A Look at Market Conditions Affecting Equity Hedge Fund Capture Ratios

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Executive Summary

In the following, we apply a method called Principal Components Analysis to S&P 500 sector data, using the results to measure certain characteristics of the U.S. equity market related to active managers' opportunity sets. We draw a relationship of these changing opportunity sets to the return properties of equity hedge funds, using the metric of up- and down-capture ratios (up- and down-capture ratios separately compare the rates at which a manager participates in an index's up months versus its down months; the higher the up-capture, and the lower the down-capture, the better). We consider down-capture as a "cost" of up-capture, and further consider how this cost changes over time and across managers, noting that the trade-off that equity hedge funds offer is most favorable when a lower total share of equity market risk is explained by broad advances and declines. Insofar as capture ratios represent the cost of gaining exposure to the equity market's prospective upside, we can observe how this cost changes with market conditions.

The paper has two purposes: first, to offer a formal measurement of a somewhat abstract concept that, for a hedge fund investor, might make intuitive sense: the degree to which the equity investment environment is dominated by broad advances and declines (which is closely related to the notion that the investment environment for equity hedge funds is better when correlations are low, and trending lower); and second, to demonstrate how this same measure fluctuates over time, the degree to which it is cyclical, and as precisely as possible, what the implications are for the hedged equity strategy relative to long-only index exposure.

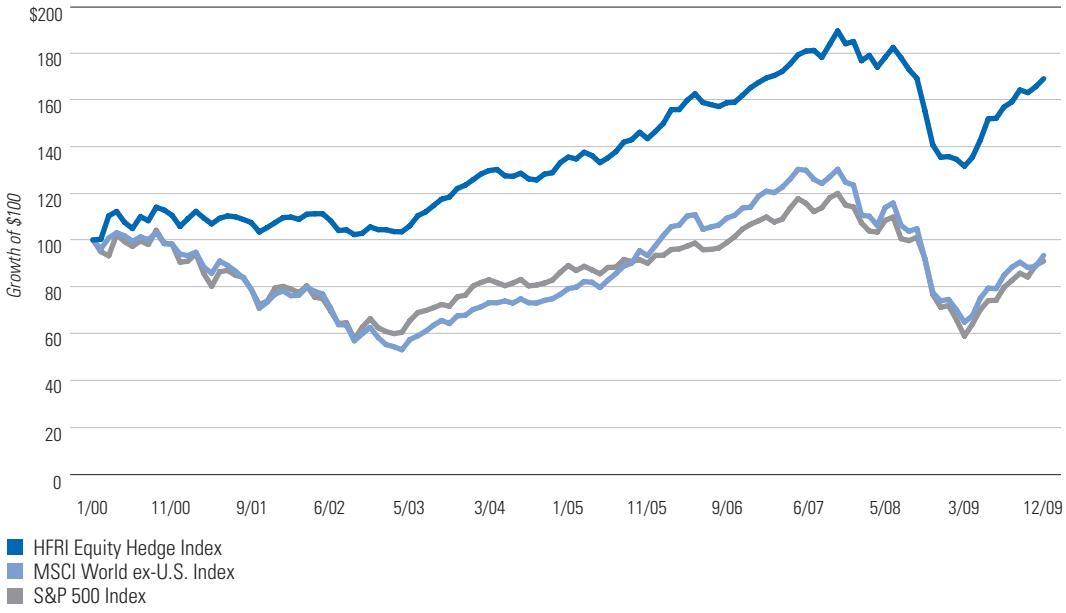
Introduction: Hedge Funds Have Asymmetric Exposure to Equity Market

The 10-year period ending December 2009 has been called a lost decade for equities, but it was not a lost decade for equity hedge funds. Over this period, the HFRI Equity Hedge Index returned 68.9 percent, as compared to -9.1 percent for the S&P 500 and -6.6 percent for the MSCI World ex-U.S. in local terms.

FIGURE I

The Lost Decade: Growth of $100

January 2000–December 2009



Sources: Commonfund, PerTrac, Bloomberg

It was not, however, a slow and steady ascent to 68.9 percent. The HFRI Equity Hedge Index did not offer returns resembling Treasuries plus a spread, nor, for that matter, resembling equities plus a fixed spread throughout the decade. Outperformance was neither uniform across all periods, nor common to all reporting hedge funds within the index. Periods when it was strongest, however, are informative about what hedge funds can do, and the role they can play in an equity portfolio.

One of the central premises behind equity hedge funds is that a skilled manager, given an expanded toolset that includes tactical short-selling, derivatives strategies and active management of net and gross exposures, can produce asymmetric exposure to the equity market. That is, the manager can produce a payoff structure relative to a long-only index that is not an even percentage of both the market's up-side and down-side. One way to measure this asymmetry in returns is up-/down-capture, which considers the market's up and down months separately and evaluates return as a percentage of each. A manager's capture ratios represent returns explicitly as a kind of on-going trade-off; up-capture might be said to "cost" a certain level of down-capture and the skill of a manager might be measured in terms of that cost.

Among managers, of course, this cost ranges widely, reflecting diverse manager skill and realized performance. But at the strategy-index level, capture ratios across the equity hedge universe are broadly quite sensitive to the distribution of risk within the equity markets. In other words, certain cyclical factors influence how much prospective upside equity hedge funds as a group are likely to capture, and at what cost—or, for an investor, what you get, in terms of upside, and what you pay, in terms of downside.

In the following, we use a technique called Principal Components Analysis to characterize various periods in equity markets, measuring their influence on equity hedge funds' capture properties. We also look at ways in which 2009 and 2010 have been outliers in this regard and consider what the implications may be for equity hedge funds' opportunity sets as the market continues to evolve.

