Predicting Earnings Day Direction: a 20-year Study

We analyze 35,000+ earnings events over 20 years to identify the most valuable indicators for predicting a stock's direction on earnings day. Fundamental managers will be comforted that the "E" in P/E is still the most important variable to predict and is 4 times more significant than any other variable. Beyond quarterly EPS we identify four proxies for positioning that can be known prior to results and add substantial predictive power. When used selectively, positioning data alone can have 60% accuracy in predicting stock direction. When used broadly, this data can lead to a performance edge between the top and bottom deciles of 100bps, big for a 1-day trade across hundreds of opportunities each year.

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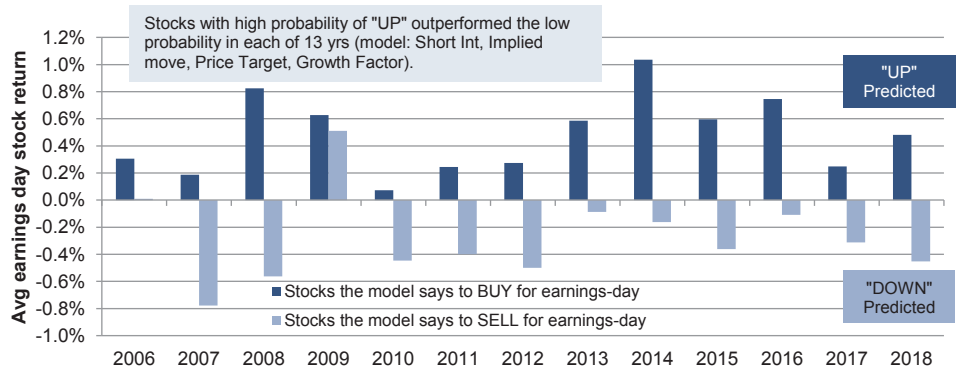
Positioning indicators and their impact on expected direction:

1. **Implied moves:** Stocks with high implied moves are more likely to trade up on earnings. Investors fear volatility and wait to buy stocks after their event.
2. **Short Interest:** High short interest stocks trade down more often on earnings as institutional investors are correctly positioned for weak fundamentals.
3. **Price Target:** High price targets raise the probability of trading up on earnings.
4. **Growth:** High revenue/EPS growth stocks trade up on earnings day.

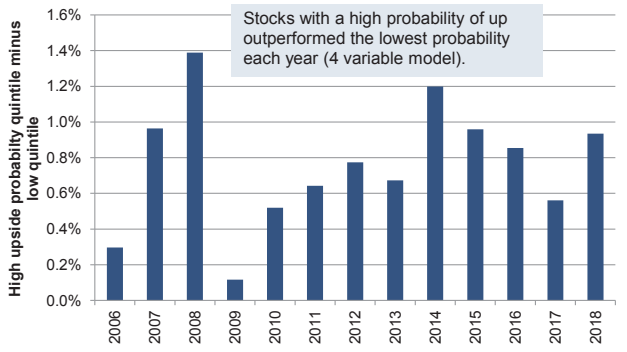
Exhibit 1: Positioning data is consistently useful for predicting earnings day direction
Avg stock return on earnings day: Top quintile, Bottom quintile by year



Source: Goldman Sachs Global Investment Research

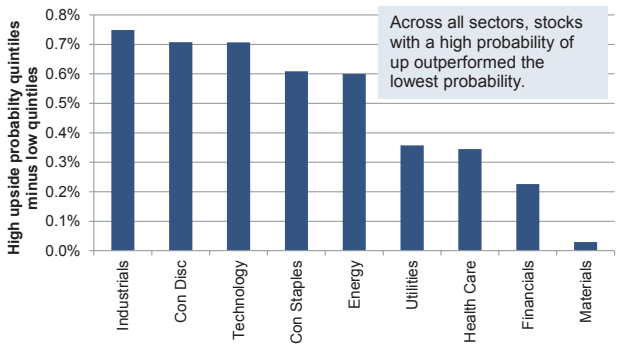
Key Charts: Predicting earnings day moves

Exhibit 2: Positioning data was useful in each year
Average earnings day move: Top quintile minus bottom quintile



