Quant Signals: Performance and Promising Ideas

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Emory University and NBER

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Outline

- Traditional Signals – Recent performance
  - Price momentum and Earnings momentum
  - Sell-side Analysts’ recommendation
  - Valuation ratios: Book-to-market and Cash-flow to price

- Lessons from 2009

- Promising Ideas
  - Exploit Deviation from fundamentals
  - Combine Momentum with fundamentals
  - Exploit biases in analysts’ forecasts
Price Momentum

- Sample:
  - US stocks
  - Exclude stocks priced < $5
  - Exclude stocks with market cap in the 20th percentile of NYSE stocks

- Strategy
  - Ranks stocks based on returns in months t-12 to t-1
  - Buy Winner decile – sell loser decile. Hold for month t.
### Performance: Momentum (-12 to -2)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Mean (% P.A.)</td>
<td>14.7</td>
<td>25.2</td>
<td>13.9</td>
<td>-83.7</td>
</tr>
<tr>
<td>SD (% P.A.)</td>
<td>29.2</td>
<td>18.8</td>
<td>34.8</td>
<td></td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>.50</td>
<td>1.34</td>
<td>.40</td>
<td></td>
</tr>
</tbody>
</table>
What was different about 2009?

- Beta (winner minus loser portfolio)
  - 1990-2008 : -.01
  - 2009 : -.65
  - Losers were high beta stocks that were beaten down with the market

- Beta neutral portfolio increases Sharpe ratio by 10%

- Reduces 2009 loss from 83% to 63%
Valuation Ratio

- Cash flow to price: Ratio of previous 12 month cash flow to recent price
  - CF-to-Price (winner minus loser portfolio)
    - 1990-2008: -3.9%
    - 2009: -13.8%
  - Losers were priced cheaply in 2009 – On average CF-to-Price for Losers was 22.5% in 2009; Losers beaten down a lot more than justified by cash flows.

Momentum profit (%) = 2.48+.29 \times \text{CF-to-P difference (\%)}

\quad (t-stat = 2.64)
## Sell-Side Analysts’ Recommendations for Past Winners and Losers

<table>
<thead>
<tr>
<th></th>
<th>Winners</th>
<th>Losers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-2008</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>2009</td>
<td>2.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Some Lessons

- Momentum strategies are highly volatile because of a low correlation between winners and losers.
- Any strategy based on technical signals should also pay attention to fundamentals and valuation.
Earnings Momentum

- Many variations of earnings momentum strategy have been proposed in the literature; e.g. Analyst forecast revision, Standardized Unexpected Earnings etc.

- Preferred Measure:

\[ \text{Earnings Surprise} = \frac{\text{Actual} - \text{Consensus Forecast the Previous Month}}{\text{Std.Dev of Analysts' Forecast}} \]
## Performance: Earnings Momentum

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Mean</td>
<td>10.6</td>
<td>14.1</td>
<td>9.6</td>
<td>-18.8</td>
</tr>
<tr>
<td>（% P.A.）</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>7.8</td>
<td>5.7</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>（% P.A.）</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>1.3</td>
<td>2.4</td>
<td>1.1</td>
<td></td>
</tr>
</tbody>
</table>

Why is the risk of the earnings momentum strategy so much lower?
Characteristics in 2009

- Beta (Positive minus negative surprise portfolio)
  - 1990-2008: -.13
  - 2009: -.14
  - Beta not very different in 2009
- Yet, beta neutral portfolio increases Sharpe ratio by 10%
- Reduces 2009 loss from 19% to 10%
Valuation Ratio

- Cash flow to price: Ratio of previous 12 month cash flow to recent price
  - CF-to-Price (Positive minus negative surprise portfolio)
    - 1990-2008: .5%
    - 2009: -1.2%

Earnings Mom profit (%) = .8 + .19 \times \text{CF-to-P difference (%)}

(t – stat = 2.26)
Sell-Side Analysts’ Recommendations

- Buy positive Fraction up and sell negative over the previous month
- Hold for one month

\[
\text{Fraction up} = \frac{\text{# of upgrades} - \text{# of downgrades}}{\text{# of upgrades} + \text{# of downgrades}}
\]
### Performance: Upgrades minus Downgrades

