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The Effects of Asset Allocation and Active Management on Total Return of Managed Funds

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The Effects of Asset Allocation and Active Management on Total Return of Managed Funds

Florian Halili

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INTRODUCTION

Portfolio managers are charged with maximizing return for a given level of risk. There are practical problems that arise in creating an efficient portfolio and maintaining a target level of risk and return. This paper will identify two important factors that a manager needs to address in creating and managing a portfolio. The first step in creating a portfolio should be the establishment of the structure of the portfolio or the portfolio policy, what asset classes it holds and in what proportions. The structure of the portfolio is the main factor that shows how a portfolio is exposed to risk. A second important factor is the strategy employed by the manager to manage the portfolio. A manager can choose to employ a buy and hold strategy or he/she can take a more active role by employing some form of a rebalancing strategy.[1] The portion of return generated by employing a particular strategy will be attributed to active management. We build a regression model that will answer the question *what percent of the total return is explained by the portfolio policy vs. active management?*

However, to implement a solid portfolio structure and management strategy, the manager must first understand the historical correlation of risk and return among various asset classes. Historical returns are examined and show that they differ over the same time period; thus managers must understand how different combinations of assets within a portfolio produce different risk-return tradeoffs. Second, the manager must understand the importance of asset allocation and how it affects total portfolio return. The importance of asset allocation is closely examined and compared with the portion of return added by active management. Third, the manger must understand the

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[1] Different rebalancing strategies and their effect on total return will be discussed in details.

theoretical and mathematical framework behind the portfolio creation. Both the systematic and unsystematic risks are discussed and how diversification eliminates the unsystematic risk associated with the assets[2].

The results of the regression models show that on average, the portfolio policy (or the portfolio structure) accounts for 73.4% of a portfolio's total return. In addition once the portfolio policy has been determined, Active Management, on average, accounts for only 1.27% of the variation of total return.

HISTORICAL RETURNS OF DIFFERENT ASSET CLASSES

Fortunately the stock market is probably the best recorded event in human history and the data for every major and minor index, stocks, and bonds is plentiful. Therefore, an examination of the historical returns is necessary to understand, not only the returns of different asset classes over the decades, but also how these assets respond to different market environments. As we will see later in this paper, an understanding of how different assets are correlated together, as well as their historical risk/return patters will be crucial in creating efficient portfolios and efficient management techniques.

While past data cannot be used to accurately predict the future returns of different asset classes, it is a starting point in understanding asset class and market behavior. Most of the following data that will be presented are cited from the work of

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[2] Appendix A provides a theoretical and mathematical framework for answering some of the most important questions related to portfolio creation. Are the characteristics of a portfolio (standard deviation and return), the same as its individual components? Why does diversification lower risk?

Jeremy Siegel, "Equity Premium: Stock and Bond Returns Since 1802" which was first published in Financial Analyst Journal, February 1992.

Figure 1. illustrates the historical returns of different asset classes, the value of one dollar initial investment with all income (dividends, capital gains or coupons) reinvested is given in for the period 1802-1990.

Figure 1.

The Value of $1 Invested: 1802 through 1990
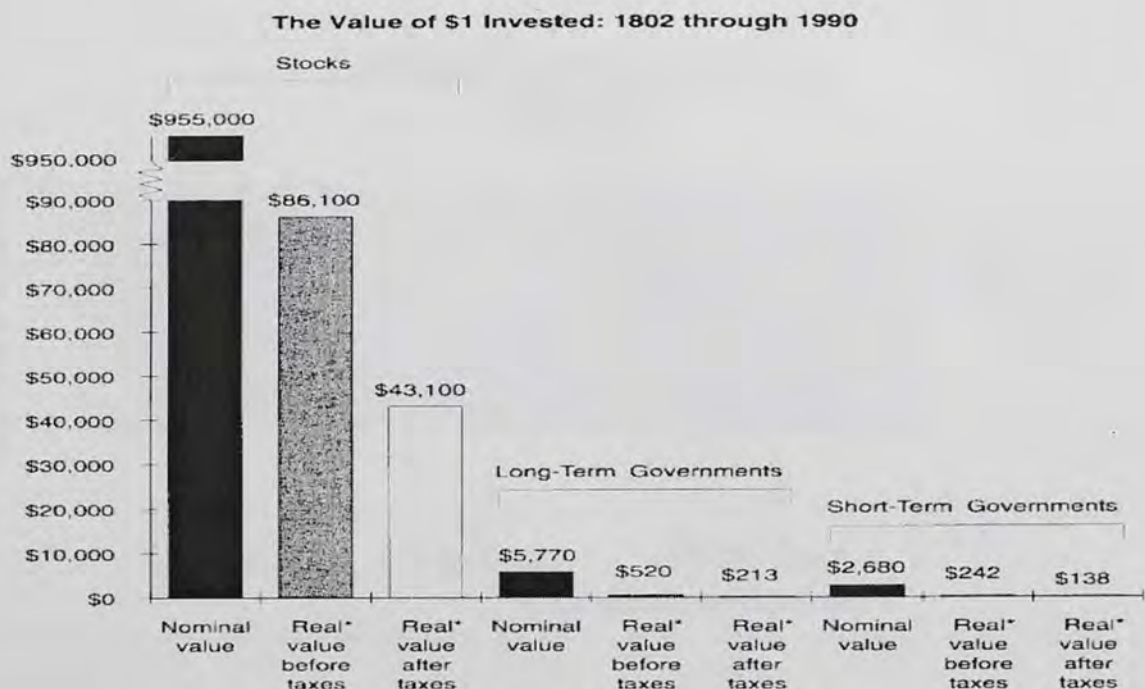
*The real return is the nominal return less inflation.
Figures assume reinvestment of all income, dividends and capital gains

The graph shows the real and nominal return of stocks, long and short term government bonds, both before and after taxes. It is clear that stocks yield a higher return than bonds. The geometric average nominal returns for the 1802-1990, for stocks is 7.6% annually (real return is 6.2% annually). The average nominal return for long term government bonds is 4.7% annually (real return is 3.4% annually). Finally, the nominal return for short term government bonds is 4.3% annually (real return is 2.9% annually). Therefore, it is possible to conclude that stocks have a higher return than bonds over long periods of time.

However, to get a better understanding of the behavior of these asset classes it is necessary to look at their historical risk pattern. The standard deviation of returns from their mean is usually used to measure the risk of a given asset. The following chart shows the standard deviation (risk) of stocks and bonds over the period 1802-1990.

Figure 2.
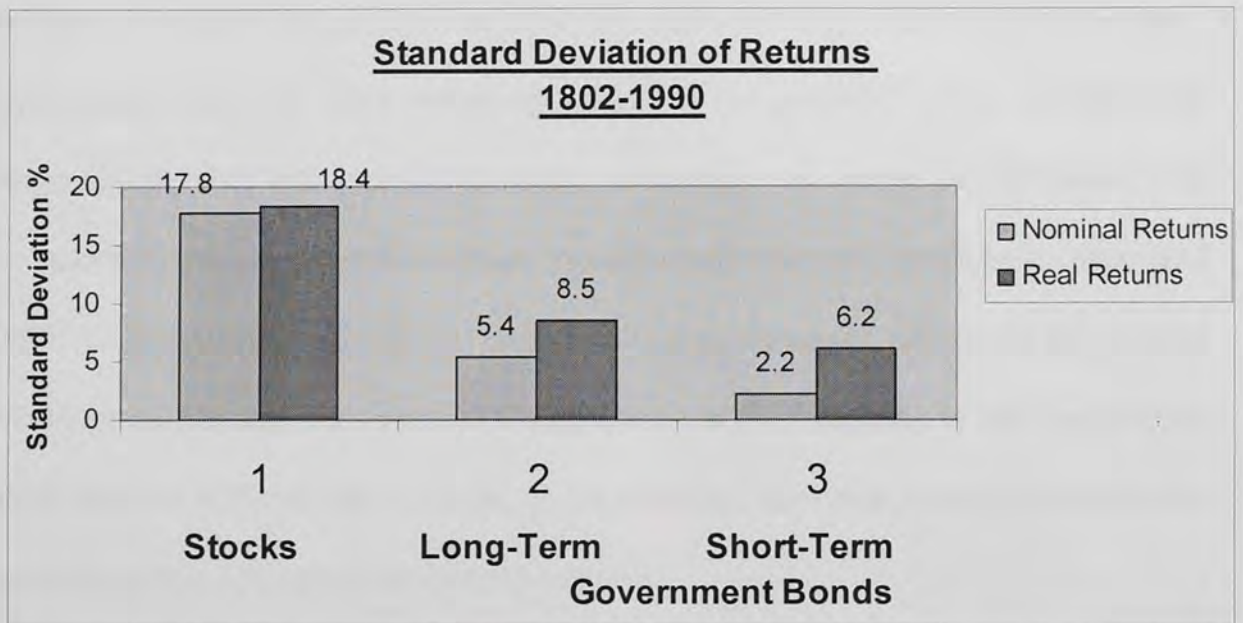
From the chart it is clear that stocks are riskier than government bonds. Also, long term government bonds are riskier than short term ones. Using the above observations we can come to the conclusion that the riskier an asset the higher the return required to invest in the asset. The historical data confirms the fact that stocks are riskier than bonds and therefore stocks will yield higher returns than bonds over long periods of time. Usually, most investors will hold more than a single stock or bond. Any combination of the same asset class or different asset classes creates a portfolio.