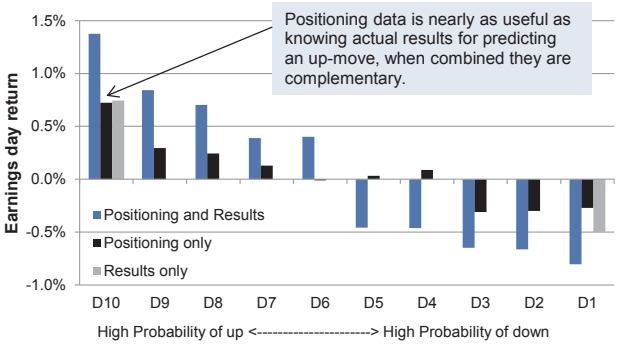
Source: Goldman Sachs Global Investment Research

Exhibit 3: Positioning data was useful for each sector
Average earnings day return: Top 2 quintiles minus bottom two quintiles



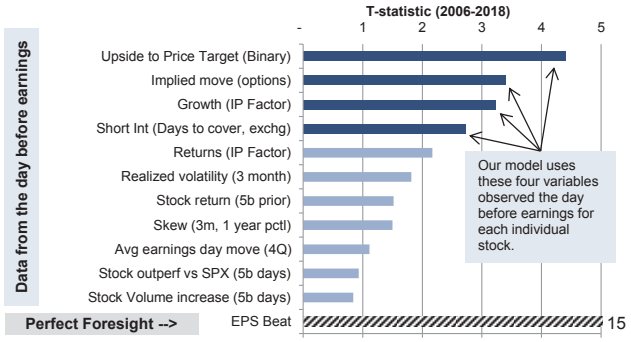
Source: Goldman Sachs Global Investment Research

Exhibit 4: Positioning data is nearly as valuable as knowing actual results
Average earnings-day return:by decile for positioning model (black) and combined with actual beat/miss results (blue)



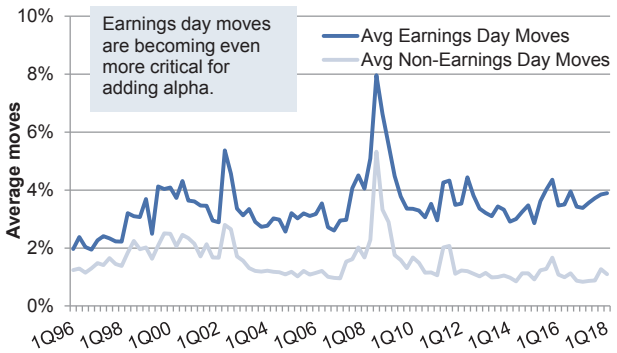
Source: Goldman Sachs Global Investment Research

Exhibit 5: Four variables are particularly useful for estimating earnings-day moves
T-statistic of univariate probit predicting earnings direction



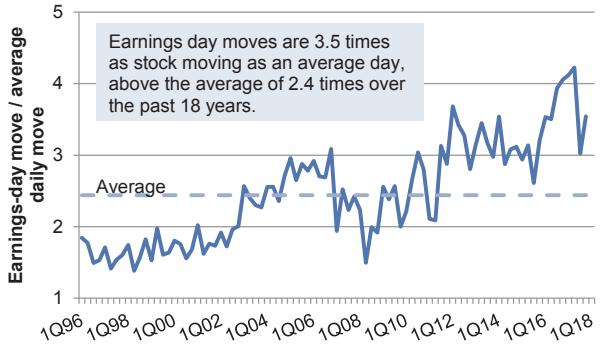
Source: Goldman Sachs Global Investment Research

Exhibit 6: Earnings moves are getting bigger
Avg S&P 500 stock earnings day move vs 1-month before/after



Source: Bloomberg, Goldman Sachs Global Investment Research

Exhibit 7: Earnings moves are even bigger vs avg daily moves
Avg S&P 500 stock earnings day move / Avg move 1-month before/after



Source: Bloomberg, Goldman Sachs Global Investment Research

Executive Summary: Predicting Earnings day moves

"Catalyst Manager" Service: For investors that would like regular updates of the probability of an up-move implied by our positioning model, please contact your GS salesperson.

Earnings events are the most widespread and well-studied single stock events; however, the complex relationship between expectations, positioning and results make it difficult to predict the stock move following its earnings releases. In fact, during the latest earnings season, there was much handwringing about stock reactions that were opposite of the earnings surprise, leading investors to conclude that investors must have been over-positioned ahead of the events.

