UBS London Quantitative Conference 2017

How do economics affect equity & bond factors?

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Introduction

- Low risk investing within equities has been a very successful strategy over the past few years, benefiting from its "quality" tilt (especially within Europe).
- The anomaly is also visible within government bonds, at least from around 1995.
- However, the question has been raised as to whether the anomaly is (partly) driven by falling interest rates.
- We aim to investigate this question, and find that although the alpha to low risk investing falls when interest rates rise, rarely do they rise enough to make the alpha fall to zero.

Section 1

Low risk & interest rates

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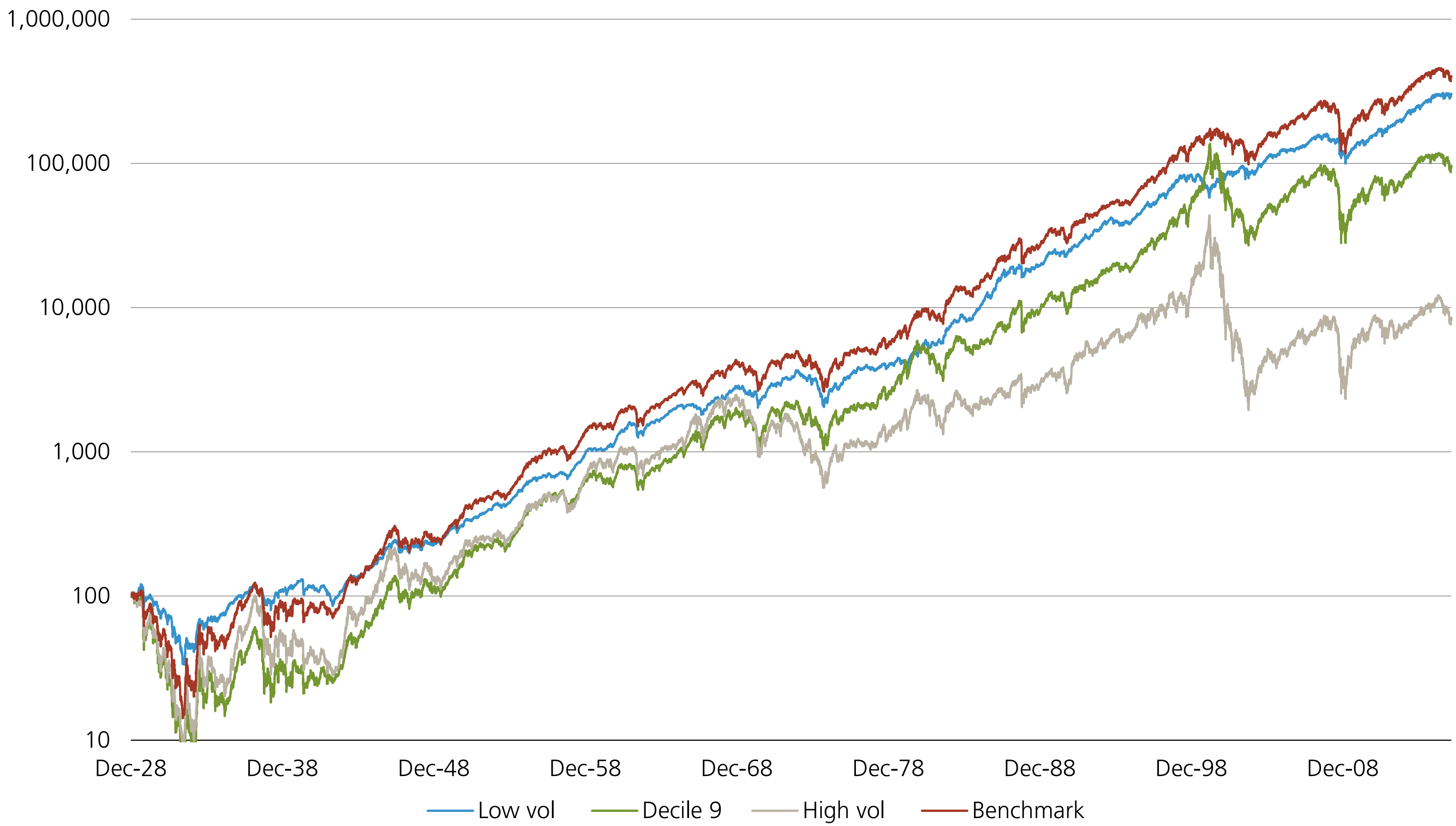
Returns to selected volatility based portfolios

- We look at the performance of various volatility based portfolios in the US



Source: UBS. The portfolios are created from the CRSP database using the largest 500 names by market cap. The volatility metric used is the 90 day volatility of daily returns and the portfolios are rebalanced quarterly to equal weights. The Sharpe ratios are calculated using the 10 year Treasury interest rate. The data goes from Dec 1928 to June 2015.

Interest rates

- 10 year bond yields in the US have gone through three long term trends from 1928.