THE IMPORTANCE OF ASSET ALLOCATION

The structure of the portfolio (or the portfolio policy), given by its asset allocation and the weighting of each asset within the class, is the main factor that shows how a portfolio is exposed to risk. Since the weighting of each asset within the different asset classes, is set in advance by the portfolio policy, the return from the policy does not come as result of active management, it is a passive return. The portion of return from policy, can easily be captured using a passive index whose components have the same weighting as that of the portfolio policy. As shown in appendix A, risk and return are highly correlated and taking on additional risk enhances the expected portfolio return. The expected return of a portfolio composed of 50/50 stocks/treasury bills, is very different from the expected return of a portfolio of 90/10 stocks/treasury bills because the difference in the weighting of the asset classes with result in different risk exposure of the portfolio. However, is asset allocation the only factor that determines the portfolio returns?

A simple observation would be that if asset allocation accounts for 100% of portfolio returns then why do investors need to hire a money manager to make buy/sell decisions? Why would an investor be concerned about security selection? Therefore, a reasonable assumption would be that the expected level of return of a portfolio is determined by two main factors: asset allocation, and active return, which depends on security selection and the ability of the manager to overweight/underweight assets within the asset classes.

Ibbotson and Kaplan (2000), have introduced a model that isolates the portion of return contributed to asset allocation and to active management. They express the total return of the portfolio as follows:

$TRit = (1 + PRit)(1 + ARit) - 1$.

Where TRit represents the total return, PRit gives policy return, and ARit active return of fund i in period t. To answer the question what percent of portfolio return is explained by the policy return, Ibbotson and Kaplan, examined 10 years of monthly returns of 94 U.S. balanced mutual funds and 5 years of quarterly returns of 58 pension funds.

The percent of fund return explained by policy return was calculated as the ratio of annualized policy return divided by the total fund return[3]. The success of an individual manager is indicated by a policy to-total-return ratio of less than 100 %, indicating that policy return was not the only factor in determining total return. While failure of a manager to add value is signaled by a ratio greater than 100 percent, indicating that the active portion of the return was negative. Table 1 shows the results of the study.

Table 1.

Average Percent of Total Return Explained by Policy Return:

	Mutual Funds	Pension Funds
Average	104%	99%
Median	100 %	99%
Risk-Adjusted Average	123%	110%
Risk-Adjusted Median	100%	99%

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[3] Where TRi = PRi + ARi

On average for both Mutual and Pension Funds, policy accounted for a little more than 100% of the total return. The data reveals some differences between the performance of mutual funds and pension funds. On average 99% of the returns from Pension Funds are explained by investment policy. However, as noted by Ibbotson and Kaplan, the Pension Fund data did not account for investment expenses (management fees) . If the data did include these expenses than the result would have been on average closer to 100% of the total return is explained by investment policy. On the other hand, the Mutual Fund data shows that on average 104% of total return is explained by investment policy. This result shows that on average active management is in fact deteriorating the performance of the mutual funds from their benchmark. Since on average 104% of the total return is explained by investment policy then the portion attributable to active management is at least -4% of the total return. Therefore, on average managers, of both mutual and pension funds are failing to add additional value to their portfolios beyond the portfolio benchmark.

However, these results do not show that active management has no merit in realizing additional return on their portfolios. The results do show that on *average* the manager fails to add additional return to their portfolios. As table 2 shows there are a few managers(top 5 percent) that contribute as much as 18% of the total return to their portfolios. The percentage of contribution by managers can be as high as 24% of the total return when calculated on a risk adjusted basis. Therefore, investors who are able to select superior managers do in fact have the potential to earn above average returns.

Table 2.

Range of % of Total Return Explained by Policy Return

| | Unadjusted for Risk | | Risk Adjusted | |
Percentile	MutualFund	PensionFund	MutualFund	PensionFund
95 (worst)	132 %	113%	161%	139 %
75	112 %	102%	126%	109 %
50	100 %	99%	110%	99 %
25	94 %	96%	97%	92%
5 (best)	82 %	88%	76%	76 %

To have a better appreciation of how active management can influence the total return of funds, it is necessary to compare the total return of different funds against each other. This kind of analysis will answer the question what percent of *the variation in return* among funds does asset allocation(policy) explain and what percent of *the variation in return* among funds is attributable to active management?

For consistency purposes the same data set as above is used in a cross-sectional analysis. The compound annual total returns TRi, and the compound annual policy returns, for the 10 years of monthly data, are used for the cross-sectional regression model. The R^2 statistic for this model showed that 40% percent of the variation in returns among funds can be explained by their asset allocation policy. For the pension funds only 35% of the variation in returns can be explained by their asset allocation policy. Therefore the other 60% of the variation in returns among funds is attributed to active management which includes components like security selection, and asset class timing. This finding reinforces the fact that asset allocation policy explains a sizable portion of the variation in returns among funds and also it shows that active management plays a very important role in explaining return variation among different funds.

Therefore, the two most important roles of a fund manager are to determine the portfolio structure, its investment policy, and to find efficient ways of managing the portfolio in order to create above average returns. In order for the manager to formulate an efficient investment policy, he/she should have a very good understanding of the risk/reward characteristics of the different asset classes. As it was shown above in the section on Historical Risk/Return Patterns of Different Asset Classes and in Appendix A, there is a risk/reward trade off for all investment assets. Therefore, a practical problem that the managers need to address is to find the proper asset mix that would maximizing return while minimizing risk.

This problem is at the heart of the modern financial theory and many different models have been created to explain the trade offs between asset allocation, risk and return. One such model is the efficient frontier of the risk/return combination. The efficient frontier is a curve in the risk-return space that gives all the possible combinations of assets in a portfolio that will maximize return while minimizing risk. Like other models, the efficient frontier has some constraints. The simpler version of an efficient frontier assumes no short sales of assets. The following graph will illustrate how the efficient frontier looks for a portfolio consisting of only two indexes: the S&P 500 and EAFE, using actual annual return and risk for the period 1973-1994[4].

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[4] The EAFE is an international stock index, representing Europe, Australia and the Far East.

Figure 4.

S&P500/EAFE 1973-94
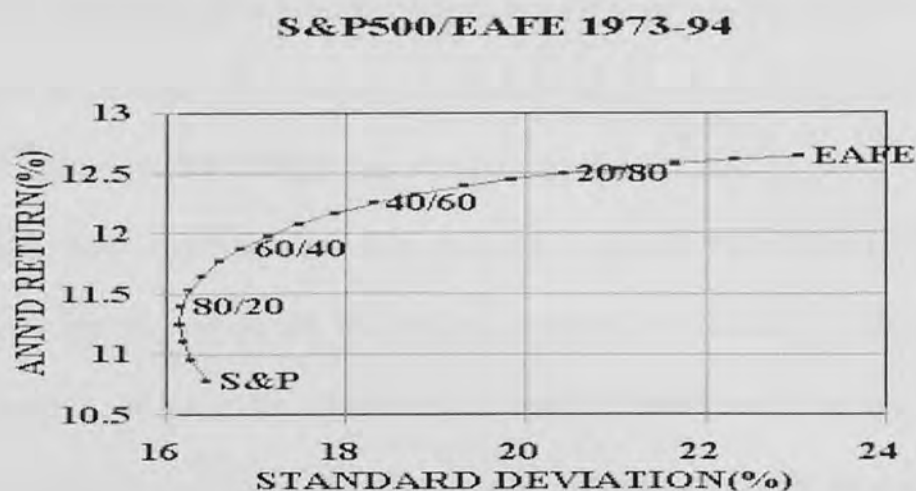
The curve shows the return/risk combinations if the investor used different weighting on these two indexes. Each point on the curve will maximize return for a given level of risk. The EAFE index has on average yielded a higher return than the S&P500 for the period 1973-1994. However, the increased return comes at the expense of higher risk. The investor is faced with three choices; first he/she can invest all the money in the S&P500, expecting lower risk and lower return. As seen from the figure, if all the money is invested in the S&P500, the maximum annual return would be around 10.75%. The second choice is to invest all the money in the EAFE, which has a higher risk and higher expected return. As seen from the figure, if all the money is invested in the EAFE, the maximum annual return would be around 12.6%. The third option is to diversify between the two indexes, and allocate a portion of the money to each index. Therefore an investor should move along the efficient frontier by selecting the appropriate mix, given his level of risk tolerance.

