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Mutual fund performance attribution: 1994–2005

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Abstract

We examine the performance of nearly 2000 actively managed equity funds using attribution analysis, a process commonly used by mutual funds to isolate management contributions from the sector allocation and stock selection components of fund returns. For the period 1994 through 2005 we show that, on average, potential gains from sector allocation were offset by poor stock selection. However, equity managers excelled at sector allocation and stock selection during the bear market of 2000–2002. Over the 12-year sample period, returns from actively managed funds dominated returns from passive portfolios with less risk, primarily because of their performance during the bear market.

JEL classification: G11; G2

Keywords: Managed mutual funds; Attribution performance

1. Introduction

Managers of actively managed funds require sound and reliable performance measurement to evaluate and guide their investment decisions. Performance evaluations reveal how managers are performing relative to their competition, how they should be rewarded, and whether changes in strategy are required. Sound and reliable evaluation also provides individual investors with information necessary to guide their financial planning.

Performance typically uses variations on the Sharpe (1966) index and alphas derived from either the single-index market model or multifactor models. However, performance attribution or attribution analysis, which is widely used in the fund industry for compensation

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purposes, differs from widely studied performance models in that it uses a fund-specific benchmark, or bogey, to evaluate fund performance. Based on the fund's bogey, the equity fund can precisely determine how their managers' sector allocation and security selection decisions each contribute to the fund's total return.[1] While fund managers are commonly judged on their performance relative to an index such as the S&P 500 for large cap funds or Russell 2000 for small cap performance, attribution analysis gauges performance relative to internal benchmarks based on under- or over-weighting of individual sectors.

Ours is the first study to examine performance attribution for a large sample of funds. We do so because attribution analysis is popular in the fund industry for assessing management performance; while factor derived alphas are not. Why? Because attribution analysis differs from factor-based models by providing estimates of both sector allocation and stock selection components of a fund's return regardless of the fund's objective or investment strategy. Accurately tracking both components enables active fund managers with a variety of investment objectives to effectively monitor them, and to make appropriate changes as information arrives. Importantly, if data services provided performance data based on attribution analysis, investors could more effectively monitor management's potential by observing their ability to generate wealth from each attribute.

Recent research challenges the assumption that betas derived from historical data represent investor risk. Fama and French (2007) report that their size (SMB) and value (HML) factors contain excess positive returns resulting from unanticipated higher growth in U.S. business productivity over the last century. This growth represents exploitable opportunities in sector allocation and stock selection for fund managers who are able to anticipate forthcoming productivity gains. Additionally, Moskowitz and Grinblatt (1999) conclude that astute investors can capture the Carhart (1997) momentum factor premiums (PYR) of Jegadeesh and Titman (1993). The same explanation applies for the single-factor market model, which incorporates the net impact of the three remaining Carhart factors, plus any unobserved priced factors representing productivity gains or losses because of changes in expected cash flows and/or risk.

By capturing the portions of stock returns that are achievable using exploitable information, the betas of factor-based performance models bias the alpha, narrowing the range of performance estimates across all managers. As a result, the positive alphas of fund managers who have a better than average ability or good fortune to predict productivity gains are biased downward, and the negative alphas of managers with less ability to make such predictions, or simply bad fortune, are biased upward.

Attribution analysis reveals that over the 12-year sample period: (1) Actively managed funds have slightly higher returns and materially less downside risk because of better performance in the 2000–2002 bear market, thereby dominating a diversified passive portfolio and enhancing the wealth of investors; (2) on average, the sector allocation component of equity fund returns for active managers materially outperforms the Center for Research in Security Prices (CRSP) index, which is equivalent to the Wilshire 5000 index. However, poor security selection within sectors eliminates most of the potential gains from sector allocation; (3) the best funds in our sample outperform their benchmark bogies through security selection and outperforms the CRSP index through sector allocation. The

worst managers under-perform relative to both attributes; and (4) only midcap, small-cap blend, and value funds outperform the CRSP index over the test period, demonstrating superior stock selection and sector allocation skills, while large-cap and growth funds under-perform the index over the 12-year period, primarily because of poor security selection. The following sections of this article present a discussion of attribution analysis, our approach to calculating a fund-specific bogey, a description of the data, and our results.

