April 17, 2009

Global Portfolio Analysis

Why Shorts Aren't Longs: Stockpicker's Reality Part IV

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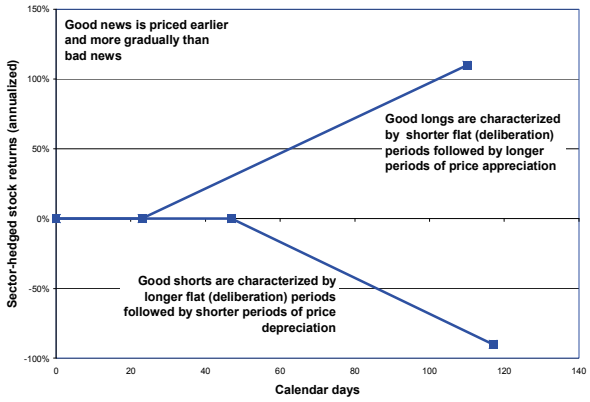
This paper is the fourth in a series examining the dynamics of stock picking. It addresses the question of what makes short investing different from long investing, and how each leg of a portfolio should be managed.

We find that an accurate view of forward fundamentals is equally valuable in the construction of both long and short equity portfolios. Yet the flow of information about fundamentals is different for longs and shorts – good news arrives sooner and in an orderly fashion, while bad news comes to market much later in bursts. Good longs therefore tend to generate returns over time, while good shorts tend to generate returns all at once. In contrast to equity specific news flow, good and bad macroeconomic news comes to market and gets priced in at a similar rate.

As a result, we recommend that short portfolios be comprised of more and smaller positions than long portfolios, as simple diversification for shorts is more effective then either concentration or active position management. Managers who take concentrated short positions are likely to benefit from activism – actions that bring valid negative information to market quickly. Additionally, the orderly and reinforcing flow of good information makes price momentum important for longs but it should not be used as a signal for shorts.

Average return profiles of good longs and good shorts show different pricing dynamics of fundamental news: early and gradual for good news, later and more rapid for bad news



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Global Portfolio Analysis: Stockpicker's Reality

This is the fourth paper of this series about the dynamics of stock picking.

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A brief summary of each is available at the end of this report and the full text of each is available on the Goldman 360 website for those with access. https://360.gs.com

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Introduction: what makes shorts different from longs?

As anyone who has managed a long-short portfolio knows, longs rarely behave the same way as shorts. Yet it has never been clear exactly why this is the case, or what should be done to adjust for these differences in behavior. This paper addresses the question of what makes short investing different from long investing, and how each leg of a portfolio should be managed. The results of our analysis have important implications for portfolio management.

Fundamental insights matter. First, we find that an accurate view of forward fundamentals has roughly the same ability to drive alpha on both the long and the short side of the portfolio.

Good and bad news flows about fundamentals have very different arrival rates.[1] The core difference will surprise no one: good news arrives sooner and in an orderly, consistent fashion, while bad news comes to market much later and in bursts, rather than diffusing over time. This may be explained by the incentives company managements have to make good information public quickly.

Differences in good and bad news flow have important portfolio management implications. From a classic growth investing perspective, longs can be more easily managed. Positions can be built over time and concentrating in winners tends to add to returns. Shorts are often harder to manage. Positions that are built early may require a high tolerance for pain, as losses tend to precede gains. Gains may also occur all at once, making it harder to add to winners. From a value (or mean-reversion) investing perspective, the same information diffusion patterns arise, but in a somewhat different form. When stock prices diverge from fundamentals, longs tend to mean revert quickly and smoothly. This is because good information comes to the market in an orderly and reinforcing fashion. Shorts, on the other hand, often experience a pause for a random length of time. This is because negative information comes to market reluctantly. As such, a similar tolerance for pain is required for short value investing as for growth investing.

The role of momentum is different for longs and shorts. This also stems from the asymmetry in good and bad information arrival rates. Positive news comes in an orderly fashion over time, and therefore tends to get priced in by increasing portions of the market. This creates a positive correlation in returns. Being moderately late, or exiting a winning position prematurely, is still profitable. Negative momentum signals also add value for longs, as unjustified negative price action in a stock is met by rapid information flows and a quick reversion to the mean. On the short side, however, the random arrival of bad information requires a more disciplined approach. Momentum signals have little, if any, value. Because shorts tend to be re-priced all at once, being late or exiting early hurts short returns more than long returns.

Short positions have more idiosyncratic risk during the period before information about fundamentals becomes well known. As a result, short portfolios should contain a greater number of positions and require more frequent rebalancing than long portfolios. This implies that short portfolios may benefit from quantitative management. Further, it suggests that fund managers who want to take concentrated short positions will benefit from activism – they are more likely to be successful if they help drive the flow of **valid** information to market.

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[1] It could be argued that information absorption is a separate process reflecting how announced information spreads through the market. Throughout the main body of this paper we make no attempt to separate the arrival and absorption processes. However, the model developed in Appendix E uses both the rate of information arrival and the rate of absorption to illustrate the pricing asymmetry of good and bad news, and the need for greater diversification in shorts.

We develop these arguments in the following sections, beginning by demonstrating that the patterns of returns for longs and shorts are consistent with different information arrival processes. Then we consider the return patterns for growth and value insights asking if the timing of payment for these fundamentals is consistent with the information process we describe. We also consider the role price momentum plays in these fundamental strategies. The last section presents our recommendations for portfolio construction and management in light of our findings.

Returns are gradual for longs and fast for shorts

Financial markets assign prices to assets by (theoretically, at least) instantaneously and accurately assessing all available information. This, in turn, means that asset price patterns reflect information arrival patterns. Thus, any asymmetry between stock price appreciation and depreciation has to come from the differences in the arrival patterns of relevant information.

Eventually, the market clears at the price that fairly reflects the quality of a given company's earnings, as well as the market's appetite for risk and the macroeconomic environment. This simply means that, given enough time, the information arrival process has no real impact on the final stock price. But it does affect the path that the price takes in the transition period. So, the study of asymmetries between "good" and "bad" stocks becomes a study of differences in price patterns as information arrives to market over time.

