



MILL STREET
RESEARCH

A Multi-Factor Approach to Stock Selection Using Earnings Estimate Revisions, Price Trends, and Valuation

EXCLUSIVE PRESENTATION FOR:

 **InteractiveBrokers**

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Contents

A review of our stock selection research and findings

- Which stock selection factors we have studied and why
 - Earnings estimate revisions
 - Price momentum and mean-reversion
 - Valuation (absolute and relative)
- Summary results of individual factors and combinations of factors
- The importance of a multi-factor approach to stock selection

Example of how we implement these factors in our multi-factor stock selection tool, MAER.

- MAER is the tool which implements our major research results and presents them in a useful format for busy investors and analysts.
- We summarize the MAER stock ranking model along with some backtest results.
- We show examples of strong and weak stocks based on current indicator readings.



Some of Our Views on Stock Selection

- Financial markets, especially the stock market, are **complex systems** and it is very difficult to navigate them using any single piece of information.
- Professional investors very rarely rely on any single “best” indicator alone, regardless of their investment style – **a multi-factor approach is crucial**.
- Choosing your **time horizon** and **investment universe** first helps guide choices of information to use.
- A **disciplined, quantitatively-driven approach** can go a long way to avoiding harmful biases and emotions in investing, but must be done carefully and with the knowledge that there are limits to what the data can do.



Stock Selection Drivers

Our research focus for stock selection has been:

Universe: global equities that meet minimum requirements for investability

Time Horizon: typical range from one to six months, sometimes shorter

Key drivers, in order of importance in our work:

- **Earnings estimate revisions:** a measure of “fundamental momentum” that works well on one- to six-month horizons.
- **Price momentum and mean reversion:** intermediate-term trend/momentum along with short-term price reversal tendencies.
- **Valuation:** both absolute and relative valuation, used as longer-term measures of mean-reversion and risk control.

While these drivers have been found useful individually, in our view a multi-factor approach that incorporates all of them should be more robust and reliable.



Why These Factors?

Our focus on estimate revisions, price trends and valuation is based on a combination of factors.

- **Effectiveness:**

Extensive academic and practitioner research, including ours, supports the case that these factors can take advantage of behavioral anomalies to produce alpha.

- **Time Horizon:**

Estimate revisions and price momentum are known to be most effective on intermediate-term horizons (three to six months). Valuation is often used for similar or longer-term horizons, price mean-reversion is effective on shorter horizons.

- **Global Availability and Timeliness:**

Earnings estimates and prices are available globally, with little or no reporting lag or historical revisions/restatements.



Earnings Estimate Revisions

One of the factors we have studied and used for a long time is **earnings estimate revisions**.

The underlying concept is that **changes** (revisions) in analysts' forecasts for a company's profits are a predictor of future relative returns.

KEY ASSUMPTIONS

Estimate revisions impact stock prices.

Estimate revisions tend to move in trends.

SUPPORTING RESEARCH

Investors respond to estimate revisions, but tend to underreact to the news embedded in analyst forecast revisions. This allows price trends in response to revisions to form.

Equity analysts often have incentives or biases that cause them to:

1. Change their earnings forecasts incrementally
2. Move in herds



Earnings Estimate Revisions

Two key revisions metrics:

1. Revisions Breadth = “How Many”

The **net proportion** of analysts covering a stock that have raised estimates versus lowered them in the last X days (we normally use X = 100 days). This is “how many estimates are going up or down”.

2. Revisions Magnitude = “How Much”

The **percent change** in the consensus (mean) earnings estimate over the last X days (we normally use 1 month). This is “how much have estimates gone up or down.”

To account for widely varying volatilities across stocks and control risk, we scale the percent changes in the context of each stock’s trailing 5-year range to produce a percentile score (0 - 100).



Revisions Persistence

A key reason for focusing on the **direction** of estimate revisions (which way the majority of analysts are moving their estimates) is that it is much more **persistent** and thus **predictable** than returns.

A few results from our studies:

- The direction of revisions breadth persists from one month to the next about **83% of the time** historically.
- Revisions breadth trends tend to last an average of about **5.5 months**, some last much longer.

BOTTOM LINE: Simply knowing the current direction of revisions provides some predictability for the future direction of revisions over the next several months.



Why Are Revisions Persistent?

FUNDAMENTAL BUSINESS TRENDS

- Trends in a business' underlying sales and profits can persist over multiple quarters or years.
- Longer-term forecasting is very difficult and thus **a focus on near-term (i.e., next quarter/year) results often dominates**, leading to “surprises” when longer-term trends develop.