2. Attribution analysis and the bogey

Attribution analysis recognizes that the performance of active fund managers is a function of their asset allocation, sector allocation, and stock selection skills. Active managers of balanced funds seek to outperform their peers through optimal allocations of debt and equity. Equity fund managers, the focus of our study, attempt to enhance performance in two ways. They adjust sector and/or industry weights relative to a passive benchmark, such as the S&P 500, by overweighting sectors they expect are poised to advance and underweighting sectors they believe to be overbought. They also seek to uncover undervalued securities within each sector. Attribution analysis assesses an equity manager's performance by examining these two attributes. First, the difference between the return on the passive fund bogey and the return on a broad benchmark provides a measure of the manager's success at sector allocation. Second, the difference between the return on the fund and the return on the fund's bogey captures the manager's security selection performance.[2]

Sector allocation reveals the manager's ability to anticipate changes in industry cash flows and risk factors that are not captured by a market index. For example, changes in expected cash flows can result from the development of new technology, the substitution effects on industrial inputs and outputs, capacity changes, shifts in the product demand curve, changes in price elasticity, and external shocks such as the impact of a hurricane on Gulf Coast oil supplies. Common characteristics within sectors result in a synchronicity in returns among firms in the same industry or sector that cannot be adequately captured by broad indexes and multifactor models. For the active manager of a diversified fund, the difference between the return on a fund's bogey and the return on the CRSP index represents the active manager's ability to identify and capture possible under- and over-valued sectors within the market. The sector-matched bogey provides a more representative performance estimate than the market-based benchmark because it reflects the manager's performance relative to the target fund return. Unlike factor-adjusted performance measures, using a sector-matched benchmark enables direct estimation of contributions to total fund return by security selection and sector allocation.

3. Fund characteristics and data

Morningstar provided data for actively managed mutual funds covering the years 1994 through 2005. The funds in our sample average 96.2% equity and 3.8% cash and cash equivalents (from here on referred to as cash holdings).[3] The data includes weights for each

fund in Morningstar's 12 sectors: utilities, energy, financial services, healthcare, consumer services, industrial materials, consumer goods, business services, hardware, software, media, and telecommunications. The median update frequency for the sectors in our fund sample is quarterly. Twenty-five percentage are updated monthly and only five percentage are updated as little as once per year. We used CRSP to calculate returns for each sector and to determine the monthly return on each fund's bogey. The Morningstar data are free of survivorship bias. However, we impose our own survivorship bias by requiring funds to have three- or 12-year lives. The final sample contains 146,338 monthly observations from 1,942 unique funds, each of which has at least 36 contiguous monthly returns. Fund data must include sector weights to be included in an evaluation period. We examine the 12-year period 1994 through 2005 and four three-year periods; 1994 through 1996, 1997 through 1999, 2000 through 2002, and 2003 through 2005.[4]

We chose the sample period because it provides an excellent opportunity to examine performance characteristics of active managers during a full market cycle. The Dow peaked in January 2000 and the S&P 500, NASDAQ 100, and NASDAQ Composite peaked in March of 2000. All major indexes bottomed in October 2002, so three of the periods (1994–1996, 1997–1999, and 2003–2005) represent bull markets and the period 2000–2002 represents the bear market. The bull markets contain 103,622 monthly observations from 2,693 funds and the bear market contains 42,676 monthly observations from 1,186 funds.[5] We use 36 contiguous monthly returns, a period commonly used by providers of fund performance data, to derive our performance measures.

4. Deriving the bogey

This section describes the procedure for constructing the sector-matched benchmark portfolio, or bogey, for each fund.

1. Each fund establishes a benchmark, or bogey, for each measurement period. The bogey must produce returns greater than the market portfolio to demonstrate superior sector allocation skill and the fund managers must beat the bogey to demonstrate excess returns from security selection. Because we do not have access to the target benchmark established by each fund, our bogeys are estimates, represented by the sector weightings at the beginning of each measurement period using Morningstar data. This proxy is based on the assumption that allocations are rebalanced at the end of each performance period to meet the fund's investment strategy for the following month. Sector weightings in a fund's portfolio represent the allocations in the 12 industrial sectors and cash holdings.
2. Sector-matched benchmarks are created using SIC codes provided by Morningstar. Using daily returns from CRSP, a value-weighted "passive sector return" is derived.[6] To achieve the weight for each security in the bogey, the CRSP daily market capitalization of each stock within a sector is divided by the sector's total market capitalization. The weight is then multiplied times the stock's daily return. This provides a given stock's weighted contribution, $w(r)_{jn}$, to the daily sector return.

$$w(r_{jn}) = r_{jn}(P_{jn}S_{jn}/(\Sigma_{i=1}^{I} P_{in}S_{in})) \quad (1)$$

where r_{jn} is the day n return on security j, P_{jn} is the price of the security on day n, S_{jn} is the shares outstanding for security j, and there are I stocks with prices in the sector on day n. The sum of these weighted returns provides a daily sector return for the bogey portfolio,

$$r_{sn} = \Sigma_{i=1}^{I} w(r)_{in} \quad (2)$$

where r_{sn} is the weighted sector s return on day n. The daily returns are then compounded to obtain monthly, quarterly, and annual returns for each sector.