A second model which identifies the relationship between risk and return was created by Eugene Fama and Kenneth French in their paper "The Cross-Section of

Expected Stock Returns". They tested several variables that could explain differences in returns. These variables included company size, leverage, price/earnings, price/cash flow, and price/book. The data set used in the study covered the period from 1963-1990, for all the NYSE, AMEX, and NASDAQ stocks.

Their work showed that all these factors relate to returns. Two of the factors, however, seemed to do the job of all the factors together, specifically, company size and book/market price variables. Based on this work, Fama-French introduced the Three Factor Model, which takes a different approach to explain the sources of risk in the market than Markowitz's Efficient Frontier approach. They found that investors are concerned about several different risks factors rather than just one(the standard deviations of returns). But, the risks that in combination do the best job of explaining return and pricing of assets are the market risk, company size risk, and value risk. The market risk represents the extra risk of stock versus fixed income or the market factor. (See Appendix A for a mathematical discussion of the overall market risk). The company size risk represents the amount of risk that the investor faces based on the size of the company. For example, a small-cap portfolio is expected to have more risk than a portfolio consisting of large-cap companies. The value risk measures the risk of stocks with a high Book/Market Price(value stocks) and stock with low Book/Market Price (growth stocks). As shown in figure 5, the study concluded that portfolios with a blend of small-cap and value stocks(high Book/Market Price) have better returns than other possible portfolios.

Figure 5.

Research Results: 1964-1997

	Large Cap				Small Cap		

Standard
Deviation (%)   17.54   15.89   17.13   23.96   25.10   27.08
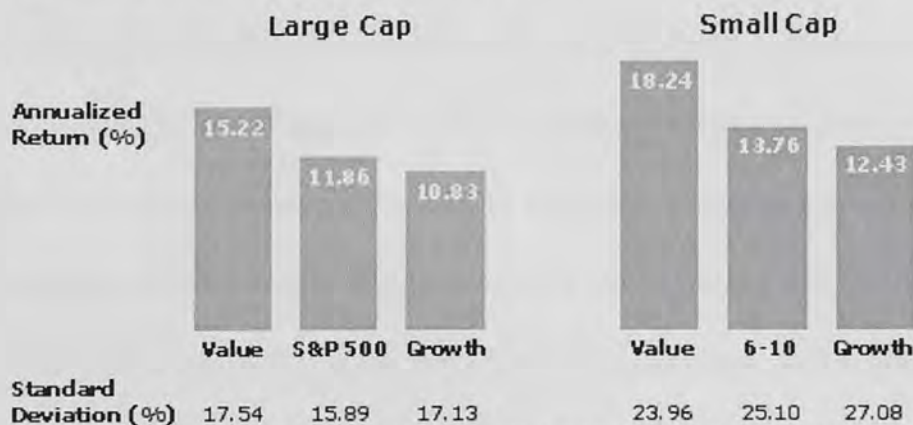
The reason why small cap and value stocks are expected to have a better return than large cap and growth stocks, is directly related to the additional amount of risk taken by investing in small cap and value stocks. Small cap companies have higher risk because they are new companies with an unproven track record and small market share when compared with their competitors. Therefore, in order for investors to take the additional risk and invest in small cap companies the expected return of such companies must be much higher. Also, companies with a high Book/Market Price (value companies) face more risks than companies with a small Book/Market Price (growth companies). The key to understanding the Book/Market ratio lies in the denominator, the price that the market is willing to pay for the given stock. High Book/Market stocks are lower priced stocks, probably because the stock is a poor earner and therefore riskier. However, riskier means higher return. In contrast, low Book/Market stocks are higher priced stocks, probably because the market expects these stocks to grow their earnings at higher rates, and therefore these stocks are safer.

Both the Markowitz model and the Fama-French model are used by academics and practitioners to create efficient portfolio allocations. However, after creating an

efficient portfolio structure, it is important to find an efficient way of managing the portfolio. Overtime the weighting of the original asset will drift towards the better performing asset. The resulting portfolio will have a different risk/reward ratio than the original portfolio. Therefore, how can a manager manage to stay close to the original goals in a highly dynamic market? In order for a manager to be effective in managing a given portfolio he/she should develop a strategy, that will facilitate his/her decisions with regard to asset allocation as well as buy and sell decisions. One such strategy that can be essential in managing a portfolio is rebalancing.

REBALANCING EXPLAINED

Rebalancing is the process of realigning the investments within a portfolio to their original allocation targets. Assume that a portfolio is weighted equally between stocks and bonds, 50% stocks and 50% bonds. Overtime, depending on the performance of these two assets the weighting of the portfolio is going to shift towards the better performing asset. Therefore, if stocks outperform bonds by 10%, the new weighting of the portfolio will be 60% stocks and 40% bonds. This allocation is off from its original target by 10%. The shift in weighting can be even more dramatic over long periods of time. For example, over the 65 years ended 1990, a portfolio which began with 50/50 stock/bond mix in 1926, with stock dividends reinvested in stocks and coupons reinvested in bonds, would have drifted to a 97/3 mix by 1990(Arnott, 2). The shift in allocation of the assets can be problematic because it is no longer consistent with the original long term risk/reward goals and objectives of the investor.

Therefore, a portfolio whose weight drifts in favor of stocks, will be exposed to higher risks and be more vulnerable to a downward market correction in the price of stocks.

The adoption of a rebalancing policy can eliminate this problem by rebalancing back to the original asset allocation mix. In the previous example a rebalancing of the portfolio would consist of selling 10% of the stock holdings, and buying 10% more bonds. Therefore the rebalanced portfolio will now be allocated 50% in stocks and 50% in bonds, which was the original goal. In addition, a rebalancing strategy provides added benefits. Most notably it enforces a buy low sell high discipline and it eliminates human emotion when making asset allocation decisions. Even though a buy low sell high approach is sell evident and very simple to understand, it can actually be very counter intuitive to implement when human sentiment and emotion is involved in investment decision making. In bear markets most investors will prefer to sell their stock positions in order to preserve their wealth. They will keep cash position until the market starts going back up again. Not wanting to miss out on a bull market, the investors will invest in a rising market. This scenario illustrates how an investor bought high and sold low, which could result in a capital loss and a reduction in expected capital gains.

Rebalancing eliminates human emotion from the decision making process, and it automatically implements a buy low sell high discipline by selling the outperforming assets and buying the under performing ones. Therefore, effectively locking in a capital gain and positioning the portfolio for future upward potential. Some studies have shown that a rebalanced portfolio will have a higher total geometric mean than

the same portfolio under a buy and hold strategy[5]. The additional return as the result of rebalancing is referred to as the rebalancing bonus. This finding contradicts the basic premise, explained above, that the investor should be rewarded only for the amount of risk that he is taking. Therefore if an investor is holding the same portfolio of assets, he should face the same level of risk no matter what strategy he employs in managing his portfolio. Moreover, it was shown that a buy and hold strategy can expose the investor to higher levels of risk, whereas rebalancing helps in controlling risk. Therefore a rebalanced portfolio should have a higher or equal total geometric return as buy and hold portfolio.

In order to closely inspect the rebalancing bonus it is necessary to develop a mathematical framework that shows what the expected return on rebalanced portfolio is and compare it to the total geometric return of a buy and hold strategy. The following model is created by Cheng and Deets(1971):

A portfolio of m securities is purchased. The original weight on each security is given by Wi and the weight of all securities add up to 1.The time horizon is given by H, and n gives the number of equal length intervals in horizon H with length from t = 0 to t = T. In other words, n gives the number of times that the portfolio will be rebalanced. When the portfolio is rebalanced each security is assigned its initial weight of Wit where the subscript t denotes the time period t = 0,1,...T-1. The portfolio is sold at time T. This model assumes that each asset is assigned an equal weigh of 1/m for all periods and it does not take into account taxes or trading cost.

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[5] See Arnott, Robert & Lovell, Robert. "Rebalancing: Why? When? How Often?", and
Cheng, Pao. "Efficient Portfolio Selections Beyond the Markowitz Frontier".

Given the above assumptions and making use of the mathematical foundations of portfolio return, which are presented in Appendix A, the total dollar amount of the portfolio, at time T, for the buy and hold strategy given by:

$$G^T(BH) = \sum_{i=1}^{m} \left(\frac{1}{m} \prod_{j=1}^{n} R_{ij} \right). \tag{1}$$

For the buy and hold strategy the equation is summing up the total geometric return of *each security* over the time period j =1...n. The returns from each security are multiplied by 1/m to reflect the weighting of each security as part of the overall portfolio.