ANALYST BEHAVIORAL BIASES/INCENTIVES

- Analysts have significant **incentives and biases** related to earnings forecasting:
- Access to company management is important to analysts.
- Incentive not to deviate too far from the consensus.



Revisions and Returns

- Stocks with strong revisions tend to have **higher returns and lower volatility** than stocks with weak revisions.
- Higher revisions forecast significantly stronger **risk-adjusted future returns**.
- The combination of breadth and magnitude rankings shows even more favorable results.

REVISIONS INDICATORS ONLY: Global Stock Universe, 2003–Present			
Revisions Breadth	Ann. 1-mth Return (%)	Ann. 1-mth Volatility (%)	Return/Risk Ratio
Top Decile	14.7	17.6	0.84
Bottom Decile	9.0	21.3	0.42
Revisions Magnitude			
Top Decile	12.7	16.7	0.75
Bottom Decile	9.2	20.0	0.46
Breadth + Magnitude			
Top Decile	14.8	16.9	0.88
Bottom Decile	8.8	21.0	0.42

Note: All results shown above are hypothetical and do not represent any actual trading. Mill Street Research does not manage money. The results shown do not include important considerations such as transactions costs or taxes, and may not have been achievable in practice. See important disclosures at the end of this document.



Risk-Adjusted Price Momentum

A lot of research supports intermediate-term momentum: **returns over the prior 6-12 months can be used to forecast returns over the next 3-6 months.**

However, momentum performance can be volatile.

Why? Often due to the “beta” effect: i.e., momentum will overweight high beta stocks at market peaks (and vice versa).

To address this, instead of traditional price momentum, we use what we call **“Alpha Momentum”**.

We use regression to estimate the “alpha” or **stock-specific return** after accounting for a stock’s market beta, size (small/large-cap) and style (value/growth) tendencies.

Removing the “beta bets” from a momentum strategy helps returns and reduces risks.



Alpha Momentum with Mean-Reversion

We combine intermediate-term price momentum from Alpha Momentum with short-term price mean-reversion to counter the risks of buying stocks which have just recently surged (i.e., overbought).

The combination shows wider top-bottom return spreads and a more stable linear relationship with returns than either of the components.

Global Momentum Ranks
Annualized Next-Month Returns (%), 2003 - Present

Decile	Alpha Momentum	1-Month Mean Reversion	Combined
10	15.4	14.2	14.6
9	12.0	12.9	13.3
8	12.1	12.6	12.4
7	11.8	11.5	11.7
6	11.1	10.7	10.6
5	10.2	10.4	11.2
4	9.6	9.2	10.6
3	10.0	9.4	11.6
2	9.1	10.0	9.9
1	9.8	9.9	5.0

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Valuation: Relative and Absolute

Problem: Momentum-oriented strategies are frequently biased toward “expensive” stocks.

Solution: Incorporate valuation metrics alongside revisions and momentum

Two valuation metrics help balance potential momentum/growth bias:

Absolute forward earnings yield (higher is better):

- Consensus mean EPS expected over the next 12 months as a percentage of current stock price

Relative forward earnings yield (higher is better):

- Forward earnings yield minus the earnings yield of the market, scaled to the stock’s trailing 5-year range

Result: Valuation metrics help to avoid the most expensive (i.e., risky) holdings in the context of a momentum-oriented strategy and improves risk-adjusted results.



Valuation Results

Quantitative value factors have struggled in recent years, but our data shows there is still “value in value”.

Combining two versions of valuation helps avoid big sector biases.

Global Valuation Ranks
Annualized Next-Month Returns (%), 2003 - Present

Decile	Absolute Earn Yld	Relative Earn Yld	Combined
10	14.1	12.9	13.3
9	11.5	11.0	11.9
8	10.7	10.8	10.7
7	11.6	10.9	11.9
6	10.8	10.9	10.9
5	11.2	11.6	11.2
4	11.3	10.7	10.6
3	10.3	11.0	10.6
2	10.1	11.4	10.8
1	9.3	9.7	9.1

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Summary of Indicator Research

We have reviewed six stock selection factors from three categories: earnings revisions, price momentum and valuation.

Each indicator can be shown to “work” on its own

The results are stronger and more consistent when the indicators are combined.

We have confidence in our analysis because it is based on:

- A broad global universe of stocks (over 5000 stocks in recent years) meeting minimum investability criteria
- A substantial time period (17 years)
- Results that are generally consistent across regions, sectors and time periods

What Do These Indicators Look Like?