3. The one-month Certificate of Deposit, Treasury Secondary Market Rate Series 1D, from the Federal Reserve Web site is used as the proxy to derive the monthly, quarterly, and annual returns on each fund's cash holdings. Combining steps 1, 2, and 3 results in a 13-element set of 12 passive sector returns (r_{sn} for $s = 1, 2, \ldots 12$), and returns on cash holdings.
4. To calculate the return on a fund's bogey for a specific period, we multiply a fund's weight in each of the 12 sectors (and cash) at the end of the prior period by their respective period return in step 3. Summing the products provides a return for the bogey for each actively managed fund. Because even passive portfolios require administration, as a proxy for administrative expense, we deduct the average annual sector ETF expense ratio of 0.26% from the bogey's return.[7] We also deduct the Vanguard Total Stock Market ETF (VTI) annual expense ratio of 0.07% from the CRSP return to adjust it for management costs. Fund returns from Morningstar are net of expenses.

5. Performance attribution

The components of an equity fund return are: Fund Minus Market (FMM), the difference between the fund and market return; Bogey Minus Market (BMM), the difference between return on the fund's bogey and the market return; and Fund Minus Bogey (FMB), the difference between the return on the fund and the return on its bogey. FMB represents the component of fund return attributable to management's security selections, BMM represents the component of fund return attributable to management's sector allocations, and the sum of BMM and FMB equals FMM. Ideally, the best actively managed funds would generate positive values for all three measures.

5.1. Fund performance

FMM reflects the active manager's performance relative to a proxy for the market portfolio. We use the CRSP value-weighted index, which is equivalent to the Wilshire 5000, as the market benchmark.

$$FMM_{fn} = r_{fn} - r_{mn} \quad (3)$$

where r_{fn} is the return in month n from fund f and r_{mn} is the month n market portfolio return.

5.2. Sector allocation

BMM reflects the active manager's success in establishing sector allocations designed to outperform the broad market. The better manager over-weights undervalued sectors and under-weights overvalued sectors. The fund's bogey represents the manager's sector attribution hurdle requirement. BMM measures these mangers' sector allocation success by showing the difference between the return on the bogey and the return on the market.

$$BMM_{fn} = r_{bn} - r_{mn} \tag{4}$$

where r_{bn} is the return in month n from the bogey b and r_{mn} is the month n return on CRSP. Because BMM reflects the difference in returns between the fund's bogey and the market, it reflects the component of fund return associated with management's sector allocation decisions. BMM is positive when the fund's bogey outperforms the market portfolio, and positive values over time would identify managers with successful sector timing.

5.3. Security selection

FMB reflects management's security selection success by measuring their ability to out-perform their fund's bogey.

$$FMB_{fn} = r_{fn} - r_{bn} \tag{5}$$

where r_{fn} is the return in month n from fund f and r_{bn} is the return on the month n bogey b. A manager's hurdle requirement for stock selection is an FMB of zero percentage.

A fund-specific bogey eliminates the "dead zone," or the portion of the fund's performance that is indeterminate. The dead zone is present in all current performance models. However, the dead zone is eliminated when the bogey is perfectly matched to the fund.[8] When using a benchmark to assess performance, the size of the dead zone grows as the sector allocations of the fund and the bogey diverge. For example, using the S&P 500 as a benchmark will produce noisier and distorted estimates for actively managed funds as the fund's sector allocations diverge from those of the index. These problems are mitigated, but not eliminated, when the composition of the bogey is closer to its fund, for example when using the Russell 2000 as a benchmark for a fund investing in low-cap stocks.

Attribution analysis using our fund-specific bogey provides a clear indication of stock and sector performance regardless of the fund's objective or investment strategy. Tracking both components of the fund return enables active fund managers with a variety of investment objectives to more effectively monitor and achieve their objectives, and to make appropriate changes as information arrives. The security selection component more effectively captures the performance of funds that focus on stock selection without regard for industry membership. By investing in individual stocks while maintaining the same sector weights as the market portfolio, fund managers decrease the tracking error because of deviations from their underlying objective, effectively immunizing their portfolios from sector effects. Alterna-

