Who should you listen to?
A sector decomposition of surprise stock returns

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A preview: Performance of analysts’ earnings forecasts

Performance of a long-short strategy based on UBS analysts’ earnings upgrades forecasts

Source: UBS estimates
Outline of the talk

♦ We decompose return surprises into the amount that can be attributed to either
  a) Cash-flow news or
  b) Discount rate news.

♦ We discuss the results with respect to a global universe highlighting
  a) Sector differences,
  b) Links to similar results from a residual income model,
  c) Correlations in the returns portfolios constructed on basis of a value screen or a
growth screen by sector.

♦ We discuss the results with respect to a US universe, estimated on quarterly data
  and augmented with macroeconomic factors, highlighting
  a) those sectors driven by cash flow news at the sector level and those where the
     majority of news is at a stock level.
  b) those sectors driven by news in the macroeconomy.

♦ We discuss the implications of the research for alpha generation
  a) Demonstrating the sectors in which a quantitative strategy performs.
  b) Demonstrating the sectors in which strategies based on fundamentals performs.
Cash-Flow or Discount Rate News

♦ The value of a share is the expected present value of its accruing cash flows

\[
P_t = \mathbb{E}_t \left[ \sum_{i=1}^{\infty} \frac{D_{t+i}}{\prod_{j=1}^{i} (1 + r_{t+j})} \right]
\]

♦ Hence an unexpected change in the value, \( P_t - \mathbb{E}_{t-1}(P_t) \) must be due to new information (news) about either
  
  a) the cash flows (dividends) – Cash-flow news
  b) or the discount rates – Discount rate news.

♦ If discount rates are constant and known, then all price changes will be due to news about the future cash flows.
Cash Flow or Discount Rate News

♦ However discount rates may vary in cross-section (a time-varying conditional beta) because the
  – firm’s mix between safe and risky projects vary over time (Green, Berk and Naik, 1999) due to investment in new projects.
  – ‘value firms’ suffer from costly irreversible investment in bad times and therefore more risky (Zhang 2005).

♦ Or risk premium may vary over time due to investors’ changing attitudes towards risk (e.g. Campbell, Cochrane 1999).

BUT in these cases discount rate news will be correlated with cash flow news (but as Campbell and Cochrane note, the correlation can be quite low but not zero).

♦ Alternatively returns may be forecastable because of systematic biases in investors’ expectations
  – In Daniel, Hirshleifer and Subrahmanyan (2000) a fundamental to price ratio is a proxy for mispricing in the cross-section.
  – Barberis, Schleifer and Vishny (1998) and Daniel, Hirshleifer and Subrahmanyan (1998) where herding or overconfidence causes returns to predictable over time.
We used two datasets for our empirical analysis:

♦ **A Global Stock Universe**
  - All constituents of the DJ World index.
  - Accounting data sourced from Worldscope, adjusted prices from Dow Jones.

♦ **A US Stock Universe**
  - All US-based constituents of the DJ World index.
  - Data sampled quarterly between 1990Q1-2006Q4.
  - Quarterly, accounting and price data from Compustat, macroeconomic series from the Federal Reserve and Bureau of Economic Analysis.
The Residual Income Model

- We illustrate our approach using a Residual Income Model

\[
P_t = \frac{B_t}{P_t} + \sum_{i=1}^{\infty} \frac{E_{t+i} - rB_{t+i-1}}{(1+r)^i}
\]

which implies

\[
r_t - r \approx \frac{B_t}{P_t} (1+g) \Delta \bar{E}_t \sum_{i=1}^{\infty} \rho^i (ROE_{t+i} - r)
\]

where \( \rho = \frac{1+g}{1+r} \), \( g \) is the average growth rate and \( \Delta \bar{E}_t(.) = \bar{E}_t(.) - \bar{E}_{t-1}(.) \) is the change in expectations.

- Assume the discount rate is fixed, and Return on Equity, \( E_t / B_{t-1} \), evolves

\[
ROE_t = \alpha + \phi ROE_{t-1} + \varepsilon_t
\]

then we can express the variance of cash-flow returns as

\[
\text{Var} \left[ \Delta \bar{E}_t \sum_{i=1}^{\infty} \rho^i (ROE_{t+i} - r) \right] = \frac{\sigma^2 \rho^2}{1-(\rho \phi)^2}
\]
The importance of cash-flow news in explaining return variance: Estimates of $\phi$

Source: UBS estimates
The main model: Decomposing surprise stock returns

♦ By taking a log-linear approximation of the Residual Income Model, Vuolteenaho (2002) was able to drop the assumption of constant discount rates.

