THE VOLATILITY OF EQUITY MUTUAL FUND RETURNS

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ABSTRACT

I investigated both the volatility and the level of diversification of domestic equity mutual funds from 1988 to 2008. I also investigated the Market Model's explanatory power for domestic equity funds during that 20 year period. The volatility of equity mutual funds did not change significantly from April 1988 to March 1998, but it increased appreciably from April 1998 to March 2003, and then declined in the following five-year period from April 2003 to March 2008. This trend seems to differ from a previous study of common stock prices that found no trend in the stock market or industry volatility from 1962 to 1997. Moreover, the volatility of mutual fund portfolios varied with the aggressiveness of the investment objective, and the portion of total volatility that remained undiversified tended to be higher during periods of high market volatility. Consistent with the previous studies of common stocks, the explanatory power of the Market Model declined from April 1988 to March 2003. However, the explanatory power of the Market Model increased substantially from 2003 to 2008. Finally, stock mutual funds lead the expansionary phase of the business cycle, but do not appear to predict recessions three months ahead of time.

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

JEL Codes: C13, C23, C25, and G23

I. INTRODUCTION

The volatility of common stock returns exhibited a significant change during the last half of the 20th Century. Campbell, Lettau, Malkiel, and Xu (2001) found that volatility at the firm level more than doubled from 1962 to 1997. Campbell et al. also found that industry and market volatility did not exhibit a significant trend during the 1962 to 1997 period, contrary to Officer (1973), Schwert (1989), and Hamilton and Lin (1996), who found that the volatility of the stock market was significantly higher during periods of economic recession, Further, Campbell et al. found that firm, industry, and market volatility were negatively correlated with the GDP growth, suggesting that diversification is more important during economic downturns.

Moreover, Campbell et al. (2001) found that the increase in firm level volatility relative to market volatility from 1962 to 1997 implies that the correlations among individual stocks and the explanatory power of the market for a typical stock tended to

decline over time, suggesting that the benefits of portfolio diversification had increased. They argued that the increase in firm level volatility over time suggested that the number of randomly selected stocks needed to achieve relatively complete diversification had also increased.

The behavior of stock prices over the phases of the economic cycle was documented by Moore (1975), Moore and Cullity (1988), Mills (1988), Schwert (1990), and McQueen and Roley (1993). Moore and Cullity (1988) observed that there were few substantial swings in stock prices, over time that were not associated with the swings in the business cycle. But whereas stock prices tended to rise during expansion and to decline during recessions, bond prices moved in the opposite direction. During economic expansions, bond prices declined as interest rates rose. However, bond prices rose during economic recessions as interest rates declined. Typically, stock prices lead the alternating expansions and contractions in business activity, and bond prices tended to lead stock prices. In other words, bond prices and stock prices are leading indicators of economic activity, but bond prices' lead is significantly longer than that of stock prices. Moreover, Schwert (1990) found a strong positive relation between real stock returns and production growth for the next several quarters. According to Moore and Cullity (1988), the stock prices' lead ranges from two to 15 months.

Generally, good times are good for stock prices and bad for bond prices. Conversely, periods of economic recession are good for bonds and bad for stocks. Interest rates and profits are the major link between security prices and economic cycle, as observed by Moore and Cullity (1988), and Bolten and Weigand (1998). According to Ewing, Payne, and Forbes (1998), security prices are more sensitive to short term interest rates such as the Treasury bill rates. They found that past changes in the certificate of deposits rates and the Prime Rate helped to explain changes in current stock returns.

The purpose of the present study is to investigate (1) the volatility of mutual fund portfolios over a 20 year period, from 1988 to 2008, (2) to investigate the level of residual risk inherent in equity mutual fund portfolios, and (3) to investigate the Market Model's explanatory power for domestic equity portfolios during that 20 year period.

II. DATA

The sample consists of 1065 domestic equity mutual funds drawn from five investment objective categories, including Aggressive Growth, Growth, Growth and Income, Equity Income, and Small Company. Mutual funds that have more than 15% of their portfolio invested in either bonds or non-U.S. stocks are not included, neither are mutual funds that have an average net assets of less than $500 million. Monthly returns for 20 years, from April 1988 to March 2008, for the mutual fund sample were obtained from the Morningstar Principia database. Monthly returns on three month Treasury bills, the Federal Reserve's Index of Industrial Production (seasonally adjusted), and the Lehman Brothers Aggregate Bond Index were also obtained from the Morningstar

Principia database. And, finally, monthly excess market returns were obtained from Kenneth R. French's data library[1].

III. METHODOLOGY

To determine the explanatory power of the Market Model for a typical mutual fund portfolio, I ran a regression of the form:

$$r_{it} = \alpha_i + \beta_i r_{mt} + e_{it,} \quad (1)$$

where:

r_{it} = the excess return for fund i, in month t;

r_{mt} = the excess market return in month t;

e_{it} = the random error term for fund i, in month t;

α_i = the Jensen's alpha for fund i; and

β_i = the market beta for fund i.