Table 1 Performance components: Average monthly percentage

	Total fund minus market	Stock selection fund minus bogey	Sector allocation bogey minus market
	FMM	FMB	BMM
Panel A: Period 1, 1994–1996, 506 funds			
Three-year period	−0.09	−0.03††	−0.05
Q1	0.28	0.25	0.03††
Q2	0.00†	0.09	−0.08
Q3	−0.16	−0.11	−0.04
Q4	−0.48	−0.36	−0.12
Range	0.76	0.61	0.15
Panel B: Period 2, 1997–1999, 745 funds			
Three-year period	−0.28	0.01†	−0.29
Q1	0.84	0.69	0.16
Q2	−0.05	0.17	−0.22
Q3	−0.61	−0.18	−0.43
Q4	−1.31	−0.65	−0.67
Range	2.15	1.34	0.83
Panel C: Period 3, 2000–2002, 1,186 funds			
Three-year period	0.41	−0.09	0.50
Q1	1.74	0.91	0.83
Q2	0.75	0.15	0.60
Q3	0.03	−0.38	0.42
Q4	−0.90	−1.05	0.16
Range	2.64	1.96	0.67
Panel D: Period 4, 2003–2005, 1,641 funds			
Three-year period	0.01†	0.01†	0.00†
Q1	0.56	0.49	0.07
Q2	0.11	0.10	0.01†
Q3	−0.16	−0.14	−0.01
Q4	−0.46	−0.40	−0.05
Range	1.02	0.89	0.12
Panel E: Four-period averages, 1994–2005			
Average	0.01	−0.03	0.04
Range	1.64	1.20	0.44

Notes: Quartiles (Q) are ranked by FMM.

All values are significantly different from zero at the one percentage level in a two-tailed test unless noted otherwise.

††Significant at five percentage in a two-tailed test. †Not significant at the five percentage level in a two-tailed test.

tively, sector attribution more effectively captures the performance of funds that focus on sector rotation. They are immunized from security selection effects by holding a security-weighted passive position within each sector. Active managers of diversified funds tend to use a combination of stock picking and sector rotation in an attempt to outperform a passive index, so performance attribution using a fund-specific bogey clearly highlights the relevant performance and variance in return resulting from each activity.

In addition, the ability to cleanly separate performance related to its security selection and sector allocation components aids the management reward structure. For example, the manager of a well-diversified fund should be rewarded for both stock selection and sector

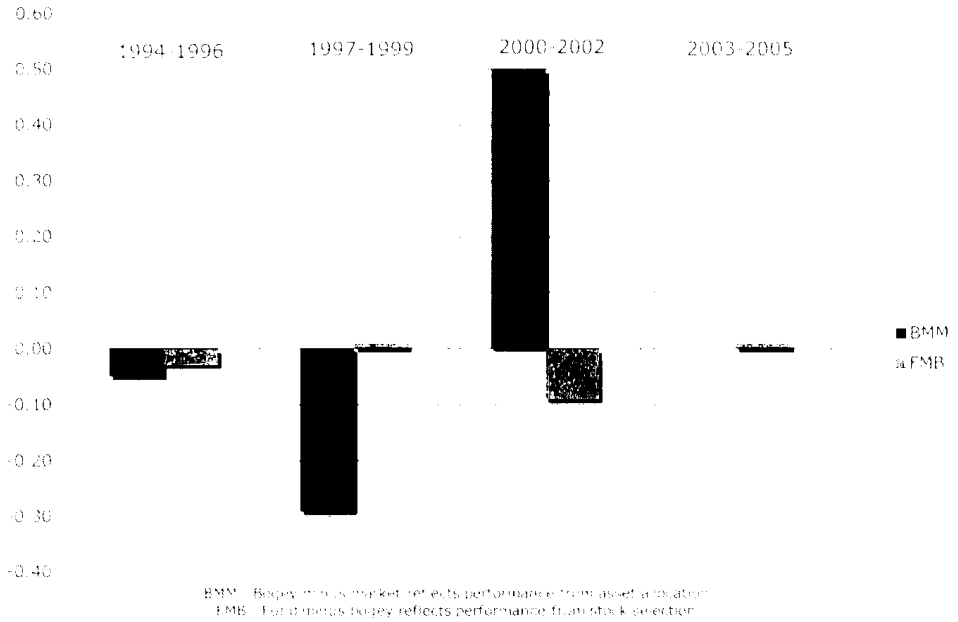

Fig. 1. Average monthly performance (%).

allocation, as both are integral to performance, while the manager of a sector or specialty fund should be rewarded solely on his or her stock selection ability, as sector allocation is not a fund objective.[9]

6. Performance attribution results

The first column of Table 1 and Fig. 1 contain the fund return minus the market return, FMM. The second column contains results for fund return minus the return on the bogey, FMB, and the last column contains results for the return on the bogey return minus the return on the market, BMM. All values are geometric average monthly percentages for funds having 36 contiguous observations. Quartiles contain funds ranked by FMM, from the best, Q1, to worst, Q4. Panel E contains the geometric average monthly values from Panels A through D. Table 2 and Fig. 2 provide results for tracking errors and Table 3 and Fig. 3 provide results for information ratios, respectively, using the same format as Table 1 and Fig. 1. Unless otherwise noted, values are significant at the one percentage significance level.

