What drives the style rotation within Low Volatility

Value or Quality?

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Previously on UBS Quants

- Last year we argued that both Low Volatility and Price Momentum are implicit and effective style timing strategies.
- Of the two, Low Volatility was the more successful and implicitly rotated between Quality and Value
  - When 'markets were stressed' Low Volatility tilted towards Quality.
  - When 'markets were relaxed' Low Volatility tilted towards Value.
- Demonstrated that one is able to reproduce the returns to a Low Volatility (or Betting against Beta) strategy by rotating between Quality and Value.
- BUT ….
  - What are the critical fundamentals causing markets to be stressed?
  - And what are the underlying economics driving the rotation?

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Outline Argument

- Show that the Corporate Credit Spread (Moodys BAA – 10 yr Gov Bonds) can explain the rotation.
  - When spreads are high (markets stressed) returns to low volatility and quality are highly correlated.
  - When spreads are low (markets relaxed) returns to low volatility and value are highly correlated.

- What are corporate spreads picking up?
  - Corporate spreads are only gently correlated with interest rates, terms spreads.
  - Corporate spreads are only gently correlated with Book-to-Market Spreads of Value and Quality.
  - Corporate spreads are only highly correlated with Book-to-Market Spreads of Low Volatility.
  - Corporate spreads are only highly correlated with the volatility of a Low Volatility strategy.

- Recent Literature – Asvanunt & Richardson (2016), Novaza (Forthcoming), Culp, Nozawa, Veronesi (2014) – argue that the credit spread is a separate risk factor that earns an independent risk premium.

Outline Argument

- Campbell and Shiller (1988a, 88b), Campbell (1991), Vuolteenaho (2002) develop a loglinear approximate decomposition of unexpected stock returns

$$r_{t+1} - E_t(r_{t+1}) = \underbrace{\Delta E_{t+1}\left[\sum_{i=1}^{\infty} \rho^i \left(roe_{t+i} - r_{t+i}^f\right)\right]}_{\substack{N_{CF,t+1} \\ \text{Cash Flow News}}} - \underbrace{\Delta E_{t+1}\left[\sum_{i=1}^{\infty} \rho^i r_{t+i}\right]}_{\substack{N_{DR,t+1} \\ \text{Discount Rate News}}}$$

- Implying that the variance of unexpected returns can be written

$$Var\left(r_{t+1} - E_t\left(r_{t+1}\right)\right) = Var\left(N_{CF,t+1}\right) + Var\left(N_{DR,t+1}\right) - 2Cov\left(N_{CF,t+1}, N_{DR,t+1}\right)$$

- We find:
  - Cash Flow News of Quality Stocks $\approx$ Cash Flow News of Value Stocks
  - Discount Rate News of Quality Stocks $\approx$ Discount Rate News of Value Stocks

HOWEVER IN TIMES OF DISTRESS (high corporate spreads)
The covariance of discount rates and cash flow news is far lower for value stocks than quality implying much higher volatility

Data and Definitions

- The universe is the constituents of the Large and Mid Cap Segments of the US MSCI Index between 1 January 1996 and 31 January 2017 (around 600 names).
- The 'Market' is the free-float market cap weighted return to stocks in this universe.

Style Scores use the UBS Style definitions:

- ROE and B/P are based on time weighted values of last published FY1 numbers.
- Size is the current market of the equity.
- Low Volatility is standard deviation of daily returns over last 12 months *(low is good).*
- Cash Flow Volatility is std. dev. of quarterly cash flows/sales over previous 3 years *(low is good).*
- Analyst Dispersion is std. dev. of analyst FY1 forecasts divided by forecasted FY1 earnings.
- Historical Earnings Growth is average of the last five years' annual growth in earnings.

Portfolio Rebalancing is at month-end based on score quintiles after robust normalisation (centre using median, scale using MAD and winsorize at +/- 3).

Fundamental and Technical Styles

- Fundamental Styles are styles constructed using fundamental data. These include:

1. Quality measures e.g. Return on Equity (ROE) or Gross Profitability to Assets.
2. Cash Flow Volatility – std. dev. of quarterly cash flows relative to sales.
3. Value Measures e.g. Book to Price or Earnings to Price ratios.
4. Size – market capitalisation.

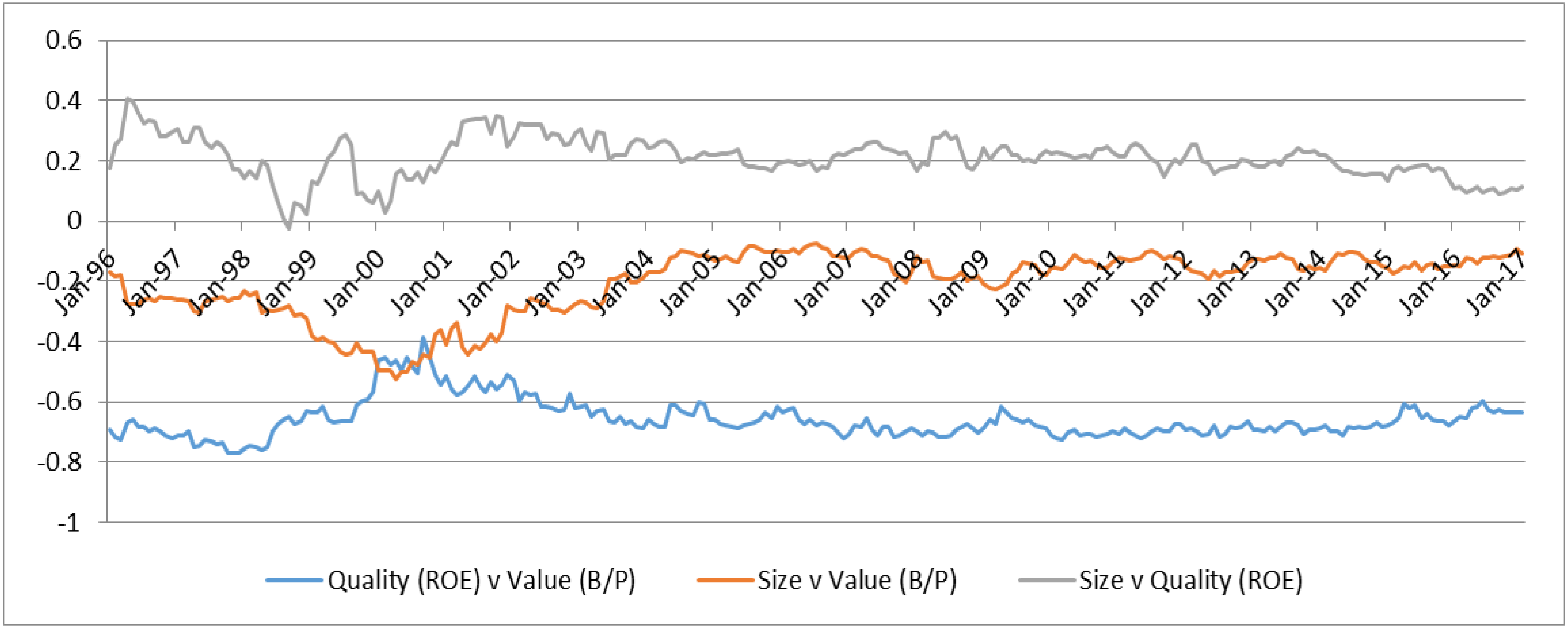
- Technical Styles are constructed using past stock return data. These include:

1. Low Volatility e.g. Stock Return Volatility over the last 12 months.
2. Price Momentum e.g. Best performers over the last 12 months.

- We argue that technical styles are implicit style timing strategies on fundamental styles.

Cross-Sectional Correlations of Scores

- Cross-Sectional correlations of the core *fundamental* style scores are remarkably stable over time



Source: UBS Quantitative Research. Note: For illustrative purposes only.

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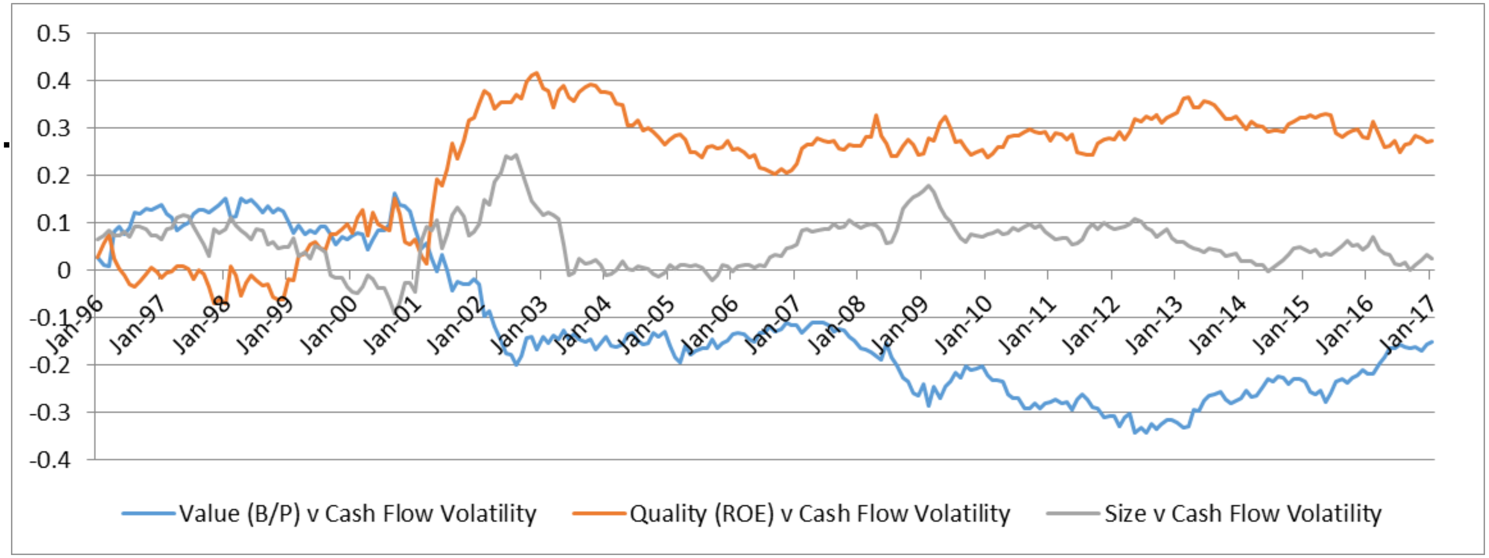
Quality (Value) is low (high) cash/earnings volatility

- CS correlations with cash flow volatility …



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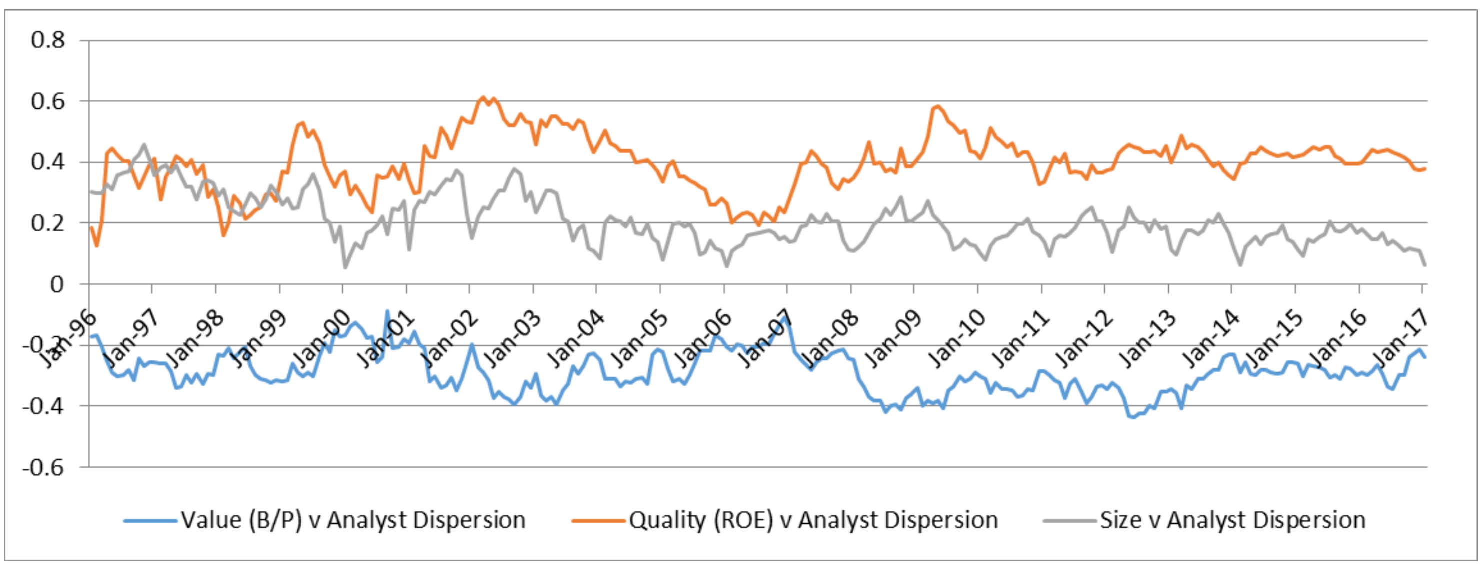
- CS correlations with analyst dispersion