As an example of how these stock selection tools could be used in practice, we can look at charts of a few stocks using Mill Street's MAER tool. MAER is the **Monitor of Analysts' Earnings Revisions**, Mill Street's proprietary stock selection tool. It is made up of two key components:

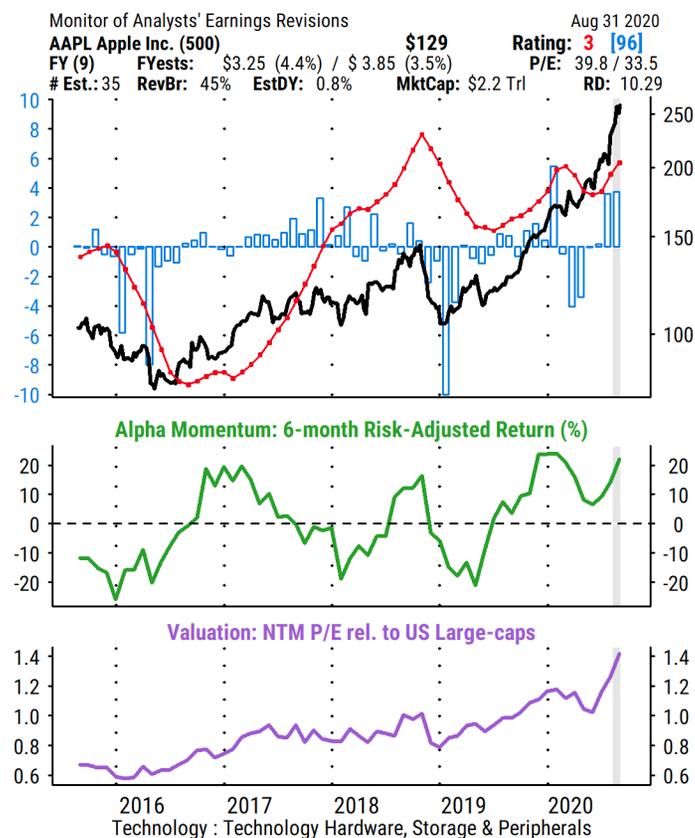
A Multi-Factor Ranking Model

Top 20 Ranked Global Large-Cap Stocks

Ticker	Name	Composite MAER Rank
ADRNY-US	Royal Ahold Delhaize N.V.	1.000
KHC-US	Kraft Heinz Company	0.999
002493-CN	Rongsheng Petrochemical	0.998
VALE3-BR	Vale S.A.	0.997
LOW-US	Lowe's Companies	0.996
BBY-US	Best Buy	0.995
ABC-US	AmerisourceBergen	0.994
W-US	Wayfair	0.993
SWK-US	Stanley Black & Decker	0.992
6030-HK	CITIC Securities Class	0.991
RIO-AU	Rio Tinto Limited	0.990
K-US	Kellogg Company	0.989
CS-US	Credit Suisse Group AG Sp	0.988
601888-CN	China Tourism Group Duty	0.987
AD-NL	Royal Ahold Delhaize N.V.	0.986
SIEGY-US	Siemens AG Sponsored	0.985
CSGN-CH	Credit Suisse Group AG	0.984
9843-JP	Nitori Holdings	0.983
UBSG-CH	UBS Group AG	0.982
RIO-GB	Rio Tinto plc	0.980

NOTE: The list above is for demonstration purposes only and is not a recommendation to buy or sell any security.