We sift through over 100 variables across 35,000 earnings events over the past 20 years and identify the 4 variables that are most useful in predicting stock moves on earnings day. Specifically, we model the probability that a stock will rise on its earnings day (although the results are broadly the same to predict outperformance over SPX). Our results suggest that both positioning information and long-term fundamental views play a significant role. We use Short Interest and Implied moves to proxy positioning; we use Price Targets and Growth expectations to proxy our analysts' fundamental views. Further, we find that positioning information has significant explanatory value for stock moves on earnings day even after controlling for the actual results. This suggests that our model can be complementary to a process that estimates whether a company will beat or miss earnings.

Earnings day moves are notoriously difficult to predict. We find that even using the actual EPS results for the quarter (perfect fundamental foresight), one would only get the stock direction correct 55% of the time. This suggests the market has a complex reaction function beyond just the beat/miss. Using fundamental and positioning data available the day before an earnings event, we find that we can predict the direction of the earnings move with 53% accuracy. When combining the positioning information with the actual results, accuracy rises to 57%.

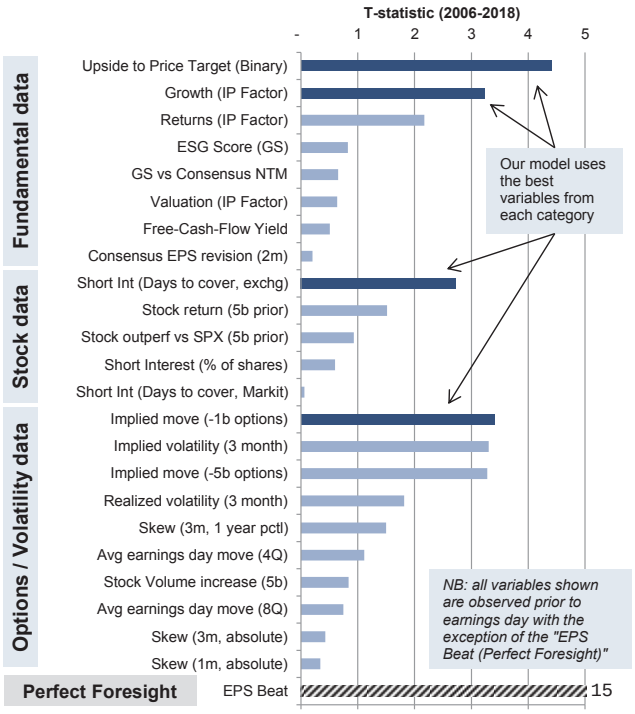
Small probability advantage = Large profit opportunity. While the probability advantages listed above may seem small, they have big implications for portfolio returns when applied over a large number of events. In cases where positioning information suggests a greater than 53% chance of rising following earnings (not using perfect foresight on actual actual EPS results) the average one day stock return was +0.73%. In cases where the positioning information suggested a less than 47% chance of rising, a short position in the stock returned -0.27%. These compare to an average daily return in the SPX over the period of 0.04%.

Big Debate: momentum vs mean-reversion. For most of our study period, we found that the stock return in the weeks and months prior to earnings were a strong contrarian indicator for the direction of the move on earnings day. This suggests that earnings were mean-reversion events. However, this effect switched sharply starting in 2015 and in recent years, stock moves in the days before earnings events have been a leading indicator of the direction of stock moves. We believe this is yet another indication that momentum strategies are becoming increasingly crowded. We leave these indicators out of our model due to lack of consistency across our sample.

What variables are useful for predicting earnings-day direction?