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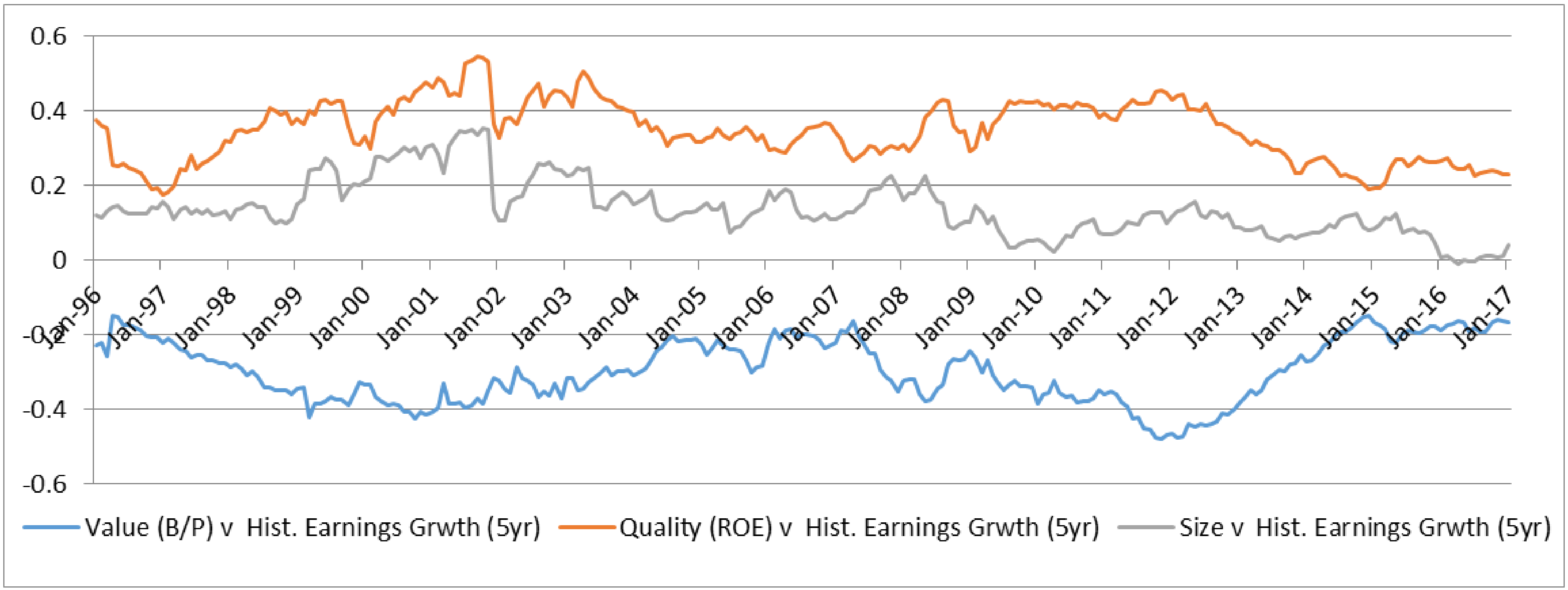
Quality (Value) is high (low) earnings growth

- CS correlations with 5-year historical earnings growth.



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- All suggest that

1. Quality is lower cash flow volatility than Value
2. Quality is possibly longer duration (higher growth) than Value

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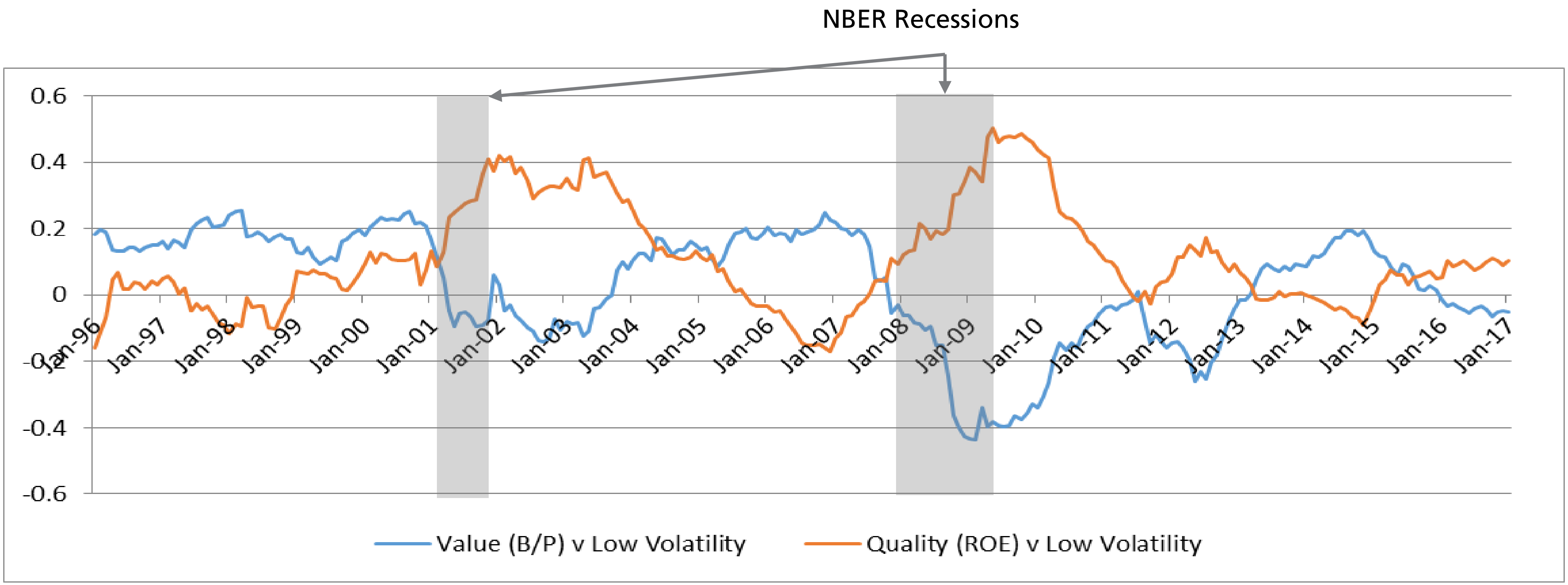
But Low Volatility rotates between Value and Quality. Why?