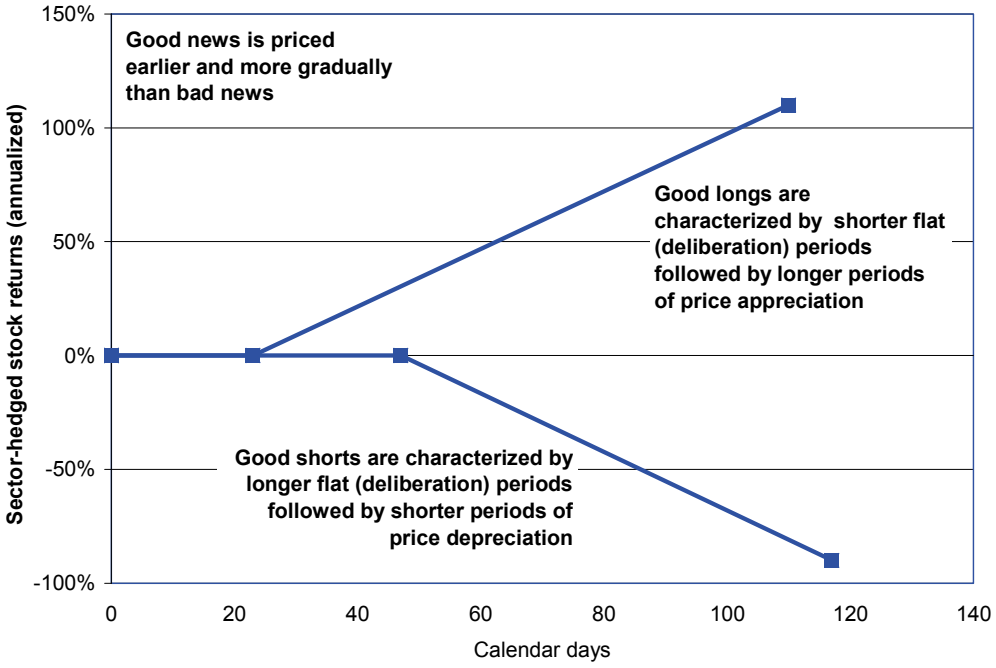
Our approach in this study is to identify a collection of stocks where the stock specific performance is positive and another where it is negative. Using this sample we look for evidence in the return patterns that good information comes to the market earlier and in smaller increments than bad. The data sample is the 4,000 largest US stocks by market capitalization each quarter from 1990 through 2008, a sample of approximately 13,000 different stocks. Regressions against sector returns remove the macro component and a filtering process identifies stocks which net of macro trended up (good longs) and those which trended down (good shorts).[2] The procedure also allows for a flat period before the price movement, reflecting the uncertainty while the validity of price action is being assessed.

Exhibit 1 presents the performance profile over time for the good longs and good shorts based on the stock specific portion of the return. It shows the average duration of the flat period and the average duration of the appreciation/depreciation period along with the annualized average stock return. The typical good long remains flat relative to its sector (beta hedged) for 23 days. In contrast, the good short stays flat for an average period of 47 days. This is why we say that good news is priced in earlier than bad news. Positive news starts as an indication of a possibility and is gradually confirmed with more and more evidence until it is reflected in the fundamentals of the company and is fully priced. By contrast, negative news is avoided until the facts must be announced.

The overall period of the price adjustment including the flat period is somewhat longer for negative news (47+70=117 days vs. 23+87=110 days for positive news), but the difference in the lengths of the flat periods is much more striking. Put simply, the payout for longs begins about a month earlier than for shorts and lasts about twice as long.

[2] The appendices at the end of the paper detail the full process described here. Appendix A describes the construction of the dataset used throughout the paper. Appendix B explains the regression process for separating stock-specific and macro returns. Appendix C presents the details of the filtering algorithm and the identification of price patterns.

Exhibit 1: Average return profiles of good longs and good shorts show different pricing dynamics of fundamental news: early and gradual for good news, later and more rapid for bad news

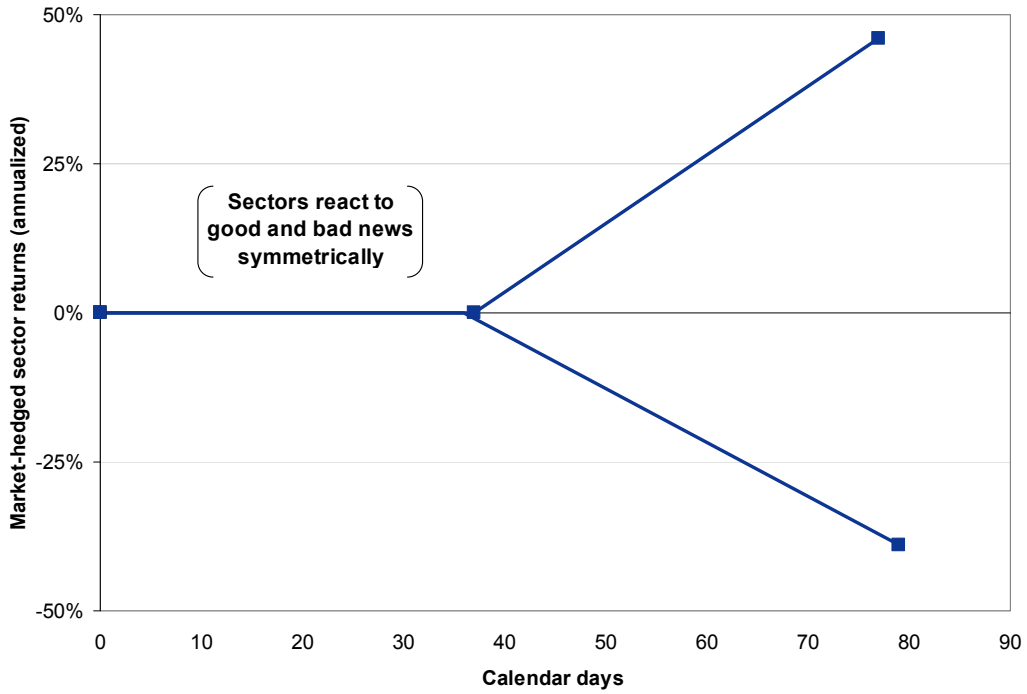


Source: Goldman Sachs Research.

Our hypothesis is that company managements have an incentive to disseminate and reinforce good news as opposed to bad, and that this dynamic underlies the asymmetry we observe. If this view is correct, we should expect macroeconomic news impacting large collections of stocks to be priced in a symmetric pattern, regardless of whether it is good or bad news. Exhibit 2 applies the same technique to the sector related portion of the return as a proxy for the macroeconomic component of stock movements. Simply put, we ignore the stock-specific component of the returns and look at the sector-driven component hedged with the market. Macro news identified in this way shows a remarkable degree of symmetry. The flat period for longs and the shorts is nearly identical at 40 days.

