

## **Market Diversity and the Performance of Actively Managed Portfolios\***

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## **Abstract**

This article shows that changes in Market Diversity, a measure of the “size effect” explains a statistically and economically significant amount variation in the relative returns of actively managed institutional large cap strategies. We estimate that an increase (decrease) in Market Diversity of 1% leads to an average increase (decrease) in relative returns of approximately 30 basis points, with higher tracking error strategies showing relatively more sensitivity. We find that another measure of the size effect, the Fama-French SMB factor, explains less of the variation in actively managed large cap strategies’ relative returns and is rejected in favor of changes in Market Diversity as the underlying explanatory variable for actively managed strategies’ relative returns. Market Diversity provides academics and practitioners an important measure of market conditions when evaluating active management.

## **1. Introduction**

The value of active management has been the subject of numerous academic and practical debates for decades. The “street’s” view of active management seems to wax and wane, usually depending on the recent ability of active managers to beat their passive benchmarks. A key to evaluating active management and specific active strategies is understanding what market characteristics or factors influence the likelihood that an actively managed portfolio beats its benchmark over a period of time. This article examines one such factor that we identify as “Market Diversity.”

Market Diversity, first introduced by Fernholz (1999), is a measure of how diverse or concentrated capital is within the market. If capital is concentrated into only a few names in the market, then Market Diversity is low. If capital is more evenly spread across a large number of names, with the extreme being capital equally distributed across names, then Market Diversity is high. Changes in Market Diversity occur through time, reflecting the relative performance of smaller versus larger capitalization stocks. That is, as the Market Diversity falls, capital becomes concentrated in fewer names – the large stocks get larger. As Market Diversity increases, smaller stocks outperform larger stocks or have higher relative returns.

Using a broad sample of institutional large cap managers, we show that changes in market Diversity explain approximately 30% of the variation in the average relative returns of actively managed large cap strategies. Moreover, nearly two-thirds of the large-cap managers’ relative returns have a positive exposure to changes in Diversity. A one-percent increase (decrease) in Market Diversity is associated with an average 21 basis point increase (decrease) in relative returns for large cap core managers, and an average 28 and 32 basis points for large cap

growth and large cap value managers, respectively. The sensitivity to changes in Market Diversity is even more pronounced for higher tracking error strategies.

Market Diversity historically has been a mean-reverting process (i.e., the market does not tend to the extremes of concentration nor equal distribution) and there is no reason to expect this source of risk to be rewarded through long-term returns or a risk premium. However, changes in Market Diversity can be long-lived with Diversity declining for several years or rising for several years in a row. Because changes in Diversity are associated with such a large component of the variation in relative returns to actively managed strategies, investors must be careful to control for this factor when evaluating active strategies in particular, or active management in general. In periods in which Market Diversity declines dramatically, such as the 2% decline in Market Diversity in the fourth quarter of 2008, actively managed strategies have a headwind and might appear less valuable than they really are over the long-term. In contrast, active managers relative returns might appear more valuable than their long-term average due to a tail-wind in periods of rising Market Diversity, such as that experienced in the period from 2000-2005.

In the next section of this article, we explain the motivation for why actively managed strategies are likely to be exposed to changes in Market Diversity. Section 3 describes our sample of institutional asset managers, our empirical methods, and the analysis of the association between changes in Market Diversity and the relative returns to actively managed portfolios. We conclude the article with Section 4 and discuss considerations in evaluating actively managed strategies in the context of changes in Market Diversity.

## **2. Market Diversity, Size, and Active Management**

### *A. Capital Distribution and Market Diversity*

The extent to which capital is distributed in the market is reflected in the market's capital distribution curve. Figure 1a shows the capital distribution curve of the S&P 500 in March 1994 and March 2000, while Figure 1b shows the cumulative distribution for the same dates. Capital is more concentrated in March 2000 than it was in March 1994, reflecting the fact that smaller capitalization stocks gained a larger share of the index's weight relative to larger capitalization stocks and, therefore, had higher relative returns. Arbitrary measures allow descriptions of the change in the shape of the capital distribution curve. For example, 33 names account for 50% of the weight in 2000, compared with 64 names in 1994, reflecting a change in capital concentration. However, Market Diversity offers a more useful measure that describes the distribution using all stocks within the universe of interest.

We employ the measure of Market Diversity that was developed by Fernholz (2001, 2002, and 2005). The measure summarizes the distribution of capital within a market of  $N$  stocks by using each stock's weight at time  $t$ ,  $w_{i,t}$ . Market Diversity at time  $t$  is given by

$$D_{p,t} = \left( \sum_{i=1}^N w_{i,t}^p \right)^{1/p}. \quad (1)$$

We use the parameter  $p$  to be  $p = 0.50$ . The change in Market Diversity is more informative than a snapshot in time.<sup>1</sup> Thus, we calculate the change in Market Diversity from time  $t-1$  to  $t$  as the difference in log diversity over the period, as given by

$$\Delta D_{p,t} = \ln(D_{p,t}) - \ln(D_{p,t-1}). \quad (2)$$

Figure 2 shows the cumulative change in Market Diversity for the CRSP universe (1927 through 2008) and the S&P 500 universe (1963 through 2008). The change in the shape of the capital distribution curves shown in figures 1a and 1b are reflected in the decline in Market

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<sup>1</sup> Note the similarities between the measure of Market Diversity and the Herfindahl Index measure of concentration. For a further discussion, see Fernholz (2002), chapters 5 and 6.

Diversity from 1994 through 2000. Figure 2 also shows the period of generally increasing Diversity that followed the burst of the “tech bubble” from 2000 through roughly mid-2006. The last half of 2008 witnessed a sharp decline in Market Diversity, indicating that smaller capitalization companies were falling more sharply during the 2008 decline than their larger capitalization counterparts.