- Cross-Sectional correlations of Quality and Value Scores with Low Volatility Scores



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- So if quality is consistently lower cash flow volatility, the rotation must be something to do with discount rate news?

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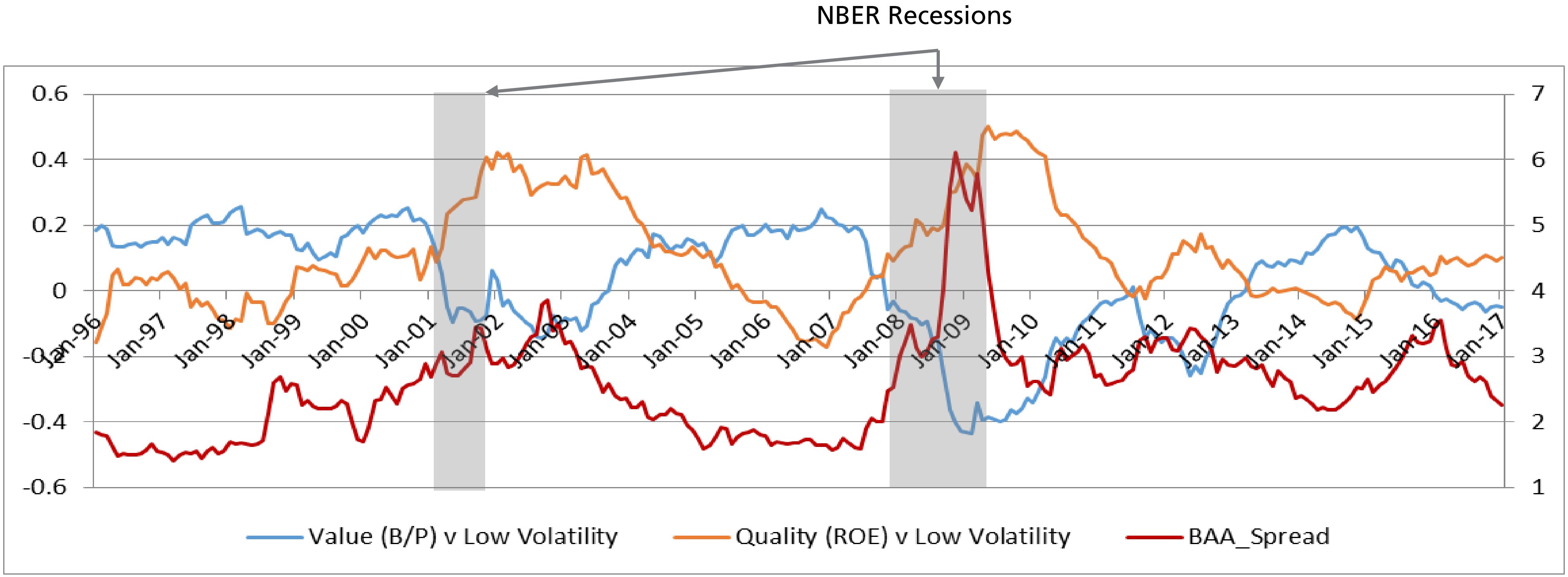
But Low Volatility rotates between Value and Quality. Why?

- Cross-Sectional correlations of Quality and Value Scores with Low Volatility Scores and BAA Moody's Corporate Spread



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- There appears to be a common driver between corporate spreads and low volatility rotation.

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Regression Check

- Transform the correlation using Fisher z-transform

$$z = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right) = \tanh^{-1}\rho$$

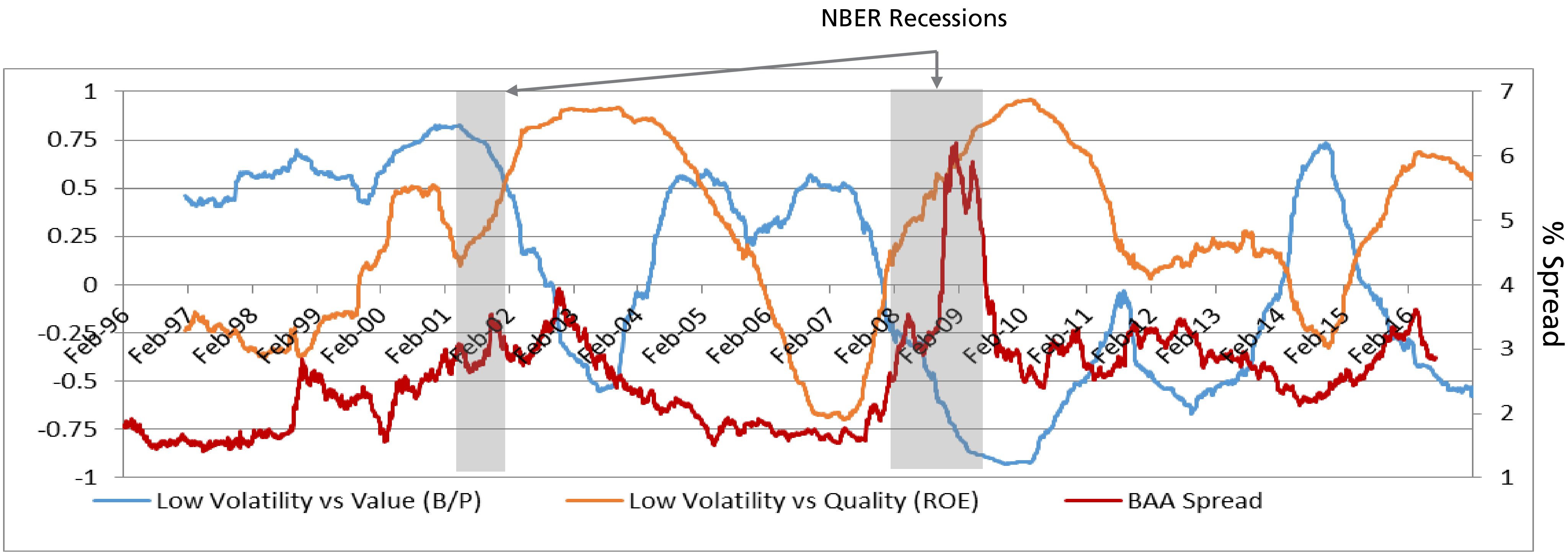
	Low Vol. v Value		Low Vol. v Quality	
	Coef.	t-stat	Coef.	t-stat
BAA Spread	-0.17	-20.81	0.12	11.48
Constant	0.47	21.19	-0.20	-6.96

Source: UBS Quantitative Research. Note: For illustrative purposes only.