These differences in the pricing of good and bad news are an average across the 19 years in our sample. Given the current weak economic outlook, it is interesting to examine bear markets separately. As shown in Exhibit 3, good news arrives sooner than bad in both bear and bull markets, but the difference in the time for the market to price positive and negative information is smaller (approximately 25%) in bear markets. This is consistent with the idea that companies are more forthcoming about bad news in periods of high economic and market stress.

Exhibit 2: Good and bad macro news priced symmetrically



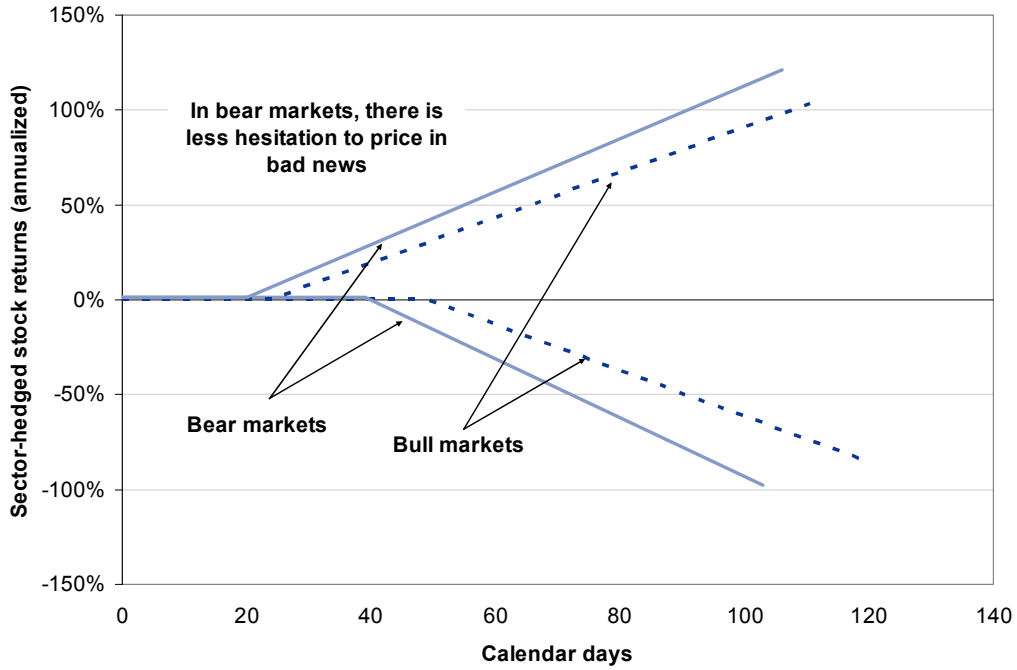
Source: Goldman Sachs Research.

The numerical values presented depend on the parameterization of the filtering algorithm, but the overall result is robust. The arrival of positive stock specific information – and, as a consequence, price appreciation – is mostly gradual, preceded by shorter deliberation periods of price stability, while the negative stock specific information – reflected in price declines – arrives abruptly, preceded by longer periods of price stability.

Our initial intuition was that larger companies would be more transparent and exhibit less differential in the time it takes to price good versus bad news. But performing this analysis on each quartile of market capitalization separately revealed that the asymmetry between good news and bad news is roughly constant across quartiles of market capitalization. The flat period is approximately twice as long for a good short relative to a good long and this is equally true for the largest quartile of companies as for the smallest. It appears that the same force that creates asymmetry between good and bad news is in action regardless of the company size.

Lastly, the timing differences presented here imply that short positions may benefit from explicit strategies to limit losses. The delay in pricing the fundamentals for shorts suggests that appropriately designed options strategies may be useful in protecting against losses, while the long portfolio, being closer to a continuous pricing of a news flow, does not need similar insurance.

Exhibit 3: Bad news priced more aggressively in bear markets but asymmetry remains



Source: Goldman Sachs Research.

A question of style

Our hypothesis is that the asymmetries discussed above result from the information flow about the company and hence we expect to see similar evidence in strategies based on fundamentals. In this section we focus on two common investment styles, growth and value. We examine how the profitability of a long (high growth or low P/E) strategy compares to that of a short (low growth, high P/E) strategy and how each strategy behaves in advance of the quarter where the fundamentals are realized. In lieu of the filtering process used in the prior section we construct the long strategy from the top quintile of stocks based on the specific metric relative to the equal-weighted market index. The short strategy is the mirror image: a long position in the market and a short position in the bottom quintile of the value or growth metric.

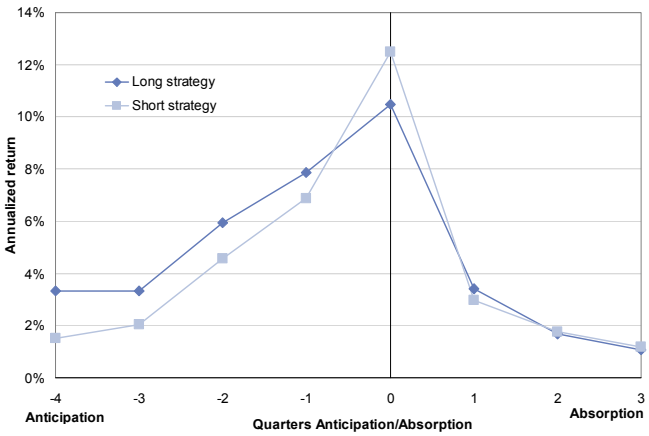
We know from prior work that without anticipation – that is, accurately forecasting earnings, buying the best stocks, selling the worst stocks, and holding for a quarter – the returns for the long and short portfolios will be roughly the same. But what happens if we transact in those same portfolios earlier? Specifically, does the market pay earlier and more smoothly for longs relative to shorts?

The broad finding is that while insights about the current quarter are priced symmetrically for longs and shorts, anticipation of fundamentals up to several quarters in advance is rewarded more strongly for longs than for shorts. In other words, high growth and value are rewarded in advance but there is little if any anticipation of bad news. Thus, long positions relative to the market have positive carry while short trades have negative, making longs much easier to hold.

Turning to the specific results for growth, Exhibits 4 and 5 show the quarterly return of each strategy over time. The horizontal axis represents the forecast horizon with zero

being the quarter matching the fundamentals, negative numbers corresponding to the number of quarters in which the fundamentals are anticipated and positive numbers representing the number of quarters after the fundamentals are realized. The vertical axis represents the annualized return of investing in best (worst) stocks and holding them for that quarter relative to an equal weight portfolio of the full universe, which removes the macro component from the performance.

