

## **The Tale Of An Index In Bull And Bear Markets**

### **S&P 500 From 1997 To 2002**

#### **S&P 500: The Scorecard of The Large Cap U.S. Stock Market**

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As the leading index of large cap stocks in the U.S., the S&P 500 has been in a unique position of chronicling market cycles. As the most benchmarked index in the country, and with nearly a trillion dollars in assets directly linked to it, the index's changes in bull and bear runs contribute directly to the change in wealth of households. The index is one of the parameters used to compute the Conference Board's index of leading indicators.

The S&P 500 serves as the scorecard of the large cap U.S. stock market; it is not meant to outperform or under perform the market. The debate on whether active fund managers perform better than the index over different time horizons and market cycles is an old and well-researched one, and this report will not address that issue. Rather, this report will use the five-year market cycle from 1997 to 2002 to show how the S&P 500 represents the markets, and how index characteristics chronicle bull and bear markets. In the process, we will address some common misconceptions regarding style and sector bias, and 'few stock' dominance of the index.

#### **Concentration: The Market versus S&P 500**

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One of the most common questions that the authors face is "How many stocks really drive returns in the S&P 500 - 20 or 50?" Our simple answer to this simple question is, "All 500". At a given point, large cap stocks have a greater weight in the index and are therefore expected to dominate smaller stocks. But the dynamic nature of the index portfolio ensures that the league tables change. To understand this, let us look at the top 10 contributors to the index's performance from 1997 in the direction of index change, given in Appendix 1. Only a handful of top contributors in one year made it to the list in the subsequent year. In 2001 only one company made a repeat entry into the list from the prior year, in 2000 and 1999 there were two, and in 1998 there were four. More interesting is the disparity in contribution rank and rank in index - the top contributors need not be the largest stocks.

To summarize, the contribution of a stock to index return is not only a function of its weight in the index at the beginning of the period, but also the return of the stock. In a diversified portfolio of 500 stocks of the S&P 500, all 500 stocks are contributing to the index's return; size of the stock is one factor that determines its contribution, but not the only one.

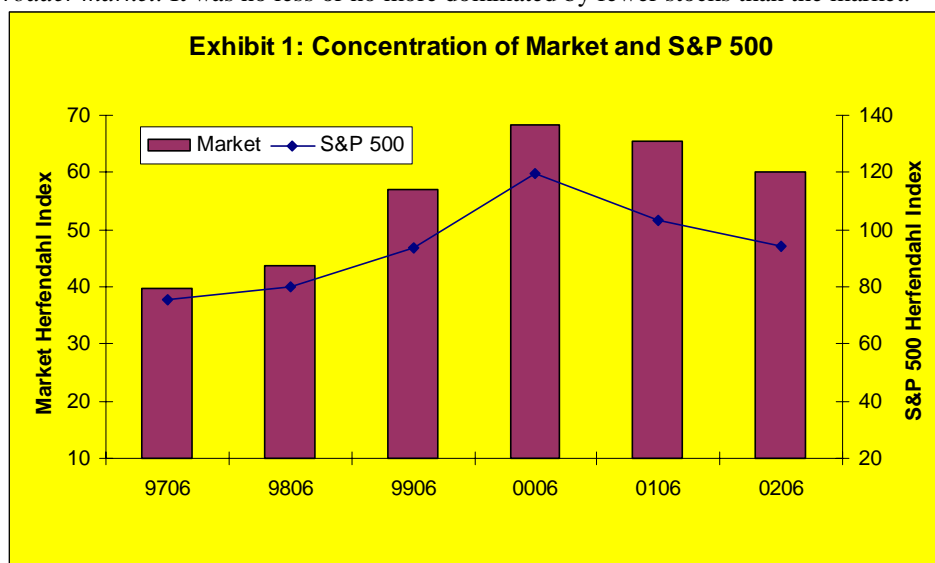
The broader question that needs to be answered is whether the dominance of a few stocks on the S&P 500 distorted the index's performance during the bull run of the late 1990's. The way to measure this is to evaluate concentration in the index and compare it to the market.

For purposes of this study, we define the U.S. equity market as all domestic stocks trading on the American Stock Exchange, the New York Stock Exchange and the Nasdaq National Market. Data on these stocks is compiled from Standard & Poor's Stock Guide Database.