- When spreads rise, low volatility tilts away from Value to Quality

And see the same with time-series correlations

- Rolling 1-year correlations of a Long-Short Quality and Value strategies with a Long-Short Low Volatility Strategy



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- However, the rolling correlations lag the change in spreads

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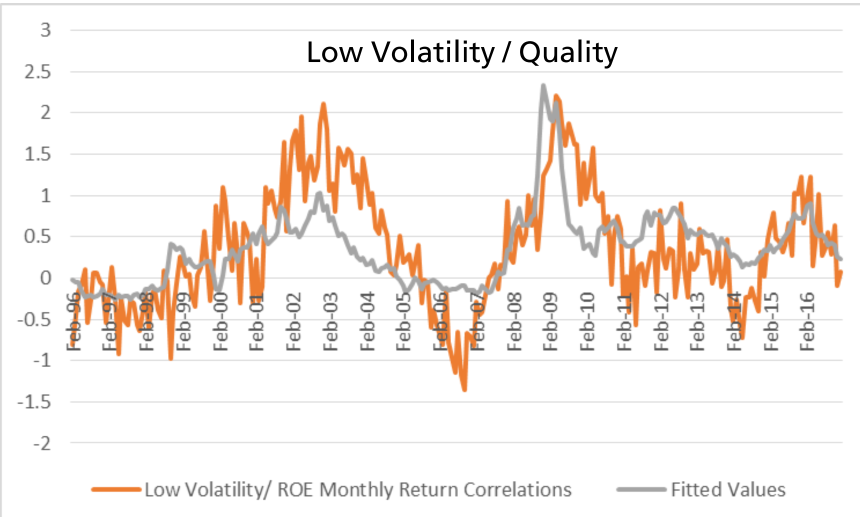
Correlation over following month



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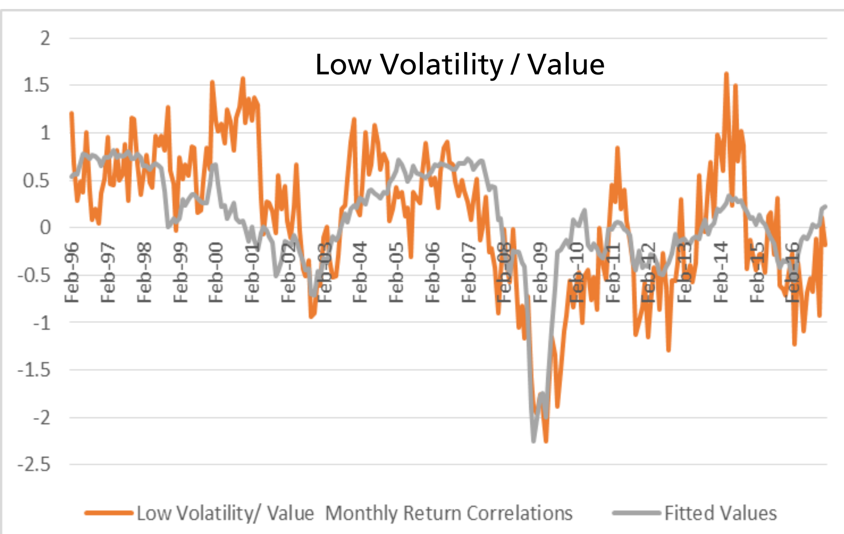

Source: UBS Quantitative Research.

- Calculate strategy return correlation over each monthly set of returns (approx. 21 obs).
- Transform the correlation using Fisher z-transform

$$z = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right) = \tanh^{-1}\rho$$

- Regress on BAA Spread at beginning of month.

	Low Vol. v Value		Low Vol. v Quality	
	Coef.	t-stat	Coef.	t-stat
BAA Spread	-0.66	-15.26	0.56	12.55
Constant	1.75	15.25	-1.06	-8.97

Source: UBS Quantitative Research. Note: For illustrative purposes only.

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So what does the aggregate credit spread capture?

- Nozawa (Forthcoming) decomposes the corporate credit spread.
  1. Corporate spreads can be decomposed into news about cash flows (default losses) and news about discount rates.
  2. At the firm level, changes in spreads are driven predominantly by changes in expected default losses.
  3. At the aggregate level, though, changes in aggregate spreads are driven predominantly by changes in credit discount rates.
  4. Changes in credit discount rates are uncorrelated with equity discount rates.
- Asvanunt & Richardson (2016) find that the credit risk premium is not spanned by other known risk premia and exhibits time variation related to economic growth and aggregate default rates.
- Culp, Nozawa, Veronesi (2016) create pseudo corporate bonds from risk free treasuries and short traded put options. They find or suggest:
  1. That the pseudo bonds have similar spreads to issued corporate bonds and the excess returns to corporate bonds are not explained by a variety of standard risk factors.
  2. That the source of the credit spread puzzle may be better explained by the same forces that explain why put options are expensive – a premium for tail events.
  3. That this underlying source of the credit spread risk is likely to be found in the dynamics of investors' risk preferences.

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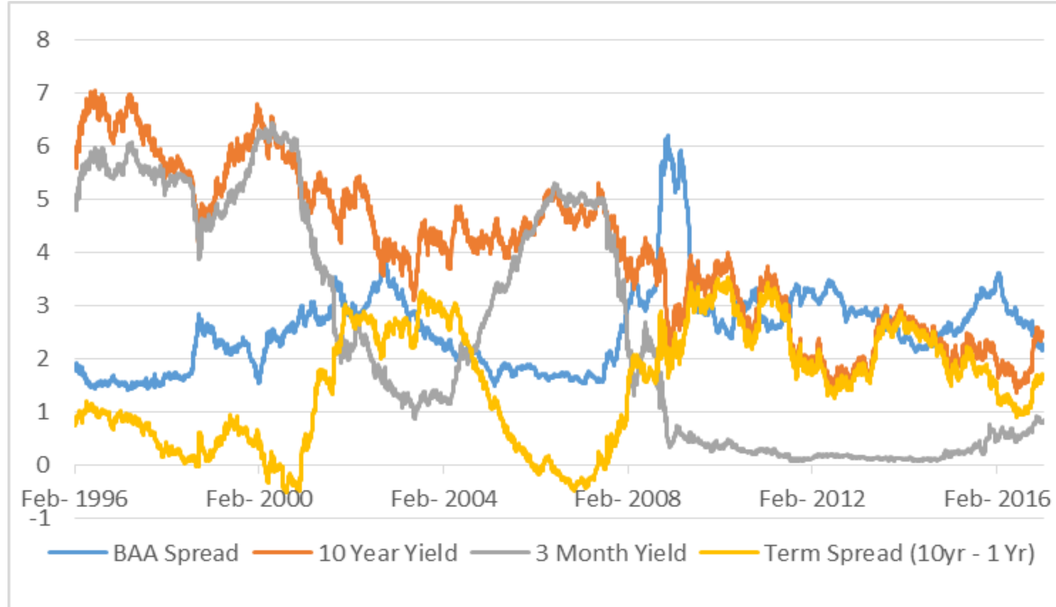
Credit Spread weakly correlated with other risk factors

- Only weakly correlated to other interest rate variables.
- Highest correlation with term spread – 0.5.