Finally, it is worth noting that changes in Market Diversity are generally long-lived. Though the graph in Figure 2 is not perfectly smooth, the period between peaks and troughs is on the order of 5 to 10 years. An analysis of the exact behavior and predictability of changes in Market Diversity are beyond the scope of this paper (we refer the interested reader to Fernholz (2005) and Audrino, Fernholz, and Ferretti (2007) for further discussion). However, we note that Market Diversity appears to have been generally mean-reverting in that there is no significant increase or decrease in Market Diversity in the last 75 years that can be relied upon to persist.

### *B. Active Management*

To be “active,” the weights in an actively managed portfolio must deviate from the benchmark weights – overweighting stocks and underweighting stocks relative to the benchmark. Most actively managed portfolios are constrained to hold only long positions, effectively resulting in a bias within the underweights and overweights relative to the benchmark. As has been discussed by Clarke, de Silva, and Sapra (2004) and Clarke, et al. (2008), long-only managers have more capacity to underweight larger benchmark names (i.e., names with larger benchmark weights) and to overweight smaller benchmark names.

This structural aspect of actively managed portfolios creates the potential for a sensitivity to changes in Market Diversity unless the portfolio construction methodology explicitly targets

this exposure. This sensitivity is expected to hold true especially for strategies that target outperformance of large capitalization benchmarks. Active management of portfolios benchmarked to mid- or small-cap benchmarks do not face as severe a bias toward underweighting large- and overweighting small-cap stocks, since the mid- and small-cap benchmarks have zero weight in larger-cap stocks that “reside” outside the benchmarks. Therefore, overweighting of larger stocks is possible when trying to outperform mid- and small-cap benchmarks. In summary, a theoretical expectation exists for active large-cap managers to have exposure to changes in Market Diversity.

Exposure to “size” in actively managed portfolios has been examined before, but the size effect is usually tied to an underlying asset pricing observation. For example, Fama and French (1992, 1995, and 1996) find that a size factor, defined by the difference in the return on a portfolio of the smallest stocks minus the largest stocks (Fama-French’s “SMB” factor), explains the cross-section of stock returns. Carhart (1997) extended the Fama-French factor models by including a momentum factor and using this model to examine the returns to actively managed mutual funds. These factor models are motivated by the empirical observation that these factors appear to be priced in the market. In contrast, this paper examines actively managed portfolios’ exposure to changes in Market Diversity in an effort to explain deviations in relative returns without relying on an underlying assumption that the change in Diversity is associated with a risk premium.

### **3. Data and Analysis of Active Large Cap Managers**

#### *A. Sample Description*

We collect a comprehensive sample of portfolio returns and characteristics for actively managed large capitalization institutional strategies from the eVestment Alliance database. For the period from January 1979 to December 2008, we obtain quarterly portfolio returns to calculate relative returns matched to manager's preferred benchmark reported in the database as of December 2008. We use database classification to categorize portfolios as core (LCC), growth (LCG) and value (LCV). Due to some discrepancies observed between database style classifications and reported preferred benchmark, especially for LCG and LCV portfolios, (see appendix Table A1), we eliminate portfolios with conflicts between the preferred benchmark and style classification, e.g., Russell 3000 growth portfolio in LCG universe. In addition, a large fraction of LCG and LCV portfolios uses core benchmarks: S&P 500 and Russell 1000, instead of style benchmarks. For a robustness check to avoid the database classification errors we re-categorize portfolios into six universes based on the following benchmarks: S&P 500, Russell 1000, S&P 500 Growth, Russell 1000 Growth, S&P 500 Value and Russell 1000 Value. Table 1 reports summary statistics across managers using quarterly returns. In all, our sample encompasses 1,357 actively managed institutional large cap strategies.

We use market capitalization and monthly returns of all S&P500 index stocks from the CRSP database to calculate Market Diversity changes over the sample period. We restrict our analysis to portfolios that have at least 8 quarters of returns during periods of both increasing and decreasing Diversity, and at least 20 continuous quarters of returns. The Fama-French small minus big (SMB) factor is obtain from Ken French's Data Library website.<sup>2</sup> Portfolio characteristics, such as portfolio weighted average market capitalization and median market capitalization, are obtained as of December 2008 from the eVestment Alliance database.

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<sup>2</sup> Ken French's website is [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data\\_library.html](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).



Figure 3 plots average relative return of the universe of large cap managers versus the annual change in Market Diversity using the S&P 500 universe from 1979 to 2008. The analysis shows average relative return of the active managers is positively relative to changes in Market Diversity. The change in Market Diversity can explain about 30% of the variation active managers' average relative returns over this period. Fernholz and Garvy (1999) find a higher R-Squared (approximately 50%) when analyzing the median return of a smaller sample of active managers in the 1971 – 1998 period, but they do not examine the relative returns of individual managers nor conduct analysis similar to what follows below.

Figure 4 shows the percentage of active managers beating their preferred benchmark each year along with the change in Market Diversity. On average, in years of increasing Market Diversity, 69% of LCC, 71% of LCG and 63% of LCV managers beat their respective benchmarks. In contrast, an average of only 54% of LCC, 54% of LCG and 53% of LCV managers beat their benchmarks in years in which Market Diversity declines. For example, during the period of declining Market Diversity from 1994 through 2000, only approximately 42% of active large cap managers beat their benchmark. Yet, during the period of rising Market Diversity from 2000 through 2006, approximately 58% of active large cap managers beat their benchmark.

#### *B. Active Managers' Exposure to Change in Market Diversity*

We examine the sensitivity of active managers' relative returns to changes in S&P500 diversity using time-series regression analysis for each portfolio. We summarize these regression by calculating average sensitivity (beta from the regression analysis) within each style universe. The regression results reported in Table 2 show that actively managed portfolio relative returns

are significantly positively associated with changes in Market Diversity in all three style universes: core, growth and value.