Equity Risk is an Active Manager's Opportunity Set

In simplest terms, equity risk can be thought of as occurring in two forms: risk that broadly affects all underlying components of the market, and risk that is specific to some subset within it. For a working definition of subsets, we turn to the Global Industry Classification System ("GICS"), which recognizes 10 sectors, 25 industry groups and 67 industries. If each of these responded the same way to market conditions at all times, there would, in fact, be only one risk in equities: the entire market moving up or down.

If this were the case—that is, if idiosyncratic risks in the returns of these subsets were overwhelmed by the risk of the entire market moving up or down, it would seem to have implications for active management—in particular, it would seem to diminish the role of sector or industry selection relative to the role of managing a portfolio's directional exposure to broad movement. Clearly this does not accurately or completely represent the risk in equities, with their idiosyncratic risk. And yet, there are protracted periods that may look much like it, when the reward for allocation and selection seems thin and "you can go long (short) anything and make money."

Measuring the degree to which this is true at any point requires a more formal measurement of broad equity risk, a tool to separate it from other forms. One approach is to use Principal Components Analysis ("PCA").

Intuition Behind Principal Components Analysis

Test scores, incomes, incidence of disease, units sold, hours worked, stock prices—all of these are observable variables. They can be directly measured and recorded. But researchers may also be interested in variables that cannot be directly measured, and may even be difficult to define with precision, whether for reasons of complexity or abstractness. Examples might include sociability, risk-seeking, or industrialization. While these may not be directly measurable, they may be detectable within observable data; for this reason, they may be considered latent (as opposed to observable) variables.

Original datasets, almost by definition, comprise observable variables. But they can be transformed to represent variables that are not directly observed; one way is by reducing a dataset through PCA based on structure in its underlying variables' correlation properties.

For example, a survey might collect data about voting, campaign participation, community voluntarism, newspaper subscriptions, civic clubs joined, etc. Each of these (observable) measures has its own nuances, and together they presumably interact in multifarious ways. But they are also conceptually related to each other in some respects, and so they should demonstrate a pattern of moving together.

In PCA terms, a new variable can be defined based on this relationship which might suitably be called "active citizenship." Using this method, a single measure for active citizenship could then be built synthetically from some linear combination of observable variables.

This procedure in effect simplifies the dataset, separating the portion of variance due to active citizenship from the variance that is independent of it. Equally important, the remaining variance—that is, what is unrelated to active citizenship—can be dealt with by the same method, until all of it is accounted for. The end result is the transformation of a set of original data into a reduced form that may be useful, as instead of thinking in terms of voting, campaign participation, membership in civic clubs, etc., researchers can potentially think and form questions in terms of active citizenship or other results they might interpret.

In essence, observable variables do not move in a vacuum, and using transformation techniques like PCA can allow us to think about the ways that they tend to move relative to each other. The results of this method have several useful properties, including that the new variables, by design, are a) uncorrelated to each other and b) maximally descriptive.

PCA, then, is most simply a method of data reduction by transformation. It reduces a large or complex dataset to a smaller, simpler dataset based on the correlation properties among the data.

PCA Applied to Sector Returns

This same method can be applied to the dataset of returns of the S&P 500's 10 industry sectors, using monthly return data for its history (which begins in October 1989). As in the survey example, it makes sense to apply PCA here because the individual sectors do not move as if in a vacuum: movement in one sector typically means some combination of movement in others, sometimes in the same direction, sometimes in an opposite direction. The goal of the analysis, then, is to reconsider the equity market in terms of the various ways that all its subgroups move simultaneously—that is, to measure the risk in the equity market in terms of constructs—and then to classify different periods in the market based on them.

To discuss the PCA results, we introduce two terms: loadings and eigenvalues. Recall that PCA is a method of data transformation. In this context, loadings can be thought of as the blueprints for that transformation. Literally, they are weights or instructions for the recombination of observable variables into constructs. That is, a construct is built algorithmically: each observable variable contributes to each principal component to some defined extent—positively, if it is positively related; negatively, if it is negatively related; and negligibly if it is unrelated.

The loadings are the key to interpreting what each component represents. If a principal component's loadings make sense—if they are statistically robust, recognizable, and meaningful—we can choose to retain a component as a factor which, in short-hand, means to attach a label to it. The loadings from the sector dataset are shown on the next page in Figure II.

The first principal component, Broad Market Advance/Decline, represents all sectors moving in the same direction. In other words, to the extent that there is a single factor (construct) that has this effect on all sectors within the S&P 500, this can be considered its representation.

It is worth emphasizing that while PCA as performed on any specific dataset is objective and has a single solution, the retention and naming of the resulting factors, i.e., the principal components, is subjective. In this case, however, a single criterion separates the first component from all of the rest: all 10 sector loadings have the same sign. We choose to call this "Broad Market Advance/Decline," because unidirectionality is a property of the first, and only the first, principal component. Every other one—that is, the second through tenth components—represents some force of opposite movement exerted simultaneously on different sectors.

For example, the second component, Defensive/Cyclical Rotation, is composed of three traditionally defensive sectors advancing (utilities, consumer staples and healthcare), and three cyclical sectors simultaneously declining (information technology, consumer discretionary and industrials). This factor is fairly recognizable as a defensive/cyclical industry rotation. Again, in contrast to the first component, which represents unidirectional movement, this second component represents a form of opposite movement among different sectors.