Source: Global Financial Data

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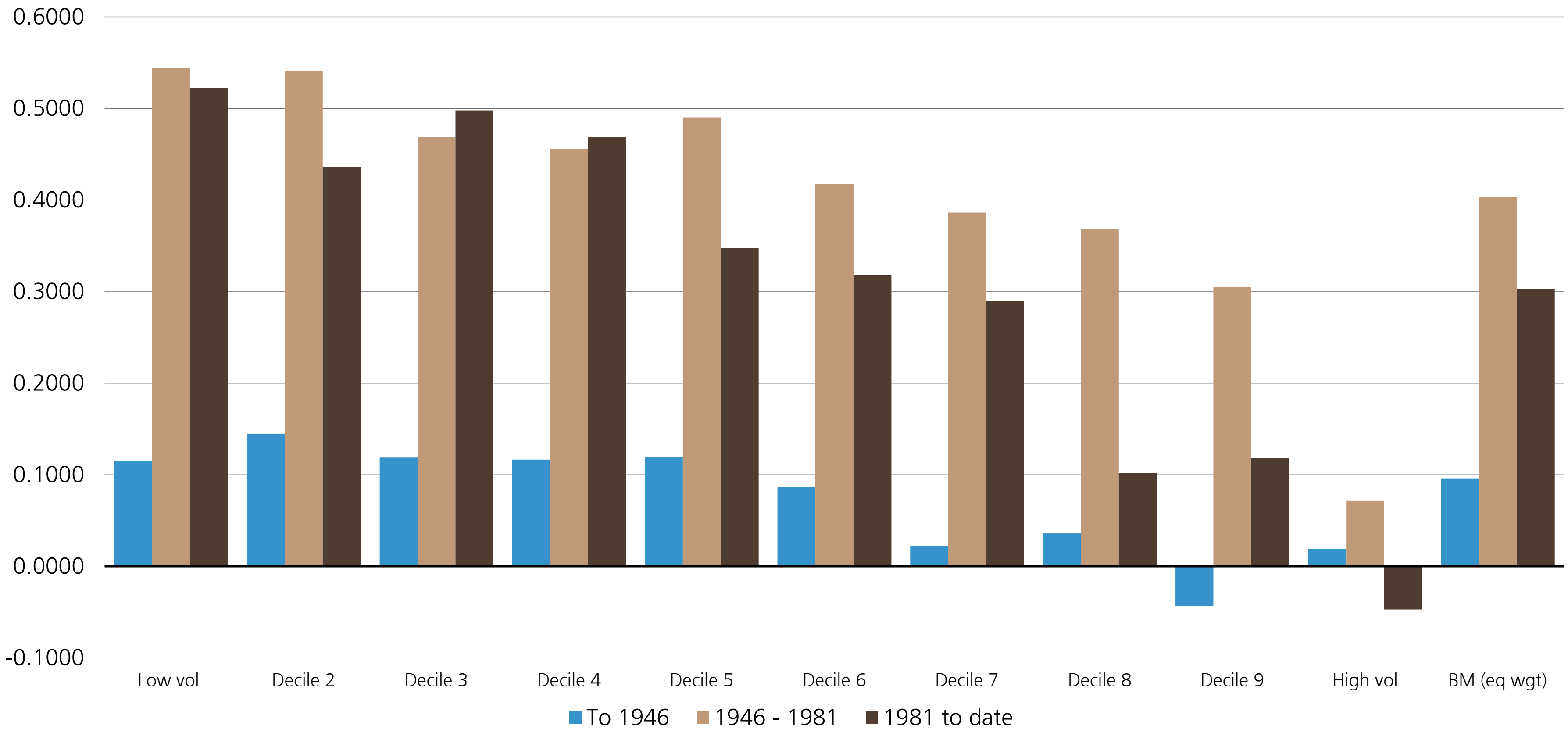
Three big periods – Sharpe ratios



	Low vol	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	High vol	BM
To 1946	0.1147	0.1449	0.1186	0.1165	0.1197	0.0864	0.0226	0.0359	-0.043	0.0188	0.0959
1946 - 1981	0.5445	0.5407	0.4688	0.4559	0.4903	0.4172	0.3864	0.3687	0.3052	0.0715	0.4031
1981 to date	0.5226	0.4363	0.498	0.4686	0.3477	0.3182	0.2895	0.102	0.1181	-0.0472	0.3031

Source: UBS

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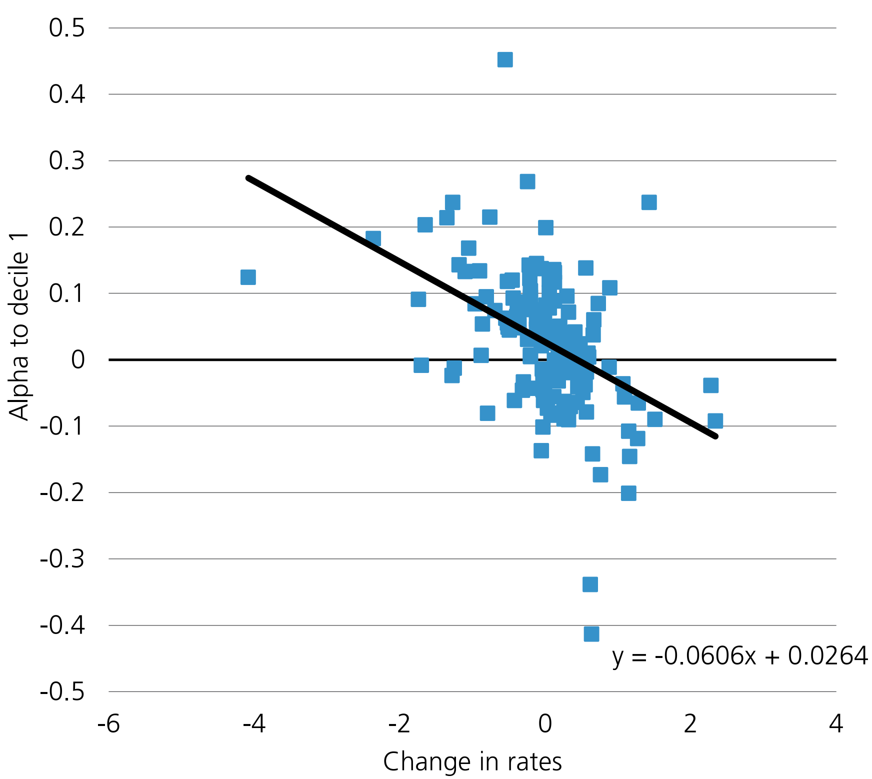
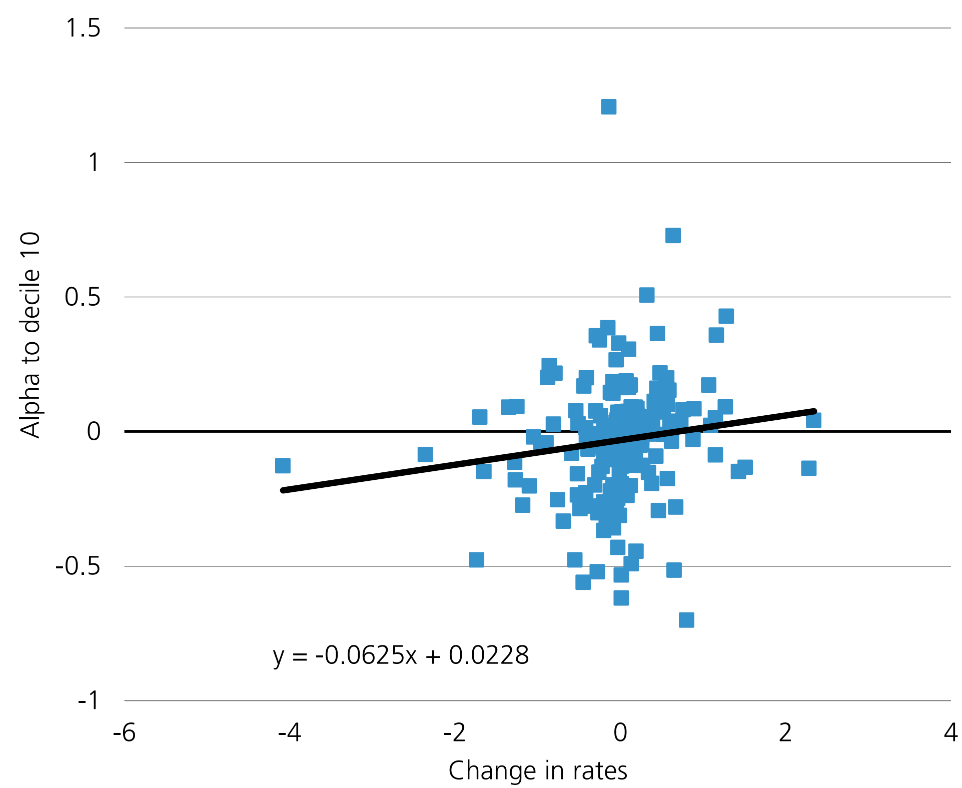
Interest rates and alpha