♦ Now the return surprise can be decomposed into cash flow or discount rate news

\[ r_t - \mathbb{E}_{t-1}(r_t) = \Delta \mathbb{E}_t \sum_{i=0}^{\infty} \phi_i e_t^{i+1} - \Delta \mathbb{E}_t \sum_{i=1}^{\infty} \phi_i r_t^{i+1} + K_t \]

where \( e_t = \log \left( 1 + \frac{\text{ROE}_t - R^f_t}{1 + R^f_t} \right) \) and \( R^f \) is the risk free rate.

♦ Further instead of the earlier simple the model describing the evolution of ROE, we use a vector autoregression (VAR)

\[ z_{i,t} = \Gamma z_{i,t-1} + u_{i,t} \]

where \( u_t \) are serially uncorrelated errors. The components of \( z_{i,t} \) will be stock return (the variable we are ultimately interested in), (log) book to market ratio and ROE, but also sector-level and macroeconomic factors.
The VAR model: example

♦ An example: The VAR below was estimated on data for all stocks in the Dow Jones Global Universe over our sample period

\[
\begin{bmatrix}
  r_t \\
  B_t / P_t \\
  e_t \\
  r_t^{Sector} \\
  (B / P)_t^{Sector} \\
  e_t^{Sector}
\end{bmatrix}
= \begin{bmatrix}
  -0.00082 \\
  0.00055 \\
  -0.0003 \\
  0.00004 \\
  -0.00001 \\
  0.00002
\end{bmatrix}
+ \begin{bmatrix}
  0.074 & 0.088 & 0.320 & 0.167 & 0.410 & 0.516 \\
  -0.059 & 0.814 & -0.043 & -0.125 & -0.084 & 0.142 \\
  0.041 & -0.037 & 0.514 & -0.017 & 0.031 & 0.013 \\
  0 & 0 & 0 & 0.198 & 0.348 & 0.799 \\
  0 & 0 & 0 & -0.127 & 0.605 & 0.165 \\
  0 & 0 & 0 & 0.014 & -0.021 & 0.542
\end{bmatrix}
\begin{bmatrix}
  r_{t-1} \\
  B_{t-1} / P_{t-1} \\
  e_{t-1} \\
  r_{t-1}^{Sector} \\
  (B / P)_{t-1}^{Sector} \\
  e_{t-1}^{Sector}
\end{bmatrix}
+ \begin{bmatrix}
  u_{1,t} \\
  u_{2,t} \\
  u_{3,t} \\
  u_{4,t} \\
  u_{5,t} \\
  u_{6,t}
\end{bmatrix}
\]

♦ Similar VARs were estimated for each global industry separately.
Results: Global model

Source: UBS

Ratio of cash-flow news and discount rate news variance (LHS Axis)
Correlation between return to relative value and return to not-growth (RHS Axis)
Results: Global model

The ‘value premium correlation’ is the correlation between returns to relative-value portfolios and relative-not growth portfolios.

Source: UBS
Deductions at the level of the Global universe

♦ **Utilities, Oil & Gas sectors and Basic Materials**: Even at the stock level, approximately 50% of the surprise return is due to news about discount rates. This suggests
  – that if discount rate news is important, then returns are forecastable.
  – If returns are forecastable, a quantitative strategy is more likely to deliver significant alpha.
  – As corroboration, in these sectors returns to the value strategy are uncorrelated with the returns to a portfolio of low growth stocks.
  – as returns are only partially driven by cash flow news, a strategy based on fundamental analysis will find it harder to out-perform.

♦ **Technology, Telecommunications and Consumer Services**: In these sectors, stocks surprise returns are largely driven by cash-flow news.
  – Not just due to the TMT bubble.
  – Suggests a strategy based on fundamental analysis is likely to deliver.
  – Little predictability in returns, and hence simple quantitative strategies unlikely to outperform.
Results for the US market (1)

Source: UBS

- Utilities
- Oil & Gas
- Consumer Goods
- Financials
- Telecommunications
- Industrials
- Basic Materials
- Technology
- Health Care
- Consumer Services

Ratio of cash-flow news and discount rate news
Results for the US market (2)

- **Sector-level** cash-flow news (as a proportion of total cash-flow news) is more relevant in highly concentrated sectors.