MAER Charts

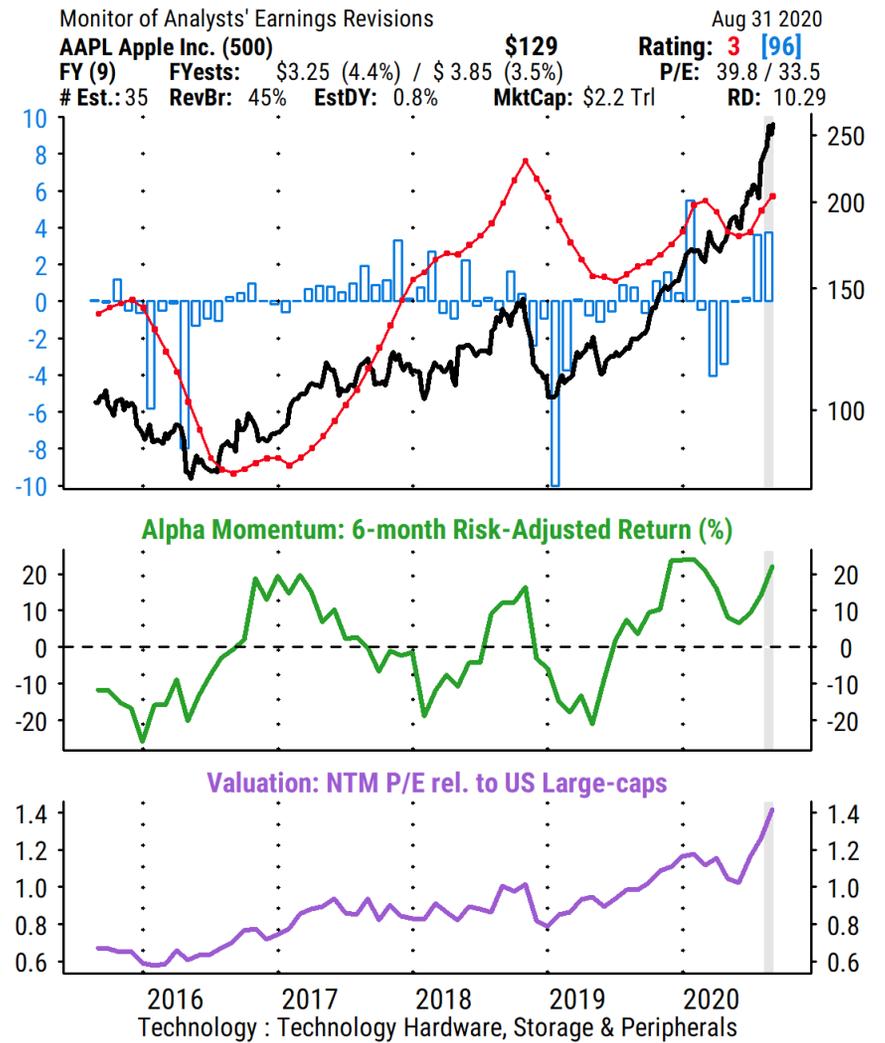




MAER Charts

MAER charts incorporate a significant amount of current and historical information into a single picture and provide useful context for the indicators and rankings.

- The main section of the chart depicts the trends in analyst estimate revisions for each stock over the last five years, showing both the direction and magnitude of the monthly revisions activity. These indicators are overlaid on *relative* returns.
- In addition to the revisions indicators, it plots our measure of risk-adjusted six-month price momentum (Alpha Momentum) and relative valuation based on forward P/E.
- The header data shows current values for key variables for the company.





MAER Ranking

The **MAER Ranking Model** uses six inputs to objectively rank stocks in any universe and help identify stocks with the most, or least, favorable combination of earnings revisions, price action and valuation. The indicators and their weights have been fixed since the model was developed in 2013. They were chosen to reflect the relative importance of each input for a 3-6 month forecasting horizon and manage risk and turnover.

<u>INDICATOR</u>	<u>WEIGHTING</u>
• Revisions breadth	30%
• Revisions magnitude	20%
Revisions inputs total	50%
• Alpha Momentum	20%
• Prior month return	10%
Price inputs total	30%
• Relative forward earnings yield vs. history	10%
• Absolute earnings yield	10%
Valuation inputs total	20%