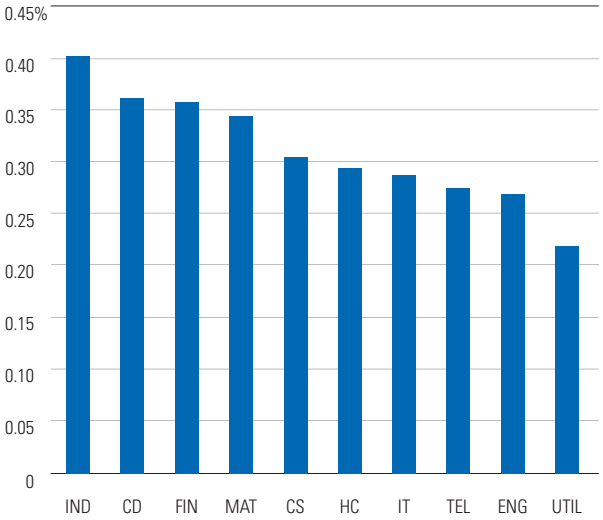
The first principal component is closely related to degree of correlation in the market: the more correlated underlying equities (and therefore, sectors) are, the more they will move together.

FIGURE II

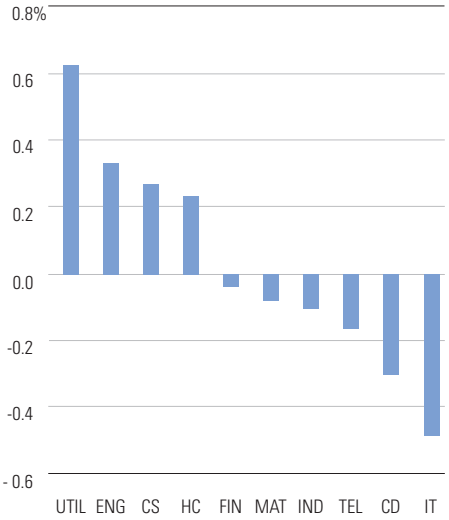
Principal Components of S&P 500 Index/GICS Sector Returns

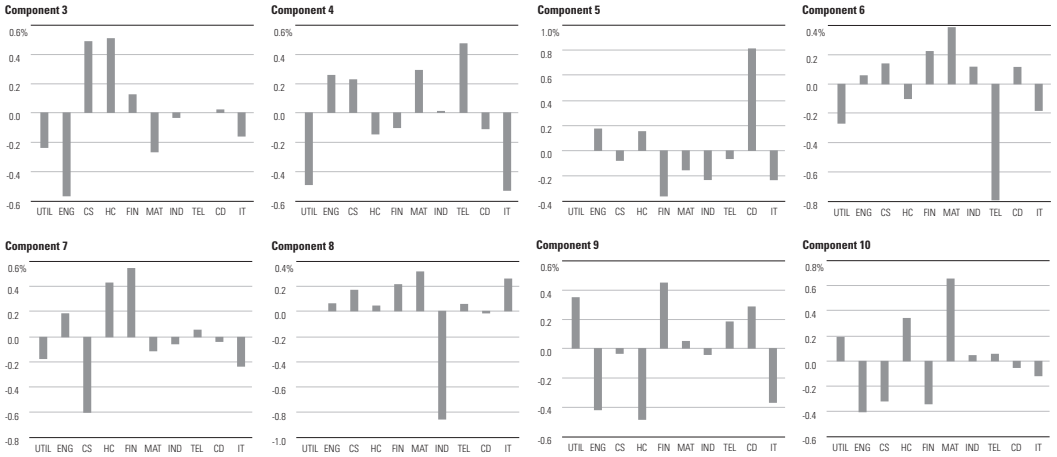
October 1989–June 2010

First Principal Component: Broad Market Advance/Decline



Second Principal Component: Defensive/ Cyclical Rotation





	Eigenvalue (%)
Broad Market Advance/Decline	57%
Defensive/Cyclical Rotation	12%
All Other Components	
Component 3	9%
Component 4	7%
Component 5	4%
Component 6	3%
Component 7	3%
Component 8	2%
Component 9	2%
Component 10	1%
	100%

Sources: Commonfund, Bloomberg

There are eight additional principal components as constructed from this dataset in decreasing order of explanatory power. It is worth observing again, as represented in the gray columns, that all eight of these have in common some form of opposite movement among sectors. That is, within the risk factor represented by each component, one or more sectors will advance while one or more other sectors decline.

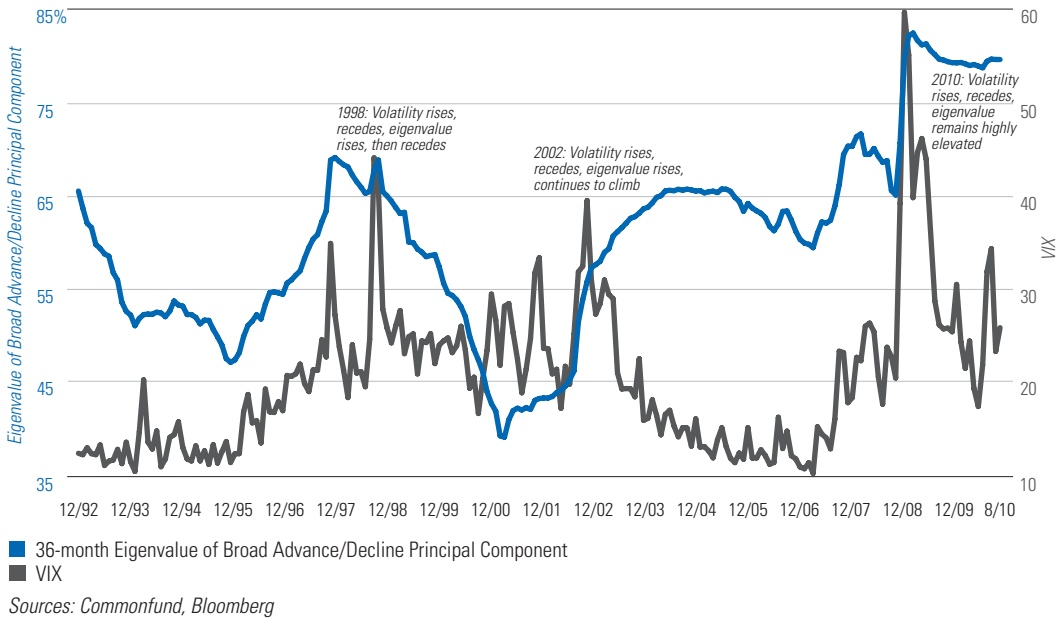
The second result from PCA we are interested in is the eigenvalues. Eigenvalues, when expressed as a percentage, represent the proportion of a dataset's total variance that individual components account for. Together, they add up to 100 percent. If the Broad Advance/Decline component's eigenvalue were 100 percent, the statement "You can go long (short) anything and make money" would be entirely true.