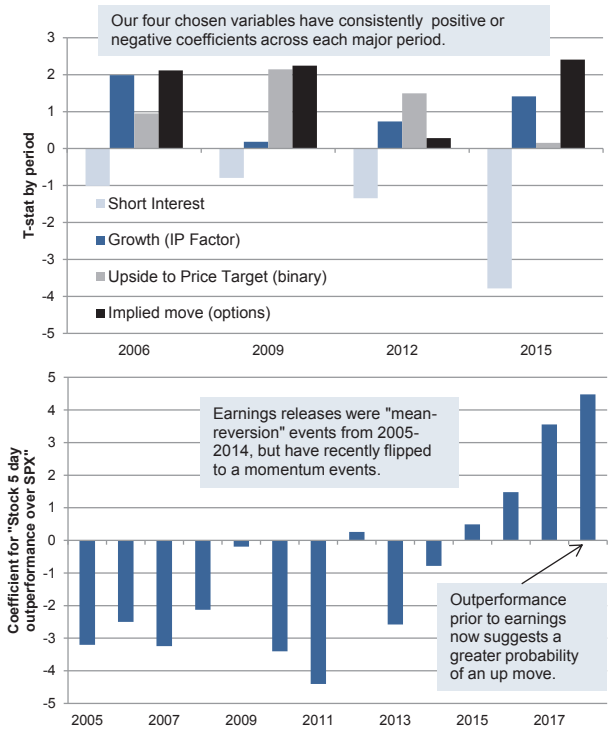
In analyzing over 100 indicators, our goal was to provide fundamental investment managers with useful intuition about positioning as they approach earnings events. Our conversations with investors over the years reveal a wide range of assumptions about key positioning metrics. Below we show the absolute value of the T-stat for each variable when used in a univariate model to predict the probability of an up-move on earnings.

Exhibit 8: Most significant variables in Univariate models
Using data when available from 1998 to present



Source: Goldman Sachs Global Investment Research

Exhibit 9: Our variables are stable over time; we avoid recent performance variables as earnings are now momentum events
Estimated coefficient or t-stat after controlling for other variables



Source: Goldman Sachs Global Investment Research

Useful Fundamental Indicators: Price Targets, Growth, Profitability

We find that our analysts' price targets were a statistically significant predictor of a stock's direction following their earnings release. While a variety of price target related variables were useful, we found the most useful was a dummy variable that indicated whether the GS analyst's price target was above or below the median level over the entire dataset (median = +13% upside to price target). From a factor perspective, we found that companies with higher growth and profitability expectations were more likely to trade up on earnings. In each of these cases, the coefficients were positive as expected. Higher expectations for Price Targets, Growth and Profitability suggested a higher likelihood of trading up on earnings. Intuition: When a company has higher fundamental expectations than the average stock, investors may perceive the company has having higher execution risk than a stock with just average growth and return

expectations. As an earnings event approaches, investors may avoid the stock of companies with high execution risk. Following their event, when the company on average performs in-line with above average fundamental expectations, investors may feel comfortable to add the stock back to their portfolio.

Useful Equity Positioning Indicators: Short Interest, Days to Cover

We find that short interest is a leading indicator of stock performance on earnings day. The higher the short interest, particularly when compared to recent stock volume (i.e. days to cover), the more likely the stock declines on earnings. We believe the short interest in a stock is more heavily influenced by institutional investors than the long positions (perhaps better informed than the average investor).

Useful Volatility Indicators: Volatility, Implied earnings day move, historical earnings day moves

A stock is more likely to trade up on earnings day if recent volatility or earnings day moves are large. We hypothesize that investors avoid high volatility stocks until after a known event where the stock is likely to make a big move. We find the options market implied moves are the most robust source of information about investors' volatility expectations on a particular event, and unsurprisingly adds the most value in the context of a larger model.

Variables we leave out due to lack of Stability: Stock returns, RSI

In our prior research, we have found that stock returns in the days leading up to an earnings event have been a useful contrarian indicator for stock moves on earnings day. This simple contrarian indicator shows up as highly significant in our period of study; however, careful examination of recent years show that this relationship has flipped. What was a highly significant contrarian indicator for two decades has flipped to be a leading indicator over the past three years. This suggests that buying stocks with strong momentum ahead of earnings has been a profitable strategy in recent years. We leave these variables out of our final model as we see the potential that market dynamics have changed with the increase in passive and quantitative strategies, but the change is too recent to know whether it is a new trend that will continue or whether it is an aberration.

Assessing the performance of various models

Focusing on the highest probability events, our model with only positioning data called the stock direction on earnings with 60% accuracy.

Establishing a benchmark for comparison: "Perfect" Fundamental foresight

Investors strive to estimate what a company's earnings will be with more precision than others in the market. Indeed, we estimate that knowing the earnings results for the quarter are more important than any of the other variables we analyzed. A dummy variable that represents whether a company beat or missed earnings for the quarter was very significant (t-stat of 15), but still could only predict the stock direction with 55% accuracy. This underscores the difficulty of predicting one-day moves even with perfect foresight on the results. While we believe this is far below the perception of many fundamental investors (based on our conversations over the years), it is consistent with the hit-rates of highly skilled short-term traders.