The total variance of fund i's portfolio, σ_i^2, is measured as:

$$\sigma_i^2 = \beta_i^2 \sigma_m^2 + \frac{1}{n}\sigma_{ei}^2 , \quad (2)$$

where:

σ_m^2 is the variance of returns on the market portfolio, n is the number of stocks in portfolio i, and σ_{ei}^2 is the variance of portfolio i's residual terms. The residual variance (RV) is therefore estimated as follows:

$$RV = 1 - \frac{\beta_i^2 \sigma_m^2}{\sigma_i^2}, \quad (3)$$

I also examined the linear relation between mutual fund returns and selected economic variables as follows:

$$IDI_{t+3} = \alpha_i + \beta_1 r_{mt} + \beta_2 r_{it} + \beta_3 ABI_t + \beta_4 Tbill_t + e_{it}, \quad (4)$$

where:

r_{it} and r_{mt} are the excess fund return and excess market return, respectively, as defined in Equation (1). IDI_{t+3} is the monthly growth rate of the Index of Industrial Production in period t+3, Tbill is the monthly return on three month Treasury bills, and ABI is the rate of return on the Lehman Brothers Aggregate Bond Index. The significance of estimated parameters, β_1 and β_2, indicate the extent to which the stock market and mutual fund portfolios, respectively, predict economic activity, with a lead of three months.

IV. THE RESULTS

Panel A of Table1 shows the average standard deviations of return for the market and for mutual funds. From April 1988 to March 1998 the volatility of mutual fund return did not change significantly. However, over the following five-year period, from April

[1] Mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

1998 to March 2003, volatility increased appreciably from 3.643% per month to 6.178%, and then declined substantially to the level of previous years. In other words, a downward trend from 1988 to early 2003 was evident, followed by a jump in the following five years, before the downward trend continued in the 2003 to 2008 period. This trend of mutual fund volatility is reflective of the stock market trend as a whole, as shown in the Table, and seems to differ from a previous study of common-stock volatility by Campbell et al. (2001), who found no trend in volatility of the market or industry from 1962 to 1997. However, my results are consistent with Officer (1973), Schwert (1989), and Hamilton and Lin (1996), who found that volatility of the stock market was significantly higher during economic recessions.

Table 1
The Volatility of Mutual Fund Returns
(April 1988 – March 2008)

Sub-Period	**#Funds**	σ_i	σ_m	**RV**	**R^2**
Panel A: Sub-Period Volatility					
4/88-3/93	706	3.894	3.379	0.179	0.786
4/93-3/98	1054	3.643	3.223	0.231	0.705
4/98-3/03	1065	6.178	5.588	0.291	0.654
4/03-3/08	1065	3.305	2.872	0.155	0.800
Average	1065	4.657	---	---	---
Market	---	4.069	---	---	---
Panel B: Volatility by Investment Objective (1988-2008)					
Inv. Objective	# Funds	σ_i	RV	RMSE	---
AG	36	6.562	0.275	3.435	---
SC	186	5.166	0.374	3.123	---
G	492	4.801	0.234	2.271	---
GI	290	3.916	0.196	1.622	---
EI	61	3.422	0.301	1.854	---

Note: RV is the portion of total return variance that has not been eliminated through diversification, as shown in Equation (3):

$$RV = 1 - \frac{\beta_i^2 \sigma_m^2}{\sigma_i^2}$$

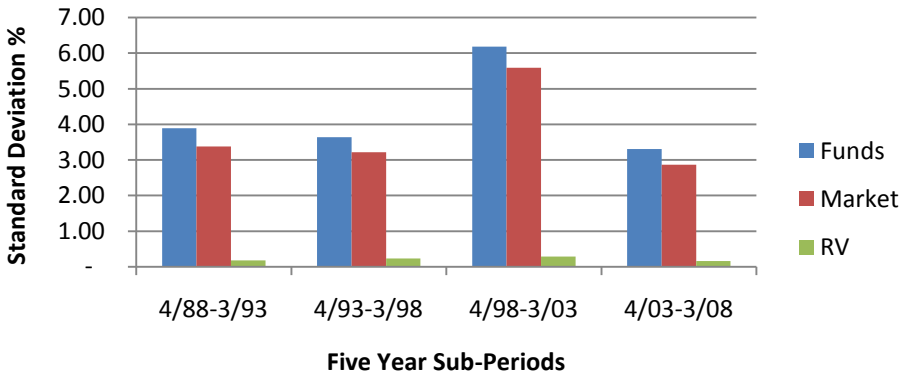
RMSE is the standard deviation of the error variance from the same Equation. σ_i Is the standard deviation of mutual fund returns—measured individually for each fund and then averaged across funds. #Funds is the number of mutual fund portfolios in each investment

(inv.) objective category, and R^2 is the cross-sectional –squared estimated using the Market Model --Equation (1).

The portion of total volatility of return that has not been eliminated by portfolio diversification, RV, ranges from 0.155% to 0.291% and is reflective of the total volatility, σ_i. Campbell et al. found that the total number of stocks needed to achieve a given level of portfolio diversification increased during their 1962 to 1997 sample period. Figure 1 graphically compares the level of both the market and mutual fund volatility with the level of residual variance, RV, the portion of total fund volatility that remains undiversified. Residual variance is shown to be higher from April 1998 to March 2003, the same period in which both the stock market and mutual fund portfolios experienced the highest levels of volatility. It appears that the more volatile the market, the greater the need to diversify a portfolio.