In the actual data, the eigenvalue of the first component (Broad Advance/Decline) is 57 percent for the entire period shown. But its prevalence over other forms of movement (represented as other components)—that is, the share of total—is far from constant. Measuring this fluctuation presents a methodological challenge, and there is no ideal way to do it while preserving the original loadings of the entire dataset. However, with minimal compromise, the same method of PCA can be applied repeatedly over rolling periods, to smaller time-sections of data—in this case, we can use daily returns from 36-month periods (exponentially weighted to give more influence to more recent observations). Over time, the sector data's first principal component consistently approximates the same construct: unidirectional, broad advance/decline, the force of the values of all equity subgroups changing in the same direction. Likewise, the remaining lower components consistently represent various forms of relative value, in which different sectors are simultaneously pushed and pulled in opposite directions. Therefore, the first principal component's eigenvalues as recalculated in rolling 36-month windows can be used as a sort of moving barometer of the market environment, specifically with regard to the prevalence of "everything going up (down)." It follows that, as correlations build among subsets within the market, this eigenvalue would climb as a proportion of the total. With this metric, we move a step closer to accomplishing what we initially set out to do, which is to formally classify equity opportunity sets.

FIGURE III

Related but Not the Same: Broad Advance/Decline Eigenvalue and Equity Volatility

December 1992–August 2010



Sources: Commonfund, Bloomberg

The Dominance of Broad Advance/Decline Over Other Forms of Sector Risk Fluctuates

As Figure III demonstrates, the proportion of aggregate risk within the S&P 500 that can be attributed to the Broad Advance/Decline principal component is not constant. Measured in rolling 36-month windows, it has ranged from a low of about 40 percent in the 36-month period ending in 2001 to about 80 percent more recently. In fact, the most recent observations are historically elevated, as they have been since the onset of the banking crisis in 2008. The increase in October 2008 is comparable only to the LTCM/Russian Debt Crisis in August 1998; unlike in 1998, however, it has not subsequently returned to pre-crisis levels. (See also Figure VI in Appendix I using Kenneth French's 10-sector data series, which begins in 1966.) This suggests at least one meaningful attribute of the U.S. equity market in the recent past: it has been dominated by the force of broad advances and declines. Correspondingly, sector selection has comprised comparatively little of it (in terms of principal components, we might say the eigenvalues of other principal components, 2–10, have been smaller). As a contrast, consider the period of 2000–2001, when less than half of equity risk in the period was attributable to unidirectional movement among sectors. Instead, during that time, the majority of risk came from various forms of opposite movements among sectors. Clearly, the active manager's opportunity set can differ quite a bit in this respect.

It is also notable, looking at the chart, that the Broad Advance/Decline eigenvalue is related to, but distinct from, equity volatility itself. Sudden increases in volatility are indeed associated with the eigenvalue spiking upward, consistent with the notion that in periods of stress "correlations go to one" (when correlations among equities climb, the first principal component's eigenvalue, representing the dominance of unidirectional movement, also rises). However, what happens to these same properties of the opportunity set when volatility falls again varies. In some periods, volatility declines and the eigenvalue follows (1998 is an example). In other cases, volatility remains elevated for a time but the eigenvalue falls (2000–2002 is an example). And in still other cases, volatility declines from its peak in the period after a large increase but the eigenvalue remains elevated (with the most recent period from 2008 to 2010 as an example). In other words, while the relative dominance of broad advances and declines over other forms of risk does tend to climb in tandem with heightened volatility, it may or may not subsequently fall with it.

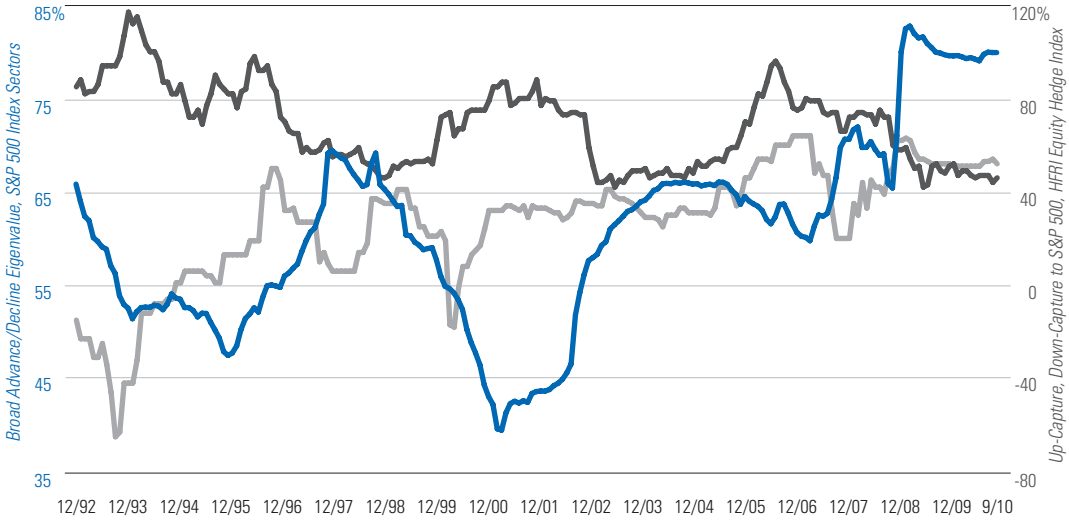
What are the implications for equity hedge funds? In Figure IV, we align eigenvalues of the sector dataset's first principal component (Broad Advance/Decline) with up- and down-capture ratios of the HFRI Equity Hedge Index for the same three-year periods. The relationship is clearly negative. When the eigenvalue increases, up-capture tends to decline and, during these same periods, the "cost" of that up-capture in terms of down-capture tends to increase. In fact, at the eigenvalue's highest elevations, reflecting the greatest degree of dominance of unidirectional movement over other forms of sector risk, the HFRI Equity Hedge Index's up- and down-capture ratios have converged to virtually 1:1, eroding all of its favorably asymmetric capture properties.