The total dollar amount of the portfolio, at time T, for the rebalanced portfolio is given by:

$$G^T(RB) = \prod_{j=1}^{n} \left(\frac{1}{m} \sum_{i=1}^{m} R_{ij} \right), \tag{2}$$

Since the portfolio is being rebalanced every period, it is necessary to add up the returns of *all the securities for each period* and then compound the total return of all securities every time the portfolio is rebalanced for j= 1..n. to get the total geometric return.

In order to compare the expected returns from the two strategies, it is important to explain that a random walk approach is assumed. From an economist perspective the random walk theory assumes that markets are efficient and that no investor can systematically earn a superior return by employing a given investment strategy. This

assumption can be captured mathematically by assuming that price changes of the same security from one period to another are independent random variables. As such no particular investment strategy would be able to consistently predict the price movements in the market. Therefore since the price changes of the same security are independent the expected value of the product of the returns of a security i in periods j and k is equal to the product of the expected returns in each period:

$$E(R_{ij}R_{ik}) = E(R_{ij}) * E(R_{ik}) \tag{3}$$

$$E(R_{ij}) = \mu_i, \quad \text{where } i = 1,2\ldots,m \text{ and } j = 1,2,\ldots,n. \tag{4}$$

Using equation 3 and 4, the expected total geometric return for the two portfolios is:

$$E[G^T(BH)] = E\left[\sum_{i=1}^{m}\left(\frac{1}{m}\prod_{j=1}^{n} R_{ij}\right)\right] = \frac{1}{m}\sum_{i=1}^{m}\mu_i^n \tag{5}$$

$$E[G^T(RB)] = E\left[\prod_{j=1}^{n}\left(\frac{1}{m}\sum_{i=1}^{m} R_{ij}\right)\right] = \left[\frac{1}{m}\sum_{i=1}^{m}\mu_i\right]^n. \tag{6}$$

The expected total geometric return of a buy and hold portfolio is given by adding the compounded excepted return on each security and multiplying it by its weight. Whereas the expected geometric total return of a rebalanced portfolio is given by adding the expected returns of all the securities, multiplying by their respective weight and then compounding the total return by the number of rebalancing periods.

The difference in total geometric return for the two strategies can be found by comparing (5) and (6). Define the difference between the two strategies as:

$$S_m = E[G_T(BH)] - E[G_T(RB)]$$

Using the above formulas S_m can be written as:

$$S_m^n = \frac{1}{m}\left[\sum_{i=1}^{m}\mu_i^n\right] - \left[\frac{1}{m}\sum_{i=1}^{m}\mu_i\right]^n = (\overline{\mu^n}) - (\overline{\mu})^n \tag{7}$$

where for BH
$$(\bar{\mu}^n) = \frac{1}{m}\left[\sum_{i=1}^{m} \mu_i^n\right]$$

and for RB,
$$(\bar{\mu})^n = \left[\frac{1}{m}\sum_{i=1}^{m} \mu_i\right]^n.$$

Therefore the difference between the two strategies can be summarized as the difference between the average of the compounded expected value μ over n periods(for BH), and the compounded average μ over n periods (for RB). Using (7) it is possible to conclude the following[6]:

a) The buy and hold strategy will always be superior or at least equal to the rebalanced portfolio.

b) The more frequently the portfolio is rebalanced the greater the superiority in returns of the buy and hold portfolio.

c) The more securities in a randomly selected portfolio the less the superiority of buy and hold.

It is necessary to empirically test the above model and the conclusions derived from it and see how well the mathematical model actually holds in practice. Weekly prices for the 30 stocks composing Dow Jones Industrial were used to test the hypothesis. The data covered a span of 31 years, starting December 31, 1937 to February 21, 1969. Different periods of length h, given in weeks, were used to test for the effects of the frequency of rebalancing on total portfolio return. Also, two portfolios of different

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[6] For a rigorous mathematical proof of the above conclusions see "Portfolio Returns and Random Walk Theory" by Cheng and Deets.

sizes were created, one consisting of 6 securities and the other consisting of 30

securities. The different size portfolios are used to test the third hypothesis which

states that the greater the number of securities in a portfolio the lower the superiority

of buy and hold. The following table shows the results of the testing.

Figure 6.

RETURN TO BUY-AND-HOLD AND REBALANCING STRATEGIES UNDER VARYING FREQUENCIES OF REBALANCING (n), FOR m = 6 AND m = 10; WITH DECISION HORIZON H = 1625 WEEKS*

$H = n \cdot h$		$m = 6$			$m = 30$		
n	h (weeks)	$G^T(BH)$ #	$G^T(RB)$†	S_6^n	$G^T(BH)$ #	$G^T(RB)$†	S_{30}
1625	1	$9.514	$19.036	−9.522	$9.514	$22.756	−13.242
812	2	9.873	13.419	−3.546	9.873	14.488	− 4.615
541	3	9.872	14.640	−4.768	9.872	15.249	− 5.377
406	4	9.873	12.580	−2.707	9.873	13.399	− 3.526
325	5	9.514	10.803	−1.289	9.514	10.686	− 1.166
270	6	9.619	11.437	−1.818	9.619	11.966	− 2.347
232	7	9.873	11.312	−1.439	9.873	11.727	− 1.854
203	8	9.873	11.862	−1.989	9.873	12.488	− 2.615
180	9	9.619	12.774	−3.155	9.619	12.414	− 2.795
162	10	9.619	10.561	− .942	9.619	10.305	− .686
108	15	9.619	10.164	− .545	9.619	9.892	− .273
81	20	9.619	10.437	− .818	9.619	10.166	− .547
54	30	9.619	10.283	− .664	9.619	9.922	− .303
40	40	9.310	9.940	− .630	9.310	9.436	− .126
27	60	9.619	10.590	− .971	9.619	10.156	− .537
18	90	9.619	9.753	− .134	9.619	9.356	+ .263

* It is possible that for some combinations of n and h, the product does not result in exactly H = 31 years or 1625 weeks. For example, for n = 54 and h = 30, H is 1620 weeks.

\# $G^T(BH)$ under m = 6 and m = 30 are identical, since the former represent the arithmetic averages of 5 portfolio returns each consisting of six different securities randomly grouped from the thirty Dow-Jones Industrials.

† When $G^T(RB)$ is given for portfolios of sizes less than the full 30 securities, it represents the arithmetic average of the smaller portfolio returns. Hence, when m = 6, $G^T(RB)$ is the average of five 6-stock portfolios.

Source: "Portfolio Returns and Random Walk Theory" by Cheng and Deets.

As the data shows neither of the assumptions hold true. First, the buy and hold

strategy is inferior to rebalancing in every single case. A dollar invested equally

among the 30 stocks in 1937 would have been worth $9.514 by 1969. But the same

dollar would have grown to as much as $22.756 under the weekly rebalancing. The

second important observation is the fact that as the frequency of rebalancing increases

from n=18 to n=1625, the total return of the rebalanced portfolio increases. Therefore, as the frequency of rebalancing increases so does the total return of the portfolio. This is contrary to what the mathematical model predicted. The third assumption that BH superiority will decrease as the portfolio size increases, is partially true. BH superiority does decrease when the portfolio with 6 stocks is compared to the one with 30 stocks but only when the frequency of rebalancing is large(around once a month).

The discrepancy between the predictions of the theoretical model and the actual data raises questions about the approach taken and the assumptions that were made when building the mathematical model. First, no trading cost and tax effects were taken into account when the total geometric return of rebalancing was considered. Even though the data presented does not help in calculating transaction costs and tax effects, it is safe to assume that the rebalancing bonus will be diminished in the presence of these costs. Second, even a more problematic flaw with the mathematical model used to calculate the total geometric return of a buy and hold strategy is that it assumes equal portfolio weighting on each security for every period of time. Recall that the total geometric return for BH is given by:

$$G^T(BH) = \sum_{i=1}^{m} \left(\frac{1}{m} \prod_{j=1}^{n} R_{ij} \right).$$

This formula assumes that for every period $j = 1..n$, the weighting of each particular stock remains constant at $1/m$. However this simplifying assumptions, can greatly impair the total return of a buy and hold portfolio because, as it was shown previously, overtime the weighting of each stock in the portfolio will drift. The outperforming

stocks will account for a larger portion of the portfolio, and the underperforming stock will account for a smaller portion. Assigning equal weight to both the underperforming and the outperforming stocks, lowers the overall total return of the portfolio. Besides the mathematical model, it is necessary to also question the result of the empirical data. The way the empirical test is performed does not allow for use of econometric testing in determining the significance of the results. Even though the data set represents a span of 31 years, it is still important to make use of significance testing to see whether or not the results are significant.

Other studies have shown mixed results on the issue of rebalancing bonus. While there seems to be some kind of additional return when rebalancing is employed, it is not consistent overtime and it is very much dependent on market trends. Arnott & Lovell, tested different rebalancing techniques to isolate a possible rebalancing bonus. The rebalancing methods that were tested include calendar rebalancing, rebalancing to a given range, and threshold rebalancing.