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Mean (% P.A.)</strong></td>
<td>4.5</td>
<td>7.9</td>
<td>1.9</td>
<td>6.9</td>
</tr>
<tr>
<td><strong>SD (% P.A.)</strong></td>
<td>5.8</td>
<td>4.2</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td><strong>Sharpe Ratio</strong></td>
<td>.78</td>
<td>1.88</td>
<td>.30</td>
<td></td>
</tr>
</tbody>
</table>
Valuation Ratios

- Book-to-Price
- Cash Flow-to-Price
- Earnings-to-price – not as effective as cash flow to price
Performance: Book-to-price

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (% P.A.)</td>
<td>2.1</td>
<td>-5.1</td>
<td>7.4</td>
<td>33.6</td>
</tr>
<tr>
<td>SD (% P.A.)</td>
<td>22.7</td>
<td>16.7</td>
<td>27.1</td>
<td></td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>.09</td>
<td>-.3</td>
<td>.27</td>
<td></td>
</tr>
</tbody>
</table>
Characteristics: 2009

- Beta (value minus growth portfolio)
  - 1990-2008: -.36
  - 2009: .34

- Beta neutral portfolio increases Sharpe ratio from .09 to .28
Valuation Ratio

- Cash flow to price: Ratio of previous 12 month cash flow to recent price
  - CF-to-Price (value minus growth portfolio)
    - 1990-2008 : 14%
    - 2009 : 20%

Value minus Growth(%) = -1.4+.11×CF-to-P difference (%)

\[
(t - \text{stat} = 1.15)
\]
### Performance: CF-to-price

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Mean (% P.A.)</td>
<td>15.4</td>
<td>10.4</td>
<td>19.8</td>
<td>35.6</td>
</tr>
<tr>
<td>SD (% P.A.)</td>
<td>22.9</td>
<td>15.9</td>
<td>28.1</td>
<td></td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>.67</td>
<td>.65</td>
<td>.71</td>
<td></td>
</tr>
</tbody>
</table>
Characteristics: 2009

- Beta
  - 1990-2008: -.57
  - 2009: .45

- Beta neutral portfolio increases Sharpe ratio from .67 to .96
Valuation Ratio

- Cash flow to price: Ratio of previous 12 month cash flow to recent price
- CF-to-Price (high minus low portfolio)
  - 1990-2008: 31%
  - 2009: 42%

Value minus Growth(%) = -.59 + .6 × CF-to-P difference (%)

\( t-stat = .99 \)
## Correlation

<table>
<thead>
<tr>
<th></th>
<th>Price Momentum</th>
<th>Earnings Momentum</th>
<th>Book-to-price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings Momentum</td>
<td>.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book-to-price</td>
<td>-.72</td>
<td>-.21</td>
<td></td>
</tr>
<tr>
<td>CF-to-Price</td>
<td>-.41</td>
<td>.02</td>
<td>.82</td>
</tr>
</tbody>
</table>
Recent Ideas

- Examine divergence between past returns and changes in fundamentals (Dha et al., 2010, “Decomposing the Short-Term Return Reversal”)

- Buy winners with strong fundamentals and sell losers with weak fundamentals (Lee and Shih, 2010, “Technical, Fundamental, and Combined Information for Separating Winners from Losers”)

- Exploit biases in analysts’ forecasts (Green et al., 2010, “Inferring Investor Sentiment From Analyst Forecasts”)
Past Returns and Changes in Fundamentals

- One-month change in fundamental value: Present value of changes in cash flows implied by changes in analysts’ one- and two-year ahead earnings forecast and long term growth (Earnings growth rate assumed to linearly decline from the LTG forecast to steady state over years +5 to +10)

- Sort stocks based on previous month returns minus change in fundamental value (Diff)
  - High Diff indicates returns too high to be justified by changes in fundamentals and Low DIFF indicates returns too low relative to change in fundamentals.
  - Low Diff portfolios should outperform high Diff portfolio
Strategy

- **Short-Horizon Return reversals:**
  - Buy Decile of stocks with the lowest return in the previous month and sell the highest return stocks (Jegadeesh, JF 1990)