Exhibit 4: Anticipation of strong earnings growth worth more than anticipation of weak growth



Source: Goldman Sachs Research.

Exhibit 5: Long growth strategy outperforms the short strategy across all segments of market capitalization

Stock size	Anticipation length				Average
	4 quarters	3 quarters	2 quarters	1 quarter	
All	1.8%	1.3%	1.4%	1.0%	1.4%
Large	1.8%	-0.2%	0.5%	-0.1%	0.5%
Mid	4.2%	1.8%	1.0%	0.3%	1.8%
Small	2.1%	1.1%	2.4%	-1.4%	1.1%
Micro	-2.1%	1.3%	0.5%	4.8%	1.1%

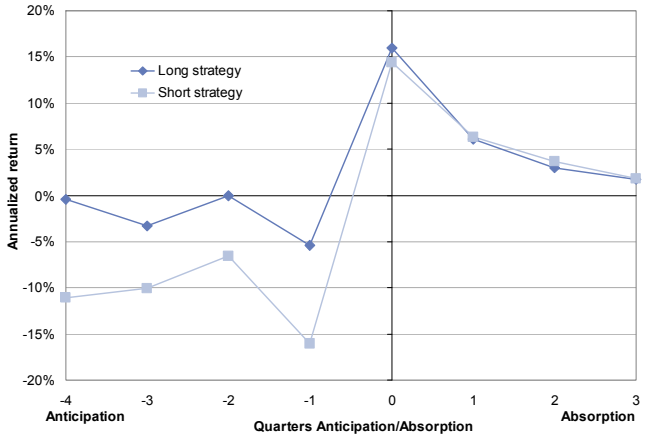
Source: Goldman Sachs Research.

For example, buying the top quintile of realized growth at the start of the quarter and selling it at the end of the quarter produces an annualized return of 10.7% over simply being long all the stocks. The lowest growth quintile underperforms the average by 12.4% when held for the one quarter; note that we show this as a positive number to provide comparability between the low and high growth portfolios. Particularly relevant to our study is the fact that anticipation of high growth (the left-most portion of Exhibit 4) generates consistently higher results than anticipating the slow growth companies. And the outperformance is apparent even several quarters in advance. We explain this outperformance, again, by the higher transparency of good news relative to bad, and the resulting impact on prices.

Exhibit 5 shows the performance spread between the strong and weak growth strategies across four size classes (micro-, small-, mid-, and large-capitalization). Note that this spread is not the return to the long-short strategy but rather a measure of whether the highest growth companies outperformed the market by more than the low growth underperformed. The largest size class shows less of the effect, perhaps reflecting a higher degree of transparency, but the important result is that the difference is seen throughout the size distribution.

Exhibits 6 and 7 repeat the analysis using price/earnings to classify stocks. The ratio uses earnings per share (excluding extraordinary items) announced at the end of the quarter and the share price at the beginning of the quarter in the stock selection process. In this way, we focus on how the stock price adjusts to the actual earnings. The dark line in the exhibit is the performance of the least expensive stocks relative to the equal weight market, and the light line is the performance of the most expensive. Over the quarter of the actual earnings announcement – the zero point on the horizontal axis – each of these strategies generate approximately 15% annualized returns, on the same order as the perfect foresight growth strategies we discussed earlier.

Exhibit 6: Long value opportunities price more smoothly than short



Source: Goldman Sachs Research.

Exhibit 7: Difference is greater for smaller companies and tends to be largest in the quarter immediately before the earnings announcement

Stock size	Anticipation length				Average
	4 quarters	3 quarters	2 quarters	1 quarter	
All	10.6%	6.7%	6.6%	10.6%	8.6%
Large	7.7%	6.5%	5.6%	5.7%	6.4%
Mid	15.4%	-0.6%	2.1%	5.6%	5.6%
Small	5.1%	10.9%	7.8%	2.4%	6.5%
Micro	14.3%	10.3%	10.8%	28.8%	16.0%

Source: Goldman Sachs Research.

Looking at the earlier quarters, one cannot help but notice that owning stocks as they become inexpensive results in negative returns. However, the point is not the level of the returns but rather, as with the growth strategy, that the spread between the long and the short strategies is positive across several quarters of anticipation. Over the quarters before the earnings are announced, the equities that are inexpensive earn the market return or a little less. However, shorting the expensive stocks early produces a loss of several percent per quarter, on the order of 10% on an annualized basis. There is a clear tendency for stocks that are expensive relative to their earnings to remain highly priced for an extended period of time – usually up to the point when the market reconsiders the fundamentals and the price plummets, a pattern of lengthy appreciation and sudden collapse.

The difference between longs and shorts is even more apparent in Exhibit 7, which focuses on the spread between the two sides, arguably controlling for the selection effect, across different horizons and slices of market capitalization. Again there is evidence of differences in information diffusion between longs and short. Our interpretation is that the knowledge that a company's earnings are in fact solid is priced into the market more smoothly and with greater foresight than in instances when a company's price is not justified by its earnings.

Building momentum into the portfolio

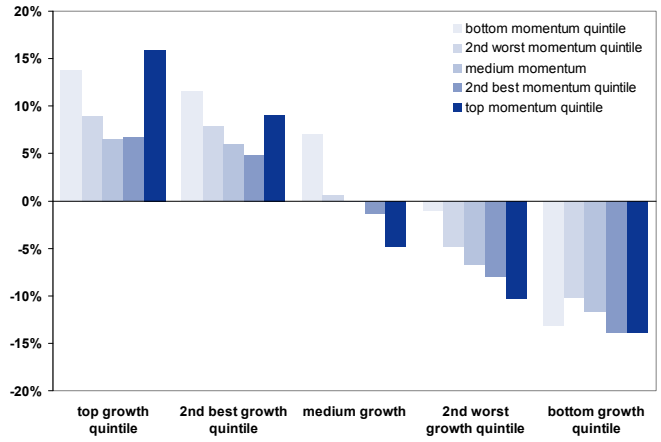
In this section we address the question of what role price momentum plays in constructing long and short portfolios. The answer we offer is that it is asymmetric – momentum plays an important role in constructing a long portfolio, and a small part, if any, in constructing the short. Moreover, this asymmetry is consistent with our main hypothesis that good news arrives gradually and over a period of time, and the bad news arrive in bursts.