In Calendar Rebalancing the portfolio is rebalanced monthly, quarterly or annually as decided by the management. This kind of rebalancing is done periodically and does not make use of any indicators in the market or the volatility of the assets. It will simply rebalance the portfolio to the original target or range as preferred by the management.

Rebalancing to Range, recognizes that assets will drift from its original position based on volatility in the market or other factors, and it establishes a range where the weight of the assets can shift without triggering a rebalancing move. For

example consider a 50/50 stock/bond allocation with a 5% deviation tolerance from the original mix. A sale of 1% will occur when stocks reach 56% weight.

Lastly, Threshold Rebalancing incorporates the wisdom of rebalancing to range with the original allocation mix. It establishes a tolerance range, but when a rebalancing action is triggered, the rebalancing is done all the way to the original asset mix. Using the above example, when stocks make up 56% of the portfolio, the rebalancing process will bring the portfolio back to the 50/50 original mix. The following data shows how the different rebalancing strategies compare to the drifting mix portfolio. The data will look at 50/50 stock/bond portfolio for the period 1968-1991.

Figure 7.

Risk and Reward for Various Rebalancing Guidelines
50/50 Normal Policy Mix (1968-1991)

	Stocks	20-Yr Bonds	Drifting Mix	Calendar Rebalancing		
				Monthly	Qtrly	Annual
Avg Return	10.59%	6.91%	9.09%	9.16%	9.12%	9.02%
Std Deviation	16.02%	11.76%	11.96%	11.47%	11.44%	11.53%
Treynor Ratio	0.661	0.588	0.760	0.798	0.798	0.782
Best Decade	17.55%	15.18%	16.74%	16.82%	16.80%	16.51%
Worst Decade	3.04%	0.07%	3.18%	3.55%	3.52%	3.48%
Avg Mix: Stocks	100.0%	0.0%	58.1%	50.0%	50.1%	50.9%
Bonds	0.0%	100.0%	41.9%	50.0%	49.9%	49.1%
Annual Turnover	0.0%	0.0%	0.0%	10.4%	6.2%	2.8%

	Rebalancing to Range			Threshold Rebalancing		
	45-55%	48-52%	49-51%	+/- 5%	+/- 2%	+/- 1%
Avg Return	8.99%	9.09%	9.10%	9.10%	9.10%	9.10%
Std Deviation	11.47%	11.45%	11.45%	11.49%	11.45%	11.46%
Treynor Ratio	0.784	0.794	0.794	0.792	0.795	0.793
Best Decade	16.49%	16.68%	16.73%	16.69%	16.71%	16.76%
Worst Decade	3.28%	3.48%	3.49%	3.49%	3.51%	3.47%
Avg Mix: Stocks	51.3%	50.4%	50.1%	50.4%	50.1%	50.0%
Bonds	48.7%	49.6%	49.9%	49.6%	49.9%	50.0%
Annual Turnover	1.0%	2.9%	4.8%	2.9%	5.8%	7.8%

Source: Rebalancing. Why? When? How Often? Robert Arnott & Robert Lovell, 1992

In addition to the already mentioned benefits of rebalancing, a careful examination of the presented data reveals an additional benefit of rebalancing, the rebalancing bonus. We can observe the rebalancing bonus in two forms: One in terms of additional return per unit of risk, as given by the Treynor ratio, and the other in terms of the total return. As seen from the table every rebalancing strategy has a higher Treynor ratio then the drifting mix, which means that rebalancing is more effective when expressed in terms of additional return per unit of risk. The less effective rebalancing strategy, rebalancing to range 45-55%, has reward/risk ratio of 2.4 units higher than the drifting mix. Moreover, when we look at absolute returns several rebalancing methods yield a higher absolute return than the drifting mix. Monthly, quarterly, 49-51% and all the threshold rebalancing ranges, yield a better total return than the drifting mix, without taking into account trading cost.

A similar study by Karen Harris, "Disciplined Rebalancing: Friend or Foe?", covers the time period 1970-2000 and accounts for transaction cost, shows very similar results. On a portfolio of 60/40 stock/bond, the reward/risk ratio is higher for every rebalancing method when compared to the drifting mix. In addition, the rebalancing method, which uses 125% of standard deviation of returns from its expected value as the rebalancing range, yields a higher total return than the drifting mix (Harris, 5). Therefore rebalancing does a better job in maximizing returns while minimizing risk, and in some cases yielding a higher total return.

However, further analysis reveals that total returns of a rebalanced portfolio might not always outperform the total return of a drifting mix strategy. In fact rebalancing, like other portfolio management strategies, will be dependent on the

market conditions. Figure 5, illustrates how different rebalancing strategies compare to the drifting mix for the time period 1990-1999.

Figure 8.

Chart 4: Risk/Return of Rebalancing Strategies in the 1990s

Rebalancing in the 1990s
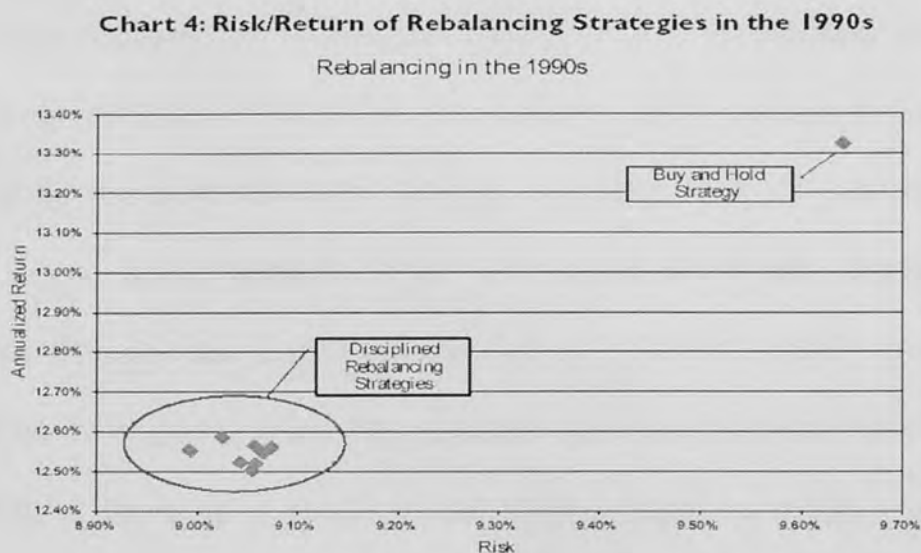
The drifting mix outperformed the best rebalancing strategy by 74 basis points. This data reveals an important observation about rebalancing. Drifting mix will outperform rebalancing on a sustained market trend, where one of the assets constantly outperforms the other. This was the case during the nineties where stocks outperformed bonds. Therefore, during periods with a sustaining upward trend in the market we would expect a drifting mix strategy to yield higher returns. However, rebalancing will yield higher returns on a volatile market by locking in additional capital gains.

SUMMARY

So far this paper has identified a few important factors that relate to the expected return and risk of a portfolio. As show by Ibbotson and Kaplan (2000), among the most important determinants of portfolio return are the asset allocation decision and the contribution of active management. After deciding the portfolio policy, given by the asset allocation decision, a manager has the opportunity to enhance or deteriorate the portfolio return by engaging in security selection and market timing. French-Fama (1992) showed that it is indeed possible to generate additional return by engaging in security selection. Their study showed that taking on additional risk by investing in small-cap and value companies, enhances portfolio return. Moreover, as shown by Cheng –King (1971), Arnott-Lovell(1992) and a few other studies presented in this paper, market timing through a rebalancing strategy can enhance portfolio return.

The aim of this paper is to test these finding using regression analysis and examining the impact of asset allocation, security selection, and rebalancing on portfolio returns. The following section, develops a few hypothesis about the expected impact of the above mentioned factors on total return, while introducing the regression model and the variables used to test our hypothesis.

EMPIRICAL SECTION

INTRODUCTION

As shown above, asset allocation, active management, and risk exposure are key factors in determining portfolio return. The next step of this paper is to create a model that would quantify and show the impact of each component of total return. The total return can be expressed as the sum of the return from investment policy and active management.

TRp = Policy + Active Management. Investment Policy is the structure of a portfolio and it is given by its asset allocation and the weighting of each asset within the different asset classes. As such the Policy return of a portfolio can be captured using the return from an index which has similar asset allocation and weighting objectives to that of the portfolio. Therefore, the index return will serve as the benchmark against which we can compare the policy return of a portfolio.