Figure 1

Volatility of Mutual Fund Returns
(April 1988-March 2008)



To determine if, for stock mutual funds, the explanatory power of the Market Model has changed over time, I estimated the regression R-squared of Equation (1). As shown in Panel A of Table 1, the R^2 declined for each five-year sub-period from April 1988 to March 2003. These results are in line with Campbell et al. (2001) who found that, for a typical common stock, the explanatory power of the Market Model declined during their 1962 to 1997 sample period. However, this trend obviously has not extended to later periods as suggested by the significant increase in R^2 from 0.654 to 0.800 during the April 2003 to March 2008 period.

Further, as shown in Panel B of Table 1, the volatility of mutual fund returns tends to vary with the aggressiveness of its investment objective. Aggressive Growth funds exhibit the highest volatility of 6.562% per month and Equity Income (EI) funds exhibit the lowest return volatility of 3.422%. The average volatility for the overall

sample of 1065 stock mutual funds was 4.657% per month and that for the market was 4.069%. However, although total volatility is lowest for the EI group, the level of diversification as judged by residual variance is second poorest for the EI group.

Table 2 shows regressions of economic activity using four predictors: the stock market, stock mutual funds, long-term bond returns as represented by the Lehman Brothers Aggregate Bond Index, and short-term interest rates as represented by the monthly return on three-month-Treasury bills (RF). As shown in the Table, the stock market appeared to be a very good leading indicator of economic activity. For the overall sample period, from 1988 to 2008, the coefficient on the market is 0.007 and is significant at the 5% level. Moreover, during both the expansionary and the recessionary periods, the stock market significantly predicted the business cycle. These results are consistent with Schwert (1990, page 1246) who found a "strong positive relation between common stock returns and production growth.

Table 2. Equity Mutual Fund Returns as Predictor of the Economic Cycle
(April 1988 – March 2008)

Regressor	Overall Data	Expansion	Recession
Intercept	0.185	0.253	-0.548
	(67.13)*	(91.53)*	(-105.21)*
Market	0.007	0.003	0.009
	(13.86)*	(5.54)*	(8.24)*
Funds	-0.003	-0.002	0.001
	(-6.35)*	(-3.66)*	(0.55)
Bond Index	0.025	0.039	0.039
	(23.09)*	(36.45)*	(14.67)*
RF	0.065	-0.006	0.195
	(8.65)*	(-0.84)	(12.48)*

Note: The response variable is the growth rate of the Federal Reserve's Industrial -Production Index, seasonally adjusted. In all cases, the condition number is less than 5. T-statistics are in parentheses. Parameter estimates as defined in Equation (4):

$$IDI_{t+3} = \alpha_i + \beta_1 r_{mt} + \beta_2 r_{it} + \beta_3 ABI_t + \beta_4 Tbill_t + e_{it}$$

All variables are as defined earlier.
*Significant at the 5% level.

Surprisingly, equity mutual fund returns do not significantly predict recessionary periods, and although fund returns predict economic expansions, the coefficient on fund returns turns out negative, suggesting that news about forthcoming economic growth is bad news for stock mutual funds. This result is counterintuitive but is consistent with McQueen and Roley (1993, pages 694-695) who found a negative coefficient on common stocks and arrived at the conclusion that "good news about economic activity is bad news for [common] stocks.''

Moreover, bond returns are also strong predictors of the economic cycle, as shown in Table 2, but short-term interest rates as represented by Treasury bills tend to

predict recession quite well but are not good predictors of upturns in economic activity—the coefficient on RF being negative and insignificant.

V. SUMMARY AND CONCLUSIONS

The purpose of the present study is to investigate (1) the volatility of mutual fund portfolios over a 20 year period, from 1988 to 2008, (2) to investigate the level of residual risk inherent in equity mutual fund portfolios, and (3) to investigate the Market Model's explanatory power for domestic equity portfolios during that 20 year period.

The volatility of equity mutual funds did not change significantly from April 1988 to March 1998, but it increased appreciably from April 1998 to March 2003 and then declined in the following five-year period from April 2003 to March 2008. This trend seems to differ from a previous study of stock prices that found no trend in the stock market or industry volatility from 1962 to 1997, but is consistent with previous studies that found that stock prices were more volatile during economic recessions. The portion of total volatility that remains undiversified tended to be higher during periods of high market volatility and that diversification appeared to be more urgent during periods of economic recession.

The explanatory power of the Market Model declined from April 1988 to March 2003, consistent with previous studies of common stocks. However, volatility experienced a jump from April 1998 to March 2003, a period that has not been covered by those previous studies, before continuing the downward trend from April 2003 to March 2008. Moreover, the volatility of mutual fund portfolios varied with the aggressiveness of the investment objective, but level of portfolio diversification did not vary with investment objective.

Finally, stock mutual funds lead the expansionary phase of the business cycle with a lead of three months but they did not appear to significantly predict recessions three months ahead of time.

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