MAER Ranking

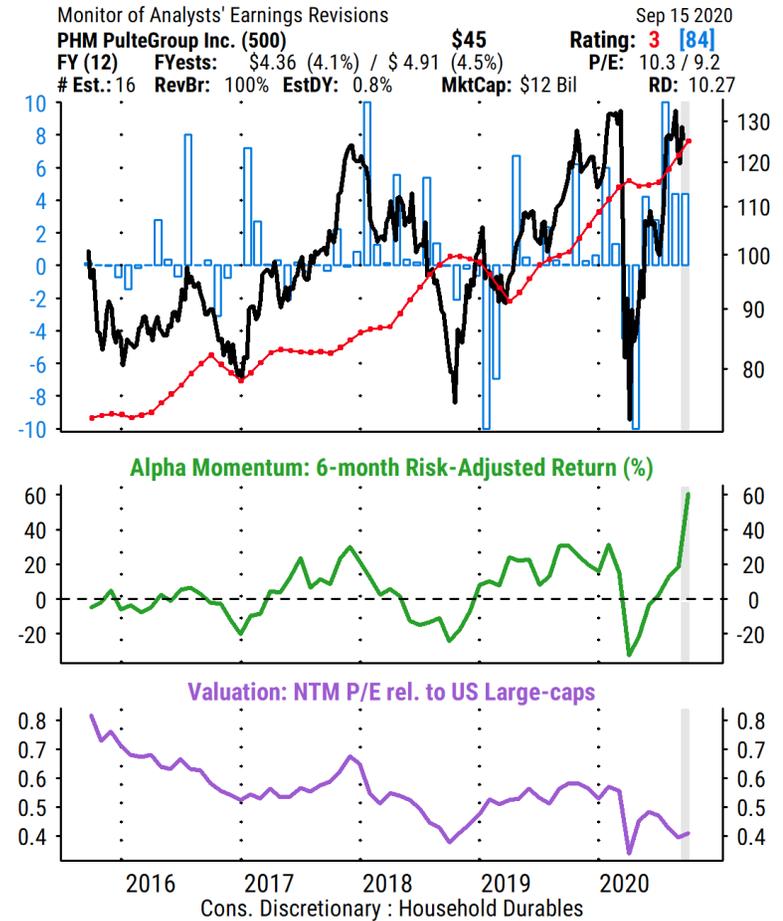
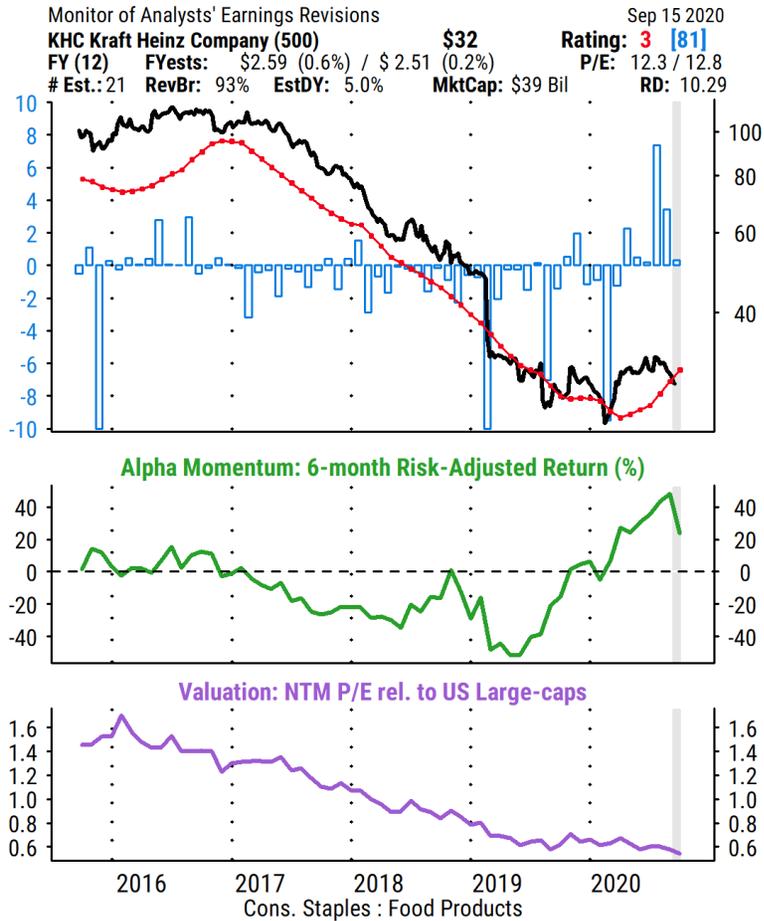
The MAER ranking model has been backtested back to 2003 and shows solid results in our testing for fixed holding periods (with 6 calendar day reporting lag): higher returns and lower volatility for high-ranked stocks vs. low-ranked stocks. Ranks can be effective out to six-month holding periods.