The average regression coefficient on the change in Market Diversity shows an average increase of 0.21%, 0.28% and 0.32% per 1% increase in Market Diversity for large core, growth and value portfolios, respectively.<sup>3</sup> The percentage of active managers with positive return exposure to Market Diversity changes is 63.3%, 68.1% and 63.2%. These percentages are statistically significant from the 50% percent level that would be expected if changes in Market Diversity were not a factor in the relative returns of active managers. Among those portfolios with positive regression coefficients, 30.0%, 38.0% and 36.1% are significant at less than the 5% level for large core, growth and value portfolios, respectively. Results of the sensitivity analysis based on reclassification of portfolio universes according to the preferred benchmark are similar to the main results: changes in diversity positively related to the relative returns, with the only exception of S&P Value portfolios. The average R-Squared across the core, growth, and value samples shows that the change in Market Diversity explains approximately 10.1%, 11.2% and 13.3%, respectively, of the variation in relative returns.

### *C. Size Exposure, SMB, and Change in Market Diversity*

Compared to the Fama-French SMB factor, the change in Market Diversity is more correlated (as measured by the regression R-Squared) with active manager's portfolio returns across all three style categories. Furthermore, only core and value show a significant average SMB regression coefficient (0.024 and 0.030, respectively) and a significant percentage of positive coefficients (57.2% and 58.2%, respectively).

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<sup>3</sup> We have conducted the analysis using monthly returns and changes in Market Diversity and find similar results in both sign and magnitude.

Based on the results in Tables 2, it appears that the change in Market Diversity provides more power than the Fama-French SMB factor in explaining the time series variation in active large cap managers' relative returns. Given the correlation between SMB and the change in Market Diversity (50%), and significance of both factor in regressions of portfolio returns on SMB and changes in diversity, we further examine whether SMB or changes in Market Diversity are the primary drivers of active portfolio relative returns. We use Davidson and MacKinnon (1981) methodology (J-test) to test the following hypotheses:

$$H_0 : ret_i = SMB_i + \varepsilon_{0i} \quad (3a)$$

$$H_1 : ret_i = Div_i + \varepsilon_{1i} \quad (3b)$$

We run the following regression:

$$ret_i = (1 - \alpha)SMB_i + \alpha \widehat{Div}_i + \varepsilon_i \quad (4)$$

where  $\widehat{Div}_i$  is the estimate from (2). If  $H_0$  is true, then the true value of  $\alpha$  is zero. To test  $H_1$  we reverse the roles of  $H_0$  and  $H_1$  and carry out the test again. Table 4 reports results of J-test. The null hypothesis that SMB is a true underlying factor explaining portfolio relative returns is rejected as  $\alpha$  is not zero with percentage of the significant  $\alpha$  coefficients across managers equal 100%. We accept the alternative hypothesis that changes in diversity is a true underlying factor of portfolio relative returns, as percentage of managers with non-zero  $\alpha$  across managers within three universes ranges between 19% and 39%, meaning that majority of portfolio returns have zero  $\alpha$  under  $H_1$  from J-test. These results suggest that the change in Market Diversity is a more relevant factor in explaining the size factor in the relative returns of actively managed large cap core portfolios.

#### *D. Determinants of Exposure to Change in Market Diversity*

Table 4 presents results of a sensitivity analysis to the change in Market Diversity with regards to how “active” a manager is, measured by size of the portfolio’s tracking error. Within each style universe managers are identified as high or low tracking error managers relative to the median tracking error.<sup>4</sup> As expected, the relative returns of higher tracking error strategies are more sensitive to changes in Market Diversity in terms of the average regression coefficient and have a higher correlation with changes in Market Diversity in terms of the average regression R-Squared. Indeed, for above-median tracking error large cap core and growth strategies, relative returns increase by an average of approximately 0.35% for every 1% increase in Market Diversity. For high tracking error large cap value strategies, the relative returns increase by an average of 0.53% for every 1% increase in Market Diversity. Even so, below-median tracking error strategies still show (statistically and economically) significant exposure to changes in Market Diversity.

We further examine whether portfolio characteristics can explain a portfolio’s sensitivity to changes in Market Diversity. We select weighted average (median) market cap of holding as a proxy for how biased a portfolio is toward smaller or large capitalization stocks. Because we do not have access to a time-series of this proxy, we use a snapshot for each portfolio as of the end of 2008. This limitation of our data is likely to weaken our tests.

We estimate the coefficient of this proxy in a cross-sectional regression using the estimated change in Market Diversity beta coefficient from time-series regression analysis as the dependent variable. We expect that portfolios with a smaller weighted average (median) market cap will have larger exposures to the change in Market Diversity, leading to a negative estimated coefficient. The results in Table 5 are mixed. The estimated coefficients are negative and

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<sup>4</sup> We use the standard definition of tracking error as given by the standard deviation of the portfolio’s relative returns.

statistically significant in the value category and insignificantly negative in the growth category. Contrary to the expected result, the estimated coefficients for both the average and median market capitalization in the core category are positive.

Interestingly, the positive estimated coefficients in the core category are not robust to classifying funds by their reported preferred benchmark. We note that this analysis provides some support for there being a link between the weighted average and median market cap of a portfolio's holdings. However, it is clear that the weighted average market cap is not a perfect proxy for determining a portfolio's exposure to changes in Market Diversity.

#### **4. Summary and Conclusion**

This article examines a measure of the "size effect," known as changes in Market Diversity. Unlike other ad hoc measures of size, the calculation in the change in Market Diversity is straight-forward and uses information in every stock in the relevant universe to measure how smaller capitalization stocks perform relative to larger capitalization stocks. These performance differences manifest themselves in changes in the capitalization profile of the market, which is the only input into the calculation of Market Diversity. Changes in Market Diversity appear to have been mean reverting historically, with Market Diversity cycles that have a period on the order of approximately 10 years.

Changes in Market Diversity explain a statistically and economically significant amount variation in the relative returns of actively managed institutional large cap strategies. Exposure to a size factor for large cap managers is motivated by the observation that large cap active managers have more capacity to overweight smaller and underweight larger stocks in order to take an active position relative to the benchmark. Changes in Market Diversity account for

approximately 30% of the variation in average relative returns of the universe of active institutional large cap strategies. Moreover, approximately two-thirds of the strategies in our sample show a positive exposure to changes in Market Diversity. We estimate that an increase (decrease) in Market Diversity of 1% leads to an average increase (decrease) in relative returns of approximately 30 basis points. While sensitivity to changes in Market Diversity is identified in both low- and high-tracking error strategies, a change in Market Diversity has a larger impact on the relative returns of higher tracking error strategies in our sample.