We measure concentration by the Herfindahl index. The Herfindahl index is calculated as the sum of squares of percent share of each stock in the portfolio. For a concentrated portfolio dominated by a few large stocks, the Herfindahl index will be higher. A one stock portfolio will have Herfindahl index of  $100 \times 100 = 10,000$ , the maximum value that the index can

take. A portfolio that does not have any concentration at all will have all stocks equally weighted. The lowest value the Herfindahl index can take is 0, when the portfolio consists of infinite stocks with equal weights. Similarly, it follows that a 500 stock basket can have a minimum index of 20, and a 5000 stock basket can have a minimum Herfindahl index of 2. So the floor value of the Herfindahl index of the S&P 500 is 20, and if we use 5000 stocks for the market, the floor for the market is 2 (it falls to 1.5 if the market is considered to have 6649 stocks, the maximum in our period of study).

Exhibit 1 below shows the annual concentration of S&P 500 and the market from mid 1997 to mid 2002. Two conclusions are evident. First, *concentration rises in bull markets and falls in bear markets*. In other words, relatively fewer stocks dominate market performance in a bull market than in a bear market. Second, *S&P 500's concentration was in lockstep with the broader market*. It was no less or no more dominated by fewer stocks than the market.



Source: Standard & Poor's

## Value, Growth or Neither?

The three-factor model proposed by Fama and French [1,2] decomposes returns into market size and price-to-book factors. The market factor is given by market-weighted return of all AMEX, NYSE and NASDAQ stocks. HML, the value factor, is given by average return of the value portfolios minus the average return on the growth portfolios, with value and growth portfolios being formed on book-to-price ratios. SMB, the size factor, is formed from the average return of small stock portfolios minus the average return on the big stock portfolios.

We decompose monthly returns of the S&P 500 index and the Wilshire 5000 index, which we take as the proxy for market return, into these three factors and arrive at factor loadings. Size, Value and Market factor loadings are coefficients obtained in the regression equation for SMB, HML and Market factors respectively. We take monthly Fama French factors from Ken French's website, and the risk free T-Bill rates from the Federal Reserve.<sup>i</sup>

A true market portfolio will have no small stock or value bias, i.e., it will have SMB and HML loadings of 0 and Market loading of 1. A positive HML loading implies that the portfolio had a value bias, while a negative loading implies a growth bias. Similarly, a positive SMB factor implies a small stock bias, while a negative implies a large stock bias.

The regression for the two indices is shown in Exhibit 2. Given the nature of the regression, it is not surprising that all our regressions have a significant F statistic and have an R-square greater than 0.98.

The factor loadings are more interesting. Not surprisingly, the S&P 500 has a statistically significant large cap bias. Interestingly, the Wilshire 5000 has a minor small stock bias in the 1998-1999 and 1999-2000 periods, the peak of the bull market. The 1998-1999 bias is statistically significant.

Neither index has had a statistically significant growth bias. The HML factor loading is negative for the S&P 500 in 1998-99, and for the Wilshire 5000 in 1999-2000, but both are not statistically significant. Interestingly, both indices have a statistically significant value bias in the first year of the bear market, 2000-2001.

We have noted significance at a 10% level, but using a 5% level does not materially alter the thrust of our argument - *the HML loadings on both the S&P 500 and the Wilshire 5000 are near zero, and neither had a statistically significant growth bias during the bull run.*

