Stock Price Informativeness: Do Factors Matter?

Roger Clarke, Harindra de Silva, and Steven Thorley
February 2021
What is price informativeness?

The degree to which stock prices reflect public information and aggregate private information (Richard Roll “R²”, JF 1988). Measures of price informativeness are based on the regression coefficients (“FERC”) and R-squareds (“FINC”) of price changes on concurrent and future earnings (Durnev, Morck, Yeung, and Zarowin, JAR 2003).

Theoretical price = f (expected future cash flows and the discount rate), for example under the constant growth model:

\[
P_0 = \frac{CF_0 (1 + g_1)}{k - g_{LT}}
\]

(Eq. 1)

where

- \( P_0 \) = current security price
- \( CF_0 \) = recent cash flow (e.g., earnings per share)
- \( g_1 \) = expected earnings growth rate over the next period
- \( g_{LT} \) = expected long-term perpetuity growth rate
- \( k \) = equity discount rate
Previous Studies on Price Informativeness

Previous empirical studies have explored the sensitivity of stock returns to:
• Corporate management investment decisions (Chen, Goldstein, and Jiang, 2007)
• Country-specific insider-trading regulations (Fernandes and Ferreira, 2009)
• The informativeness of markets over time (Bai, Philippon, and Savov, 2016)

Dávila and Parlatore (NBER working paper, 2019) show that regressions of prices on fundamentals recover exact measures of dispersed information aggregation.

We examine price informativeness relative to earnings with more precision and data than previous studies:
1) Multi- versus single-period regressions.
2) Monthly versus annual stock returns.
3) Quarterly versus annual income statement data.
4) Capitalization “importance” weighting versus equal weighting.
5) Use report date of earnings announcements (Compustat RDQ).
6) Largest one thousand U.S. stocks from 1975 to 2019 (540,000 returns).
7) Adjustments for fiscal quarters, seasonality, and time-series dependencies.
8) We add factor exposures: value, momentum, small size, low beta, profitability.
Research Questions

When do stock prices capture information on corporate earnings?
How much of a given stock return is explained by realized earnings?
Does the timing or magnitude depend on stock characteristics?

The theoretical percentage stock price change due to an earnings growth report can be illustrated from the constant-growth valuation equation. Take the derivative of price with respect to the reported earnings growth rate, $g_1$, and divide by beginning price:

$$\frac{\%\Delta P}{\Delta g_1} = \frac{1}{1 + g_1} + \frac{g_{LT}'(g_1)}{k - g_{LT}}$$

(Eq. 2)

The reported earnings growth rate has an approximate 1-for-1 impact on return plus a return for the change in the expected long-term growth rate.

For example, if a one percentage-point change in $g_1$ is associated with a 10 basis-point change in $g_{LT}$, then

$$\frac{g_{LT}'(g_1)}{k - g_{LT}} = \frac{0.10}{0.08 - 0.06} = \frac{5}{-1} = -5$$

(Eq. 3)

for a total 6-to-1 ratio of stock return to earnings growth rate.
Data Description and Statistics

1) Largest 1000 stocks each month in the U.S. (CRSP data)

2) Income Statement report dates from Compustat
   a) RDQ = Date when earnings are publicly reported, typically between 2 to 5
   months after the end of the fiscal quarter. About one third of corporate fiscal
   quarters do not end in March, June, September, and December.
   b) Start date of 1975 is based on populated Income Statements in Compustat.
   c) 170,566 quarterly earnings reports (missing 9,434 “small” and “early”)

3) Calculate earnings growth rate
   a) Net Income before Extraordinary Items (Compustat IBQ)
   b) Change over the previous quarter has strong seasonal effects, so earnings
   growth is measured over the same fiscal quarter in the previous year.
   c) Growth rates are winsorized at +/- 100 percent. If the prior earnings are
   negative, then the growth rate is set to the sign of the current earnings.

3) Beginning-of-period capitalization-weighted regressions
   a) Measure importance relative to the broad market.
   b) All returns are in excess of the contemporaneous t-bill rate.
   c) Later in the study we use security exposures to five factors …
Data Description and Statistics

Value:
Earnings yield (i.e., inverse trailing P/E ratio). Not book equity because U.S. GAPP now has a lot of industry-specific (i.e., mergers, buy-back, etc.) “noise”.