6.1. 1994–2005

Table 1, Panel E shows that the average monthly fund return relative to the market, FMM, over the four evaluation periods is 0.01%, or a little over 12 basis points per year, compounded monthly. The contribution from sector allocation over the 12-year period is represented by the bogey minus market, BMM, of 0.04% (48.1 basis points per year). However, the contribution by BMM is largely offset by the stock selection component, represented by the average monthly fund return minus the bogey, FMB, of −0.03% (−36 basis points per year). All values are significant at the 1.0% level.

Table 2 Tracking errors: Average monthly percentage

	Total fund minus market	Stock selection fund minus bogey	Sector allocation bogey minus market
	FMM	FMB	BMM
Panel A: Period 1, 1994–1996, 506 funds			
Three-year period	1.94	1.66	1.00
Q1	2.20	1.83	1.14
Q2	1.66	1.48	0.92
Q3	1.71	1.49	0.94
Q4	2.18	1.85	1.00
Range	0.54	0.37	0.22
Panel B: Period 2, 1997–1999, 745 funds			
Three-year period	3.06	2.82	1.61
Q1	3.76	3.45	1.76
Q2	2.20	2.32	1.34
Q3	2.70	2.46	1.53
Q4	3.58	3.05	1.80
Range	1.56	1.13	0.46
Panel C: Period 3, 2000–2002, 1,186 funds			
Three-year period	4.25	4.09	2.93
Q1	4.72	4.02	2.66
Q2	4.02	3.67	2.40
Q3	3.34	3.85	2.63
Q4	4.93	4.80	4.04
Range	0.91	1.13	1.64
Panel D: Period 4, 2003–2005, 1,641 funds			
Three-year period	1.89	1.73	1.30
Q1	2.76	2.29	1.46
Q2	2.04	1.76	1.31
Q3	1.46	1.44	1.21
Q4	1.30	1.41	1.22
Range	1.46	0.88	0.25
Panel E: Four-period averages 1994–2005			
Average	2.80	2.58	1.71
Range	3.42	3.39	3.12

Notes: Quartiles (Q) are ranked by FMM.
No significance levels were calculated for tracking errors.

The modest 12-year FMM of 0.01% is due largely to the 2000–2002 bear market FMM of 0.41% (5.0% per year), which is primarily attributable to the period's sector allocation component of 0.50% (6.2% per year). The BMM in the bear market more than offsets the poor stock selection during the period, shown by an FMB of −0.09% (−1.1% per year). This supports the oft-stated ability of active managers to successfully rotate into defensive sectors and cash during a bear market.

An average monthly FMB of −0.03% over the 12-year period (−35.9 basis points per year), is a reflection of poor stock selection. This might be because of management's tendency to sell "winners" too soon and carry "losers" too long. This evidence is consistent with general investor behavior reported by Shefrin and Statman (1985), and indicates the condition also holds for professional fund managers. Actively managed funds shifting to a passive sector allocation strategy would have outperformed those that did not by 0.03% per

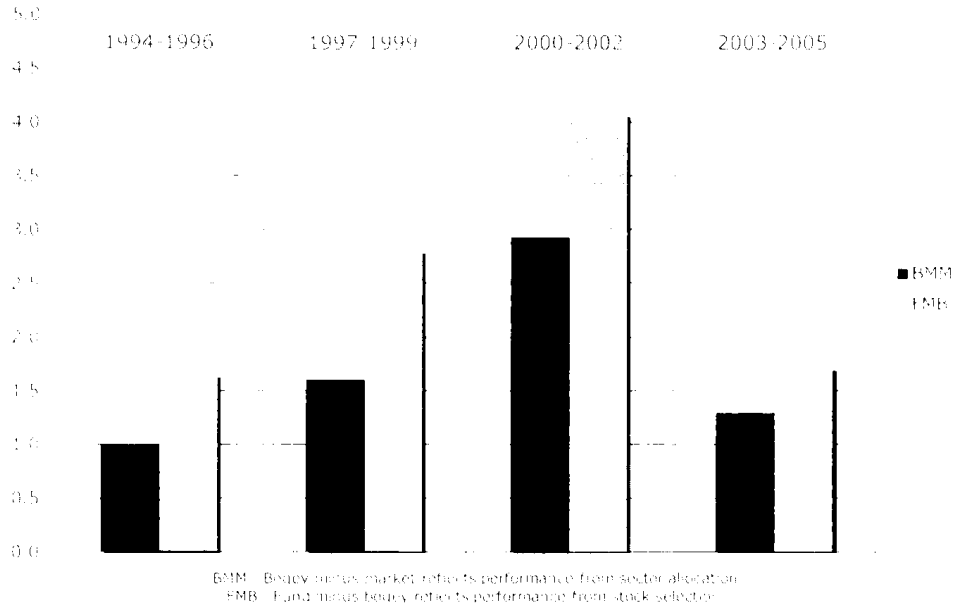

Fig. 2. Tracking errors (%).

month (FMB in Table 1, Panel E), accumulating an additional six percentage points over the 12-year period. These funds would also have lower trading costs.