Unlike, the Policy return which can be captured using an index, Active Management is composed of a few components and it is therefore harder to measure. Active Management is defined as the ability of a manager to add additional return by engaging in security selection (stock picking) and market timing (deciding when to buy and sell a given security). Therefore Active Management = Security Selection + Market Timing. Security Selection involves decisions such as investing in value vs. growth companies, or investing in small vs. large cap companies. Whereas, market timing involves buying low, sell high decisions that could potentially enhance portfolio return. The regression model will include variables that capture both Policy

return and Active Management. The objective of the model is to determine the percent of the total return that is attributable to portfolio policy vs. active management.

REGRESSION MODEL

The regression model will look at the level of total return that is attributable to the Policy return, and Active Management. Policy return is captured by the return of a Benchmark (or Index fund) that has similar asset allocation policy as the fund being examined. The return from Active Management can be attributed to two main factors: security selection and timing. The portfolio turnover ratio will be used to capture the effects of timing. The higher the turnover of a Fund the higher the expected return, keeping everything else constant, because the turnover captures the ability of the manager to time the market, assuming that the manager would make a timing decision only if he thinks that it will generate extra return. It is pointless for a manager to make a timing decision if he thinks that it will deteriorate the total return. However, it is reasonable to assume that total return is not a linear function of turnover due to the fact that continuous turnover would imply that total return will go to infinity. But this level of return is never observed in the market therefore the effects of turnover should be increasing at a decreasing rate, allowing for a curve linear relationship.

Moreover, it is reasonable to assume that a manager who makes timing decisions is likely to develop a strategy that allows him/her to consistently buy low and sell high. As discussed in this paper, rebalancing is one such strategy that enforces a buy low, sell high discipline. Therefore, a dummy variable will be created to capture the effects of rebalancing on return from Active Management. The dummy variable

takes a value of 1 if the fund does rebalance and a value of 0 if it doesn't.[7] The purpose of the dummy variable is to determine whether or not a rebalancing strategy adds value to the portfolio. We would expect a rebalanced portfolio to have a higher return than a non-rebalanced one, keeping everything else constant. In addition, as shown by the Fama-French the Price/Book ratio is a key factor in determining portfolio return. Therefore, the difference between Fund's Price/Book and Benchmark's Price/Book ratio will be used to determine the effects of security selection on Active Management return. The difference in Price/Book ratios shows the ability of the manager to differentiate the portfolio from its benchmark by selecting companies that are expected to have returns higher than average. A low Price/Book ratio is characteristic of value companies, whereas a high Price/Book ratio is characteristic of growth companies. As French-Fama show, a portfolio that overweighs value companies is expected to have a higher return than overweighting growth companies. Therefore, the higher the difference in Price/Book ratio between a Fund and its Benchmark the lower the total return, keeping everything else constant, because it shows that the Fund has overweighed growth companies.

Another characteristic of security selection is the risk exposure that the manager chooses to take by selecting a given group of securities. Therefore, another way in which the manager can differentiate his fund from its benchmark is by taking more/less risk than the benchmark. The percent difference between the Fund's beta and the Benchmark's beta is used to capture the ability of the manager to choose securities with risk exposure above or below that of the Benchmark. Over the long run, portfolios with higher risk should be expected to gain a higher return, but in the

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[7] Later on we explain the criteria used to distinguish a rebalanced portfolio from a non-rebalanced one.

short run the addition of risk in a given period means that the manager is adding securities that are out of favor with the market, therefore have a depressed price, and are likely to result in lower total return.

To complete the regression model, a dummy variable is created to see the effects on total return from a change in managers during the year. A value of 0 means that there were no changes in management during the year and a value of 1 means that there was a change in management. We would expect a change in managers to have a positive effect on total return, assuming that the new manager is hired because of his/her ability to generate better return than the previous manager. The regression model is as follows:

$TR = \beta_0 + \beta_1(Benchmark_i) + \beta_2(Funds' Price/Book_i - Benchmark's Price/Book_i) + \beta_3($ Fund Beta$_i$- Benchmark Beta$_i$)/(Benchmark Beta$_i$)$+ \beta_4(Turnover_i) + \beta_5(Turnover_i)^2 +$ $\beta_6(Rebalancing Dummy_i) + \beta_7(Tenure_i)+ \varepsilon_i$

where ε_i is the random error term for the ith fund.

DATA

The data used to test this model was collected from the annual publications of Morning Star Funds 500. This Morning Star publication provides data on some 500 mutual funds that have performed well on the past and that are expected to perform above average in the future. Morning Star uses a style matrix to determine the investment style of the manager. For example a fund that invests in value and small cap stocks is different from a fund that invests in growth and large cap companies. Moreover, Morning Star has developed a passive index for each investment style, for

example there is a separate index that tracks the performance of large-growth style funds and a different index for small-value funds. We selected a sample of 50 mutual funds from different categories and tracked their performance for a period of 7 years. The data collected included total annual return, beta, Price/Book ratio, turnover, manager changes during the year, whether the fund is rebalanced or not, and size of the fund. Also, we collected data for each index corresponding to the investment style of our funds. The index data included total annual return, beta, and Price/Book ratio. From this data we calculated two new variables that are needed for the regression model they are the difference in P/B ratios, and percent difference in beta values between the fund and that of the corresponding index. The difference in P/B ratios captures the security selection ability of the manager and how the securities that compose the fund differ from the securities that compose the index. The percent difference in the beta values accounts for the risk differential between the fund and its index. To determine whether or not a fund does use a rebalancing strategy, we considered the investment style of the manager. If the manager preferred to hold more than 10% of the portfolio value in cash, or if the manager rebalanced between different asset classes based on his/her expectations of the future, then we considered the fund to be rebalanced. The rationale being that the manager needs to have cash in hand in expectation that he will be able to allocate the cash to assets that will be expected to perform better than average.

Even though the sample of funds was chosen at random there are a few problems that arise in this particular data sample. The most important one is that of survival bias. The funds were chosen from a publication that for the most part reports only the above average

performing funds. Also, in the span of seven years the coverage of certain funds was suspended due to poor performance of these funds. Therefore there are years with missing observations. Moreover, given the fact that the data used to test this model is from the period 1995-2003, we would expect that the observations from the 1999-2000 period to be structurally different from the rest of the observations, because of the market bubble that occurred in during 1999-2000. The extremely high market valuations of the 1999-2000 period would have a direct effect on the Price/Book measure used in our regression model. Therefore, it might become necessary to split the data in two groups, Non-Bubble period and Bubble period.

The following are the summary statistics for the Total Return, Benchmark return and Active Management return:

Variable Maximum	N	Mean	Median	Std Dev	Minimum
TR 108.78	322	13.62	17.15	23.515	-35.80
Benchmark 57.51	321	12.375	19.02	21.79	-27.73
ActiveManagement 73.73	321	1.26	0.84	12.13	-46.71

The average total return of a given fund from our sample data is 13.62 %, of that 12.375 % is attributable to the benchmark, assuming that the portfolio is tracking the benchmark one to one. The rest of the return, 1.26 % is attributable to Active Management. Also, as seen from the standard deviation, the return from the benchmark is more volatile than the return attributable to Active Management.

REGRESSION RESULTS

Since managers may hold cash for strategic purposes, or only hold a subset of the index

to we would not expect that there will be a one to one correspondence between the

benchmark and the portfolio.The regression model yielded will account for these

movements and will assess the effectiveness of the manager's decisions.   The results of the

model is given in table 9:

Figure 9.
Regression Results

Variable [8]	Entire Period		Pre-Bubble Period		Bubble Period		Post-Bubble Period	
	Coefficient	Pr > |t|	Coefficient	Pr > |t|	Coefficient	Pr > |t|	Coefficient	Pr > |t|
Intercept	-0.10542	0.9527	5.66987	0.0979	-1.76263	0.7950	-1.16465	0.4852
Benchmark	0.93519	<.0001	0.73960	<.0001	0.96989	<.0001	0.93854	<.0001
Diff_PB	0.47442	0.3260	0.49511	0.5353	0.31087	0.7674	-0.09012	0.9151
Beta	-4.39303	0.1604	7.9003	0.0751	-6.76616	0.5424	-10.152	0.0002
Turnover	0.07947	0.0392	0.04804	0.2054	0.12808	0.4397	0.12297	0.0018
TurnSqr	-0.000328	0.0441	-0.000142	0.3377	-0.000563	0.4739	-0.00067	0.0002
Rebalance	-0.80927	0.6034	-1.10763	0.5467	-0.70658	0.8952	-0.62870	0.6536
Tenure	-4.05151	0.0510	-5.76706	0.0195	-4.94097	0.5007	-3.39906	0.0802
F-value	120.92	<.0001	10.48	<.0001	9.86	<.0001	185.33	<.0001
R-Square	0.7400	----	0.43	----	0.49	----	0.9238	----
N (observations)	300	----	105	----	79	----	114	----

As seen from the F- statistic the Entire Period regression model is significant and it

can explain about 74% of the variation in total annual return. However, a closer look

at the independent variables shows that only the benchmark, turnover, turnoversqr,

and tenure are statistically significant, at a 95% level of confidence. The benchmark

has a coefficient of 0.93 suggesting that for every 1% increase in the benchmark

return, the total fund return increases by 0.93%. Both turnover and turnover square

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[8] Originally we had intended to include another variable that would account for the possible size effects of a fund's total assets on the fund's total annual return. However, we weren't able to get the necessary data for the size effect.

are statistically significant and as expected, the turnover has a positive coefficient, while turnover square has a negative coefficient. This suggests that the positive effects of additional turnover are increasing at a decreasing rate, and that eventually increased turnover has negative effects on portfolio return. Further mathematical analysis shows that the optimal level of turnover is at around 120%, implying that a portfolio will have the highest level of return when the turnover is at 120%, keeping everything else constant[9]. A turnover of 120% generates on average a total return of 4.76%, keeping everything else constant. Even though, our regression model did not account for transaction costs or tax implications, associated with turnover, a return of 4.76% would more than offset the above costs[10]. Therefore it is reasonable to conclude that turnover does increase total after cost return of a portfolio.