As an illustration of potential effects of these market conditions, we might consider the period 2000–2001, when volatility was elevated but the eigenvalue was low: hedge funds offered highly favorable capture ratios throughout this period. To contrast, there is the striking case of the most recent period, with historically elevated eigenvalues: up- and down-capture ratios over this period have converged, and even crossed. In other words, the HFRI Equity Hedge Index has produced about the same rate of down-capture as up-capture, reflecting adverse conditions for the strategy.

FIGURE IV

HFRI Equity Hedge Index Rolling 36-Month Up-Capture and Down-Capture to S&P 500 with Broad Advance/Decline Eigenvalue*

December 1992–September 2010



Sources: Commonfund, PerTrac, Bloomberg

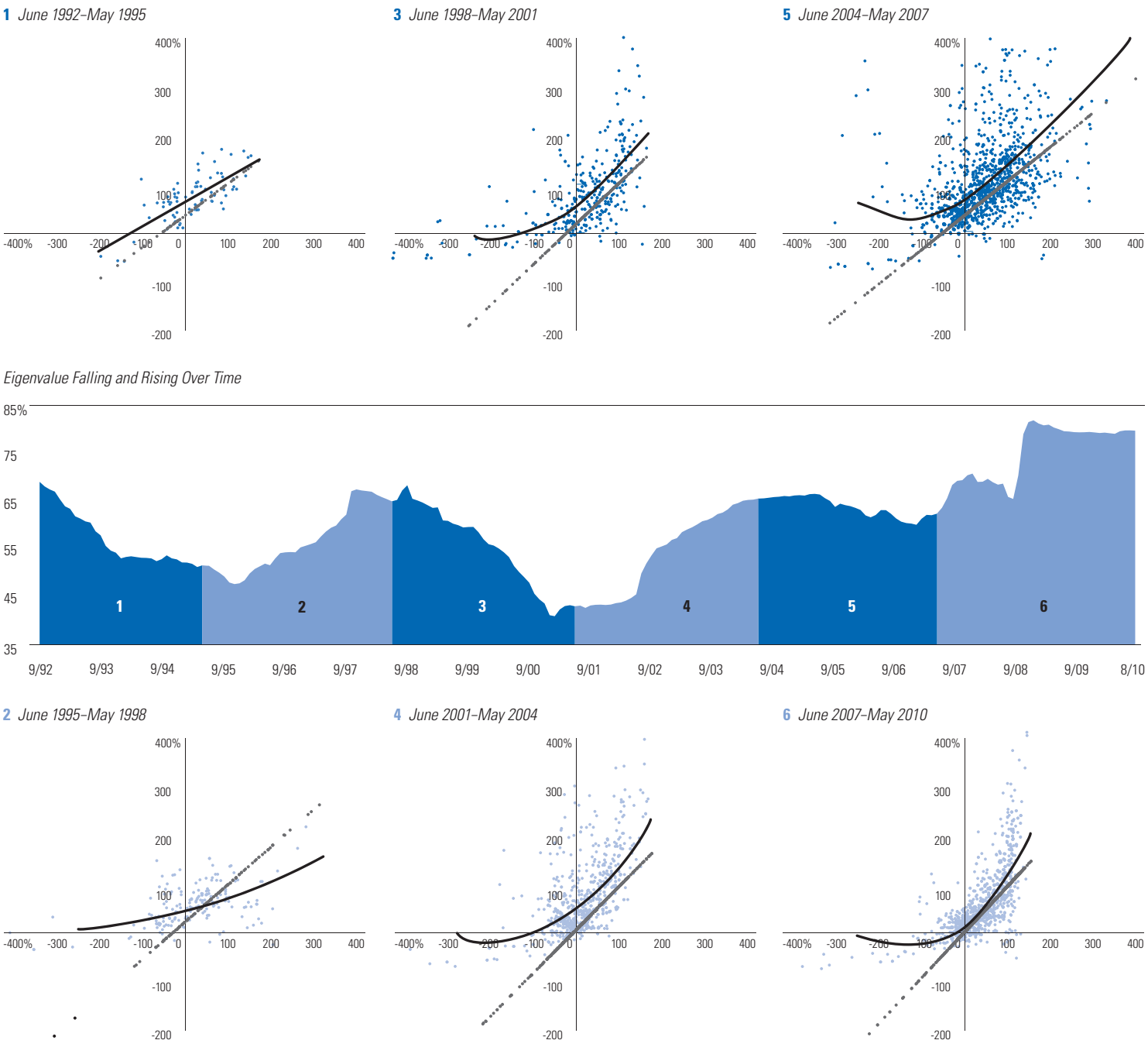
*Capture ratios and rolling eigenvalues are calculated using exponential weights to give more influence to recent observations; rolling eigenvalues are calculated using three-year windows of daily sector returns.