<b>Exhibit 2: Factor Loadings Of S&amp;P 500 and Wilshire 5000</b>						
<b>SMB (Size) Factor</b>		7/97-6/98	7/98-6/99	7/99-6/00	7/00-6/01	7/01-6/02
<b>S&amp;P 500</b>	Factor Loading	-0.223	-0.185	-0.211	-0.111	-0.108
	Standard Error	0.047	0.063	0.097	0.060	0.026
	Coefficient significant at 10% level ?	Yes	Yes	Yes	Yes	Yes
<b>Wilshire 5000</b>	Factor Loading	0.020	-0.074	-0.041	0.010	0.002
	Standard Error	0.034	0.027	0.047	0.027	0.007
	Coefficient significant at 10% level ?	No	Yes	No	No	No
<b>HML (Book To Price) Factor</b>		7/97-6/98	7/98-6/99	7/99-6/00	7/00-6/01	7/01-6/02
<b>S&amp;P 500</b>	Factor Loading	0.058	-0.014	0.024	0.103	0.033
	Standard Error	0.077	0.053	0.080	0.045	0.059
	Coefficient significant at 10% level ?	No	No	No	Yes	No
<b>Wilshire 5000</b>	Factor Loading	0.091	0.037	-0.046	0.040	0.044
	Standard Error	0.056	0.022	0.038	0.020	0.015
	Coefficient significant at 10% level ?	No	No	No	Yes	No
<b>Market Factor</b>		7/97-6/98	7/98-6/99	7/99-6/00	7/00-6/01	7/01-6/02
<b>S&amp;P 500</b>	Factor Loading	1.037	1.008	0.954	0.939	0.978
	Standard Error	0.039	0.043	0.099	0.045	0.024
	Coefficient significant at 10% level ?	Yes	Yes	Yes	Yes	Yes
<b>Wilshire 5000</b>	Factor Loading	1.041	1.045	0.939	0.998	0.982
	Standard Error	0.029	0.018	0.048	1353.752	0.006
	Coefficient significant at 10% level ?	Yes	Yes	Yes	Yes	Yes

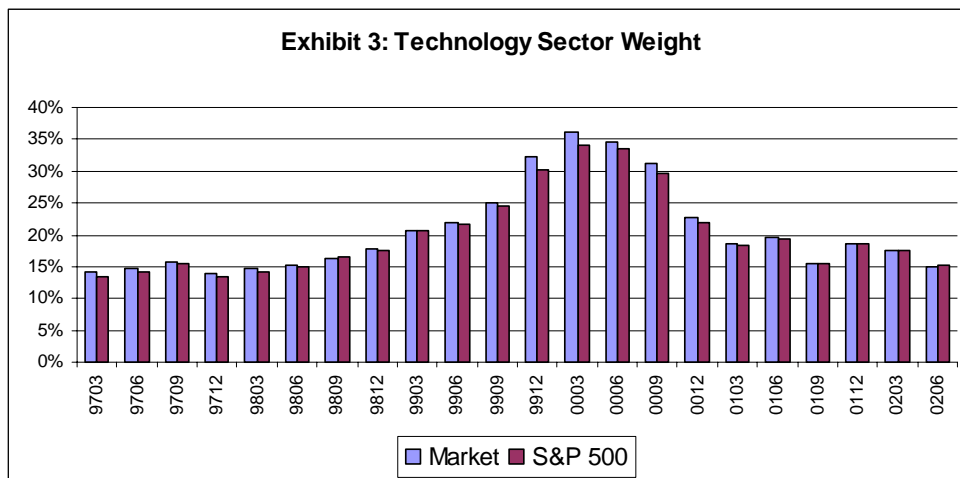
Source: Standard & Poor's

## Sector Indices and Market Cycles

Sector indices of the S&P 500 often portend an impending downturn. In this section, we will show the variation of sector concentration and the industry return dispersion during a market cycle.

Consider sector weights.<sup>ii</sup> Exhibit 3 shows the weight of technology stocks in the S&P 500 and the market from 1997 to 2002. In the three years from 1<sup>st</sup> quarter 1997 to 1<sup>st</sup> quarter 2000, the share of technology stocks in the market grew by one and half times from 14.3% to 36.2%. A single sector accounting for more than a third of the market was a sign of how risky the market had become. The S&P 500's sector composition mirrored this trend, with the technology sector's weight increasing from 13.5% to 33.9% during this period. The S&P 500's technology sector weight actually lagged the market through much of the rise and the fall in the cycle. This was not because of a qualitative judgment by Standard & Poor's, but because the index inclusion criteria of four quarters of positive earnings kept out many of the