Global MAER Ranking Backtest Results				US MAER Ranking Backtest Results			
	1m	3m	6m		1m	3m	6m
Top Decile Mean	1.38	3.66	7.18	Top Decile Mean	1.24	3.25	6.22
Top Decile Median	2.22	5.04	9.57	Top Decile Median	2.10	4.22	7.89
Top Decile SD	5.42	9.63	14.36	Top Decile SD	6.07	9.91	14.33
Top Decile Sharpe	0.81	0.69	0.64	Top Decile Sharpe	0.65	0.59	0.55
Bot Decile Mean	0.55	1.43	2.84	Bot Decile Mean	0.63	1.65	3.23
Bot Decile Median	0.88	2.29	4.00	Bot Decile Median	0.96	2.78	4.69
Bot Decile SD	6.30	10.43	15.57	Bot Decile SD	7.79	12.54	18.61
Bot Decile Sharpe	0.24	0.21	0.20	Bot Decile Sharpe	0.23	0.21	0.20
Bench Mean	0.93	2.64	5.27	Bench Mean	0.96	2.65	5.18
Bench Median	1.43	3.91	6.96	Bench Median	1.45	3.69	6.35
Bench SD	5.23	8.85	13.35	Bench SD	6.10	9.78	14.24
Bench Sharpe	0.55	0.52	0.49	Bench Sharpe	0.48	0.47	0.45

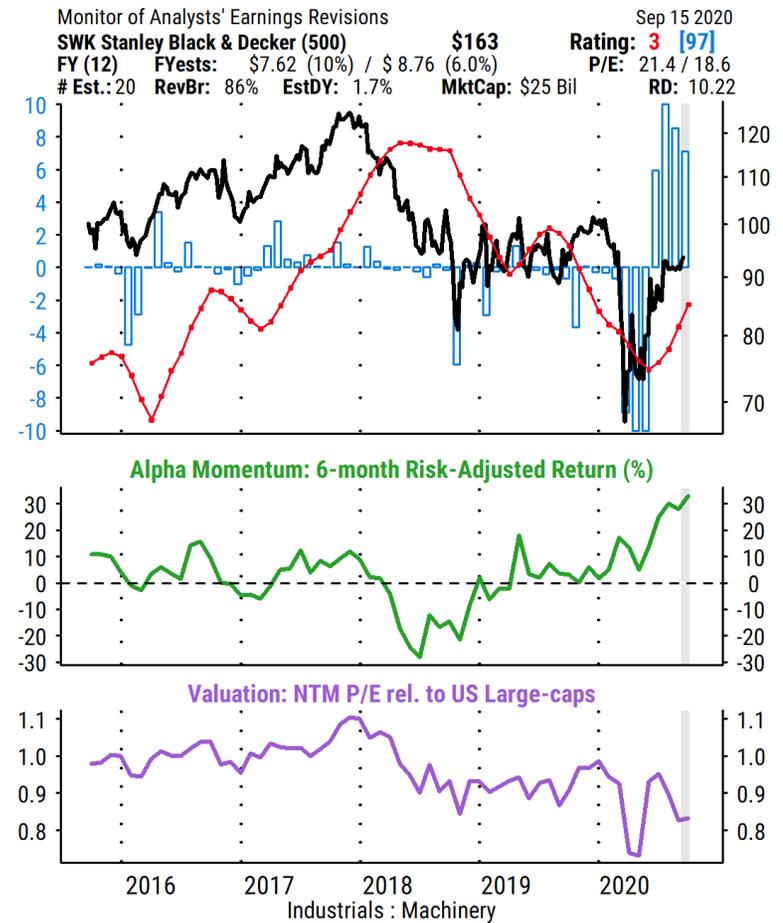
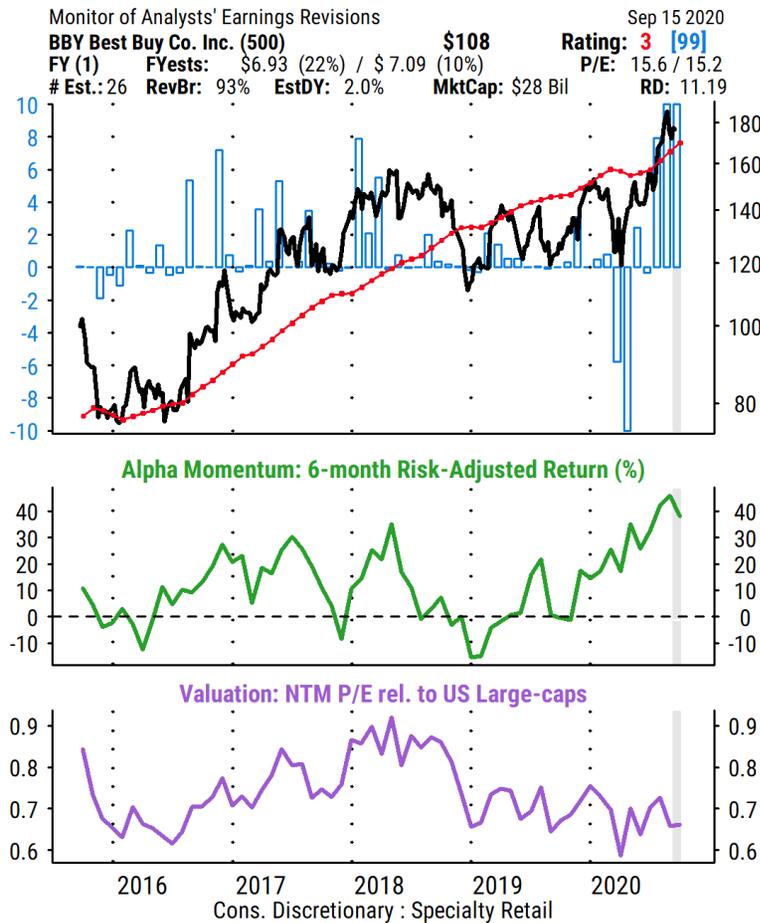
All returns shown are hypothetical percentage total returns in local currency for equal-weighted portfolios based on monthly rebalancing using the MAER ranking process. "Bench" = benchmark returns based on equal-weighted total return for full indicated MAER universe as of each monthly rebalancing. Data for May 2003 - Dec 2019.