Capture Ratios Within the Index

Figure V suggests that an equity hedge fund investor has more favorably asymmetric exposure to the equity market—that is, that an investor "pays" less for its upside, in terms of downside—when the first principal component, representing broad advances and declines, explains less total equity risk.

FIGURE V

HFRI Equity Hedge Index Reporting Managers, Down-Capture (x) versus Up-Capture (y)



Sources: Commonfund, PerTrac, Bloomberg

But within the HFRI Equity Hedge Index, what form does the relationship between up- and down-capture tend to take, and how might we think about it on a prospective basis? To approach this question, we can turn to the universe of underlying reporting managers and chart them as pairs of achieved up-captures and achieved down-captures over different periods. The scatter plots in Figure V show these for each of six three-year time periods ending in May, from 1992 to 2010, with the periods marked by declining and rising broad market dominance.

In all time periods, observed rates of up-capture and down-capture are clearly positively related. This makes sense—hedge fund investors may gravitate toward higher rates of up-capture, but not, on average, without incurring some cost in terms of down-capture. In most periods, this relationship is non-linear; the reporting hedge fund universe presents opportunities for trade-offs between rates of upside and downside capture that are not best represented as some fixed percentage. That is, an increase in up-capture is associated with greater down-capture, but the increase is not a fixed multiple.

The table below presents the constant terms for each of the six trendlines shown in the scatter plots. The relationship between up- and down-capture changes in each period and the constant term for that period might be thought of as a measure of excess up-capture relative to the down-capture risk taken. In the three periods when the Broad Advance/Decline eigenvalue is falling, the constant ranges from 55 percent to 71 percent, and is 63.5 percent on average; in the three periods when this eigenvalue is rising, it ranges from 13 percent to 49 percent, and is 36.5 percent on average. The difference is consistent with what the index data suggests; the dominance of the Broad Advance/Decline factor has a significant effect on capture ratios. In particular, it is notable that for the most recent period, which is measured through May 2010 and is distinguished by an unusually elevated eigenvalue, the value of the constant term is the lowest for any observed period, at 13 percent.

TABLE I

Constant Term: Regression of Up-Capture Against Down-Capture

Three-Year Periods Ending in May

	Constant
Falling Eigenvalue	
1995	**64.4%**
2001	**55.3**
2007	**70.8**
Rising Eigenvalue	
1998	**47.9%**
2004	**48.6**
2010	**13.0**

Source: PerTrac

These regressions make a certain intuitive sense: if a manager produces a rate of up-capture greater than down-capture, it suggests some form of value in active management—at least, as compared to a passive index, which would presumably return the same percentage of the index's up and down returns (100 percent of each, for instance).

Another approach to the question of the prospective value of up- and down-captures, and the active management that they suggest, is given by Brian Jacobsen in "The Value and Price of Active Management."[1] Jacobsen applies a concept from option pricing, risk-neutrality, as a frame of reference for evaluating the capture ratios within a sample of mutual funds. In this context, an active manager can be thought of much like an option—that is, as an asset that will deliver a payoff of a certain percentage of the S&P 500's upside return (up-capture), with its cost further expressed as some percentage of the S&P 500's down returns (down-capture). Risk-neutrality is a hypothetical concept, but it is useful for providing some intuition about certain kinds of instruments, such as an option (in this case, a manager) on an underlying index that can take one of two possible paths with some probability.

In his sample, Jacobsen represents the S&P 500's upside and downside using the returns implied at .67 standard deviations above and below the mean (the mean is taken to be the risk-free rate, and the returns at .67 standard deviations are chosen to bookend 50 percent of observations in a normal distribution). The expected value of the "option" on these outcomes must rise with the risk-free rate, so that, assuming no change in implied volatility, the ratio of up-capture to down-capture should increase as the risk-free rate increases. For every observed down-capture, the fair value of up-capture is therefore calculated using both implied volatility and the risk-free rate. This method, then, gives us an alternate method of evaluating whether active management is reflected in capture ratios and how it is affected by market conditions.

In Figure V, we apply this method to the individual equity hedge funds reporting to HFRI. The line (in gray) on each plot defines the risk-neutral fair value of up-capture for each period, based on observed down-captures. An observed up-capture that falls above the corresponding gray line can be said to represent a surplus, by this measure.

TABLE II

Average Surplus Up-Captures by Risk-Neutral Method

Three-Year Periods Ending in May

Average in Periods with Falling Broad Advance/Decline Eigenvalue	Average Surplus
1995	27.4%
2001	52.1
2007	43.3
Average with Falling Eigenvalue	**41.0%**

Average in Periods with Rising Broad Advance/Decline Eigenvalue	Average Surplus
1998	13.4%
2004	51.3
2010	18.3
Average with Rising Eigenvalue	**27.7%**

Sources: PerTrac, Bloomberg

Within all time periods, a majority of managers produce some positive surplus, according to the risk-neutral measure. Again, however, the average surplus produced is significantly greater in periods with declining Broad Advance/Decline eigenvalue.

1 Brian Jacobsen, "The Value and Price of Active Management," paper prepared for Wells Fargo Funds Management, December 2009. http://SSRN.com/abstract=1528484

Regression

Finally, as a potentially interesting exercise, we can return to the Lost Decade. By applying the same separation of time periods that we used to look at capture ratios within the index (see Figure V on page 10), we can compare returns from periods 3 and 5, and 4 and 6, that fall within the decade of January 2000 to December 2009. Using a traditional 3 equity-factor regression that includes the S&P 500 as well as Fama/French factors HML (value) and SMB (small cap), we can note some important contrasts.