The variable Tenure is statistically significant at a confidence level of 95%. However, contrary to what was predicted it has a negative impact on total portfolio return. The evidence suggests that if there was a change in managers during the year the total portfolio return would diminish by 4.05%, keeping everything else constant. This fact has two possible explanations. The first reason might be that the diminished total return is not due to the new manager, but is largely due to the previous manager, who presumably was not able to achieve a required rate of return. It is this poor performance that ultimately leads to change in managers. Therefore, the poor results of the first manager would be reflected upon the new manager, at least during his first year. The second explanation might be that the new manager has not had enough time

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[9] To find the optimal level of turnover we maximized the regression function using partial derivatives.
[10] Most mutual funds charge fees that range from 0.18% to 2% of assets under management.

to test his security selection and timing ideas and therefore it is expected, on average, to diminish the total annual return during his first year.

An examination of the t-values shows that the other variables are not statistically significant and therefore the coefficient estimate is unreliable. This result is particularly surprising in the case of the Price/Book ratio because as shown in this paper, previous studies have found this variable to be significant and play an important role in explaining variation in total return. The fact that the Price/Book ratio is not significant might be due to a probable structural change in data during the market bubble period of 1999-2000. To test if this is the case the data is separated in three groups; Pre-Bubble period, Bubble period, and Post-Bubble period. The same regression model is tested using the separate data sets and a Chow test is performed to determine if the data sets are significantly different.

As shown in the regression table, the F- statistics show that the regression models are significant in all three periods. However, the statistical significance of most of the variables is pretty volatile, with Benchmark being the only variable that is consistently significant at a level of 99.99% confidence. Moreover, the explanatory power of the regression model varies from a low R-square of 43% for the Pre-Bubble period to a high of 92% for the Non-Bubble period. This results implies that the model is able to explain 43% of the variation in returns during the Pre-Bubble period, and about 92% of the variation in returns during the Post-Bubble period.

To determine whether the data from the three periods are structurally different we performed a Chow test. This test showed that we could not reject the null

hypothesis that the data are structurally similar[11]. Therefore, there appears to be no structural breaks and the results given by the Entire Period regression model are the most reliable ones. Given the fact that the statistical significance of the variables used was pretty volatile throughout the three periods, a few other statistical tests are necessary to ensure that the volatility of the variables is not due to problems with the data. More specifically we tested for the presence of serial correlation, heteroskedasticity, and multicollinearity in the regression model.

Since the data is both cross-sectional and time series it is possible that presence of serial correlation could account for some of the error term from one period to the other and thus create bias in the coefficient estimates. To check for the presence of serial correlation we performed a Durbin-Watson test and got a value of 2.32. Because this value is approximately 2, then it is safe to assume that our data does not exhibit any form of serial correlation. Moreover, the Chi-square test showed a value Chi of 32.01 and Pr > Chi of 0.157, therefore heteroskedasticity is not a major problem with our data. Also, a variance inflation test showed that multicollinearity is not present in the model. Therefore we can conclude that the statistical results presented were not affected by serial correlation, heteroskedasticity, or multicollinearity in the model.

In addition, we tested to see if a given investment style would be superior in explaining variation in total return. We added to the regression model nine dummy variables, corresponding to the nine different investment styles[12] tracked by the Morningstar Funds 500 publication. The analysis showed that none of the styles were

[11] The F-value = 0.2717 and Fcrit =2.64, therefore F-value < Fcrit and fail to reject the null hypothesis
[12] The Investment styles tracked by Morningstar are: largecap-value, largecap-core, largecap-growth, smallcap-value, smallcap-core, smallcap-growth, midcap-value, midcap-core, madcap-growth.

statistically significant, in explaining variation in total return. Therefore, none of the investment styles help explain the variation in total return for our sample data.

THE PORTION OF RETURN EXPLAINED BY PORTFOLIO POLICY & ACTIVE MANAGEMENT

The above regression models have helped clarify the effects of the benchmark, P/B ratio, beta value, turnover, rebalancing, and tenure on the total return of a fund. However, these regression models have not addressed the question of *what percent of the total return is explained by the benchmark (portfolio policy) vs. active management?* To answer this question we performed a different kind of analysis. First, to address the question of what percent of a funds total return is explained by its benchmark, we calculated an expected total return for a portfolio based on the benchmark coefficient obtained by the regression model.

Therefore, E[TR]= -0.10542 + 0.93519 * Benchmark.

Then we calculated an R-square statistic to determine the percent of variation in total return that is explained, by the variation of the benchmark.

$$\text{R-square} = \frac{\sum_{i=1}^{n}(E(TR)-\overline{\overline{TR}})^2}{\sum_{i=1}^{n}(TR-\overline{\overline{TR}})^2}$$

This analysis shows an R-square of around 0.734, suggesting that 73.4% of the variation in total return of a given fund is explained by its benchmark.

Once the benchmark(the policy) for a portfolio has been determined it is interesting to find out the contribution of active management to the total return, in addition to that of the benchmark. A similar analysis like above shows that after the

benchmark has been set, Active Management (as defined by the variables used in the Whole Period regression model) explains around 1.27% of the variation in total return. This finding is rather surprising because it suggests that once the portfolio policy (the benchmark) has been determined, on average, Active Management will explain only 1.27% of the variation in total return of the fund. The Active Management contribution is almost zero if we were to account for management fees, and tax costs related to portfolio management. However, it is important to point out that the Whole-Period regression model explained about 74% of the variation in total return, which means that around 26% of the variation of return could not be explained by our model. Obviously, the unexplained portion cannot be attributed to the portfolio policy (the benchmark) because the benchmark was one of the variables in the model. Therefore by the definition of the total return[13], the unexplained portion of the variation has to be attributed to either Active Management or to random error. However, it is next to impossible to assume that a portfolio manager would accept the notion that 26% of the variation of a portfolio's total return is due to random error. A manager would rather cite his superior abilities and even instinct as the main reason for the generated return. Therefore, it is safe to assume that the unexplained portion of the total return is due to Active Management and that our model has left out other variables that could contribute in explaining Active Management.

To test whether the additional return from active management is pure random error and therefore not attributable to the manager, we performed further analysis. We calculated the fund residuals as :

$$RESID_{it} = TR_{it} - E(TR_{it})$$

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[13] TR= Benchmark + Active Management

where TRi is the return of fund I, and E(TRi) is the expected fund return due to portfolio policy. The model assumes that the residuals are normally distributed with a mean of 0. We find the mean residual for fund i and calculated a t-value for the each of the funds.[14] The t value that we calculated represents the number of Standard Deviations the fund's mean is from 0. The t-critical is 1.96 for 95% level of confidence. Thus, for any t value over 1.95 we are 95% confident that the return from Active Management is not due to random error. Thus, a t value of +2.5 means the residual mean exceeds zero by 2.5 standard deviations, and there is less than a 5% chance that it could be zero. This result indicates that Active Management added additional return to the established benchmark. Likewise, a -2.5 t value means the residual mean fell below zero by 2.5 standard deviations, and there is less than a 5% chance that it could be zero. This result indicates that Active Management had a negative impact on the fund's total return.

We screened our sample of mutual funds to determine the ones whose Active Management return is attributable to the manager and not to random error. Out of 56 mutual funds, 19 have the portion of Active Management attributable to their managers' skills, and 37 funds have the return from Active Management attributable to random error. Table 10 gives a summary of the top 5 positive performers and the 4 negative Active Management performers from the 19 funds whose Active Management return is attributable to managers' skills.[15]

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[14] The standard deviation used in the t test is a weighted by the sample size.
[15] The ten remaining funds had residual returns between 0 and 3.19.