Theoretically, price momentum should not play a role in stock picking, with market efficiency ensuring that all available public information is instantaneously, and correctly, priced in. This is indeed how the bad news appears to affect stock prices, as we will demonstrate further on. The best shorts are largely independent of the previous price momentum, regardless of the investment style, as if the market considered the price before the announcement of bad news as fair, and then repriced quickly as the fundamental weakness is revealed.

This is however not what we see in stocks with strong fundamentals. As a matter of fact, we identify two distinct forces are at work, both related to the price momentum. First, there is serial correlation in the information flow with "soft" news (company commentary, business expansion plans, guidance, etc., as well as building/unwinding of a large position) preceding "hard" news (sales, orders, earnings, etc). The sequential pricing of this information results in positive price momentum. Second, the hard information provides an anchor that characterizes fair value for the stock. Thus, upon the revelation of "hard" information, we may see either a price reversal or a continuation of the price momentum, depending on which side the market erred while pricing the "soft" information.

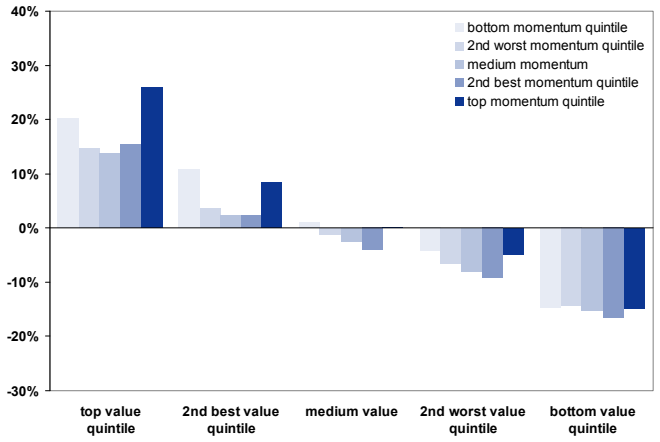
Consider now Exhibits 8 and 9, where we show the growth and value performance broken down by fundamental signal strength and by the price momentum of the prior quarter.

Exhibit 8: Price momentum impact on growth strategy



Source: Goldman Sachs Research.

Exhibit 9: Price momentum impact on value strategy



Source: Goldman Sachs Research.

On the long side (left side in Exhibits 8 and 9, corresponding to the top quintile in growth and value), we observe a "bowl"-shaped return profile to price momentum; the stocks with the most extreme moves last quarter — positive or negative — and solid fundamentals perform the best. Our interpretation is that stocks that recently turned down tend to rally as the positive news is revealed, which is intuitively clear. But also, the stocks that have already rallied tend to rally further as the news is reinforced. Stocks with strong fundamentals but little prior movement underperform, forming the bowl shape. We see this pattern most pronounced in the top two quintiles of both the growth and value strategies. These momentum effects are seen when stocks are grouped by market capitalization as well, and is more prominent in the smaller stocks. This is consistent with the theory that they are the least transparent, and thus have a delayed transmission of news making them benefit the most from momentum.

In contrast, performance in the short portfolio (right side in Exhibits 8 and 9) is less connected to prior price movements. Within the bottom quintile of the value and the growth strategies, the performance is roughly constant across the quintiles of price movement. There is some evidence of price reversion where the best performing stocks under perform the worst from the prior quarter but the effect is considerably less pronounced than the patterns observed in longs.

Implications for portfolio management

While there are many sources of alpha, fundamentally driven stock picking largely divides into two conceptual processes. The first process is recognition of price swings that are not warranted by fundamentals, and subsequently positioning for the mean reversion to the true underlying value. The second process is the recognition of a change in the underlying value of the company (the structural change story) that the market refuses to fully price due to some form of persistent skepticism, which leads to serially correlated returns as the market slowly realizes the full extent of the created value.

The main difference in managing long and short positions that we present in this paper is that, on the short side, these two processes are much less distinct and orderly. While long and short positions require essentially identical fundamental analysis creating similar potential alpha, portfolio management of longs and shorts should in most cases be quite different. Because of the somewhat disorderly way in which shorts deliver value, they should be managed either quantitatively – smoothing, at the portfolio level, the disorderliness on the stock level – or with concentrated portfolios with a high tolerance for pain and a willingness to actively engage in educating the market about true underlying fundamentals. On the other hand, the orderliness of longs suggests a moderately concentrated portfolio.

Appendix

A. Data sample

Our dataset contains quarterly data, from 1Q1990 to 4Q2008, on the 4,000 largest (by market capitalization) US companies, with additional screening on earnings and price. We started by considering all US companies in the Compustat universe each quarter, and screened for penny-stocks and negative earnings. We dropped all stocks whose average price during the quarter was below $5 to avoid the outsized returns penny stocks often experience. As most of our analysis is based on simple averaging of various performance measures the extreme behavior of unlisted, illiquid stocks must be eliminated. Next, we dropped all stocks with negative earnings in the current and previous quarter, thus avoiding difficulties in computing earnings growth. While the analyses that do not depend on earnings growth (including the time durations analysis of Section 2 and value portion of Sections 3 and 4) could include negative earnings, we preferred to base all the results on a consistent data set. Including the companies with negative earnings in the duration analysis of Section 2 produced results essentially identical to those of the restricted dataset.

After this screening, we selected the largest 4,000 companies (by average market capitalization, computed as a product of shares outstanding and the average price throughout the quarter), resulting in a total of roughly 13,000 companies in the entire dataset, across all quarters. We further categorize these 4,000 companies into four equal size buckets (large-, mid-, small- and micro-capitalization).

B. Separating the stock specific return from macro and market forces

The main thesis of this paper is that there is a substantial time difference in the stock-specific information flow and resulting market reaction depending on whether the news is good or bad. This requires that we separate the price drivers that are not stock-specific, such as macro information and market trends.

A simple way to extract the stock-specific portion of returns is to regress the stock return on the sector return, and treat the residual of this regression as the stock-specific portion. For each stock we perform a regression using weekly returns and define

Stock specific component = Stock return - β Sector return

Sector component = β Sector return

where β is the regression coefficient for each stock.

We further break down the sector component into a macro component and a market component by regressing the sector component on the market return and define

Macro component = Sector component – γ Market return

where γ is the stock specific regression coefficient. Neither of the regression models includes an intercept. This process produces an estimate of the stock component, the macro (or sector component), and the market component of each stock.