TABLE III

The Lost Decade: Falling Broad Advance/Decline Eigenvalue

	Coef	T	P
Alpha	0.79%	5.03	0.000
S&P 500	0.352	8.19	0.000
HML	-0.148	-4.05	0.000
SMB	0.296	6.20	0.000

R^2 (adj) = 81.3%

The Lost Decade: Rising Broad Advance/Decline Eigenvalue

	Coef	T	P
Alpha	0.17%	0.90	0.369
S&P 500	0.430	10.39	0.000
HML	-0.099	-1.95	0.056
SMB	0.193	3.18	0.002

R^2 (adj) = 70.4%

Sources: PerTrac, Bloomberg, Kenneth French Data Library

Most crucially, we note the difference in the alpha terms: in those periods when the Broad Advance/Decline factor explains increasing amounts of equity risk, the HFRI Equity Hedge Index produces an alpha of 0.17 percent after accounting for the S&P 500 Index, value, and small-cap factors. To contrast, for those periods when the same measure is falling, the alpha term is a substantially higher 0.79 percent. The increase suggests an intuitive, but nevertheless important conclusion: When the opportunity set for alpha grows, it is reflected in equity hedge funds' returns. Therefore, when we consider *why* up- and down-captures are sensitive to market conditions, it becomes important to think about different sources of return for an active manager, and the opportunity set for security selection.

Summary Review

In this paper, we have described some of the return properties of equity hedge funds that suggest an effect of active management relative to a long-only equity index (here, the S&P 500). In particular, we have looked at the asymmetry in their returns, relative to the equity index's upside and downside, as represented in capture ratios. We have in particular looked at how these return properties change over time and at some factors that influence them. Some summary conclusions are below:

- Principal Components Analysis is a useful approach to measuring the dominance of Broad Advance/Decline, or unidirectional movement, as an equity risk factor. In this case, it is applied to U.S. equities as represented in GICS sectors.
- Measured on a rolling 36-month basis, the explanatory power of the Broad Advance/Decline factor as a percentage of total risk rises and falls, usually in somewhat cyclical fashion. When it is highest, it follows that sector selection is relatively less important for a manager's opportunity set; when it is falling, sector selection becomes more important. By inference, this level affects active management; hedge funds appear to have the best (i.e., most favorably asymmetric) up-/down-capture ratios when this measure is trending down.
- For the S&P 500, this same factor's importance is currently at a recent high, as it has been since the onset of the credit crisis in mid-2008. This suggests that the recent equity environment has been unusually dominated by broad advances/declines.