- We start by looking at the relationship between the 6 month alpha and the change in the 10 year rate (first difference) over the same period. We find a negative relationship for the low volatility alpha (left hand chart), and a positive relationship for the high volatility alpha (right hand chart).





Source: UBS

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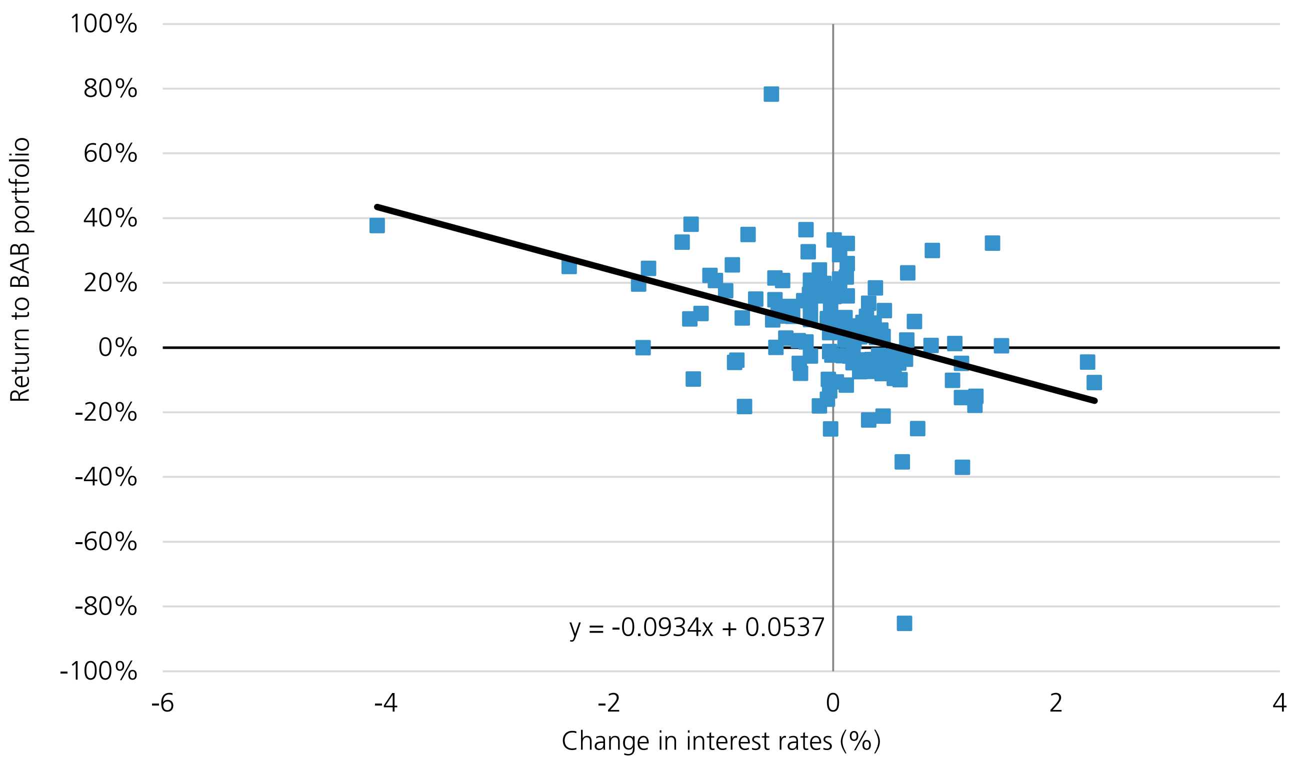
Does Betting against Beta have the same problem?

- We created a betting against beta style portfolio, rebalanced on a 6 month basis using the preceding 6 months' betas to scale the long and short sides. The returns to this portfolio have a similar relationship with rates.



Source: UBS. The chart shows the six month returns to a betting against beta strategy against changes in 10 year rates. The slope has a t-stat of -5.34 and the intercept one of 3.93. The -85% return occurs in the last six months of 1999.