Backtest results do not reflect any actual trading, and actual results could vary significantly from backtest results. Past performance is no guarantee of future results. No transactions costs or other expenses included in the above figures.

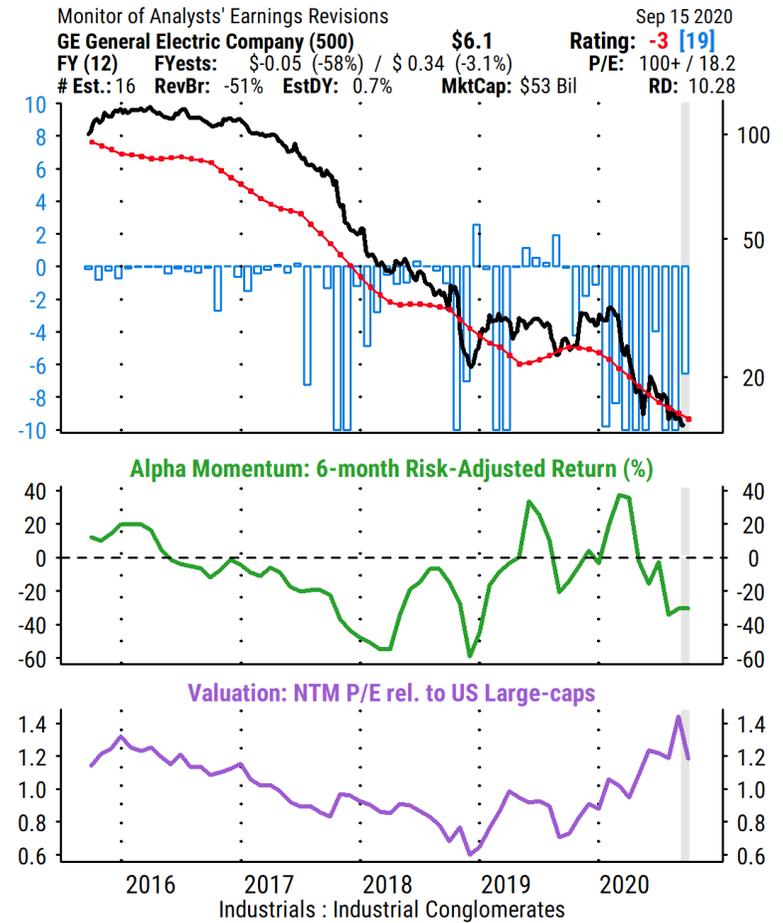
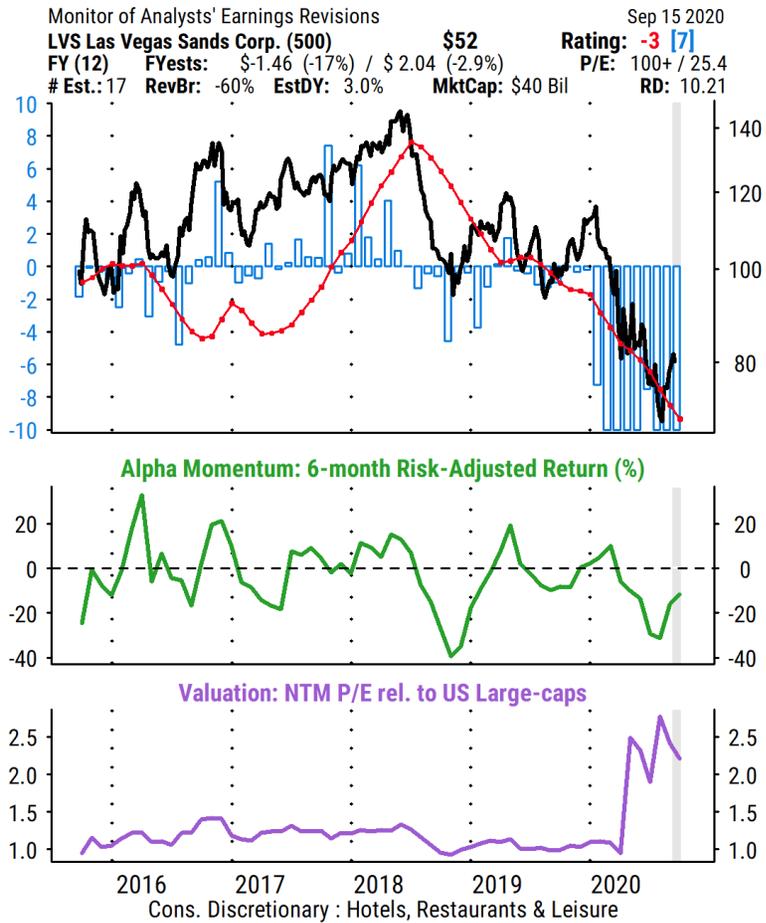
Examples of Strong MAER Charts