We examine compare another popular measure of the “size effect,” the Fama-French SMB factor, with changes in Market Diversity. We find that the Fama-French SMB factor explains less of the variation in actively managed large cap strategies’ relative returns. More importantly, when testing for model specification, we are able to reject the Fama-French SMB factor in favor of the change in Market Diversity factor as the underlying explanatory variable for relative returns. Finally, we examine whether a measure of a portfolio’s weighted average market cap can explain the cross-sectional variation in sensitivity to changes in Diversity. We find evidence that the sensitivity to changes in Market Diversity is not meaningfully explained by the weighted average market cap measure. This results serves as a caution to investors who wish to understand the sensitivity of a particular strategies’ relative returns to size, as weighted average market cap alone does not meaningfully reflect a strategies’ sensitivity to changes in Market Diversity.

Market Diversity is an important market characteristic or condition. While a “size” effect is generally acknowledged in the market, its characteristics and impact on actively managed strategies have been less understood. Changes in Market Diversity can be used as a conditioning variable in judging active management, in general, or an active strategy, in particular. For

example, during the late 1990's, Market Diversity declined dramatically and the proportion of active managers that lagged their benchmarks increased. During the first half of the 2000's, Market Diversity increased as small stocks outperformed larger stocks and active management once again appeared more valuable.

More recently, the last half of 2008 witnessed a sharp decline in Market Diversity of nearly 3%. This provided a significant headwind to active large cap managers as only approximately 40% of them beat their benchmarks. In contrast, the dramatic rise in Market Diversity of nearly 1.50% in the first half of 2009 is associated with a period in which 60% of active large cap managers beat their benchmarks. While it is unlikely that changes in Market Diversity are responsible for all of this variation, our results suggest that changes in Market Diversity are a significant determinant in the relative returns of active management and can be an important factor in evaluating active strategies' relative returns.

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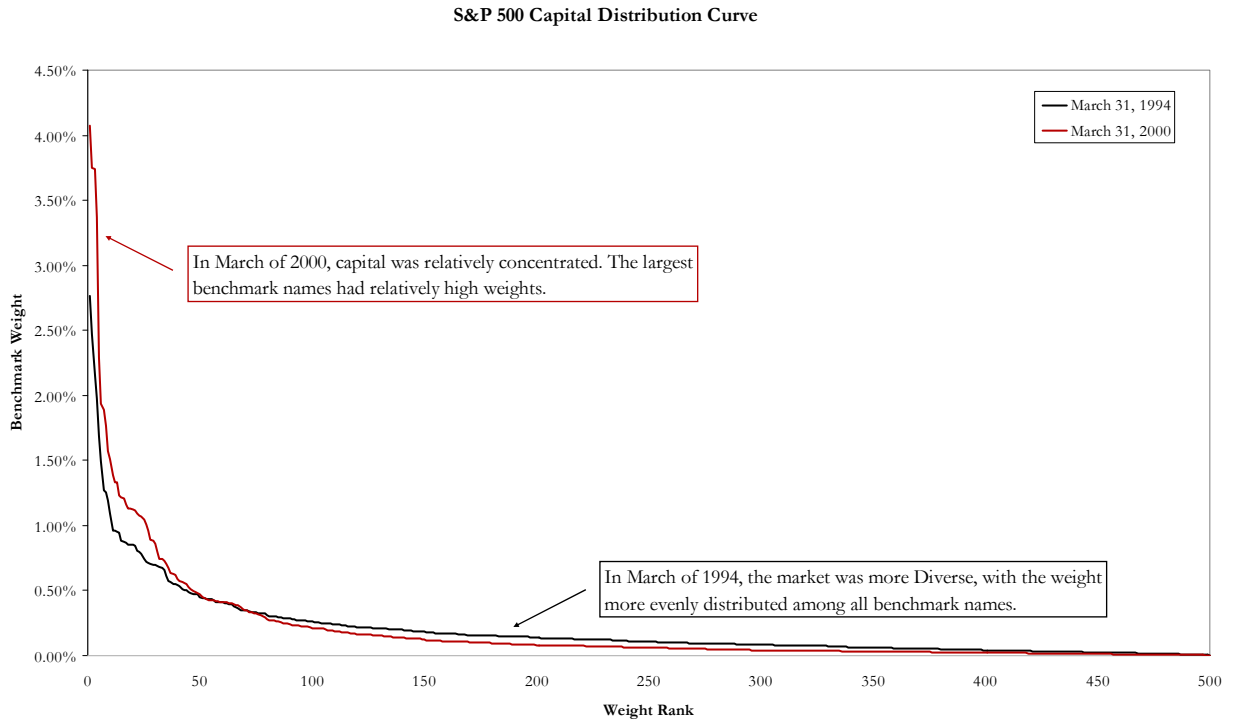




