.27)*	(32.95)*	(4.21)*		
4/01-3/06	-0.158	0.992	0.154	0.038	0.011	1.894	0.829
	(15.80)*	(304.28)*	(46.10)*	(8.31)*	(3.65)*		
4/86-3/06	-0.019	0.999	0.104	0.110	0.007	2.583	0.728
	(-2.57)*	(540.80)*	(49.46)*	(42.11)*	(4.73)*		

Note: The regression equation (1):

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \beta_{j4}MOM_t + \varepsilon_{jt},$$

is estimated as shown in the Table. Idiosyncratic risk is measured by the root mean squared error (RMSE); and R^2 is the adjusted R-squared. All variables are as defined in equation (1). T statistics are in parentheses.

*Significant at the 1% significance level.

IV. SUMMARY AND CONCLUSIONS

The purpose of this study is to investigate the degree to which the domestic equity mutual fund is diversified, to determine the trend of undiversified idiosyncratic risk from 1986 to 2006, and to determine the extent to which the undiversified idiosyncratic risk is associated with the average fund returns. My sample consists of 698 mutual funds drawn randomly from six investment objective categories, including aggressive growth, small company, growth, growth and income, equity income, and index funds. Undiversified idiosyncratic risk, measured using regressions based on both the CAPM and the Fama-French-Carhart three factor model, confirm that, except for the index funds category, the average domestic fund is substantially undiversified. The average idiosyncratic volatility as a percentage of the fund's total volatility ranges from 0.82% for the index funds to 34.28% for the small company category.

The explanatory power of the Fama-French-Carhart model declined from during the 1986 to 2001 sub period, in support of Campbell, Lettau, Malkiel and Xu (2001) who found that the explanatory power of the market model declined during the 1962 to 1997 period. However, we also find that the explanatory power of the Fama-French-Carhart model went back up during the April 2001 to March 2006 period.

The average number of stocks held by the typical fund in this sample, as shown in Table 1, is 170. Therefore, the major implication of this study is that just because a mutual fund holds a large number of stocks, it does not necessarily mean that its portfolio is completely diversified.

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