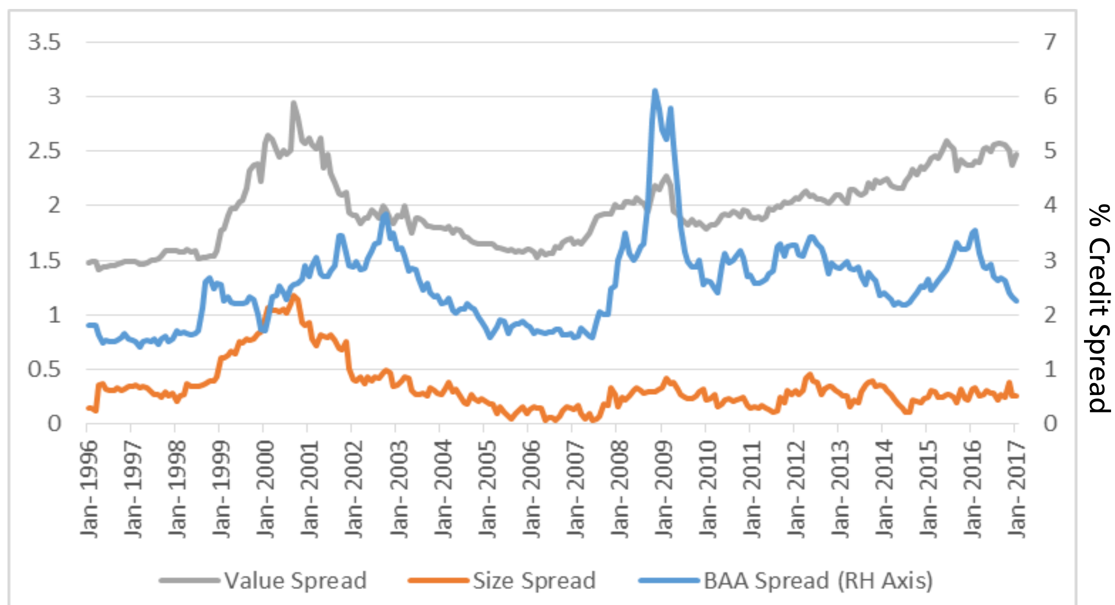


Source: UBS Quantitative Research

- Weakly correlated with value (0.45) and size spreads (0.12).

$$\text{Size Spr.} = \log\left(\frac{B}{P}\right)_{\text{Small}} - \log\left(\frac{B}{P}\right)_{\text{Large}}$$

$$\text{Value Spr.} = \log\left(\frac{B}{P}\right)_{\text{Value}} - \log\left(\frac{B}{P}\right)_{\text{Growth}}$$



Source: UBS Quantitative Research

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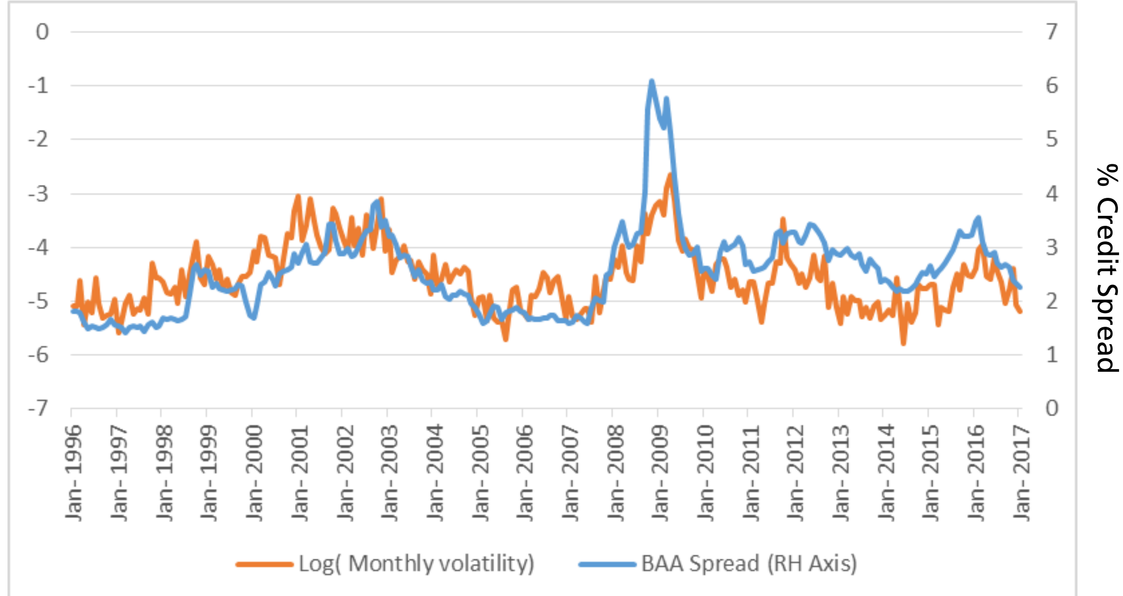
But it is intimately related to the Low Volatility Strategy

- Highly correlated with the log of the monthly volatility of a long-short low volatility strategy.