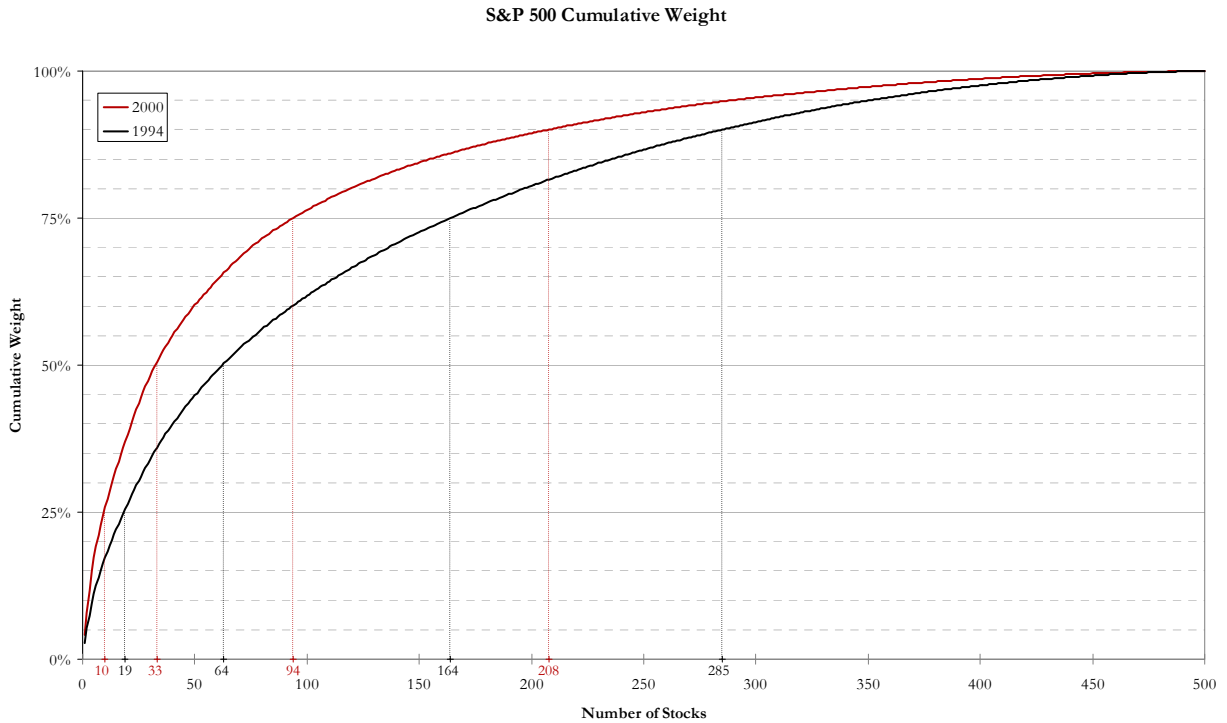
## Appendix: Managers Preferred Benchmark

LCC			LCG			LCV		
Benchmark	Frequency	%	Benchmark	Frequency	%	Benchmark	Frequency	%
S&P 500	350	81.59	Russell 1000 Growth	367	73.55	Russell 1000 Value	318	64.24
Russell	64	14.92	S&P 500	98	19.64	S&P 500	119	24.04
Other	5	1.17	S&P 500/Citigroup Growth	14	2.81	S&P 500/Citigroup Valu	27	5.45
DJ Wils	2	0.47	Russell 1000	6	1.20	Russell 1000	12	2.42
Domini	2	0.47	Russell 3000 Growth	6	1.20	Other	5	1.01
S&P 100	2	0.47	Russell Top 200 Growth	3	0.60	Russell 3000 Value	5	1.01
S&P 150	2	0.47	NASDAQ	2	0.40	Russell Top 200 Value	4	0.81
Custom	1	0.23	Other	1	0.20	DJ Wilshire Large Cap	1	0.20
Dow Jon	1	0.23	Russell 2000 Growth	1	0.20	Dow Jones Industrial A	1	0.20
			Russell 3000	1	0.20	Russell 3000	1	0.20
			Missing	1	0.20	Russell Top 200	1	0.20
						S&P 500/Citigroup Grow	1	0.20
						Missing	1	

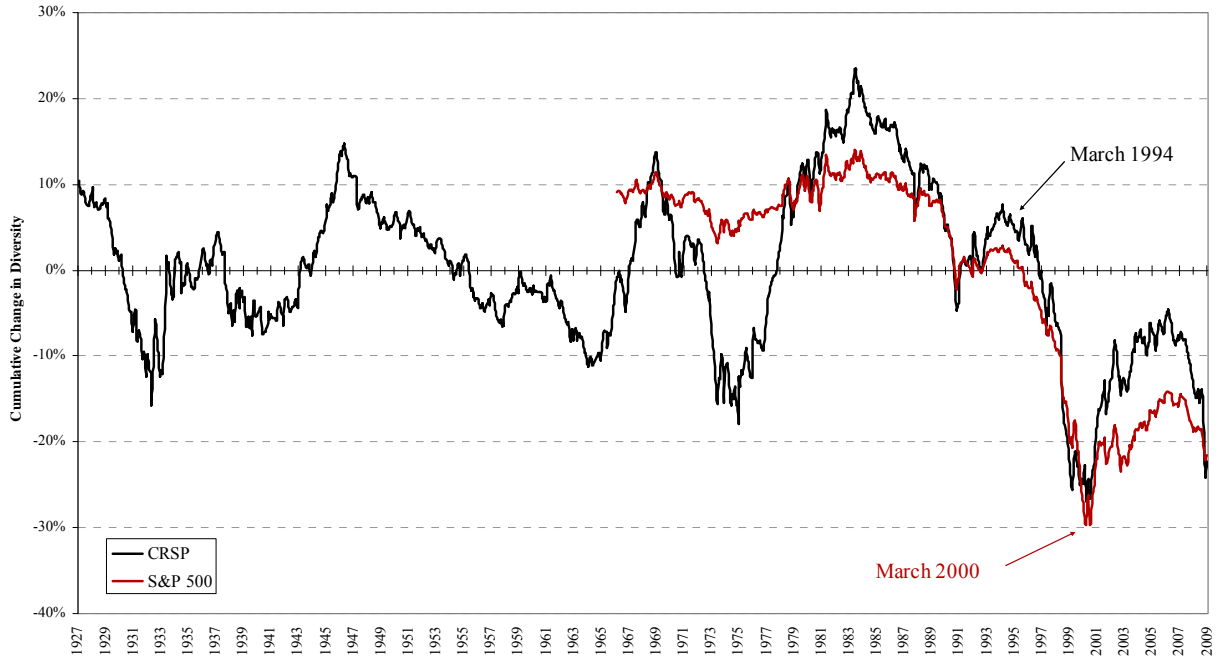
**Figure 1a: S&P 500 capital distribution curve**