- **Diff Reversal**
  - Buy Decile of stocks with the smallest (or negative) Diff in the previous month and sell the highest Diff stocks
Performance: Reversal and Diff (1982-2008)

<table>
<thead>
<tr>
<th></th>
<th>Reversal</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean (% P.A.)</strong></td>
<td>8.0</td>
<td>18.9</td>
</tr>
<tr>
<td><strong>SD (% P.A.)</strong></td>
<td>14.5</td>
<td>9.3</td>
</tr>
<tr>
<td><strong>Sharpe Ratio</strong></td>
<td>.56</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Second month profit for Diff strategy is 3.6%
Momentum and fundamentals

- Lee and Shih (2010)
  - 12-month momentum
  - Covariance between returns and abnormal trading volume of the previous 12-months (Intuition – larger the covariance, larger is the informed trading)

- Fundamentals based on Financial statements
  - F-Score for value firms (Piotroski, JAE, 2000)
  - G-Score for growth firms (Mohanram, RAS 2005)
Piotroski (JAE, 2000): F-score

- Sum of the following indicator variables
  - 1 if ROA > 0; 0 otherwise
  - 1 if cash flow > 0
  - 1 if change in ROA > 1
  - 1 if accrual (Earnings - Cash flow) < 0
  - 1 if change in leverage < 0
  - 1 if change in current ratio > 0
  - 1 if No new equity issue in the last 12 months
  - 1 if year-over-year increase in gross margin
  - 1 if year-over-year increase in asset turnover

- Large F-Score indicates strong and improving fundamentals
- F-Scores predict returns for value firms (quintile of firms with largest book-to-price ratio) High score minus low score portfolio earns about 10% per year over the sample period 1976-1996
G-Score (Mohanram, RAS 2005)

- Sum of the following indicator variables
  - 1 of ROA greater than median ROA for growth firms in the same industry; and 0 otherwise
  - 1 of Cash Flow ROA greater than industry median
  - 1 if cash flow > earnings (negative accruals)
  - 1 if earnings variability is less than industry median
  - 1 if sales growth variability is less than industry median
  - 1 if R&D/assets greater than industry median
  - 1 if Capex/assets
  - 1 if advertisement/sales greater than industry median

- Large G-Score indicates better fundamentals than industry peers
- G-Scores predict returns for Growth firms (quintile of firms with smallest book-to-price ratio)
- High score minus low score portfolio earns about 18% per year over the sample period 1978-2001
## Performance (1982-2007)

<table>
<thead>
<tr>
<th>Signals</th>
<th>Growth</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Momentum Quintiles (-6 to -2) (winner – Loser)</td>
<td>.91%</td>
<td>.60%</td>
</tr>
<tr>
<td>Momentum + Cov (unexpected Vol., ret)</td>
<td>.84%</td>
<td>.91%</td>
</tr>
<tr>
<td>Momentum + Cov (unexpected Vol., ret) + G-Score/F-Score</td>
<td>3.3%</td>
<td>1.78%</td>
</tr>
</tbody>
</table>

Abnormal returns persist for up to 6 months
Strategy to directly exploit biases in analysts’ expectations

- Numerous papers document that analysts’ earnings forecasts are biased
- It is likely that stock for which analysts are most favorably biased are overpriced and stocks for which analysts are most unfavorably biased are underpriced
- How would we identify analyst biases?
- Green et al. (2010, Emory) measure bias as Analysts’ forecasts minus Statistical Forecast soon after earnings announcements and construct a trading strategy
Statistical Forecasts

- Estimate statistical forecast for year-ahead EPS using the following independent variables soon after fourth quarter earnings announcements for December year-end firms:
  - Past annual EPS
  - F-Score
  - Accrual
  - Earnings Volatility

\[ EPS_{t+1} = 0.145 + 0.719 \times EPS_t + 0.0126 \times F_{SCORE_t} + 0.3304 \times ACCRUALS_t - 0.022 \times \sigma(Earnings_{t,t-4}) \times EPS_t \]
Timing

Compute mean AF and SF
Calendar year t-1 Calendar year t Calendar year t+1
Form deciles for December fiscal year end firms by (AF-SF)
Returns from June year t to May year t+1