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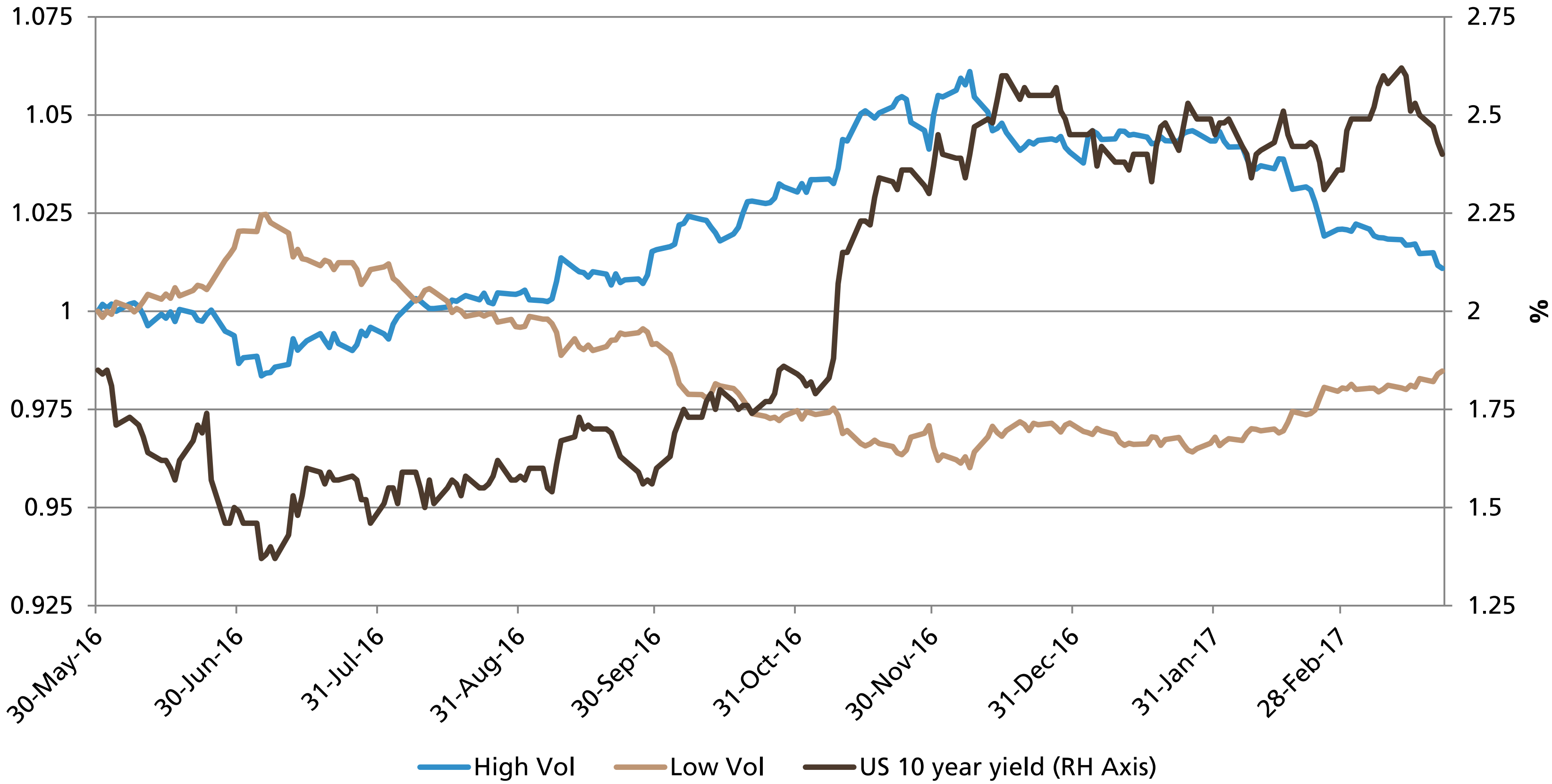
And so it came to pass …

- Chart shows beta adjusted relative performance of our global high and low volatility indices from end May 2016



Source: UBS, GFD. The chart shows the relative performance of the UBS High and Low volatility index against Dow Jones World index, beta adjusted; all total returns in USD terms. The beta of the high vol index was 1.33; the low vol index was 0.77.

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Section 2

Other factors & interest rates

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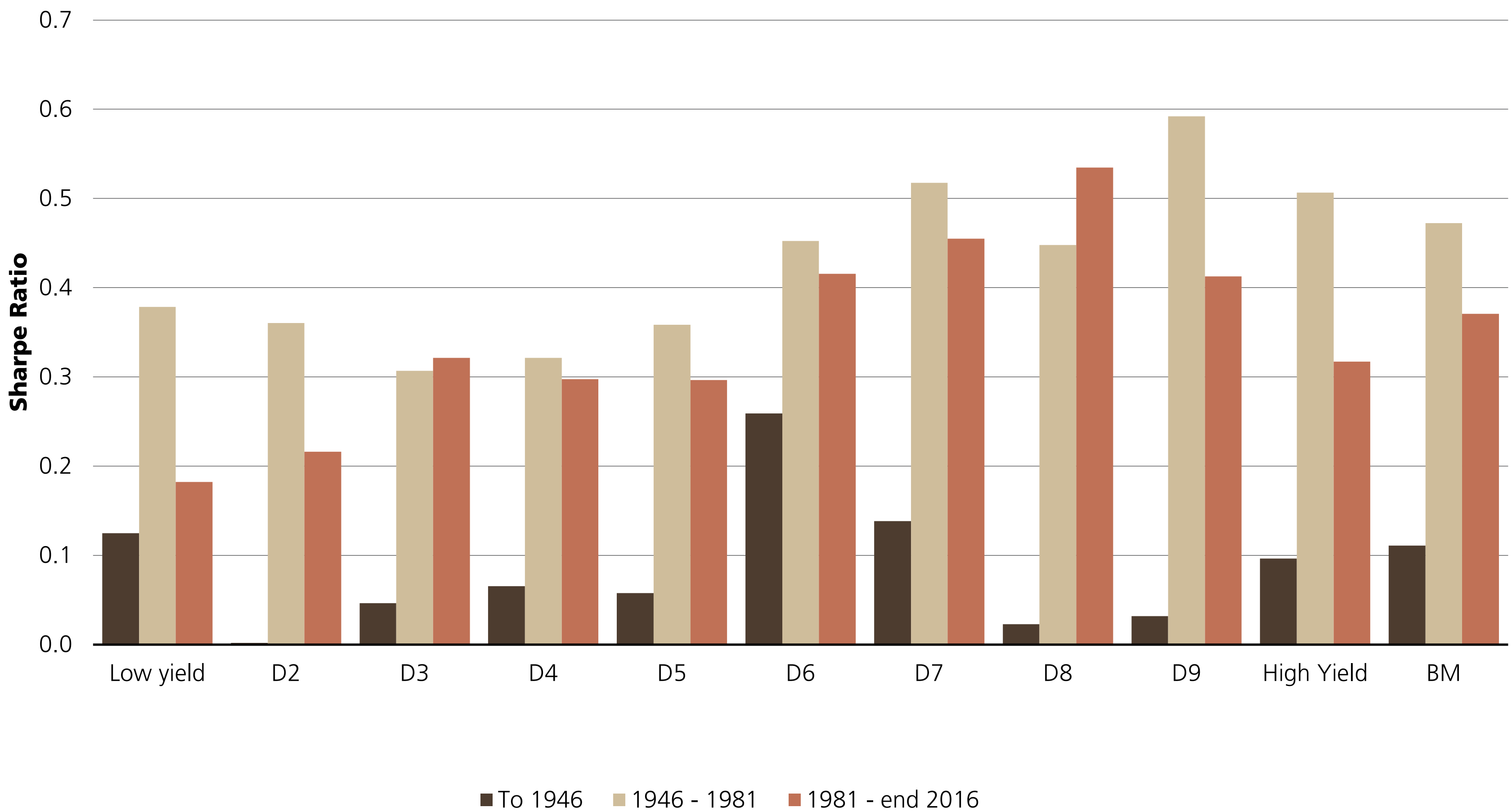
Dividend yield

- Dividend yield is the "obvious" other candidate for having an interest rate sensitivity. We analyse it in the same way as we used for the low risk analysis: first looking at the three regimes, and then looking at the shorter term alphas and their relationship with interest rates.