C. Identifying stock price patterns

In this Appendix we detail the pattern identification process used to characterize discrete periods of price stagnation (flat), appreciation (up), and depreciation (down) that underlie section 2. This is essentially a filtering problem, for we want to look at the price time history with a blurred vision that smoothes out the daily gyrations and extracts longer-lasting patterns. For this purpose, we employ a two step filtering process.

The **first step** is to apply a low-pass 2-sided window filter to the time series of stock specific returns. We apply a 10-day Kaiser window (10 days a side, totaling in 21 points for each filtered observation), although any two-sided window with enough attenuation would suffice. Exhibit 10 is an example of the filtering process applied to an example stock; the figure shows an index of the cumulative performance of the stock specific component.

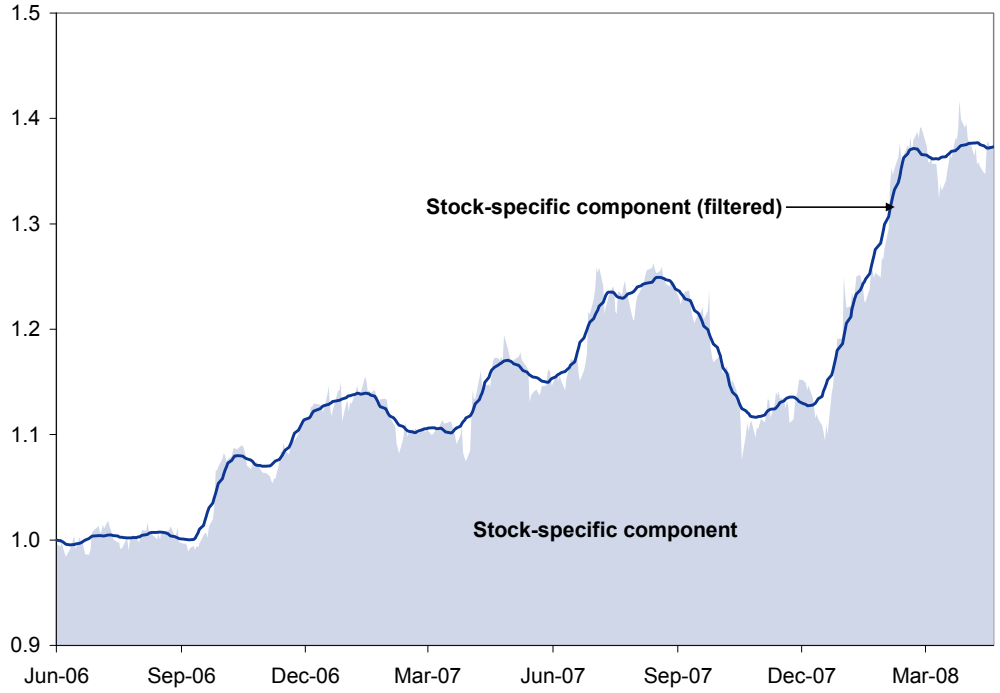
The **second step** in the filtering process is to recognize the points when the smoothed series moves between the three states. We adopt a threshold of 10%, meaning that as long as the smoothed series stays within 10% of the starting value we are in the "flat" state, and as soon as we break out of this range we are in the "up" or "down" state. An example of this process is shown in Exhibit 11, where we use the smoothed stock-specific series shown in the prior exhibit. The dots mark the inflection points when the filtered series switches from rising to falling, and define the candidates for the boundaries of price states, since between them the filtered series was monotonic – either rising or falling.

The stock starts out in a flat period and breaks out of the ±10% band on January 25, 2007 (point B in Exhibit 11). This point determines *the end* of the rising period. The beginning of the up period is determined depending on the period that precedes it:

- a. If the preceding period was flat (as in the example in Exhibit 11), the beginning of the up period, and the end of the flat period, is the last inflection point *below* the mid-point of the flat range (which, by construction, coincides with the first point of the flat period). This last point in the first flat period in Exhibit 11 is point A.
- b. If the preceding period is down, then the beginning of the up period is simply the last point of the down period.

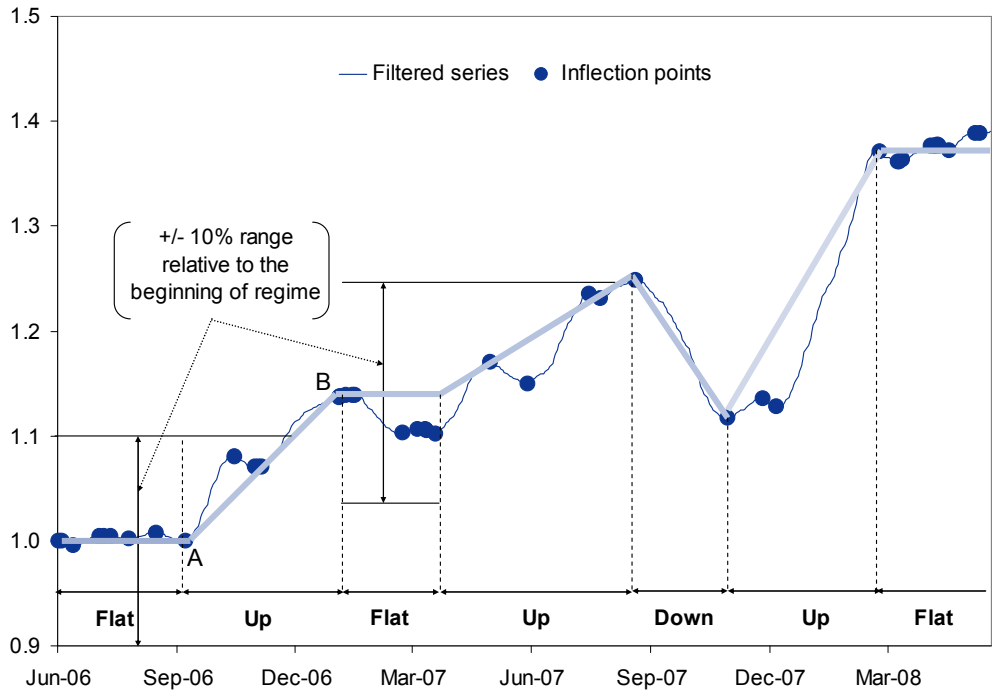
The starting point for a down period is the mirror image of the above method. Continuing this process, we partition the time line into periods that correspond to stock price rising, falling and range-bound periods, as shown in Exhibit 11.

Exhibit 10: An example of smoothing the stock specific time series



Source: Goldman Sachs Research.