Combining positioning and fundamental indicators to predict earnings day moves

Through an iterative optimization process we evaluated combinations of the most useful indicators. In many cases we evaluated various transformations of the variables; however, it was often the most simple representation of the indicators that proved the most useful. Below are the four key explanatory variables. They form the base case model that we evaluate in the subsequent sections of this report.

1. **Options Market Implied Move (sign = positive):** The greater the expectation of earnings volatility, the greater the likelihood the stock rises on earnings. We find that past earnings day moves were similarly useful, but did not provide the additional forward looking content that options market implied moves provided.
2. **Short Interest Days-to-cover (sign = negative):** The higher the short interest relative to daily volume of the stock, the more likely the stock declines on earnings.
3. **Upside to Price Target (sign = positive):** The probability that a stock trades up on earnings was positively correlated to the percentage upside to our analysts' published priced targets.
4. **Strong Growth relative to other companies (sign = positive):** The greater our analysts' revenue and earnings growth expectations for a stock, the greater the probability that a stock trades up on earnings.

Exhibit 10: Four positioning/fundamental variables provide an edge on earnings day move direction
Probit: Positioning model coefficients, t-stat, p-value

Variable	Coefficient	t-statistic	p-value
Implied move from options	1.47	**3.0**	0.003
Short Interest - Days to Cover	(0.02)	**(3.2)**	0.001
Growth (Investment Profiling Factor)	0.0014	**2.1**	0.036
Upside to priced target (above/below avg)	0.07	**2.2**	0.030

Source: Goldman Sachs Global Investment Research

Exhibit 11: Even after controlling for actual EPS beat/miss, each variable remains significant
Probit: Positioning and actual EPS beat/miss coefficients, t-stats, p-value

Variable	Coefficient	t-statistic	p-value
EPS Beat/Miss (Perfect Foresight)	0.4327	**15.3**	<.0001
Implied move from options	1.9779	**3.9**	<.0001
Short Interest - Days to Cover	-0.0175	**(2.8)**	0.005
Growth (Investment Profiling Factor)	0.00165	**2.5**	0.012
Upside to priced target (above/below avg)	0.0662	**2.0**	0.051

Source: Goldman Sachs Global Investment Research

Our base 4-variable model had a hit-rate of 53% over the sample period, only 2% less that achieved with perfect foresight of the EPS results. Further, if we add these four variables to the model which includes the EPS actual vs. consensus, it further improves

the perfect foresight model to 57% accuracy. This suggests that positioning information is useful even if one has perfect foresight on the results.

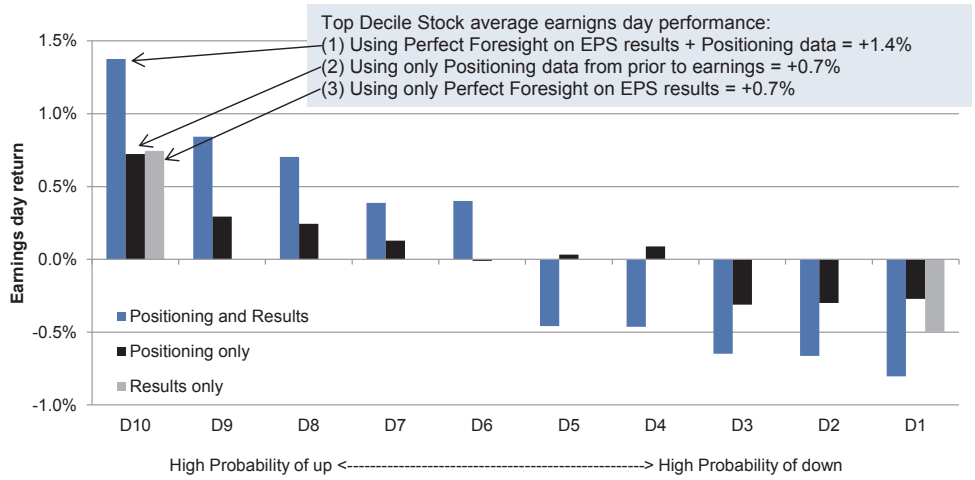
Accuracy could be further increased to 60% by only focusing on the extreme signals. In the next section, we choose to focus on events with a 53% probability of occurring to increase the overall profit opportunity (top decile). In practice, investors can set thresholds wherever they are most comfortable.