Momentum:
11-month return, lagged one month, a la Carhart.

Small Size:
Log of inverse market capitalization from the prior month.

Low Beta:
Sign change on the trailing 36-month beta to the S&P 500. Not simply low-volatility which includes idiosyncratic risk that is irrelevant in portfolios.

Profitability:
Most recent annual statement of (Sales – COGS)/Book Assets a la Novy-Marx with an extension (i.e., subtract “deposits” in the denominator) for financial firms.
**Corporate Earnings Growth Rates** (percent change over prior year)
180 thousand quarterly reports from 1975 to 2019 ("missing" set to zero)

<table>
<thead>
<tr>
<th>Weighting</th>
<th>Average</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>12.20%</td>
<td>49.98%</td>
</tr>
<tr>
<td>Value Portfolio</td>
<td>6.33%</td>
<td>46.71%</td>
</tr>
<tr>
<td>Momentum Portfolio</td>
<td>21.08%</td>
<td>48.99%</td>
</tr>
<tr>
<td>Small Size Portfolio</td>
<td>10.52%</td>
<td>52.83%</td>
</tr>
<tr>
<td>Low Beta Portfolio</td>
<td>12.15%</td>
<td>47.91%</td>
</tr>
<tr>
<td>Profitability Portfolio</td>
<td>11.77%</td>
<td>44.35%</td>
</tr>
</tbody>
</table>

**Stock Returns** (excess of risk-free rate, and annualized by x12)
540 thousand monthly observations from 1975 to 2019

<table>
<thead>
<tr>
<th>Weighting</th>
<th>Average</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>8.44%</td>
<td>29.53%</td>
</tr>
<tr>
<td>Value Portfolio</td>
<td>9.92%</td>
<td>29.48%</td>
</tr>
<tr>
<td>Momentum Portfolio</td>
<td>10.25%</td>
<td>31.19%</td>
</tr>
<tr>
<td>Small Size Portfolio</td>
<td>9.32%</td>
<td>32.67%</td>
</tr>
<tr>
<td>Low Beta Portfolio</td>
<td>8.61%</td>
<td>27.23%</td>
</tr>
<tr>
<td>Profitability Portfolio</td>
<td>9.86%</td>
<td>30.12%</td>
</tr>
</tbody>
</table>
Price Informativeness Regression Coefficients (1975 to 2019)

Monthly cross-sectional regressions: \[ r_i = \gamma + \sum_{t=-6}^{17} \lambda_{i,t} g_{i,t} + \epsilon_i \] (Eq. 4)

Observations weighted by market-cap “importance” (not model fit or heteroscedastic errors.)

Simple average of coefficients over time with t-statistics based on the coefficient sample.

<table>
<thead>
<tr>
<th>Time</th>
<th>Coefficient</th>
<th>t-stat</th>
<th>Time</th>
<th>Coefficient</th>
<th>t-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6</td>
<td>0.08%</td>
<td>0.6</td>
<td>6</td>
<td>1.22%</td>
<td>8.4</td>
</tr>
<tr>
<td>-5</td>
<td>0.16%</td>
<td>1.2</td>
<td>7</td>
<td>1.12%</td>
<td>8.0</td>
</tr>
<tr>
<td>-4</td>
<td>-0.01%</td>
<td>-0.1</td>
<td>8</td>
<td>0.91%</td>
<td>6.4</td>
</tr>
<tr>
<td>-3</td>
<td>0.21%</td>
<td>1.2</td>
<td>9</td>
<td>0.97%</td>
<td>7.3</td>
</tr>
<tr>
<td>-2</td>
<td>0.20%</td>
<td>1.2</td>
<td>10</td>
<td>0.77%</td>
<td>5.7</td>
</tr>
<tr>
<td>-1</td>
<td>0.34%</td>
<td>2.6</td>
<td>11</td>
<td>0.68%</td>
<td>5.4</td>
</tr>
<tr>
<td>0</td>
<td>2.69%</td>
<td>16.2</td>
<td>12</td>
<td>0.49%</td>
<td>3.3</td>
</tr>
<tr>
<td>1</td>
<td>1.42%</td>
<td>10.0</td>
<td>13</td>
<td>0.30%</td>
<td>2.3</td>
</tr>
<tr>
<td>2</td>
<td>0.78%</td>
<td>6.1</td>
<td>14</td>
<td>0.33%</td>
<td>2.9</td>
</tr>
<tr>
<td>3</td>
<td>1.66%</td>
<td>10.4</td>
<td>15</td>
<td>0.50%</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>1.18%</td>
<td>8.4</td>
<td>16</td>
<td>0.16%</td>
<td>1.2</td>
</tr>
<tr>
<td>5</td>
<td>0.89%</td>
<td>6.2</td>
<td>17</td>
<td>-0.05%</td>
<td>-0.4</td>
</tr>
</tbody>
</table>
Price Informativeness Cumulative Coefficient Plots