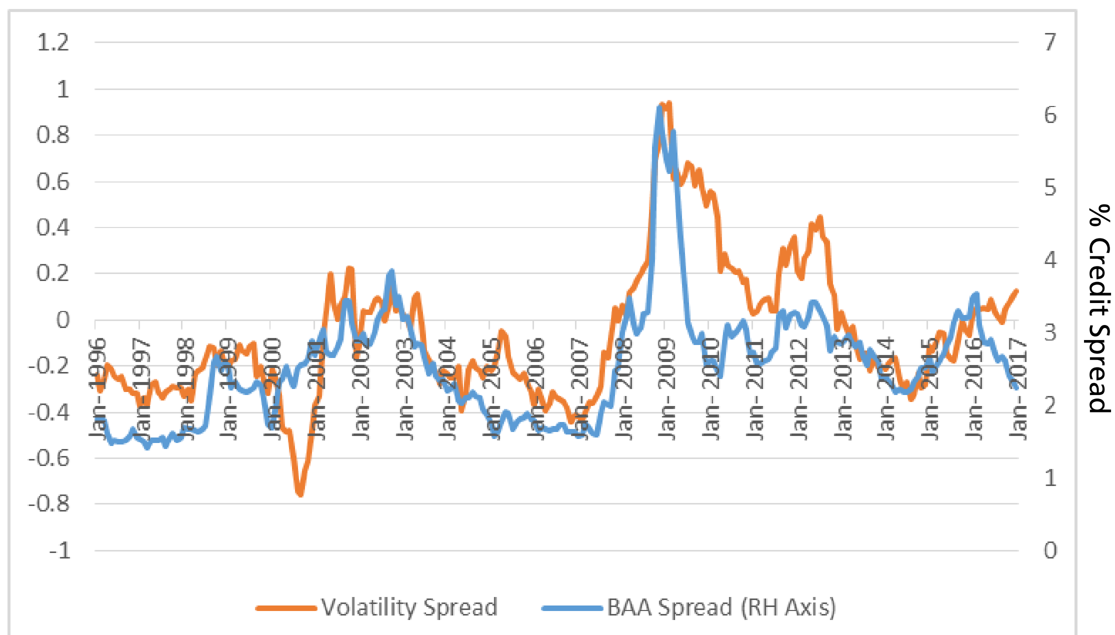


Source: UBS Quantitative Research

- Highly correlated with volatility spread (0.76).

$$\text{Vol Spr.} = \log\left(\frac{B}{P}\right)_{\text{HVol}} - \log\left(\frac{B}{P}\right)_{\text{LVol}}$$

- So spreads are high when low volatility is tilted towards the more expensive quality stocks and low when tilted towards the cheaper value stocks.



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So the puzzle?

- Quality is consistently lower cash flow volatility
  - Cross-sectional scores positively correlated with low cash flow volatility and analyst forecast dispersion
- So why does low volatility ever tilt towards value?

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- So why does low volatility ever tilt towards value?

The variance of unexpected stock returns can be decomposed

$$Var\left(r_{t+1} - E_t\left(r_{t+1}\right)\right) = Var\left(N_{CF,t+1}\right) + Var\left(N_{DR,t+1}\right) - 2Cov\left(N_{CF,t+1}, N_{DR,t+1}\right)$$

Lower for Quality Stocks

Probably higher for Quality Stocks as they are longer duration *but will be particularly dominant in periods of market stress just when low volatility tilts towards quality*

By elimination, reason must be due to changes in the correlation

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Vuolteenaho (2002): What drives firm value?

- Vuolteenaho finds $Cov\left(N_{CF,t+1}, N_{DR,t+1}\right) > 0$ over his sample.

- Possible explanations:

1. Market under-reaction to cash flow news (Behavioural)

   If markets under-react to good news, then future expected returns will be higher.

2. If firms take on risky NPV zero projects (competitive market), expected returns in the future will be higher (due to the risk) and if firm value is to stay constant then cash flow news must be also positive => positive correlation.

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Vuolteenaho (2002): What drives firm value?

- However, it is possible $Cov\left(N_{CF,t+1}, N_{DR,t+1}\right) < 0$ especially in stressed markets

- Possible explanations:

1. Market over-reaction to bad cash flow news (Behavioural)

   If markets are jittery, then possible over-reaction to bad news implying future expected returns will be higher. Hence, negative correlation.

2. Leverage effect: Bad news reduces the value of equity, increasing leverage and future expected returns. Hence, negative correlation.

3. Time-varying credit risk: Bad cash flow news, increases exposure to credit risk factor driving higher future expected returns (bonds and assets priced by same discount factor). Will be more acute for firms in financial distress. See Chen, Collin-Dufresne & Goldstein (2009) for a model on these lines.

Estimating Firm Level Cash Flow and Discount Rate News

- We estimate a first order VAR

$$\begin{bmatrix} r_{t+1} - r_{t+1}^{Mkt} \\ roe_{t+1} - roe_{t+1}^{Mkt} \\ \theta_{t+1} - \theta_{t+1}^{Mkt} \end{bmatrix} = \underbrace{\begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{bmatrix}}_{A} \begin{bmatrix} r_{t} - r_{t}^{Mkt} \\ roe_{t} - roe_{t}^{Mkt} \\ \theta_{t} - \theta_{t}^{Mkt} \end{bmatrix} + \underbrace{\begin{bmatrix} u_{t+1}^{1} \\ u_{t+1}^{2} \\ u_{t+1}^{3} \end{bmatrix}}_{u_{t+1}} \quad \text{where} \quad \begin{aligned} r_{t+1} &= \log(1+R_t) \\ roe_t &= \log(1+E_t/B_t) \\ \theta_t &= \log(B_t/P_t) \end{aligned}$$

on quarterly data for 25 style portfolios (Volatility, Value, Quality, Cash Flow Volatility and Earnings Growth) over the period 1996Q1 to 2016Q4.

- We then calculate the cash flow and discount rate news as

$$N_{CF,t+1} = \Delta E_{t+1}\left[\sum_{i=1}^{\infty}\rho^{i}\left(roe_{t+i} - roe_{t+i}^{Mkt}\right)\right] = e_1\left(I-\rho A\right)^{-1}u_{t+1}$$

$$N_{DR,t+1} = \Delta E_{t+1}\left[\sum_{i=1}^{\infty}\rho^{i}\left(r_{t+i} - r_{t+1}^{Mkt}\right)\right] = \rho e_1 A\left(I-\rho A\right)^{-1}u_{t+1}$$

where ρ is a constant around which the first order log-linear approximation is taken. We set $\rho = 0.967$ as in Vuolteenaho (2002).

Estimation Results

- The transition matrix A is estimated as

$$A = \begin{bmatrix} 0.0972 & 0.2301 & 0.0332 \\ (0.0368) & (0.0968) & (0.0182) \\ 0.0181 & 0.8200 & -0.0090 \\ (0.0038) & (0.1976) & (0.0042) \\ -0.0681 & 0.0640 & 0.9291 \\ -(0.0804) & (0.1109) & (0.0361) \end{bmatrix}$$

where standard errors (estimated using jackknife bootstrapping) in brackets.