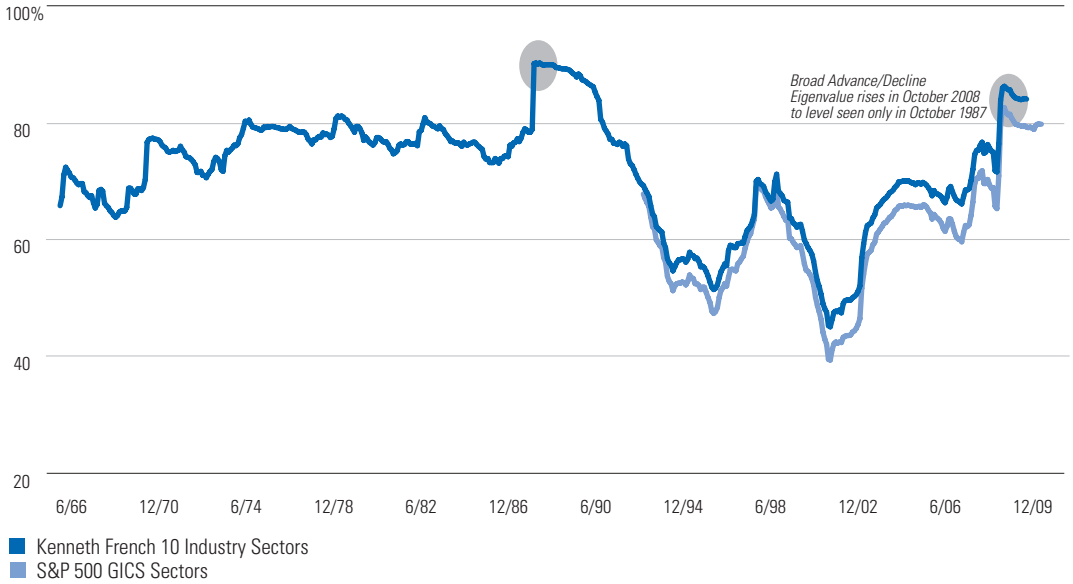
Appendix I

Elevated Broad Market Eigenvalue in Historical Context

FIGURE VI

Shock Persistence: First Principal Component Eigenvalues

1966–2009



Sources: Commonfund, PerTrac, Kenneth French Data Library

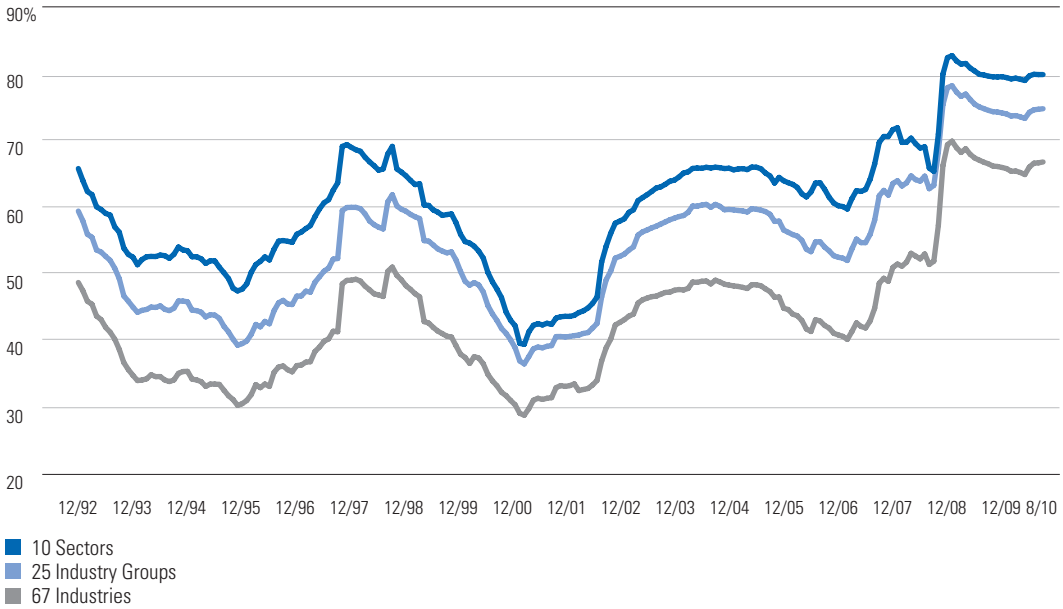
The eigenvalue of the Broad Advance/Decline principal component is at its highest level since 1987 and has remained elevated for an unusually long time.

What Applies to Sectors Affects Sub-Sectors and Sub-Industries As Well

FIGURE VII

Rolling 36-Month Portraits: Broad Advance/Decline as a Percent of Total Variance Within S&P 500 Index

December 1992–August 2010



Sources: Commonfund, Bloomberg

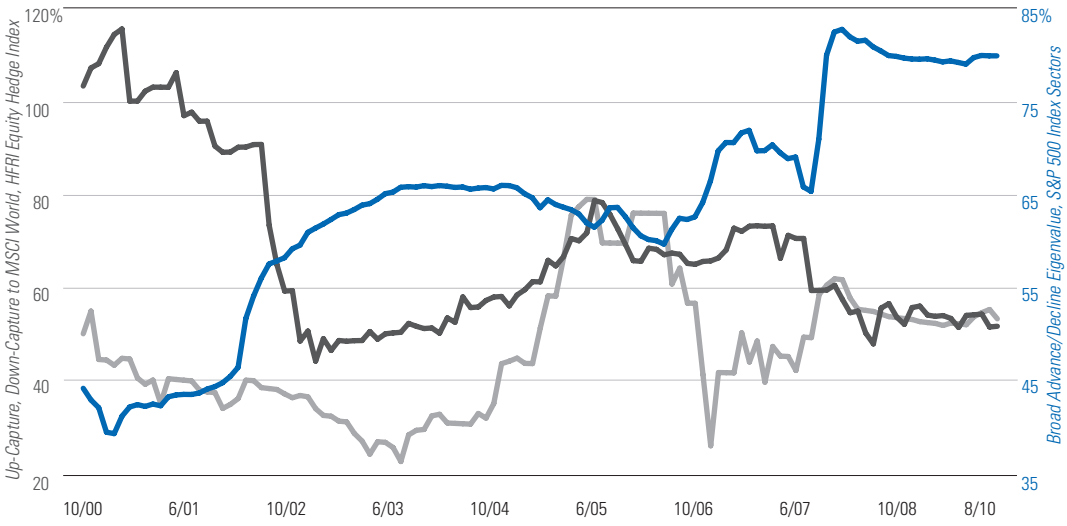
The progressively smaller levels can be interpreted as the amount of idiosyncratic risk introduced at each level of increasingly granular classification.

A Similar Pattern is Evident in the MSCI World

FIGURE VIII

Rolling 36-Month Up-Capture, Down-Capture versus MSCI World, HFRI Equity Hedge Index

October 2000–August 2010



Sources: Commonfund, PerTrac, Bloomberg

Appendix II

About the Authors

Kristofer Kwait

Kristofer Kwait is a Managing Director, Marketable Alternatives, and shares responsibility for portfolio analysis, manager identification, due diligence and investment monitoring. He is also head of quantitative research and is responsible for managing the team's analysts and overseeing the design and implementation of proprietary models for risk management, portfolio construction and manager analysis. Prior to joining Commonfund in 2001, Mr. Kwait was a proprietary fund manager at both Andover L.L.C. and A.B. Watley. Prior to his experiences as a relative value trader, he was a stockbroker at Smith Barney. Mr. Kwait attended pre-college at Juilliard School of Music, has a B.S. from Purdue University and has a M.B.A. from Yale University.

John Delano

John Delano is a Director, Marketable Alternatives. As a member of the Marketable Alternatives Team, Mr. Delano is responsible for quantitative analysis of our funds and managers. Before coming to Commonfund in 2005, he had been a consultant in Global Public Opinion Research at Altria Corporate Services, and a research assistant at Columbia University's Institute of Social and Economic Research and Policy. Prior to that, he worked as a media buyer at Horizon Media, using statistical analysis to forecast audience deliveries for television commercials. Mr. Delano has a B.A. in Political Science from the University of Chicago and an M.A. in Quantitative Methods in the Social Sciences from Columbia University.

Appendix III

About Commonfund

Founded in 1971, Commonfund is devoted to enhancing the financial resources of nonprofit institutions and corporate pensions, as well as family offices, through superior fund management, investment advice and treasury operations. Directly or through its subsidiaries—Commonfund Capital and Commonfund Asset Management Company—Commonfund manages approximately $25.5 billion for about 1,580 educational institutions, foundations, healthcare organizations and other institutions. Commonfund, together with its subsidiary companion organizations, offers more than 30 different investment programs. All securities are distributed through Commonfund Securities, Inc. For additional information about Commonfund, please visit www.commonfund.org.

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