Exhibit 11: Inflection points (smoothed time series) are candidates for state transitions As soon as a point is found outside of a ± 10% range, the state changes



Source: Goldman Sachs Research.

It is important to emphasize here the significance of the specific parameterization of the filtering process. If we use a filter with a bandwidth that is too wide, we will end up with time intervals that will be too short and would not reflect the picture of stock price moves that is relevant to a fundamental investor. On the other hand, too narrow a bandwidth will filter out too much of the relevant price moves, resulting in time intervals that are too long. With the 21-day windowing and 10% threshold, we achieved time intervals (several weeks to several months) that are comparable with time intervals that are of interest to the fundamental investor. While the numerical results will change with the filter parameterization, the overall message remains that downfalls are preceded by a deliberation period which is roughly twice as long for shorts as it is for longs.

D. Computation of growth and value

The growth and value measures used in this paper are based on the earnings data from the Compustat database. In order to identify more precisely the timing of events caused by earnings announcements, we focus on the earnings of individual quarters.

Our growth measure is a simple ratio of earnings in two subsequent quarters. Our value measure is a P/E ratio calculated for each quarter, using the announced earnings per share (excluding extraordinary items) and the price at the beginning of the quarter.

E. A model of information arrival

This section develops a simple stochastic model of information arrival based on differences between good and bad stocks observed in the data. The purpose of this model is to study the effects of other relevant parameters, such as the number of stocks in a portfolio and the length of the holding period. The model is not a full pricing framework that can be used to, say, price options; however, it does draw on a number of ideas such as jump-diffusion processes used in those methodologies.

We begin by considering a stock undergoing a transformation such as the unveiling of a new product or the development of a new technology. Initially the share price is P_0 and ultimately it will become P_∞ when the fundamental change is complete and known to the market. Under this framework, the price of the stock at each point in time P_t is determined by the fraction of the market not yet aware of the fundamental change (u_t) and the fraction already aware of the change ($1-u_t$), or, more simply, the fraction of "nonbelievers" and "believers". Incorporating a random market component (ε_t) results in an equation for the price of the stock:

E.1: $$P_t = u_t P_0 + (1 - u_t) P_\infty + \varepsilon_t P_{t-1}$$

There are two sources of randomness in the expression: the market component which we model as mean zero return with volatility σ_M and the fraction of believers at any point in time which, in turn, depends on information flow. The main message of this paper is that good news arrives frequently and is priced in gradually, while bad news arrives sparsely and is priced in all at once. We use two parameters to capture this behavior: the rate at which information arrives to market, and the rate at which the information is priced in upon its arrival. Assume, then, that information arrives randomly with the likelihood of arrival at any point in time of $\alpha \in (0,1)$, and that each time the information arrives to the market, a fixed fraction $\theta \in (0,1)$ of nonbelievers converts into believers.

E.2: $u_t = \begin{cases} (1-\theta)u_{t-1} & \text{if information arrives (probability } \alpha\text{), and} \\ u_{t-1} & \text{if no information arrives (probability (1 - } \alpha\text{))} \end{cases}$

As summarized in Exhibit 12, good news is assumed to arrive frequently (high α) and each time the information arrives some amount of non-believers become believers (low θ) and the opposite for bad news (low α and high θ).

Exhibit 12: Comparison of absorption of good news and bad news

Conversion rate	Informative arrival rate	
	Frequent	Infrequent
Gradual	Good news	
Abrupt		Bad news

Source: Goldman Sachs Research.

After some algebraic manipulation we derive the expression for expected return to the stock from time 0 through time t:

E3: $E(r_t) = (1-(1-\alpha\theta)^t)\ r_\infty$

Where $r_\infty = P_\infty / P_0 - 1$ is the ultimate change in equity value based on the fundamental.

Relation E.3 underscores a point made earlier in the paper that stock returns don't distinguish between information arrival (parameterized by α) and information absorption (parameterized by θ). These parameters enter symmetrically in the formula.

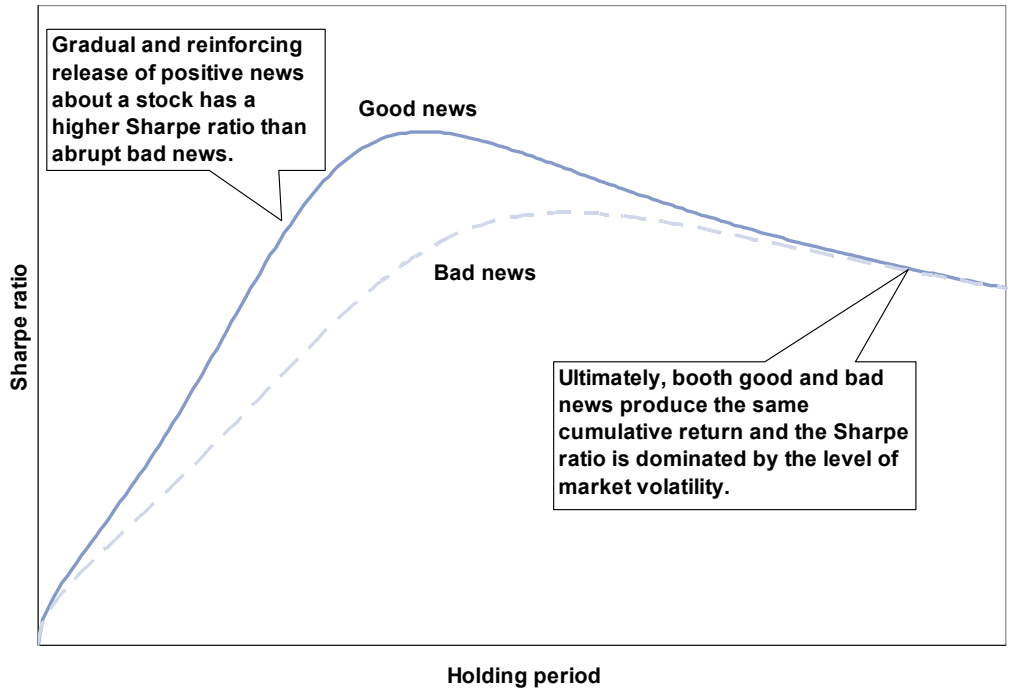
The framework can be expanded to consider an equal weigh portfolio of *N* stocks and we can derive expressions for the portfolio variance and Sharpe ratio:

E.4: $Var(r_t) = \frac{r_\infty^2}{N}\left((1-\alpha(2\theta-\theta^2))^t - (1-\alpha\theta)^{2t} + \frac{t\sigma_M^2}{r_\infty^2}\right)$

E.5: $Sharpe\,Ratio_t = \frac{1-(1-\alpha\theta)^t}{\sqrt{(1-\alpha(2\theta-\theta^2))^t - (1-\alpha\theta)^{2t} + \frac{t\sigma_M^2}{r_\infty^2}}}\sqrt{N}$

To help us understand these formulas, Exhibit 13 shows the Sharpe ratio at different holding periods for two hypothetical single stock portfolios, with different parameterizations of the information absorption processes. The parameters are chosen so that the long run returns are equal but information arrives frequently about one stock ("good news") and abruptly for the other ("bad news").