	Low yield	Q2	Q3	Q4	High Yield	BM
Whole Period	0.221	0.241	0.321	0.389	0.337	0.323
To 1946	0.081	0.060	0.172	0.108	0.076	0.111
1946 - 1981	0.382	0.325	0.419	0.513	0.580	0.473
1981 - end 2016	0.205	0.318	0.361	0.504	0.381	0.371

Source: UBS

Dividend Yield



	Low yield	D2	D3	D4	D5	D6	D7	D8	D9	High Yield	BM
Whole Period	0.221	0.194	0.227	0.232	0.243	0.374	0.377	0.352	0.336	0.296	0.323
To 1946	0.125	0.002	0.046	0.065	0.058	0.259	0.138	0.023	0.032	0.096	0.111
1946 - 1981	0.378	0.361	0.307	0.321	0.359	0.452	0.518	0.448	0.592	0.507	0.473
1981 - end 2016	0.182	0.216	0.321	0.297	0.296	0.416	0.455	0.535	0.413	0.317	0.371

Source: UBS

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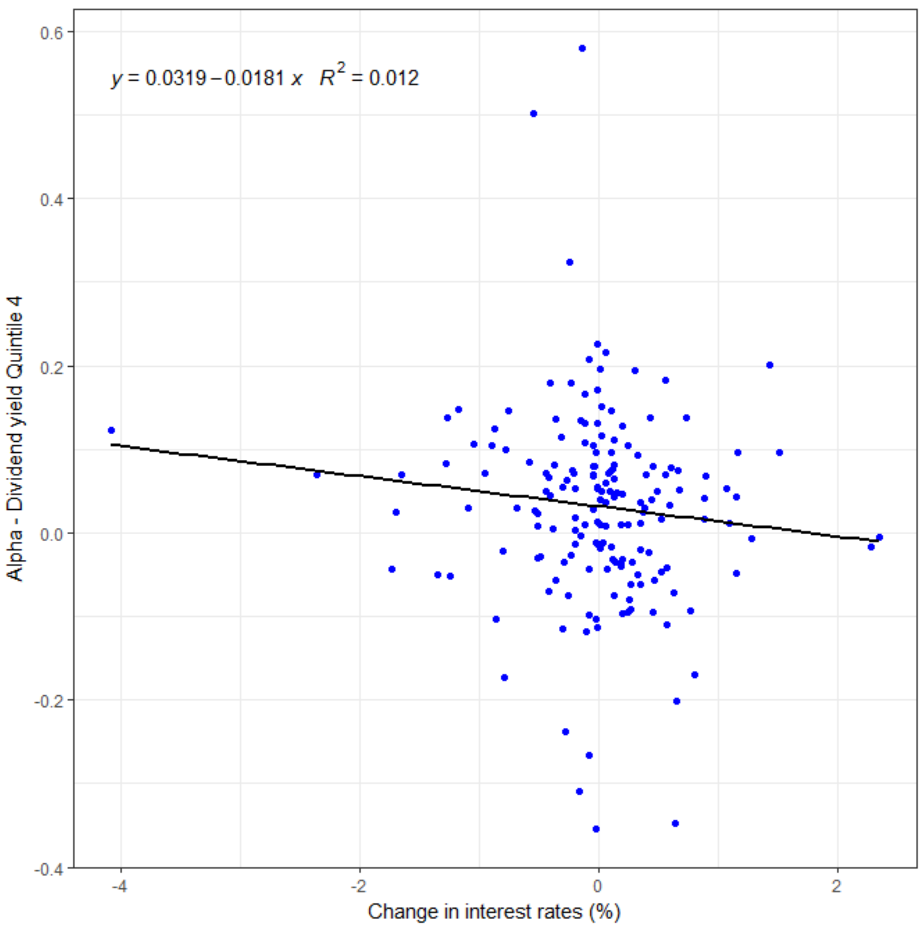
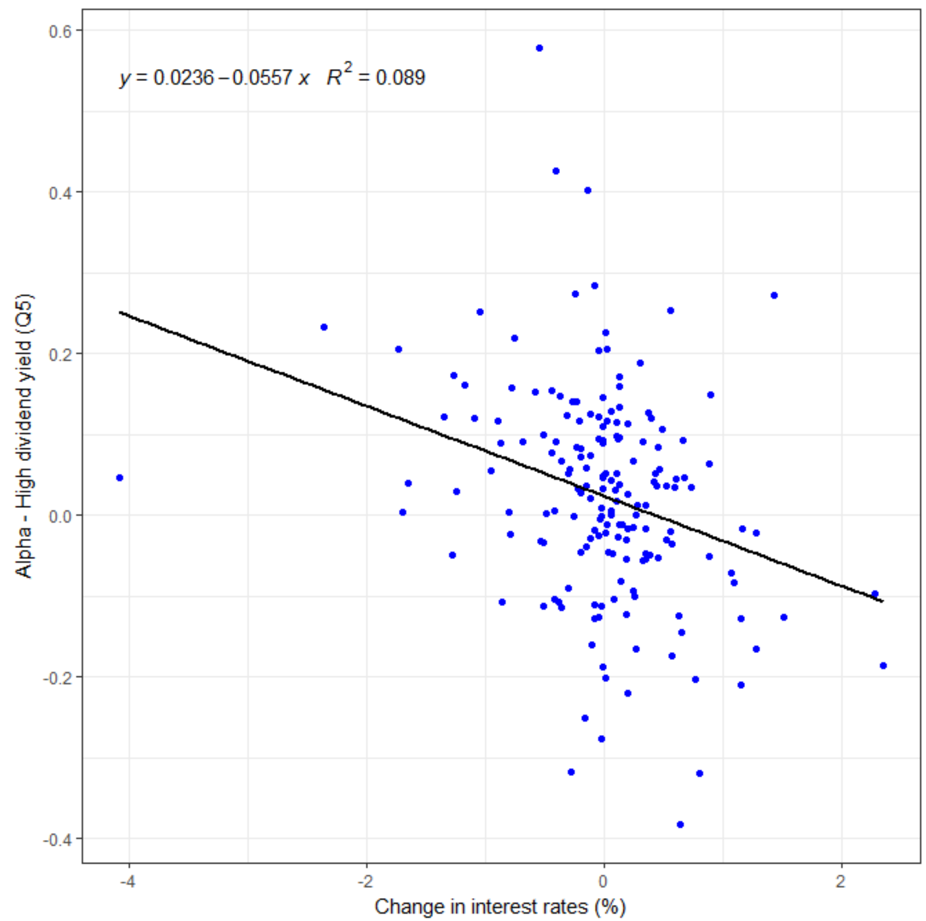
Dividend yield – short term alphas