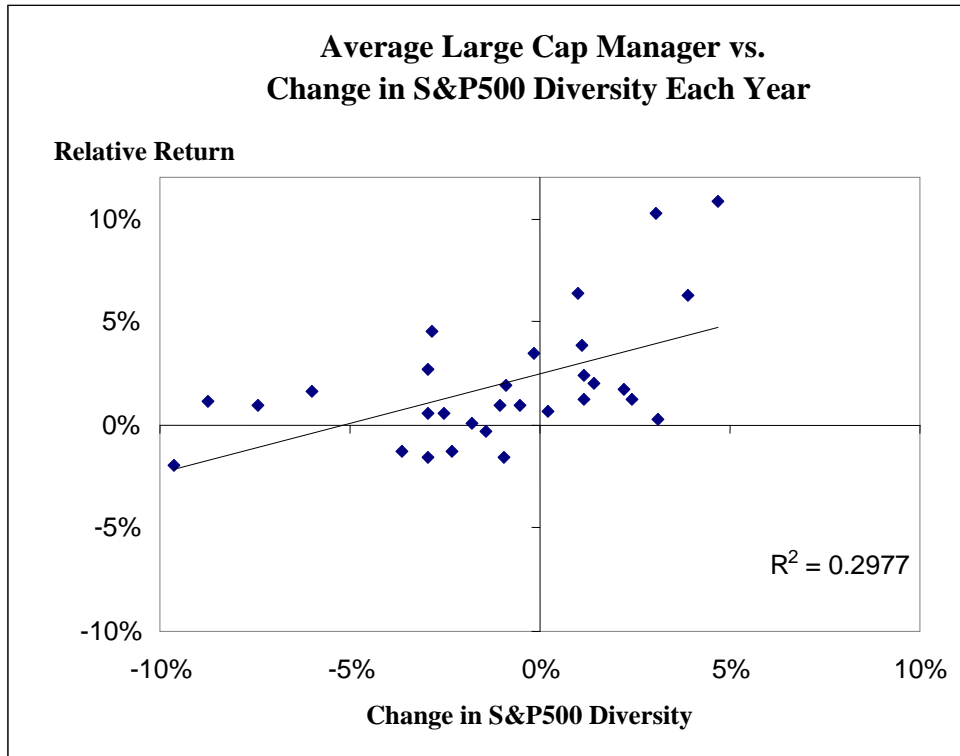
**Figure 1b: S&P 500 cumulative weights**



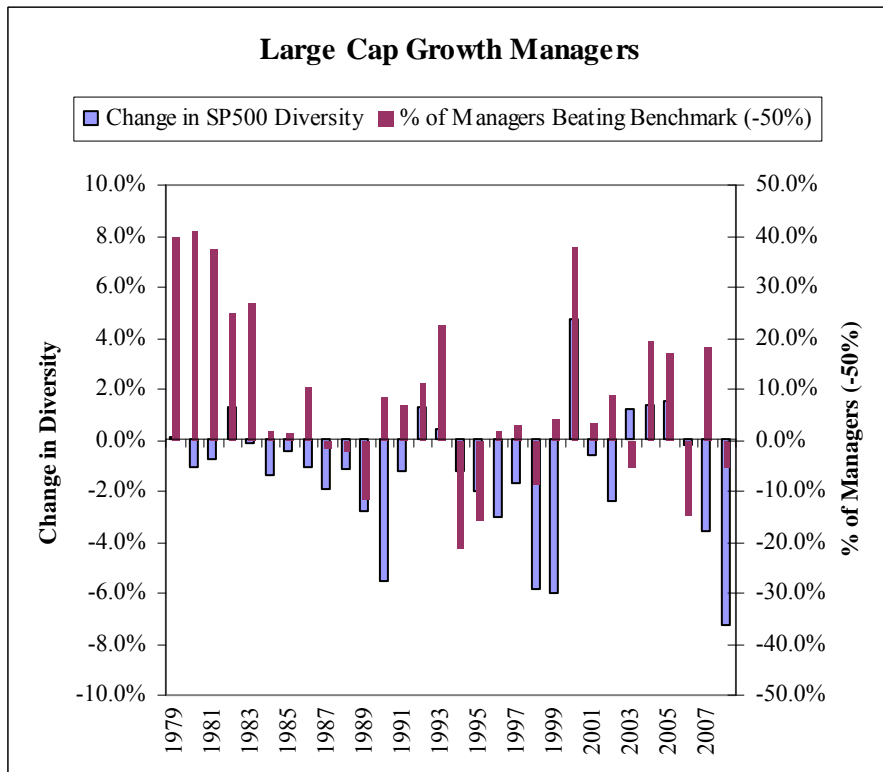
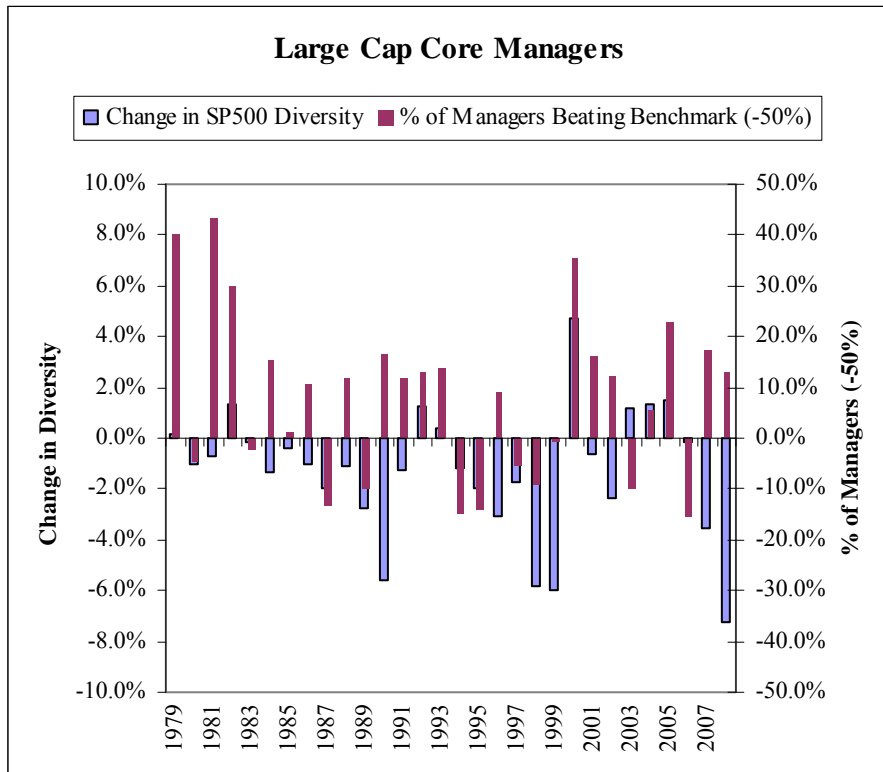
**Figure 2:** Cumulative change in Market Diversity