Cumulative Coefficient

Month (0 = concurrent report)
Price Informativeness Cumulative Coefficient Plot
(2005 to 2019 sub-sample)

"Future Earnings Response Coefficient" FERC (10.40%)  
Concurrent earnings coefficient (2.52%)  
6 months of "old news"  18 months of earnings news
Price Informativeness Regression R-squared

FINC = “Future earnings INCremental explanatory power”

Difference between the R-squared of a regression on the concurrent and future earnings (time 0 to 17) and a regression on just the concurrent (time 0) earnings.

<table>
<thead>
<tr>
<th></th>
<th>Concurrent and Future</th>
<th>Concurrent</th>
<th>FINC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average R-squared</td>
<td>8.82%</td>
<td>-</td>
<td>1.22%</td>
</tr>
</tbody>
</table>

The average R-squared from cross-sectional regressions of stock returns on just one fundamental variable, realized earnings growth rates, is high for financial economics.

by Sub-period

<table>
<thead>
<tr>
<th></th>
<th>Concurrent and Future</th>
<th>Concurrent</th>
<th>FINC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975 to 1989</td>
<td>8.23%</td>
<td>1.50%</td>
<td>6.73%</td>
</tr>
<tr>
<td>1990 to 2004</td>
<td>9.64%</td>
<td>0.93%</td>
<td>8.71%</td>
</tr>
<tr>
<td>2005 to 2019</td>
<td>8.59%</td>
<td>1.23%</td>
<td>7.36%</td>
</tr>
</tbody>
</table>

Price Informativeness does not appear to increase over time, but R-squared based FINC may not be the best measure. For example, the most recent 15-year sub-period plot shows an “old news cumulative coefficient” of zero, similar to the disappearance of “post earnings announcement drift” in event study CARs.
Do Factors Matter?

Value  Momentum  Small Size  Low Beta  Profitability

Beginning-of-month data for each stock are converted into pure (zero secondary exposure) benchmark-anchored (capitalization-weighted) scored (mean-zero unit-variance) cross-sectional (by month) factor exposures: \( s_{k,i} \)

The factor \( k \) portfolio weight for each stock \( i \) is calculated from the score by:

\[
w_{k,i} = w_{M,i} (1 + s_{k,i})
\]

(Eq. 5)

The active (market differential) return for the factor \( k \) portfolio is:

\[
r_k = \sum w_{M,i} s_{k,i} r_i
\]

(Eq. 6)

The PI regression gives fitted and residual returns for each stock. The “explained” factor return is:

\[
\hat{r}_k = \sum w_{M,i} s_{k,i} \hat{r}_i
\]

(Eq. 7)
Active (market differential) Pure Factor Portfolio Returns
1975 to 2019 (540 months)

*Portfolio return (i.e., sum of security returns times portfolio weights)*

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Momentum</th>
<th>Small Size</th>
<th>Low Beta</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.66%</td>
<td>2.21%</td>
<td>1.07%</td>
<td>0.20%</td>
<td>1.50%</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>2.89%</td>
<td>4.98%</td>
<td>3.59%</td>
<td>5.62%</td>
<td>3.06%</td>
</tr>
</tbody>
</table>

Note: Market betas are close to one, except for the Low Beta Portfolio. The Low Beta portfolio “alpha” using 0.8 instead of an implicit one is 2.36%.