6.2. Differences among quartiles and across evaluation periods

Most notably, the best funds, Q1, excelled in security selection and sector allocation in all time periods and the worst performing funds were poorer at security selection than at sector allocation in all but Period 2. Volatile equity markets produced wide ranges of fund performance relative to the market. During the bear market, 2000–2002, the range in average monthly FMM between the best funds, Q1, and worst, Q4, is 2.64% (36.7% annually). The range is 2.15% in the strongest bull market, 1997–1999. Ranges are driven primarily by the stock selection component, FMB, which is greater than BMM for the top quartile funds and less than BMM for bottom quartile funds in Periods 1, 2, and 4. This indicates that performance ranges are driven primarily by stock selection, with a smaller contribution from sector allocation.

6.3. Tracking errors

Table 2 and Fig. 2 contain Tracking Errors (TE), which are the standard deviation of the attribute. They provide a measure of the volatility of the attribute and are inversely related to the reliability of the attribute. To the extent that a fund is diversified, its TE would contain more systematic risk and less residual risk. Thus, for an investor in a style fund, such as small cap blend, the TE would be a better measure of risk exposure than a systematic risk measure. This represents a rational explanation for the predominant use of TEs in evaluation of fund risk exposure. Calculating the TEs of the sector allocation and stock selection components

Table 3 Information ratios: Average monthly percentage

	Total fund minus market	Stock selection fund minus bogey	Sector allocation bogey minus market
	FMM	FMB	BMM
Panel A: Period 1, 1994–1996, 506 funds			
Three-year period	−0.051	−0.003†	−0.094
Q1	0.146	0.166	−0.031††
Q2	0.004†	0.084	−0.130
Q3	−0.114	−0.067	−0.091
Q4	−0.238	−0.194	−0.123
Range	0.384	0.360	0.092
Panel B: Period 2, 1997–1999, 745 funds			
Three-year period	−0.110	0.013††	−0.204
Q1	0.231	0.217	0.045
Q2	−0.030	0.103	−0.184
Q3	−0.258	−0.060	−0.298
Q4	−0.385	−0.209	−0.382
Range	0.616	0.426	0.427
Panel C: Period 3, 2000–2002, 1,186 funds			
Three-year period	0.092	−0.022	0.206
Q1	0.388	0.235	0.311
Q2	0.198	0.034	0.270
Q3	0.004††	−0.116	0.180
Q4	−0.224	−0.240	0.063
Range	0.612	0.475	0.248
Panel D: Period 4, 2003–2005, 1,641 funds			
Three-year period	−0.073	−0.033	0.005††
Q1	0.212	0.219	0.045
Q2	0.059	0.058	0.016
Q3	−0.145	−0.112	−0.004††
Q4	−0.417	−0.296	−0.038
Range	0.629	0.515	0.083
Panel E: Four-period averages 1994–2005			
Average	−0.036	−0.018	−0.022
Range	0.805	0.531	0.693

Notes: Quartiles (Q) are ranked by FMM.

All values are significantly different from zero at the one percentage level in a two-tailed test unless noted otherwise.

††Significant at five percentage in a two-tailed test. †Not significant at the five percentage level in a two-tailed test.

provides an estimate of the contribution of each attribute to the tracking error on the fund's return. Not surprisingly, the highest TEs for FMM and its components occur during the bear market, Period 3. Stock selection, FMB, still generates most of the volatility for funds and is higher than the volatility of the sector allocation component, BMM, in every period and in every quartile.