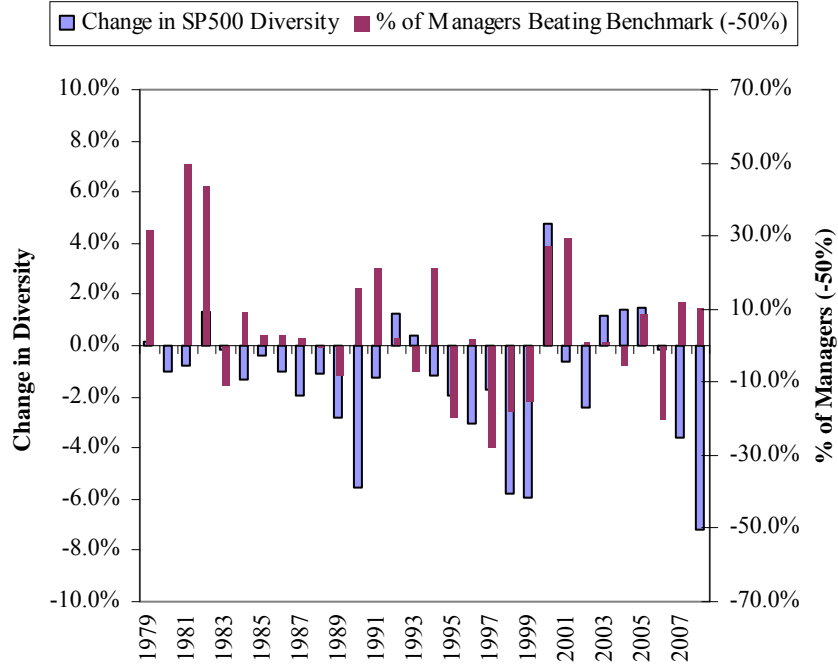
**Figure 3:** Average relative returns vs. change in Market Diversity



**Figure 4:** Percentage of active managers beating their respective benchmarks and change in Market Diversity by year



## Large Cap Value Managers



**Table 1:** Summary statistics across managers using quarterly returns and change in S&P500 Diversity

Cap	Style	Number of Managers	Obs. Per Manager	Relative Return, %		Benchmark	Change in Diversity, %		Date Range
				Avg.	Avg. St.Dev		Avg.	Avg. St.Dev	
Large	Core	414	53.8	0.33	3.04	S&P 500*	-0.28	1.55	1/1979 - 12/2008
	Growth	479	52.0	0.53	4.21	Russell 1000 Growth*	-0.28	1.55	1/1979 - 12/2008
	Value	464	52.8	0.25	3.35	Russell 1000 Value*	-0.28	1.55	1/1979 - 12/2008
Large	S&P 500	567	55.5	0.35	3.59	S&P 500	-0.28	1.55	1/1979 - 12/2008
	Russell 1000	64	49.1	0.40	2.85	Russell 1000	-0.28	1.55	1/1979 - 12/2008
	S&P 500 Growth	14	38.9	0.19	3.82	S&P 500 Growth	-0.37	1.72	1/1992 - 12/2008
	Russell 1000 Growth	367	51.6	0.60	4.19	Russell 1000 Growth	-0.38	1.56	1/1985 - 12/2008
	S&P 500 Value	27	47.6	0.32	2.80	S&P 500 Value	-0.28	1.55	1/1979 - 12/2008
	Russell 1000 Value	318	51.4	0.16	2.93	Russell 1000 Value	-0.28	1.55	1/1979 - 12/2008

**Table 2:** Regression results for S&P 500 Diversity and Fama-French SMB factor. Statistics for slope coefficients and R-squared

Table 2									
	Core	Growth	Value	S&P500	Russell 1000	S&P Growth	Russell Growth	S&P Value	Russell Value
Panel A D SP500									
Avg.	0.208***	0.275***	0.321***	0.278***	0.124	0.666***	0.427***	-0.131	0.121***
Std dev	0.604	0.792	0.737	0.806	0.637	0.727	0.687	0.499	0.564
Median	0.150	0.325	0.185	0.197	0.102	0.914	0.429	-0.119	0.074
%>0	63.3%***	68.1%***	63.2%***	63.5%***	60.9%	85.7%	77.1%***	44.4%	55.1%***
% >0 Sig	30.0%	38.0%	36.1%	35.6%	23.4%	64.3%	44.7%	3.7%	25.9%
%<0	36.7%	31.9%	36.8%	36.5%	39.1%	14.3%	22.9%	55.6%	44.9%
%<0 Sig	10.4%	10.0%	11.5%	12.9%	14.1%	0.0%	3.8%	14.8%	13.9%
Ave. R2	10.1%	11.2%	13.3%	13.0%	10.9%	25.2%	10.9%	7.6%	9.8%
Panel B SMB									
Avg.	0.024***	0.010	0.030***	0.030***	0.010	0.095***	-0.008	-0.035	0.041***
Std dev	0.128	0.197	0.154	0.156	0.126	0.106	0.196	0.137	0.141
Median	0.023	-0.008	0.031	0.030	-0.011	0.104	-0.023	-0.036	0.037
%>0	57.2%***	48.9%***	58.2%***	58.7%***	45.3%	78.6%	43.9%***	33.3%	62.3%***
% >0 Sig	15.9%	13.4%	18.2%	16.8%	12.5%	21.4%	10.4%	11.1%	21.2%
%<0	42.8%	51.1%	41.8%	41.3%	54.7%	21.4%	56.1%	66.7%	37.7%
%<0 Sig	7.7%	11.1%	8.2%	8.5%	4.7%	0.0%	12.5%	11.1%	7.3%
Ave. R2	5.0%	5.3%	5.5%	5.1%	4.4%	6.5%	5.1%	5.9%	5.9%
N	414	479	462	567	64	14	367	27	316