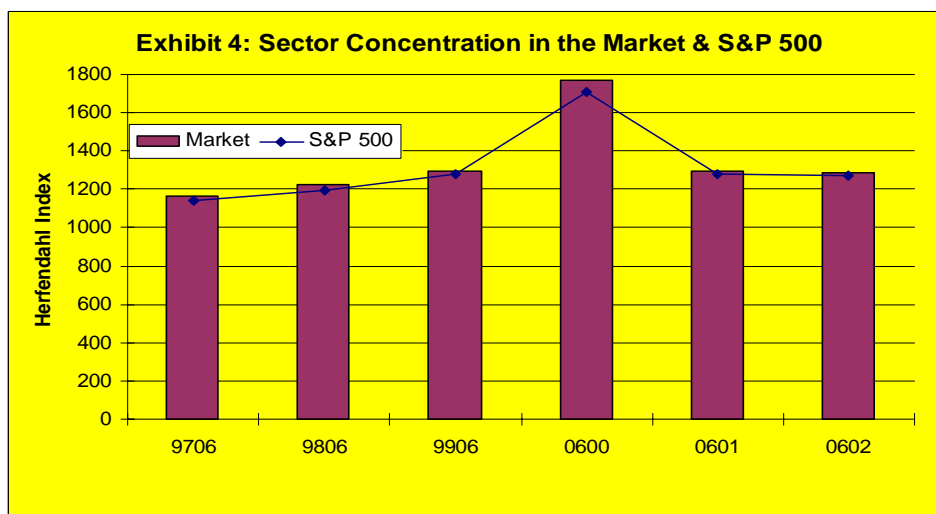
start-ups with no profits and stratospheric valuations. The change in weight of the technology sector in the index was in many ways reminiscent of the rise and fall of the weight of the Energy sector in the bull and bear run in the early 1980's.



Source: Standard & Poor's

Given the rise and fall of the technology sector, sector concentration rose in the bull run and then fell off with the market downturn. This is shown in Exhibit 4, which plots the Herfindahl indices of the market and the S&P 500. Note that we use a single axis for Exhibit 4, unlike Exhibit 1, since both the market and the index have the same number of sectors. As would be expected from a sector-balanced index, the sector concentration of the S&P 500 tracked the sector concentration of the market.

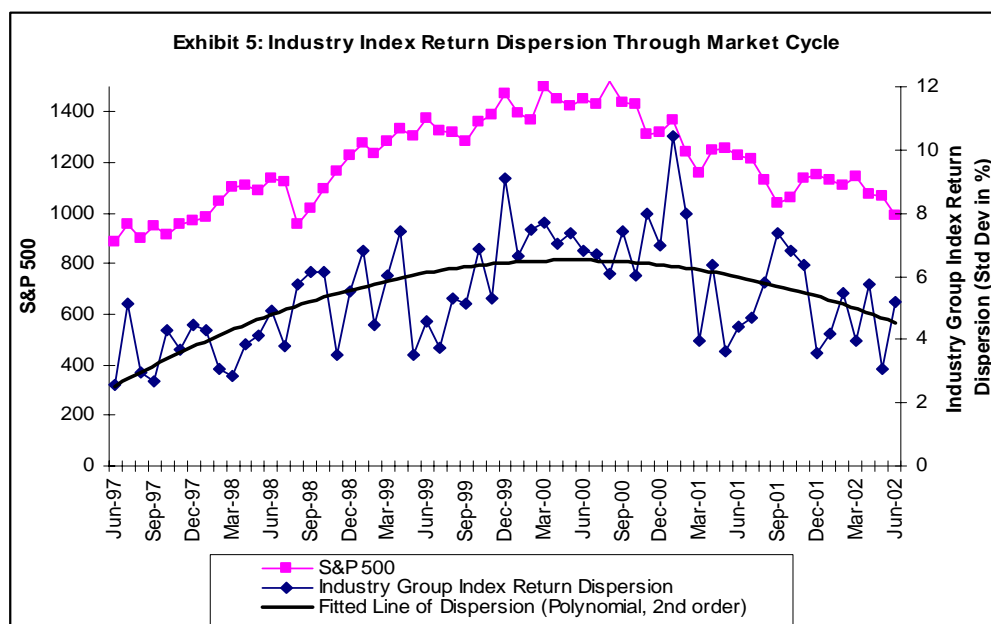
In sum, the *relative weight of sectors in the S&P 500 is a measure of the market risk*. Rising sector concentration and a fast-rising share in the index of a particular sector are an indication that the market is becoming more risky. And since S&P 500 is sector balanced, sector concentration of the S&P 500 tracks the sector concentration of the market.



Source: Standard & Poor's

Prior research has shown asymmetric correlation in cross-sectional returns during bull and bear markets [2,3]. Industry return volatility and dispersion can be indicators of market downturns. Specifically, the cross-sectional dispersion in industry returns is higher in bull markets, and lower in bear markets. This is an indication of increasing industry risk in the market, and Campbell and Lettau [4] suggest that industry level volatility is a particularly important leading indicator for the business cycle.