Average TEs for FMB and BMM are generally lower than TEs for FMM. However, in Q2 of Period 2 and Q4 of Period 4, the TE for FMB is greater than the TE for FMM, which can occur when BMM and FMB are negatively correlated. Disaggregating performance into separable attributes highlights the source of fund volatility, enabling management to poten-

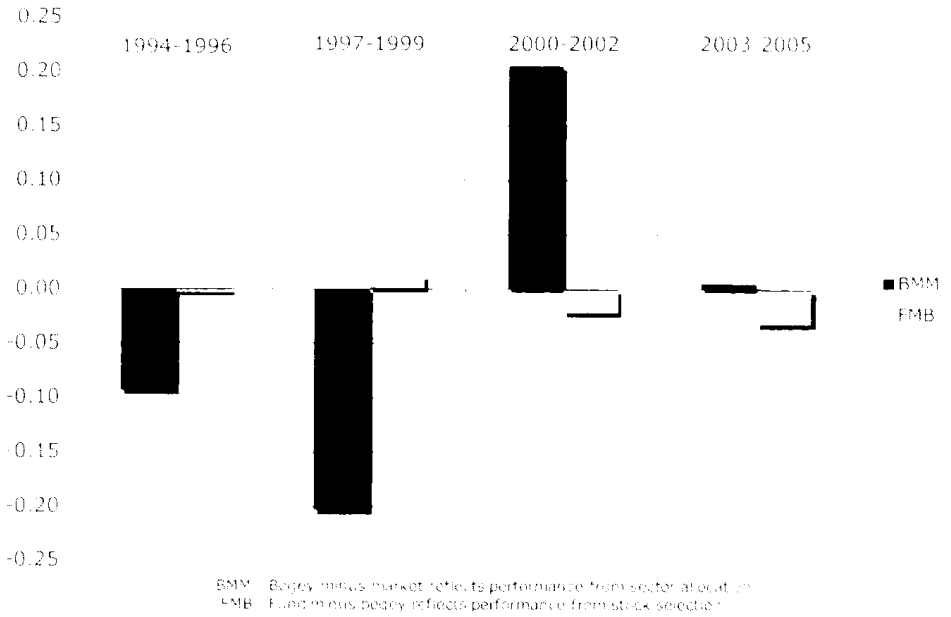

Fig. 3. Information ratios (%).

tially alter the covariance between BMM and FMB, which can reduce the volatility of FMM and the fund. The benefit to investors could be measurable, both in terms of lower risk per unit of return, as well as information regarding management's ability to create value from each attribute.

6.4. Information ratios

Table 3 and Fig. 3 contain average Information Ratios (IRs). For the attributes that are not factor-adjusted, IRs measure the excess return per unit of total risk, which is composed of unsystematic and systematic risk. For this attribute we use the *Selection Sharpe Ratio.*

$$IR_{fn} = (r_{fn} - r_{mn})/\sigma(r_{fn} - r_{mn}) \tag{6}$$

where IR_{fn} is the information ratio for FMM, r_{fn} is the return on the fund, and r_{mn} is the return on CRSP for period n. $\sigma\,(r_{fn} - r_{mn})$ is the standard deviation of their difference, or tracking error. Funds outperforming the market benchmark have positive information ratios and the size of the IRs would be positively related to its attribution value and inversely related to its tracking error. Similarly, we derive IRs for BMM and FMB using modifications to Eq. (6).

The IRs for FMM indicate that the average active manager generated a slightly negative risk-adjusted excess return from 1994 through 2005.[10] Active fund managers in the top quartile produced positive risk-adjusted returns in all periods, and managers in Q2 produced positive IRs in all but Period 2. Performance across quartiles is inconsistent from period to period, but managers were best at sector allocation in the bear market, where the average IR for BMM is positive for funds in all quartiles, and worst in the market run-up from 1997 to 1999. Funds in the top quartile excelled at both security selection and sector allocation, generating a positive average IR for FMB in all periods and for BMM in all but Period 1.

Note that our methodology differs from published studies in this area (Daniel, Grinblatt, Titman, and Wermers, 1997) by using fund-specific sector weights to establish each fund's benchmark.[11] The attribution measures for stock selection and sector allocation are not adjusted for other known market-priced factors, such as style and momentum effects.

7. Implementation of sector-matched benchmarking

More frequent monitoring by managers leads to better decisions regarding security selection and sector allocation, more timely changes in the fund's bogey, and more timely indications of success or weaknesses in investment strategies, resulting in better performance evaluation. For this reason, we suggest that reporting services consider providing performance results from attribution analysis. Results from attribution analysis, in addition to traditional measures, would be useful for investors holding actively managed funds by enabling them to compare sector and security selection ability across funds and managers. Together with fees, this would provide investors with greater insight on fund quality, resulting in better investment decisions. More information results in improved efficiency of mutual fund and security markets. In addition, based on our results, reporting the stock selection attribute would be of significant value to individual investors.

Because we could not observe each fund's bogey directly, the contributions from sector allocation and stock selection we present are based on estimates of each fund's bogey using sector weights at the beginning of each month. However, fund managers have the data to provide nearly continuous performance evaluations, and industry analysts and reporting services can work directly with funds to produce more frequent, and thereby more accurate, evaluations.