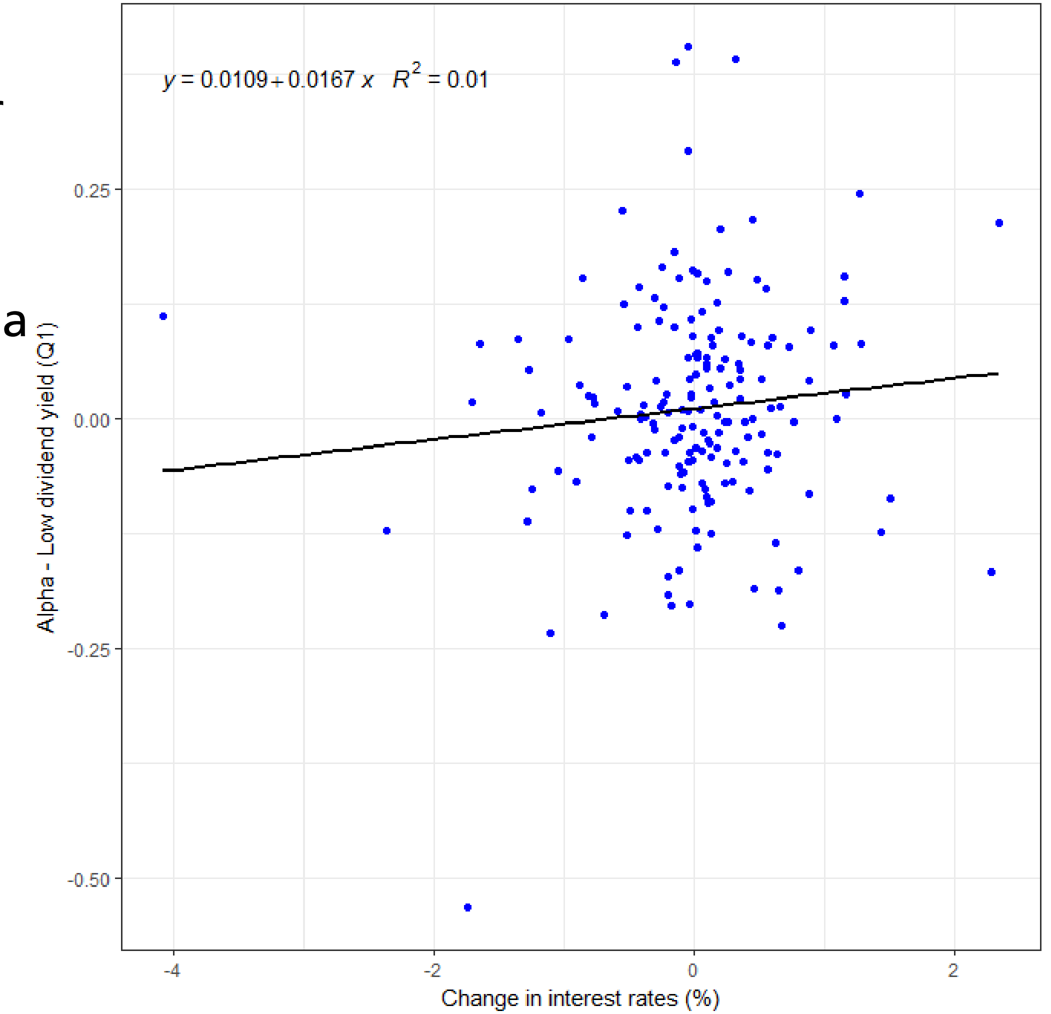
- We look at the relationship of Q1, Q4 and Q5 to rates, using alphas calculated on non-overlapping six month windows.





Dividend yield – short term alphas (2)

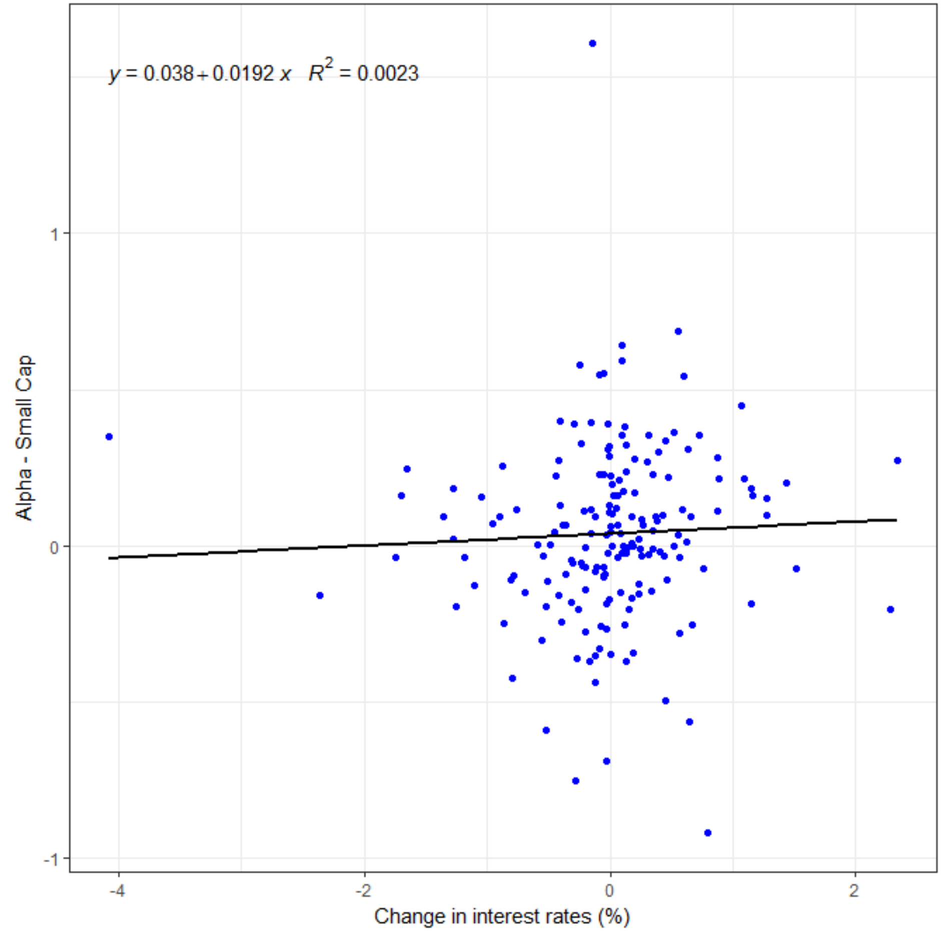
- Low yield has a positive slope; high yield has a negative slope – worse for the top quintile than quintile 4.
- As with low risk, the relationship is one where high yield's expected alpha turns negative at around 50 basis points (highest yield) or more.
- The results are similar for the decile portfolios.
- There does not appear to be a relationship to the level of rates.