In order to test the asymmetry of sector returns during different halves of the market cycle, we plot the dispersion of the return of 22 GICS Industry Group indices of the S&P 500. We keep out the Real Estate Industry Group since stocks in that group became eligible for inclusion in the index only in 2001. We take the cross-sectional standard deviation of the industry group indices as our measure of dispersion. The results are plotted in Exhibit 4.



Source: Standard & Poor's

As suggested by prior research, we see that industry return dispersion moved upwards during the bull run, and gradually fell during the subsequent bear run. A simple 2<sup>nd</sup> order trend line fitted into industry index return dispersion has a  $R^2$  of 0.40 and almost tracks the path of the S&P 500 index. This shows the importance of the S&P 500 industry index return dispersion as another metric of market risk.

## Conclusions

Understanding index dynamics of the S&P 500 is key to understanding index returns. Concentration changes with market cycles, but the diversified basket of 500 stocks in the S&P 500 ensures that index concentration is in lockstep with market concentration. Similarly, the S&P 500 tracks the large cap segment of the U.S. market through the market cycle without lurching favoring a value or growth bias. Finally, sector composition and industry return dispersion are important measures of market risk, with both turning downward at the peak of the market cycles.

## Appendix 1: Top 10 Contributors To Index In The Direction Of Index Change

Contribution Rank	1997		1998		1999	
	Company	Rank in Index At Year Beginning	Company	Rank in Index At Year Beginning	Company	Rank in Index At Year Beginning
1	Genl Electric	1	Microsoft Corp	3	Oracle Corp	25
2	Travelers Group	44	Wal-Mart Stores	14	Northern Telcm Ltd	36
3	Microsoft Corp	5	Genl Electric	1	Sun Microsystems	38
4	Pfizer, Inc	14	Lucent Technologies	32	Cisco Systems	14
5	Bristol-Myers Squibb	13	Cisco Systems	29	EMC Corp	24
6	Wal-Mart Stores	16	Intel Corp	7	Motorola, Inc	30
7	Lilly (Eli)	28	Intl Bus. Machines	10	Microsoft Corp	4
8	Procter & Gamble	10	Dell Computer Corp	66	Texas Instruments	35
9	Coca-Cola Co	2	Pfizer, Inc	12	Morgan Stan Dean Witter	27
10	AT&T Corp	11	Merck & Co	5	Amgen Inc	66

Contribution Rank	2000		2001		2002	
	Company	Rank in Index At Year Beginning	Company	Rank in Index At Year Beginning	Company	Rank in Index At Year Beginning
1	Microsoft Corp	1	Cisco Systems	4	Genl Electric	1
2	Lucent Technologies	7	EMC Corp	16	Intel Corp	7
3	MCI WorldCom	17	Oracle Corp	11	Intl Bus. Machines	8
4	AT&T Corp	13	Merck & Co	9	Tyco Intl	17
5	Cisco Systems	3	Genl Electric	1	AOL Time Warner	11
6	Yahoo Inc	29	Nortel Networks	23	Microsoft Corp	2
7	America Online	10	Enron Corp	47	Citigroup Inc	4
8	Dell Computer Corp	23	Sun Microsystems	27	Pfizer, Inc	6
9	Intel Corp	4	Amer Intl Group	8	Bristol-Myers Squibb	23
10	Wal-Mart Stores	6	Qwest Communications Intl	43	Home Depot	17

Source: Standard & Poor's, Factset. 2002 data is for the first 6 months

## References

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<sup>i</sup> We use benchmark factor data from Ken French's website. The URL for the 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). T bill data is from <http://research.stlouisfed.org/fred/data/irates>.

<sup>ii</sup> A note about sector classifications is required. Beginning January 2002, Standard & Poor's industry indices are reported using only the Global Industry Classification System (GICS). GICS, a four level sector classification system developed jointly with MSCI, replaced the earlier two level industry classification system that Standard & Poor's used. A back history for S&P U.S. indices using GICS has been calculated from 1989. However, the full U.S. universe has not been classified into GICS beyond December 1999. Therefore, unless otherwise noted, we are using the old classification system in this report. There is substantial overlap in both classification, and we believe the results of this study would not change if we used GICS. For information on similarities between old and GICS classifications, go to [www.spglobal.com](http://www.spglobal.com).