- The columns display:
  1. Proportion of cash-flow news originating at sector level
  2. Average Herfindahl Hirschman index of concentration (calculated on market capitalization) over the sample period.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Sector/Total</th>
<th>HH index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.09</td>
<td>1251.23</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>0.03</td>
<td>489.93</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.03</td>
<td>633.14</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.04</td>
<td>440.02</td>
</tr>
<tr>
<td>Health Care</td>
<td>0.01</td>
<td>528.91</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.03</td>
<td>288.07</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>0.15</td>
<td>1522.13</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.11</td>
<td>260.96</td>
</tr>
<tr>
<td>Financials</td>
<td>0.11</td>
<td>209.55</td>
</tr>
<tr>
<td>Technology</td>
<td>0.05</td>
<td>602.91</td>
</tr>
</tbody>
</table>

Correlation: 0.48

Source: UBS
Adding macroeconomic factors to the model (1)

♦ We augment the VAR model with macro factors. Our preferred specification is selected by maximising the Akaike information criterion. This model includes GDP growth, 3M Bill Rate and trade balance changes, and the three-month rate.

♦ A triangular structure is imposed on the VAR:

\[
\begin{bmatrix}
\text{Stock Level Variables} \\
\text{Sector Level Variables} \\
\text{Macro Variables}
\end{bmatrix}_t =
\begin{bmatrix}
A_{11} & A_{12} & A_{13} \\
0 & A_{22} & A_{23} \\
0 & 0 & A_{33}
\end{bmatrix}
\begin{bmatrix}
\text{Stock Level Variables} \\
\text{Sector Level Variables} \\
\text{Macro Variables}
\end{bmatrix}_{t-1} + u_t
\]

♦ For a sanity check:

- We compare the VAR equilibrium values with historic means of the macro variables
- We compare our model’s predictions for Q1 2007 with UBS forecasts

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GDP</strong></td>
<td>3.08%</td>
<td>2.93%</td>
<td>0.51% (Qtr)</td>
<td>0.45% (Qtr)</td>
</tr>
<tr>
<td><strong>Trade balance</strong></td>
<td>0.00%</td>
<td>-0.06%</td>
<td>-0.02%</td>
<td>0.10%</td>
</tr>
<tr>
<td><strong>Short rate</strong></td>
<td>3.55%</td>
<td>4.08%</td>
<td>4.62%</td>
<td>4.85%</td>
</tr>
</tbody>
</table>

Source: UBS. Source for UBS forecasts: “US Economic Perspectives”, Feb 16th. The UBS predicted 3-month rate is reduced by 15bp to ensure comparability with the historical figures from the Federal Reserve. UBS forecasts the change in the Trade Balance for good and services, whereas the VAR is for goods only. Mean levels are computed over the whole sample period.
Adding macroeconomic factors to the model (2)

- The significant of the macro variables on the respective sector return when measured relative to the market (robust F-test results):

<table>
<thead>
<tr>
<th>Sector</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sectors</td>
<td>0.020 **</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>0.298</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>0.020 **</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.009 **</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.000 **</td>
</tr>
<tr>
<td>Health Care</td>
<td>0.129</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.005 **</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>0.481</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.897</td>
</tr>
<tr>
<td>Financials</td>
<td>0.030 **</td>
</tr>
<tr>
<td>Technology</td>
<td>0.657</td>
</tr>
</tbody>
</table>

Source: UBS

** indicates 5% significance, * 10% significance in the robust F-test. Included macro variables are: 10Y rate, industrial production, GDP, trade balance, credit spread, 3M rate.
Discussion of the findings for the US market

♦ In more concentrated sectors, the relevance of sector-level cash-flow news tends to increase.

♦ **Utilities, Oil & Gas sectors**: These sectors have the lowest ratio of cash flow to discount rate news. This implies
  – Even in the US returns are forecastable in these sectors.
  – As corroboration, in these sectors returns to the value strategy are uncorrelated with the returns to a portfolio of low growth stocks.

♦ **Technology, Telecommunications and Consumer Services**: In these sectors, stocks surprise returns are largely driven by cash-flow news.
  – Suggests a strategy based on fundamental analysis is likely to deliver.
  – However a considerable proportion of the news originates at the sector-level. A position in the sector alone would be sufficient to capture this alpha.
Using the US model to design a quantitative strategy

♦ We simulate a quantitative trading strategy based on our estimated model. This strategy is equivalent to weighted screens on momentum, ROE and Book/Price. The weights are the coefficients implicit within the VAR.

♦ For each quarter in the sample period, we rank all US stocks within a sector by predicted return one quarter ahead.