Error=Analysts Forecast - Statistical forecast

Analysts consensus forecasts measured as the average of the first forecast by each analyst after earnings announcement
# Performance: Subperiods

## Subperiods, Portfolio (AF-SF) ranking

<table>
<thead>
<tr>
<th>Year</th>
<th>D1 (Low AF-SF)</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>D7</th>
<th>D8</th>
<th>D9</th>
<th>D10 (High AF-SF)</th>
<th>D1-D10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981-1987</td>
<td>0.47**</td>
<td>0.47***</td>
<td>0.66***</td>
<td>0.44**</td>
<td>0.42***</td>
<td>0.36</td>
<td>0.05</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.20</td>
<td>0.67***</td>
</tr>
<tr>
<td>t-stat</td>
<td>(2.65)</td>
<td>(4.25)</td>
<td>(4.10)</td>
<td>(2.60)</td>
<td>(3.85)</td>
<td>(1.67)</td>
<td>(0.22)</td>
<td>(0.47)</td>
<td>(0.07)</td>
<td>(-0.83)</td>
<td>(3.44)</td>
</tr>
<tr>
<td>1988-1994</td>
<td>0.49</td>
<td>0.46</td>
<td>0.52</td>
<td>0.33</td>
<td>0.24</td>
<td>0.03</td>
<td>-0.06</td>
<td>-0.23</td>
<td>0.11</td>
<td>-0.39</td>
<td>0.88*</td>
</tr>
<tr>
<td>t-stat</td>
<td>(1.63)</td>
<td>(3.47)</td>
<td>(6.30)</td>
<td>(2.26)</td>
<td>(1.66)</td>
<td>(0.31)</td>
<td>(-0.34)</td>
<td>(-1.71)</td>
<td>(0.67)</td>
<td>(-1.92)</td>
<td>(2.36)</td>
</tr>
<tr>
<td>1995-2001</td>
<td>0.31</td>
<td>0.49</td>
<td>0.21</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.02</td>
<td>-0.28*</td>
<td>-0.34</td>
<td>-0.71***</td>
<td>1.01***</td>
</tr>
<tr>
<td>t-stat</td>
<td>(1.11)</td>
<td>(1.85)</td>
<td>(1.41)</td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(-0.07)</td>
<td>(-2.19)</td>
<td>(-1.81)</td>
<td>(-6.47)</td>
<td>(3.72)</td>
</tr>
<tr>
<td>2002-2008</td>
<td>1.02***</td>
<td>0.37</td>
<td>0.36</td>
<td>0.77***</td>
<td>0.45</td>
<td>0.16</td>
<td>0.12</td>
<td>0.12</td>
<td>-0.18</td>
<td>-0.33</td>
<td>1.35***</td>
</tr>
<tr>
<td>t-stat</td>
<td>(2.93)</td>
<td>(1.75)</td>
<td>(1.38)</td>
<td>(3.62)</td>
<td>(1.82)</td>
<td>(1.24)</td>
<td>(1.01)</td>
<td>(0.99)</td>
<td>(-0.92)</td>
<td>(-1.35)</td>
<td>(2.89)</td>
</tr>
</tbody>
</table>

- Raw return difference is of the same magnitude as 3-factor alpha
- Average return for 1981 to 2008: 12%
- Sharpe Ratio: 1.17
Annual Returns

3 factor alpha
4 factor alpha


-10.00 0.00 10.00 20.00 30.00 40.00 50.00
Exploiting Analysts’ Biases

- Profits increase over time; investors seem more focused on analysts’ forecasts in recent periods
- Strategy could be improved when complimented with momentum and fundamental signals
Conclusion

- Performance of momentum strategies weaker over the last decade compared with the ’90s
- Performance of Value strategies stronger over the last decade compared with the ’90s
- Value and momentum strategies are negatively correlated
- More money likely chasing momentum after the strong performance in the ’90s and the poor performance of value strategies
- Important to pay attention to valuation even when applying momentum strategies
Conclusion

- Evidence on some strategies that combine past returns with measures of valuation is promising
  - Short and intermediate horizon strategies
- Biases in analysts’ earnings forecasts lead to mispricing
  - Longer horizon strategies
- More precise estimates of forecast biases coupled with momentum and fundamental signals could lead to improved strategies