Integration of the model into a trading strategy

Our model focuses on estimating the probability of an up-move on earnings day. While investors could trade binary outperformance options to gain direct exposure to the outcome contemplated by the model, it is far more likely for investors to use this framework as part of their process to buy or sell stocks ahead of their earnings event.

We analyze the results of a simple long or short strategy in the stock based on the expected probabilities produced by the model. Investors that bought stocks with a >53% probability of rising on earnings, saw an average 1-day return of +0.73%, with stocks with only <47% probability of rising on earnings saw an average decline of 0.27% on earnings day.

Exhibit 12: Positioning data is a useful guide to earnings-day stock reaction
Average return of stock based on the probability estimated by our model

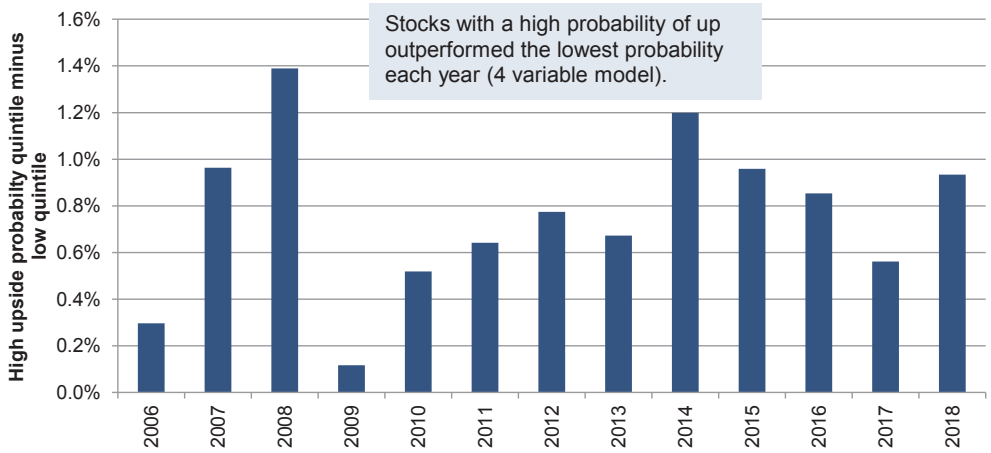


Source: Goldman Sachs Global Investment Research

Results by year: The model has been more effective in some years than others. Similar to the exhibit above, we look back at the difference between the average returns in the top quintile vs the bottom quintile each year. The top quintile outperformed the bottom quintile in 13 of the 13 years.

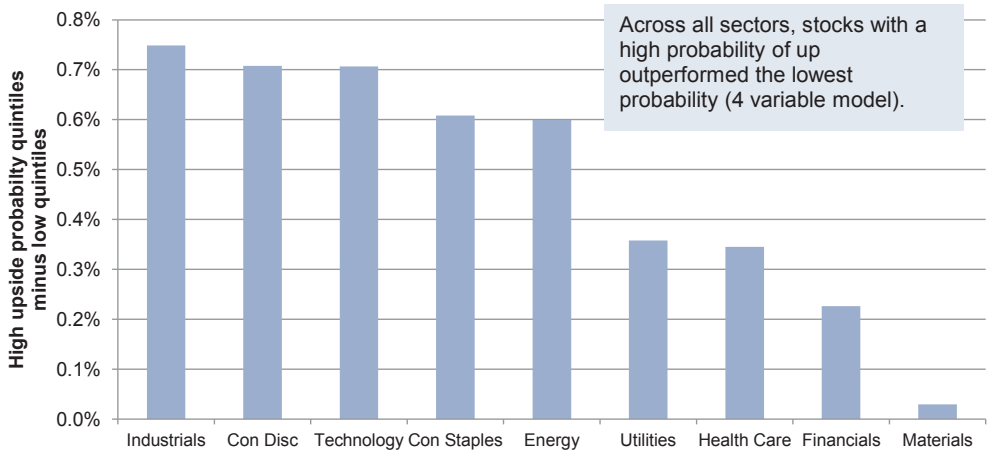
Results by sector: We find this methodology is useful across each of the major sectors without building sector specific models. This suggests to us that positioning dynamics are similar enough across sectors that it doesn't require sector dummies or sector specific measures.