1. Similar numbers to Vuolteenaho, though we have more return predictability.
2. ROE is more persistent, but B/P less.
3. Further higher returns predict a fall in B/P (reasonable).

Cash Flow and Discount Rate News Decomposition

- We assume the same transition matrix for all our decompositions.
- However, we estimate the covariance matrix

$$E\left(u_{t+1}u_{t+1}^{T}\right)=\Sigma$$

on different samples:

1. Using all observed residuals
2. Using the residuals for a given style over the entire sample
3. Using all residuals when the Credit Spread > 2.561% (its sample median).
4. Using the residuals for a given style when the Credit Spread > 2.561% (its sample median)

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Cash Flow and Discount Rate News Decomposition

- Using the variance matrix calculated on the different samples, we estimate

$$Var\left(N_{CF,t+1}\right) = e_1\left(I-\rho A\right)^{-1}\Sigma\left(I-\rho A^T\right)^{-1}e_1^T$$

$$Var\left(N_{DR,t+1}\right) = \rho^2 e_1 A\left(I-\rho A\right)^{-1}\Sigma\left(I-\rho A^T\right)^{-1}A^T e_1^T$$

$$Cov\left(N_{CF,t+1},N_{DR,t+1}\right) = \rho e_1 A\left(I-\rho A\right)^{-1}\Sigma\left(I-\rho A^T\right)^{-1}e_1^T$$

	Var(r) x 1000	N_CF x 1000	N_DR x 1000	N_COV x 1000	N_CORR	N_DR / Var(r)
All	1.05	1.17	0.27	0.20	0.35	0.25
Value	1.10	1.02	0.16	0.04	0.10	0.15
2	0.59	0.60	0.12	0.06	0.24	0.20
3	0.28	0.35	0.04	0.05	0.46	0.14
4	0.36	0.44	0.11	0.10	0.43	0.30
Growth	1.68	2.23	0.95	0.75	0.52	0.56
Quality	0.50	0.60	0.25	0.17	0.45	0.50
2	0.47	0.56	0.19	0.14	0.43	0.41
3	0.43	0.47	0.14	0.09	0.35	0.32
4	0.42	0.45	0.10	0.07	0.32	0.25
Junk	1.65	1.75	0.35	0.23	0.29	0.21
Value Stressed	1.40	1.27	0.18	0.02	0.05	0.13
Value Unstressed	0.63	0.69	0.21	0.13	0.35	0.33
Quality Stressed	0.88	1.17	0.28	0.29	0.50	0.32
Quality Unstressed	0.57	0.59	0.25	0.13	0.35	0.43

Source: UBS Quantitative Research. Note: For illustrative purposes only.

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- Using the variance matrix calculated on the different samples, we estimate

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Quality	0.50	0.60	0.25	0.17	0.45	0.50
2	0.47	0.56	0.19	0.14	0.43	0.41
3	0.43	0.47	0.14	0.09	0.35	0.32
4	0.42	0.45	0.10	0.07	0.32	0.25
Junk	1.65	1.75	0.35	0.23	0.29	0.21
Value Stressed	1.40	1.27	0.18	0.02	0.05	0.13
Value Unstressed	0.63	0.69	0.21	0.13	0.35	0.33
Quality Stressed	0.88	1.17	0.28	0.29	0.50	0.32
Quality Unstressed	0.57	0.59	0.25	0.13	0.35	0.43

Source: UBS Quantitative Research. Note: For illustrative purposes only.

Cash Flow and Discount Rate News Decomposition

- Using the variance matrix calculated on the different samples, we estimate

$$Var\left(N_{CF,t+1}\right) = e_1\left(I - \rho A\right)^{-1}\Sigma\left(I - \rho A^T\right)^{-1} e_1^T$$

$$Var\left(N_{DR,t+1}\right) = \rho^2 e_1 A\left(I - \rho A\right)^{-1}\Sigma\left(I - \rho A^T\right)^{-1} A^T e_1^T$$

$$Cov\left(N_{CF,t+1}, N_{DR,t+1}\right) = \rho e_1 A\left(I - \rho A\right)^{-1}\Sigma\left(I - \rho A^T\right)^{-1} e_1^T$$

	Var(r) x 1000	N_CF x 1000	N_DR x 1000	N_COV x 1000	N_CORR	N_DR / Var(r)
All	1.05	1.17	0.27	0.20	0.35	0.25
Value	1.10	1.02	0.16	0.04	0.10	0.15
2	0.59	0.60	0.12	0.06	0.24	0.20
3	0.28	0.35	0.04	0.05	0.46	0.14
4	0.36	0.44	0.11	0.10	0.43	0.30
Growth	1.68	2.23	0.95	0.75	0.52	0.56
Quality	0.50	0.60	0.25	0.17	0.45	0.50
2	0.47	0.56	0.19	0.14	0.43	0.41
3	0.43	0.47	0.14	0.09	0.35	0.32
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Source: UBS Quantitative Research. Note: For illustrative purposes only.

Cash Flow and Discount Rate News Decomposition

- Using the variance matrix calculated on the different samples, we estimate

$$Var\left(N_{CF,t+1}\right) = e_1\left(I-\rho A\right)^{-1}\Sigma\left(I-\rho A^T\right)^{-1}e_1^T$$

$$Var\left(N_{DR,t+1}\right) = \rho^2 e_1 A\left(I-\rho A\right)^{-1}\Sigma\left(I-\rho A^T\right)^{-1}A^T e_1^T$$

$$Cov\left(N_{CF,t+1}, N_{DR,t+1}\right) = \rho e_1 A\left(I-\rho A\right)^{-1}\Sigma\left(I-\rho A^T\right)^{-1}e_1^T$$

	Var(r) x 1000	N_CF x 1000	N_DR x 1000	N_COV x 1000	N_CORR	N_DR / Var(r)
All	1.05	1.17	0.27	0.20	0.35	0.25
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Quality Unstressed	0.57	0.59	0.25	0.13	0.35	0.43

Source: UBS Quantitative Research. Note: For illustrative purposes only.

Conclusions

- Low Volatility rotates rather intuitively between Quality and Value over the cycle

1. When corporate spreads are high – market stressed – Quality is low volatility
2. When corporate spreads are low – market unstressed – Value is low volatility

- However, even when markets are unstressed, quality has lower cash flow volatility, so why does low volatility tilt towards value?

- Suggest that the reason is it is driven by the way the market discounts the cash flows to value stocks.

1. In stressed markets, bad stock level news results in discount rates rising – resulting in high volatility.
2. In unstressed markets, there is less evidence that bad news leads to higher discount rates – resulting in lower volatility.

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