Size

- Small cap has a better Sharpe ratio in all except the most recent period, and no real relationship to rates.

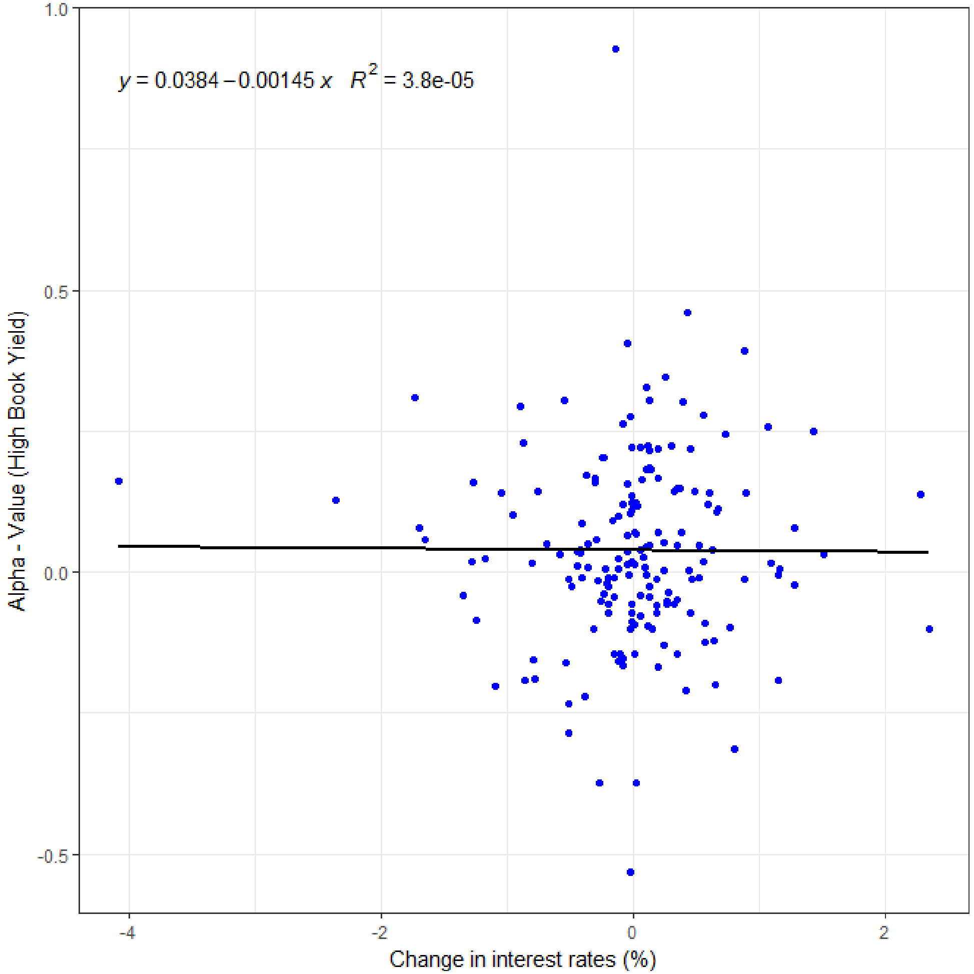
	Small	Big
Whole Period	0.365	0.300
To 1946	0.246	0.084
1946 - 1981	0.607	0.423
1981 - end 2016	0.357	0.400



Value (Book Yield)

- Value outperforms not-value in every period, and again no relationship to rates.

	Low	High
Whole Period	0.259	0.379
To 1946	0.068	0.138
1946 - 1981	0.339	0.658
1981 - end 2016	0.365	0.507