*Return “explained by earnings” (i.e., sum of regression fitted returns times weights)*

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Momentum</th>
<th>Small Size</th>
<th>Low Beta</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.00%</td>
<td>1.07%</td>
<td>0.08%</td>
<td>0.43%</td>
<td>0.64%</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.97%</td>
<td>1.50%</td>
<td>0.85%</td>
<td>1.49%</td>
<td>0.86%</td>
</tr>
</tbody>
</table>

Conclusion: Little of the active return to the Value and Small Size portfolios is explained by the realized aggregate earnings in those portfolios. On the other hand, almost half of the active return to the Momentum and Profitability portfolios is from realized earnings.
Price Informativeness Regression with Factor Scores

\[ r_i = \gamma + \sum_{t=0}^{17} \lambda_t g_{i,t} + s_{k,i} \left( \sum_{t=0}^{17} \lambda_{k,t} g_{i,t} \right) + \varepsilon_i \]  

(Eq. 8)

1) Five (factor \( k \) = 1 to 5) separate monthly cross-sectional regressions.

2) Observations still weighted by market-capitalization.

3) Average of differential coefficients \( \lambda_{k,t} \) over time.

4) “Current” is the month 0 differential coefficient.

4) “Future” is the sum (months 1 to 17) of differential coefficients.
## Price Informativeness Regressions with Factor Scores

<table>
<thead>
<tr>
<th>Current</th>
<th>Value</th>
<th>Coeff</th>
<th>t-stat</th>
<th>Momentum</th>
<th>Coeff</th>
<th>t-stat</th>
<th>Small Size</th>
<th>Coeff</th>
<th>t-stat</th>
<th>Low Beta</th>
<th>Coeff</th>
<th>t-stat</th>
<th>Profitability</th>
<th>Coeff</th>
<th>t-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.14%</td>
<td>1.2</td>
<td></td>
<td>0.01%</td>
<td>0.1</td>
<td></td>
<td>0.14%</td>
<td>0.8</td>
<td>-0.03%</td>
<td>-0.3</td>
<td></td>
<td>0.34%</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.09%</td>
<td>0.8</td>
<td>-0.15%</td>
<td>-1.6</td>
<td>-0.18%</td>
<td>-0.9</td>
<td>-0.20%</td>
<td>-2.0</td>
<td>0.24%</td>
<td>2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.33%</td>
<td>3.6</td>
<td>0.05%</td>
<td>0.5</td>
<td>-0.26%</td>
<td>-1.6</td>
<td>-0.12%</td>
<td>-1.2</td>
<td>0.17%</td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0.09%</td>
<td>0.7</td>
<td>0.26%</td>
<td>2.4</td>
<td>-0.12%</td>
<td>-0.6</td>
<td>-0.04%</td>
<td>-0.3</td>
<td>0.46%</td>
<td>3.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>0.29%</td>
<td>2.5</td>
<td>0.27%</td>
<td>2.9</td>
<td>0.26%</td>
<td>1.3</td>
<td>-0.06%</td>
<td>-0.6</td>
<td>0.36%</td>
<td>3.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>0.13%</td>
<td>1.1</td>
<td>0.11%</td>
<td>1.0</td>
<td>-0.05%</td>
<td>-0.3</td>
<td>-0.16%</td>
<td>-1.6</td>
<td>0.13%</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>0.15%</td>
<td>1.2</td>
<td>-0.03%</td>
<td>-0.2</td>
<td>-0.05%</td>
<td>-0.3</td>
<td>-0.09%</td>
<td>-0.8</td>
<td>0.32%</td>
<td>2.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>0.11%</td>
<td>1.0</td>
<td>0.17%</td>
<td>1.7</td>
<td>-0.10%</td>
<td>-0.6</td>
<td>-0.16%</td>
<td>-1.6</td>
<td>0.07%</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>0.16%</td>
<td>1.2</td>
<td>-0.10%</td>
<td>-1.0</td>
<td>0.02%</td>
<td>0.1</td>
<td>-0.02%</td>
<td>-0.2</td>
<td>0.03%</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>0.23%</td>
<td>2.0</td>
<td>0.29%</td>
<td>2.4</td>
<td>0.05%</td>
<td>0.3</td>
<td>-0.11%</td>
<td>-1.0</td>
<td>0.12%</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>-0.07%</td>
<td>-0.6</td>
<td>0.07%</td>
<td>0.6</td>
<td>0.00%</td>
<td>0.0</td>
<td>0.05%</td>
<td>0.5</td>
<td>0.05%</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>-0.11%</td>
<td>-0.9</td>
<td>0.17%</td>
<td>1.6</td>
<td>-0.19%</td>
<td>-1.2</td>
<td>-0.19%</td>
<td>-1.8</td>
<td>-0.15%</td>
<td>-1.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>-0.15%</td>
<td>-1.1</td>
<td>-0.18%</td>
<td>-1.5</td>
<td>0.00%</td>
<td>0.0</td>
<td>-0.15%</td>
<td>-1.3</td>
<td>0.47%</td>
<td>3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>0.03%</td>
<td>0.3</td>
<td>0.18%</td>
<td>1.7</td>
<td>0.07%</td>
<td>0.4</td>
<td>0.01%</td>
<td>0.1</td>
<td>0.05%</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>0.02%</td>
<td>0.2</td>
<td>-0.06%</td>
<td>-0.6</td>
<td>-0.32%</td>
<td>-1.8</td>
<td>0.07%</td>
<td>0.7</td>
<td>0.10%</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>0.03%</td>
<td>0.2</td>
<td>-0.06%</td>
<td>-0.5</td>
<td>-0.02%</td>
<td>-0.1</td>
<td>-0.03%</td>
<td>-0.2</td>
<td>0.23%</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>0.19%</td>
<td>1.8</td>
<td>0.04%</td>
<td>0.4</td>
<td>0.10%</td>
<td>0.5</td>
<td>0.03%</td>
<td>0.2</td>
<td>0.23%</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>-0.19%</td>
<td>-1.5</td>
<td>0.05%</td>
<td>0.4</td>
<td>0.13%</td>
<td>0.7</td>
<td>0.07%</td>
<td>0.7</td>
<td>0.06%</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future</td>
<td></td>
<td>1.33%</td>
<td>3.1</td>
<td>1.07%</td>
<td>2.6</td>
<td>-0.66%</td>
<td>-1.0</td>
<td>-1.08%</td>
<td>-2.6</td>
<td>2.92%</td>
<td>5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cumulative Coefficient