Exhibit 13: Evolution of Sharpe ratio for good news and bad news



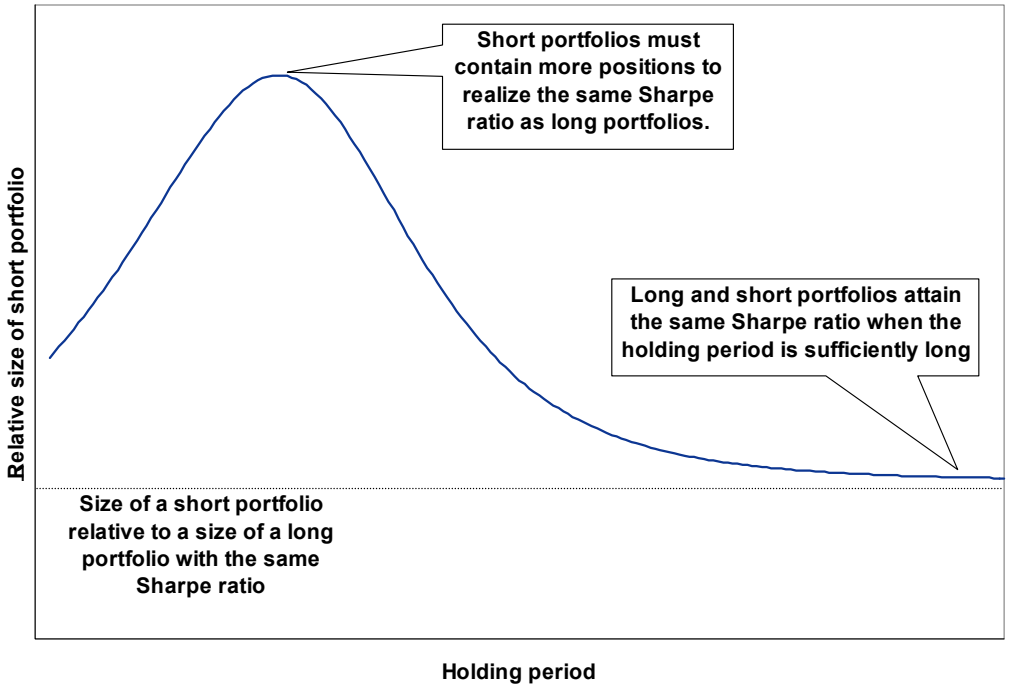
Source: Goldman Sachs Research.

There are several conclusions to be drawn from this Exhibit and the Sharpe ratio formula (E.5):

- We observe two regimes for the Sharpe ratio: rapid growth as the stock specific fundamentals are digested by the market followed by the period where the information has been priced and the market is the prevalent source of uncertainty.
- The Sharpe ratio is higher for a single "good news" position than for a single "bad news" position particularly while the fundamentals are being absorbed.
- But in the long run, both good news and bad news are priced in, and the Sharpe ratios become identical with all the volatility being driven by the market component.

As a result, in order to keep the Sharpe ratio constant in a long (good news) and short (bad news) portfolio, we need more stocks in the short portfolio than in the long. Exhibit 14 demonstrates this by graphing the ratio of portfolio sizes needed to produce an equal Sharpe ratio for the bad news and good news portfolios using the parameterization of Exhibit 13. It is clear that for shorter holding periods, more short positions are needed to produce the risk/reward tradeoff of the long portfolio. This is the period where the performance is driven by the pricing of new information. The difference diminishes as the holding period increases and market uncertainty becomes the major driver.

Exhibit 14: Portfolio size for different holding periods
Short portfolio must be more diversified



Source: Goldman Sachs Research.

F. Review of the Stockpicker's Reality Series

Why Shorts Aren't Longs
A Stockpicker's Reality: Part IV

- Good and bad news on fundamentals have different arrival rates
    - Good news arrives sooner and orderly, bad news later and in bursts
- Different portfolio management implications
    - Longs have positive carry, possible to concentrate on winners
    - Shorts require higher tolerance for losses, helped by diversification
- Momentum plays a different role for longs and for shorts
    - Both positive and negative momentum help longs
    - Good shorts are largely independent from momentum

Sector strategies for maximizing returns to stockpicking
A Stockpicker's Reality: Part III

- Optimal risk management differs for growth and value managers
    - For value investing, sector neutral portfolios outperform
    - For growth investing, sector exposure is important
- Sectors have different style effectiveness
    - Growth strategies are particularly effective in Technology and Healthcare
    - Value strategies are effective in Technology but also consumer cyclicals and transportation
- However, overall manager efficiency is enhanced when all sectors are actively managed

Beating Benchmarks
A Stockpicker's Reality: Part II

- Cap-weighted benchmarks contain large risk positions
- For a stockpicker's skill to drive the portfolio's outperformance, the PM must either
    - Reduce the effective risk in the benchmark, which can be done by benchmark weighting the largest stocks in the benchmark, or
    - Take more active risk than the benchmark, which can be done by concentrating the portfolio
- Portfolio diversification is very fragile with respect to the portfolio weights
    - Significant deviation from equal-weighting rapidly reduces the diversification value of a position
    - Positions more than twice the average weight add back stock-specific risk

Style, Size and Skill
A Stockpicker's Reality: Part I

- Different investment styles exploit different types of market inefficiencies and require different types of insight and holding periods
- Large-cap growth managers should focus on broad thematic investment insights and have relatively long holding periods
- Smaller-cap growth managers should focus on short-term earnings catalysts and have relatively short holding periods
- Value managers should focus on long-term earnings but have an aggressive trading attitude toward individual names to maximize results, regardless of capitalization
- On a pure return basis, growth at a reasonable price strategy generally outperforms pure style strategies. However, on a risk-adjusted basis, mixes of value and growth and hybrid strategies outperform any single style strategy.

Reg AC

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