Table 10

Top Active Management Performance		
Fund Name	Mean Residual	t-value
OPPENH. QUEST VALUE A	7.5	10.4
VANGUARD WINDSOR	7.29	3.16
FIDELITY LOW PRICE STOCK	4.52	1.99
NEUBERGBERMAN GUARDIAN	4.07	2.01
T.ROW NEW AMERICA GROWTH	3.19	2.05
Worst Active Management Performance		
VANGUARD US GROWTH	-7.64	-2.05
KAUFMANN	-5.11	-2.65
COLUMBIA GROWTH	-3.49	-2.28
OPPENH. MAIN ST A	-3.36	-2.12

As the table shows there are certain managers whose superior ability generates above average returns. Also, there are managers who deteriorate the performance of their funds by engaging in active management.

Conclusion

This paper has identified two important factors that a manager needs to address in creating and managing a portfolio. The first is the establishment of the structure of the portfolio or the portfolio policy, what asset classes it holds and in what proportions. The structure of the portfolio is the main factor that shows how a portfolio is exposed to risk, and it accounts for 73.4% of the variation in total return of a portfolio. The second important factor is the strategy employed by the manager to manage the portfolio. Our results show that the effects of active management on total return are limited for the sample of funds during the period 1995-2003, with active management, as defined by the variables used, accounting for only 1.27 % of the variation in total return. However, as pointed out in this paper, it is plausible that the unexplained portion(26%) of the variation in total return is due to omitted variables

that could explain Active Management. Moreover, our analysis showed that certain

managers can enhance the total return of a fund by engaging in Active Management.

Appendix A.

WHY HOLD A PORTFOLIO? IT'S THEORY AND MATHEMATICS.

In order to develop a framework for portfolio return and risk we need to first define the return and risk of individual assets. The expected return of an asset i is given by the following formula:

$$E(R) = \overline{R}_i = \sum_{j=1}^{n} P_{ij} * R_{ij}$$ (1)

Where P_{ij} represents the probability of the *j*th return on the *i*th asset. P_{ij} gives the occurrence of a given return, the sum of the individual returns adjusted by their probability of occurring will give the expected return of the particular asset. The risk of an individual asset can be captured by using its deviation from the expected return. Since the deviation form the expected return can be negative as well as positive, it is necessary to use the square of the deviation so that the differences between the negative and positive deviations do not offset each other and result in a zero sum variance.

Therefore the variance of asset *i* is given by: $\sigma^2 = \sum_{j=1}^{n} [P_{ij}(R_{ij} - \overline{R}_i)]^2$ (2)

Since a measure of risk and return for individual assets is defined, it is possible to express the expected risk and return of a portfolio of assets. Assuming that X represents the weight of the asset in the portfolio, the expected return of a portfolio consisting of n assets can be derived as follows:

$$\overline{R}_p = E(Rp) = E\left(\sum_{i=1}^{n} X_i * R_i \right)$$ (3)

This equation can be rewritten as

$$\bar{R}_p = \sum_{i=1}^{n} E(X_i \cdot R_i) = \sum_{i=1}^{n} X_i \bar{R}_i \qquad (4)$$

and therefore the expected return of a portfolio of assets is given by

$$\bar{R}_p = \sum_{i=1}^{n} X_i \bar{R}_i \qquad (5)$$

Similarly it can be shown that the variation in a two asset portfolio is given by

$$\sigma_p^2 = X_1^2 \sigma_1^2 + X_2^2 \sigma_2^2 + 2 X_1 X_2 \sigma_{12} \qquad (6)$$

where σ_{12} gives the covariance between the two assets. In a more general portfolio of N assets the variance can be given by:

$$\sigma_p^2 = \sum_{i=1}^{N} (X_i^2 \sigma_i^2) + \sum_{i=1}^{N} \sum_{k=1}^{N} (X_i X_k \sigma_{ik}) \qquad (7)$$

The first part of this equation is the sum of the weighted variances of the individual assets and the second part is the covariance between the individual assets. Equation (7) highlights the two most important ideas behind portfolio management. First, while the expected return of a portfolio is the weighted average return of the individual assets, the risk of the portfolio is not simply measured by the weighted average risk of each asset. The risk of the portfolio is also a function of the covariance between the assets of a portfolio. The risk of the portfolio is also a function of the covariance between the assets of a portfolio. If the correlation is positive the variance will be large and if the correlation is negative the variance will be small. Second, by modifying the above equation it is possible to completely eliminate any risks that are particular to a given asset.

Assume that equal amount of money is invested in N assets. The formula for the variance can be written as:

$$\sigma_p{}^2 = \sum_{i=1}^{N} (\frac{1}{N})^2 \sigma_i{}^2 + \sum_{i=1}^{N} \sum_{k=1}^{N} (\frac{1}{N})(\frac{1}{N})\sigma_{ik}) \tag{8}$$

Further mathematical simplifications will yield the following formula for the variance:

$$\sigma_p{}^2 = \frac{1}{N}\overline{\sigma^2}_i + \frac{N-1}{N}\overline{\sigma_{ik}} \tag{9}$$

If we take the limit of the above expression as N approaches infinity we observe that

the risk of the individual assets can be diversified away (it approaches zero), but the

risk caused by the covariance terms cannot be diversified (it approaches $\overline{\sigma_{ik}}$).

Therefore the risk faced by investors has in fact two components the unsystematic risk

or the risk related to the individual asset as shown in the first part of the equation (9),

and the systematic risk or the market risk, as shown in the second part of the equation

(9). As shown above the systematic risk cannot be diversified away, but the

unsystematic risk can. A graphical representation to illustrate this finding is presented

below.

Figure 1.
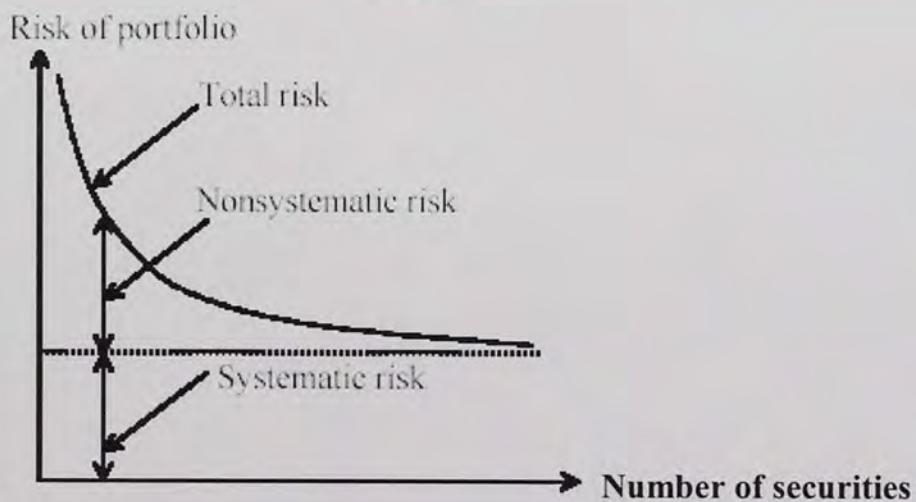
This finding when combined with the idea that there is a certain amount of reward for bearing risk, leads to a very important conclusion: "The expected return on an asset should depend only on that asset's systematic risk"(Ross, 397). Therefore, for investors systematic risk is the relevant risk as long as they hold a portfolio. The unsystematic risk can be diversified away and therefore it should not have a risk premium associated with it.

Bibliography

Arnott, Robert & Lovell, Robert. "Rebalancing: Why? When? How Often?". First Quadrant, 1992.

Bernstein, William. "The Coward's Portfolio- A Modest proposal". Efficient Frontier, September 1996.

Cheng, Pao & King, Deets. "Portfolio Returns and Random Walk Theory", The Journal of Finance, March 1971.

Cheng, Pao. "Efficient Portfolio Selections Beyond the Markowitz Frontier", The Journal of Financial and Quantitative Analysis, December 1971.

Fama, Eugene & French, Kenneth. "The Cross-Section of Expected Stock Returns", Journal of Finance, June 1992.

Ibbotson, Roger & Kaplan, Paul. "Does Asset Allocation Policy Explain 40, 90, or 100 Percent of Performance?". Association for Investment Management and Research, 2000.

Markowitz, Harry. "Portfolio Selection", Journal of Finance, March 1952.

Markowitz, Harry. " Markowitz Revisited", Financial Analyst Journal, September/October 1976.

Ross, Stephen. The Fundamentals of Corporate Finance. 5th edition, 2000.

Harris, Karen. "Disciplined Rebalancing: Friend or Foe?", Callan Associates Investment Institute, August 2000.

Siegel, Jeremy. "Equity Premium: Stock and Bond Returns Since 1802", Financial Analyst Journal, February 1992.

Gruber, Martin & Goetzmann, William. Modern Portfolio Theory and Investment Analysis. 6th edition, 2003.