Examples of Strong MAER Charts CONTINUED



Examples of Weak MAER charts





Example Screen from S&P 500 Stocks

S&P 500 Buy Ideas 16 Sep 2020

Rank	Ticker	Name	Market Cap (\$Mil)	Sector
1	SEE	Sealed Air Corporation	6,010	Materials
2	HOLX	Hologic, Inc.	15,722	Health Care
3	PHM	PulteGroup, Inc.	12,080	Cons. Discretionary
4	KHC	Kraft Heinz Company	39,067	Cons. Staples
5	DHI	D.R. Horton, Inc.	26,091	Cons. Discretionary
6	LKQ	LKQ Corporation	9,681	Cons. Discretionary
7	HBI	Hanesbrands Inc.	5,468	Cons. Discretionary
8	BBY	Best Buy Co., Inc.	27,746	Cons. Discretionary
9	LEN	Lennar Corporation Class A	23,699	Cons. Discretionary
10	SWK	Stanley Black & Decker, Inc.	24,997	Industrials
11	LH	Laboratory Corporation of America	18,053	Health Care
12	AAP	Advance Auto Parts, Inc.	10,841	Cons. Discretionary
13	LOW	Lowe's Companies, Inc.	127,618	Cons. Discretionary
14	HAL	Halliburton Company	12,621	Energy
15	DGX	Quest Diagnostics Incorporated	15,221	Health Care
16	PFG	Principal Financial Group, Inc.	10,922	Financials
17	EMR	Emerson Electric Co.	40,875	Industrials
18	SLB	Schlumberger NV	25,258	Energy
19	DE	Deere & Company	67,506	Industrials
20	WHR	Whirlpool Corporation	11,059	Cons. Discretionary

NOTE: The list above is for demonstration purposes only and is not a recommendation to buy or sell any security.

Source: Mill Street Research, Factset



How Do Clients Use Tools Like MAER?

While there are many ways clients can use quantitative stock selection tools and incorporate them into their investment process, we find three primary ways that clients use them:

1. An initial stock screen

Clients looking for new stock ideas to potentially research often screen the list of highly-ranked stocks to find names that stand out on the quantitative metrics. Knowing that highly-ranked stocks have historically tended to outperform on average helps narrow the focus onto favorable indicator profiles and make research more efficient.

2. Check against current holdings

Clients also like to review their current or proposed holdings against the objective message from the multi-factor analysis. Holdings that have weak profiles can be scrutinized more closely (or sold), and strong profiles can corroborate other fundamental or technical analysis inputs.

3. Quantitative model input

Process-oriented clients use quantitative rankings directly as an input to their own process as a way to combine alpha sources.



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- Prior to founding Mill Street Research in 2016, Sam Burns, CFA worked as a senior strategist at leading firms including Oppenheimer & Co., Brown Brothers Harriman, State Street Global Markets, and Ned Davis Research.
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