**Table 3:** Regression results for S&P 500 Diversity, by high and low tracking error. Statistics for slope coefficient and R-squared

	Core	Growth	Value	S&P500	Russell 1000	S&P Growth	Russell Growth	S&P Value	Russell Value
<b>Panel A</b> Low tracking error managers									
Avg.	0.063***	0.198***	0.190***	0.090***	0.021	0.779***	0.330***	0.165**	0.056**
Std dev	0.307	0.549	0.577	0.421	0.293	0.305	0.419	0.291	0.364
Median	0.078	0.246	0.113	0.088	0.006	0.914	0.357	-0.159	0.072
%>0	60.19%**	68.28%***	58.93%**	59.31%**	54.29%	100.00%	79.56%**	35.71%	55.36%**
%>0 Sig	*	*	*	*	*	100.00%	79.56%**	35.71%	*
%>0 Sig	19.90%	36.12%	29.29%	24.48%	8.57%	75.00%	41.99%	0.00%	22.62%
%<0	39.81%	31.72%	41.07%	40.69%	45.71%	0.00%	20.44%	64.29%	44.64%
%<0 Sig	12.14%	11.45%	13.21%	14.14%	14.29%	0.00%	2.76%	14.29%	14.29%
Ave. R2	7.80%	11.02%	12.46%	9.40%	7.95%	30.54%	9.75%	7.59%	8.58%
N	206	227	280	290	35	8	181	14	168
<b>Panel B</b> High tracking error managers									
Avg.	0.351***	0.345***	0.529***	0.475***	0.300*	0.514	0.520***	0.095	0.205***
Std dev	0.770	0.956	0.892	1.035	0.866	1.094	0.863	0.667	0.723
Median	0.310	0.439	0.485	0.535	0.512	0.630	0.671	0.105	0.099
%>0	66.35%**	67.86%***	70.11%**	67.87%**	68.97%	66.67%	74.73%**	53.85%	55.33%**
%>0 Sig	*	*	*	*	*	66.67%	74.73%**	53.85%	*
%>0 Sig	39.90%	39.68%	47.28%	47.29%	41.38%	50.00%	47.31%	7.69%	30.67%
%<0	33.65%	32.14%	29.89%	32.13%	31.03%	33.33%	25.27%	46.15%	44.67%
%<0 Sig	8.65%	8.73%	8.70%	11.55%	13.79%	0.00%	4.84%	15.38%	13.33%
Ave. R2	12.42%	11.33%	14.70%	16.79%	14.35%	18.15%	12.00%	7.52%	11.18%
N	208	252	184	277	29	6	186	13	150

**Table 4:** SMB vs. Change in Market Diversity This table presents results of the Davidson-MacKinnon J-test whether SMB or change in Market Diversity are the true factor models of portfolio returns.

	Core	Growth	Value	Core	Growth	Value
	<u>H0: ret=SMB</u>			<u>H1: ret=D SP500</u>		
	<u>SMB (1-<math>\alpha</math>)</u>			<u>D SP500 (1-<math>\alpha</math>)</u>		
Avg	-0.003	-0.035	-0.009	0.209	0.286	0.328
Std Dev	0.131	0.204	0.152	0.682	0.956	0.804
Median	0.005	-0.039	-0.003	0.139	0.355	0.183
% Sig	25%	36%	30%	42%	52%	49%
	<u>Hat D SP500 (<math>\alpha</math>)</u>			<u>Hat SMB (<math>\alpha</math>)</u>		
Avg	1.003	1.035	1.009	1.319	2.031	-0.366
Std Dev	0.131	0.204	0.152	3.120	8.467	13.790
Median	0.995	1.039	1.003	1.047	1.260	0.943
% Sig	100%	100%	100%	19%	39%	33%

**Table 5:** Sensitivity to changes in Market Diversity and portfolio weighted average market cap

Diversity beta	Core			Growth			Value			Russell	SP500	Russell Growth	Russell Value				
Intercept	-0.58	**	1.78	3.48	***	3.25	0.51	-0.46	5.03	***	(-1.28)	(1.46)	(4.99)	(0.94)	(0.99)	(-0.37)	(5.19)
LogWAVEMktCap	0.07	*	-0.13	-0.28	***	-0.27	-0.02	0.08	-0.45	***	(1.79)	(-1.18)	(-4.50)	(-0.87)	(-0.34)	(0.74)	(-5.06)
R <sup>2</sup>	0.01		0.01	0.07		0.02	0.0004	0.002	0.11								
Intercept	-0.74	*	1.01	1.78	***	-0.08	0.55	-0.08	2.02	***	(-1.89)	(1.23)	(3.37)	(-0.05)	(1.21)	(-0.11)	(3.59)
LogMedMktCap	0.10	***	-0.07	-0.15	***	0.03	-0.02	0.06	-0.19	***	(2.48)	(-0.82)	(-2.72)	(0.20)	(-0.48)	(0.68)	(-3.36)
R <sup>2</sup>	0.03		0.002	0.03		0.001	0.001	0.002	0.05								
N obs	237		277	284		37	309	232	208								