Exhibit 13: Positioning and Fundamental data has been consistently useful for predicting earnings day moves
Average stock return: Top quintile minus bottom quintile



Source: Goldman Sachs Global Investment Research

Exhibit 14: Positioning data was useful for predicting earnings-day direction across all sectors
Average stock return: Top two quintiles minus bottom two quintiles



Source: Goldman Sachs Global Investment Research

Appendix: Methodology and Variables

We use a logistic regression to estimate the probability that a stock trades up on earnings. We use earnings events from 1996 to present for US companies. Our explanatory variables (fundamental or positioning) are not all available for the full period, but the variables in our final model were available from 2005 to 2018. We used an iterative process to identify the best models by assembling thousands of possible 3, 4 or 5 variable models using a combination of over 100 potential variables. Our iterative process produced dozens of potential models which we stress tested over various time periods to identify which relationships are constant through time and which may be changing. This stress testing process also helped us understand which variables are redundant with one another and which may be stronger together.

The stock return statistics were calculated after the model development. The model is optimized for predicting the probability of a move, but these statistics illustrate that it may be useful for more simple stock buy/sell strategies. We estimated models to predict "stock outperformance/underperformance" on earnings day, but find the results are almost identical, leading us to show the results of the more simple model in this report. Below, we define select explanatory variables listed above in Exhibit 8.

Exhibit 15: Definition of variables used in models
Variables shown in Exhibit 8

	Variable	Definition
Fundamentals	EPS Beat	Reported EPS vs consensus EPS (upcoming quarter) estimates from Factset, as of the day before earnings.
	Upside to Price Target (Binary)	Upside to GS Price Target, as of the day before earnings. We use a binary variable;1 if the price target is above median levels over entire dataset, 0 if below.
	Growth (IP Factor)	Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher
	Returns (IP Factor)	Returns is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns.
	Valuation (IP Factor)	Percentile rank of a stock based on its forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only
	Free-Cash-Flow Yield	Free cash flow yield. For Financials, we use change in book value growth y-o-y.
	ESG Score (GS)	Percentile rank of GS ESG score across a global universe.
	GS vs Consensus NTM	% upside to Goldman Sachs EPS estimates for next four quarters vs Factset consensus.
	Consensus EPS revision (2m)	Percent increase (decrease) in consensus EPS (upcoming quarter) estimates over the prior 2 months (Factset consensus).
Stock/Short Interest	Short Int (Days to cover, exchg)	The total number of shares investor have sold short, divided by the average daily trading volume. Data from the Exchange (observed twice a month).
	Stock return (5b prior)	1 week stock performance as of the day before reporting.
	Stock outperf vs SPX (5b prior)	1 week stock performance relative to S&P 500, as of the day before reporting.
	Short Interest (% of shares)	Latest available short interest as a percentage of equity float. Data from the Exchange (observed twice a month).
	Short Int (Days to cover, Markit)	Ratio of number of days, given average trade volume, would it take to close the total short position. Data observed daily from Markit.
	Stock Volume increase (5b)	Percentage increase in 20-d average stock volumes over the prior week
Volatility/Options	Avg earnings day move (4Q)	Absolute Average 1-day stock move over prior 4 earnings events.
	Avg earnings day move (8Q)	Absolute Average 1-day stock move over prior 8 earnings events.
	Implied move (-1b options)	Earnings implied move derived from options on the day prior to earnings.
	Implied move (-5b options)	Earnings implied move derived from options observed 5 days before earnings.
	Implied volatility (3 month)	3 month 50 delta call implied volatility for the stock on the day prior to earnings.
	Realized volatility (3 month)	Annualized standard deviation of daily stock move over the 3 months prior to earnings.
	Skew (1m, absolute)	1 month normalized put call skew, calculated as ((1m25dp-1m25dc)/1m50dc)
	Skew (3m, 1 year pctl)	Percentile rank of 3 month normalized put call skew ((3m25dp-3m25dc)/3m50dc) relative to prior year.
	Skew (3m, absolute)	3 month normalized put call skew, calculated as ((3m25dp-3m25dc)/3m50dc)

Source: Goldman Sachs Global Investment Research, Bloomberg, FactSet, Markit