Attribution analysis is also applicable to balanced and fixed-income funds. The sector-matched bogey may not be appropriate for some equity funds even though the logic of a firm-specific bogey applies. For example, an actively managed fund using a dividend yield strategy may use a bogey comprised of a dividend-based passive portfolio. Future research should examine attribution analysis for this group of funds.

8. Conclusion

We use attribution analysis to measure the sector allocation and stock selection components of total returns for nearly two thousand actively managed equity mutual funds over a 12-year period that included three bull markets and one bear market. Attribution analysis is a popular performance measure used by industry professionals for assessing performance because of its intuitive way of providing estimates of the asset allocation, sector allocation, and stock selection components of a fund's return. In practice, each fund establishes a proprietary passive portfolio benchmark, or bogey, by which to measure the sector allocation and stock selection components of the fund's return.

We use fund-specific sector weights at the beginning of each measurement period to create proxies for fund-specific bogeys. We show that, overall, actively managed equity funds

generate higher returns and less market risk than a passive diversified portfolio. Active managers excelled at sector allocation over the period with their bogeys outperforming the CRSP index. However, their bogies performed at or under the CRSP index during the three bull markets in our sample. Their ability to outperform the CRSP index over the sample period was primarily because of superior allocations during the bear market of 2000–2002. Active managers were generally poor at stock selection, significantly underperforming their bogies over the 12-year period, and underperforming their bogeys in two of the four subsamples. Their worst security selection performance was during the bear market.

Fund managers in the top performance quartile, ranked by their market-adjusted return, demonstrated superior stock selection and sector allocation skills during the 12-year period and in each of the four three-year sub-periods. However, managers of funds in the bottom three quartiles more frequently produced negative excess returns because of poor sector allocation and even poorer stock selection.

Attribution analysis measurement and reporting would seem to be an important additional evaluation method for use by investors. This study should also encourage funds and fund data reporting services to supply the data needed for better performance estimation and investment decisions by investors.

Notes

1 The CIPM, or Certificate in Investment Portfolio Management, is offered by the CFA Institute. It requires that the analyst be proficient in a number of performance attribution methods. See Bodie, Kane, and Marcus, INVESTMENTS, 9th edition, Chapter 24; *Performance Attribution Procedures* for a description and examples. Attribution analysis generally applies to asset-allocation. The approach estimates the contributions to total fund return made by asset allocation (stock and bond allocation), sector or industry allocation, and stock selection.

2 Managers may base their bogies on a variety of factors, including dividends, size or value, which will influence their sector allocation and stock selections.

3 Funds with material international holdings were avoided because we lacked data regarding specific country allocations. Income and balanced funds with large debt holdings were also excluded because information on each fund's specific fixed income characteristics were not available.

4 Seven extreme monthly returns exceeding 90% were removed from the sample. Funds containing these outliers within a sub-period were not included in that sub-period, but may be included in other periods in the analysis.

5 The total number of funds from the four sub-periods is greater than the number of funds in the sample because funds are double counted when they are included in more than one sub-period.

6 This is an appropriate benchmark because: (1) CRSP is a market-weighted average of all NYSE, AMEX, and NASDAQ common stock returns, including dividends; (2) the VTI tracks the Wilshire 5000, which is mapped by CRSP; and (3) results of tracking error tests by Morgan Stanley in 2006 found the VTI to have the lowest tracking-error

of index ETFs. Also see: http://seekingalpha.com/article/36875-tracking-error-in-exchange-traded-funds.

7 Sector ETF data is from the Morningstar.com Library Edition on September 19, 2006.

8 Errors could still be introduced to the extent that we have missing intra-period data preventing continuous updating of a fund's sector changes. However, biases in average results are mitigated to the extent that the errors are independent across funds

9 The majority of the funds in our sample are diversified. Specialty funds represent, on average, 9.6% of all funds per period.

10 The sign of the IR will generally be the same as the sign of its attribute. In Table 3 the attribute is divided by the standard error, TE. Variations in TEs across funds can change the sign of the average IR because IRs are computed by fund and then averaged. For example, a small number of funds with a negative attribute and very low TEs could produce a negative average in a period even though the average performance measure is positive. The likelihood is greater when the sample attribute is very close to zero. For example, see the reversal in sign for the positive unadjusted FMM in Panel E from positive in Table 1 to a negative information ratio in Table 3.

11 A similar methodology is used by Grinblatt and Titman (1994) to examine industry performance. They use 109 passively managed portfolios, including 37 industry portfolios constructed from individual firm SIC codes, to evaluate the performance of 279 mutual funds. They do not decompose results into sector and security attribution measures nor derive a fund-specific sector weighting scheme.

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