♦ Buy the top 30% stocks, equally weighted

♦ Short the bottom 30% stocks, equally weighted.

♦ All portfolios are self-financing

<table>
<thead>
<tr>
<th>Sector</th>
<th>Mean Excess Return</th>
<th>Annualised Volatility</th>
<th>Sharpe Ratio</th>
<th>Momentum weight</th>
<th>Value weight</th>
<th>Quality weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities</td>
<td>3.3%</td>
<td>9.0%</td>
<td>0.37</td>
<td>-0.0024</td>
<td>0.0056</td>
<td>0.0066</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>9.5%</td>
<td>16.4%</td>
<td>0.58</td>
<td>0.0266</td>
<td>0.0128</td>
<td>0.0046</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>10.7%</td>
<td>12.8%</td>
<td>0.84</td>
<td>0.0030</td>
<td>0.0053</td>
<td>0.0151</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>5.6%</td>
<td>14.0%</td>
<td>0.40</td>
<td>-0.0049</td>
<td>-0.0030</td>
<td>0.0047</td>
</tr>
<tr>
<td>Industrials</td>
<td>10.1%</td>
<td>12.4%</td>
<td>0.81</td>
<td>0.0036</td>
<td>0.0109</td>
<td>0.0099</td>
</tr>
<tr>
<td>Financials</td>
<td>9.0%</td>
<td>8.0%</td>
<td>1.12</td>
<td>-0.0007</td>
<td>0.0053</td>
<td>0.0095</td>
</tr>
<tr>
<td>Health Care</td>
<td>13.8%</td>
<td>23.6%</td>
<td>0.59</td>
<td>0.0022</td>
<td>0.0131</td>
<td>0.0105</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>9.9%</td>
<td>10.1%</td>
<td>0.99</td>
<td>-0.0005</td>
<td>0.0061</td>
<td>0.0124</td>
</tr>
<tr>
<td>Technology</td>
<td>13.4%</td>
<td>22.1%</td>
<td>0.61</td>
<td>0.0082</td>
<td>0.0195</td>
<td>0.0087</td>
</tr>
</tbody>
</table>

Source: UBS
Designing a Macro Strategy using the model

♦ The output of our forecasting model (VAR) can be combined with macroeconomic views and/or views about sector performances.

♦ Effectively this is a Bayesian or Black and Litterman approach;
  – The priors are the VAR forecasts
  – These are combined with the strategist views using the covariance matrix implicit in the VAR.
  – We are able to incorporate uncertainty in the strategist’s view into the model as well. In the case of the sector views we make the uncertainty proportional to the relevance of cash-flow news.

♦ As illustration of the methodology we incorporate the UBS US macroeconomic forecasts for 2007:Q1.
  GDP +0.45%   Trade bal 0.1%   Short rate 4.85%

♦ And the following subset of sector views
  Oil & Gas 0.00   Technology -2.5%   Industrials +2.5%

These returns are proportional to recommended sector weightings in the UBS Global Equity Strategy document of 9th December 2006. (For the other sectors, the recommended portfolio weights are in line with VAR predictions).
Designing a Macro Strategy using the model (2)

- Large adjustment for Oil & Gas where we attach more importance to the strategist’s view.

- Sectors like Health Care and Telecoms adjust because of the correlations among returns.

<table>
<thead>
<tr>
<th></th>
<th>Prediction of VAR</th>
<th>Prediction after Combination with Forecasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>-0.137</td>
<td>-0.088</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>0.007</td>
<td>0.012</td>
</tr>
<tr>
<td>Industrials</td>
<td>-0.006</td>
<td>-0.004</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.069</td>
<td>0.069</td>
</tr>
<tr>
<td>Health Care</td>
<td>0.034</td>
<td>0.030</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.048</td>
<td>0.044</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>0.088</td>
<td>0.080</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.021</td>
<td>0.024</td>
</tr>
<tr>
<td>Financials</td>
<td>-0.048</td>
<td>-0.048</td>
</tr>
<tr>
<td>Technology</td>
<td>-0.003</td>
<td>-0.011</td>
</tr>
<tr>
<td>GDP Growth</td>
<td>0.505</td>
<td>0.452</td>
</tr>
<tr>
<td>Change in Trade Balance</td>
<td>0.000</td>
<td>-0.001</td>
</tr>
<tr>
<td>3M Bill Rate</td>
<td>4.618</td>
<td>4.834</td>
</tr>
</tbody>
</table>

Source: UBS
And of course, it predicts in which sectors a fundamental strategy is likely to be more successful…

Performance of a long-short strategy based on UBS analysts’ earnings upgrades forecasts

Source: UBS
Conclusion

- We measure the relative importance of news about future cash-flows and news about future expected returns in explaining surprise returns.