Month (0 = concurrent report)

Value  Momentum  Small Size  Low Beta  Profitability
Regression R-squared with Factor Scores

FINC = “Future earnings incremental explanatory power”

The difference between the R-squared of a regression on the concurrent and future earnings (time 0 to 17) and a regression on just the concurrent (time 0) earnings.

<table>
<thead>
<tr>
<th></th>
<th>Concurrent and Future</th>
<th>Concurrent Only</th>
<th>Price Informativeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>8.82%</td>
<td>-</td>
<td>1.22%</td>
</tr>
</tbody>
</table>

with Factor Scores (incremental R-squared over the market numbers):

- **Value**: 3.62% ++ 0.33% = 3.29%
- **Momentum**: 4.75% ++ 0.46% = 4.29%
- **Small Size**: 5.31% ++ 0.45% = 4.85%
- **Low Beta**: 4.11% ++ 0.31% = 3.80%
- **Profitability**: 4.19% ++ 0.40% = 3.79%
Summary and Conclusions

We study the stock price informativeness of past, concurrent and future realized earnings with much more precision and data than past studies.

1) Prices are informed by realized earnings up to 15 months before they are reported.

2) The largest return sensitivity is to concurrent earnings, with a monotonic decline for earnings further in the future.

3) Past earnings growth has little to no impact on current returns.

4) The R-squared of cross-sectional return regressions on realized earnings is impressive.

5) Price informativeness of the U.S. equity market has not changed much over time.

… with an extension to exposures to five popular equity factors.

6) Almost none of the positive active return to the Value and Small Size factors is explained by subsequent earnings growth.

7) Stocks with high exposure to the Profitability factor have returns that are the most sensitive to realized earnings growth. Low Beta stocks are the least sensitive.

8) Yes, factors (stock characteristics) do matter in terms of price informativeness, and the results may help us understand the sources of factor portfolio performance.
The price informativeness cumulative coefficient plot is **not** an “Earnings growth event study CAR”.

Price informativeness regressions explain a return with events over time …

.. **not** an event with abnormal returns over time.

But for reference purposes …

.. this is an event study CAR plot using the same data.
References and Prior Research

Price Informativeness


References and Prior Research

Equity Market Factors