- In the Utilities and Oil & Gas sectors, the majority of the return variance can be attributed to discount rate news. This suggests a quantitative strategy is more likely to deliver significant alpha.

- As corroboration, sectors where a significant proportion of return variance can be attributed to discount rate news are the very sectors where returns to a relative value strategy is uncorrelated with the returns to a portfolio of low growth stocks.

- For Industrials, Technology, Telecommunications and Consumer Services, return variance is largely driven by cash-flow news. The evidence is that strategies based on fundamental are more likely to outperform in these sectors.

- We illustrate how our model can be used in practice to guide asset allocation, possibly by incorporating macroeconomic views and sector outlooks and/or earnings forecasts at the firm level.
References


Appendix
Derivation of Vuolteenaho’s Decomposition (1)

♦ We can write the return as

\[
(1 + R_t + r_t^{rf}) = \left( \frac{P_t + D_t}{P_{t-1}} \right) = \left( \frac{P_t + D_t}{D_t} \right) \left( \frac{D_t}{D_{t-1}} \right) \left( \frac{D_{t-1}}{P_{t-1}} \right)
\]

♦ Campbell and Shiller (1988) take a log-linear approximation, to show

\[
r_t + r_t^{rf} = \log \left( 1 + e^{-\delta_t} \right) + \Delta d_t + \delta_{t-1}
\]

\[
\approx \left( \kappa - \rho \delta_t \right) + \frac{\Delta d_t}{\log \text{linear approx}} + \frac{\delta_{t-1}}{\log \text{of Dividend Yield}}
\]

♦ If returns in any period are higher than expected then either

1) Dividend growth is higher than expected or
2) Yields have fallen.
Derivation of the Decomposition Formula (2)

♦ Similarly note that the clean surplus accounting relation can be written

\[
(1 + E_t / B_t) = \left( \frac{B_t + D_t}{B_{t-1}} \right) = \left( \frac{B_t + D_t}{D_t} \right) \left( \frac{D_t}{D_{t-1}} \right) \left( \frac{D_{t-1}}{B_{t-1}} \right)
\]

and taking logs implies

\[
e_t + r_t^r \approx \left( \kappa - \rho \gamma_t \right) + \Delta d_t + \gamma_{t-1}
\]

-log linear approx - log of dividend growth - log(Dividend/Book)

♦ Subtract this relation from Campbell and Shiller relation

\[
e_t - r_t \approx \rho \left( \delta_t - \gamma_t \right) - \left( \delta_{t-1} - \gamma_{t-1} \right)
\]

-log(Book/Market) - lagged log(Book/Market)

♦ If ROE is greater than returns then the Book to Market Ratio increases (by an amount related to payout ratios).
**Required disclosures & ratings definition**

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**UBS Investment Research: Global Equity Ratings Definitions and Allocations**

<table>
<thead>
<tr>
<th>UBS rating</th>
<th>Definition</th>
<th>UBS rating</th>
<th>Definition</th>
<th>Rating category</th>
<th>Coverage(^1)</th>
<th>IB services(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buy 1</strong></td>
<td>FSR is &gt; 6% above the MRA, higher degree of predictability</td>
<td><strong>Buy 2</strong></td>
<td>FSR is &gt; 6% above the MRA, lower degree of predictability</td>
<td>Buy</td>
<td>44%</td>
<td>36%</td>
</tr>
<tr>
<td><strong>Neutral 1</strong></td>
<td>FSR is between -6% and 6% of the MRA, higher degree of predictability</td>
<td><strong>Neutral 2</strong></td>
<td>FSR is between -6% and 6% of the MRA, lower degree of predictability</td>
<td>Hold/Neutral</td>
<td>43%</td>
<td>36%</td>
</tr>
<tr>
<td><strong>Reduce 1</strong></td>
<td>FSR is &gt; 6% below the MRA, higher degree of predictability</td>
<td><strong>Reduce 2</strong></td>
<td>FSR is &gt; 6% below the MRA, lower degree of predictability</td>
<td>Sell</td>
<td>13%</td>
<td>26%</td>
</tr>
</tbody>
</table>

1: Percentage of companies under coverage globally within this rating category.
2: Percentage of companies within this rating category for which investment banking (IB) services were provided within the past 12 months.

Source: UBS; Rating allocations as of 31 December 2006.

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