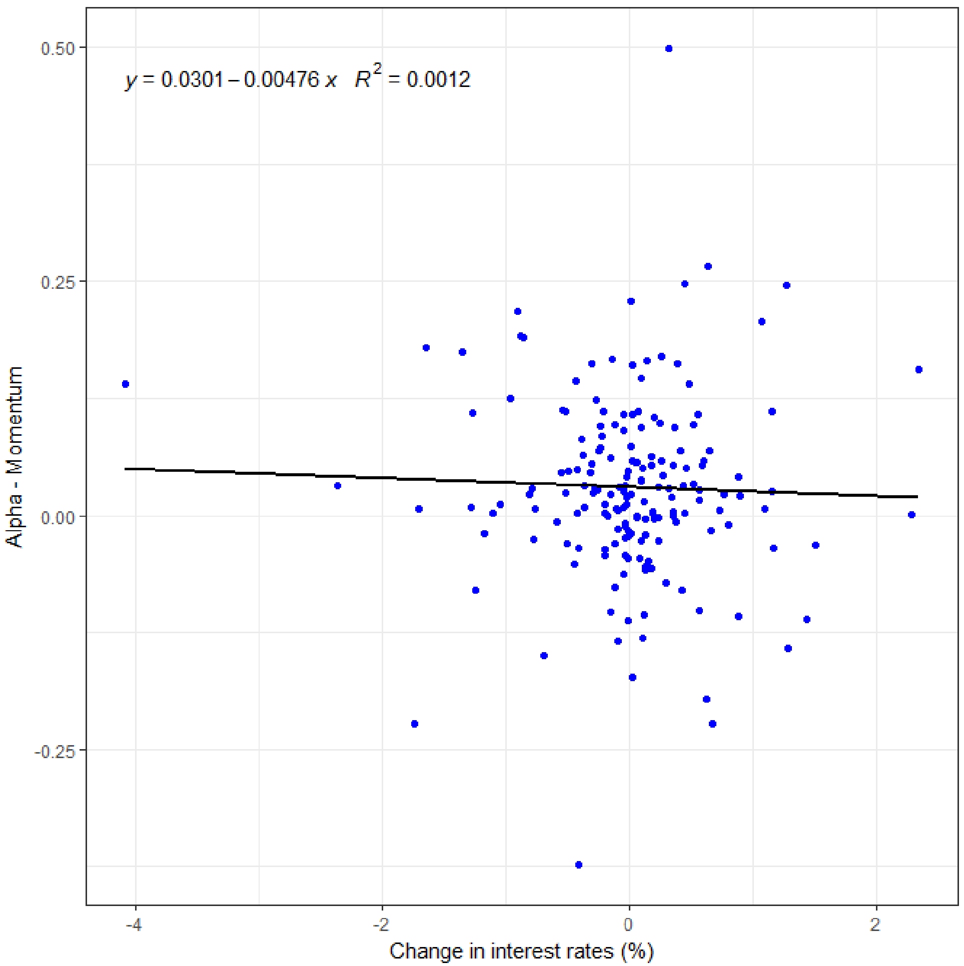


Source: UBS

Momentum

- High momentum outperforms in every period, and again no rate sensitivity.

	Low	Medium	High
Whole Period	0.074	0.269	0.414
To 1946	-0.043	0.036	0.145
1946 - 1981	0.042	0.425	0.622
1981 - end 2016	0.172	0.386	0.517



Source: UBS

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Section 3

Volatility

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Momentum and volatility

- The relationship between momentum and volatility is now relatively well known: momentum does badly when volatility is high.
- For example we created a US long / short momentum portfolio and split it by its own 20 day volatility and then measured the average future 20 day return.

Volatility of momentum	Future 20 day return
Quartile 1	0.65%
Quartile 2	0.70%
Quartile 3	0.64%
Quartile 4	0.37%
Quartile 5	0.05%
Top decile	-0.01%

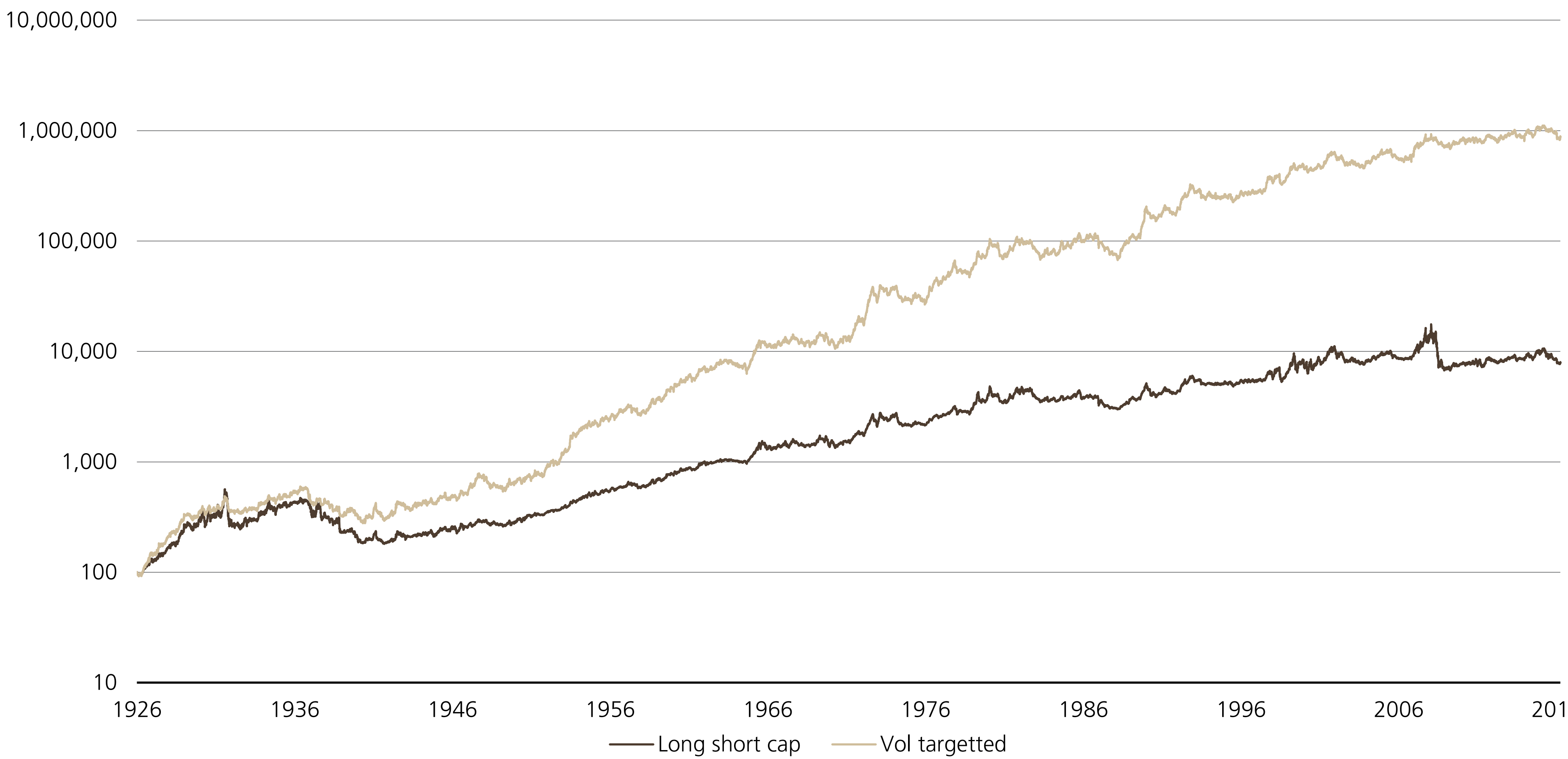
Source: UBS

Momentum and volatility

- We summarised two papers based on this idea, Barroso and Santa-Clara (2015) and Daniel and Moskowitz (2016) in our first Academic Research Monitor (July 2013).
- A number of approaches have been suggested to counter or use this effect, but volatility targeting (or tracking error targeting in a long only portfolio) seems to us the most effective.
- Using crowding as a timing indicator was suggested in Chabot et al (2014) and also in our publication Where are the crowded trades? (16 January 2015)

Volatility targeting momentum

- Volatility targeting momentum is very effective – the return / risk goes from 0.40 to 0.75.

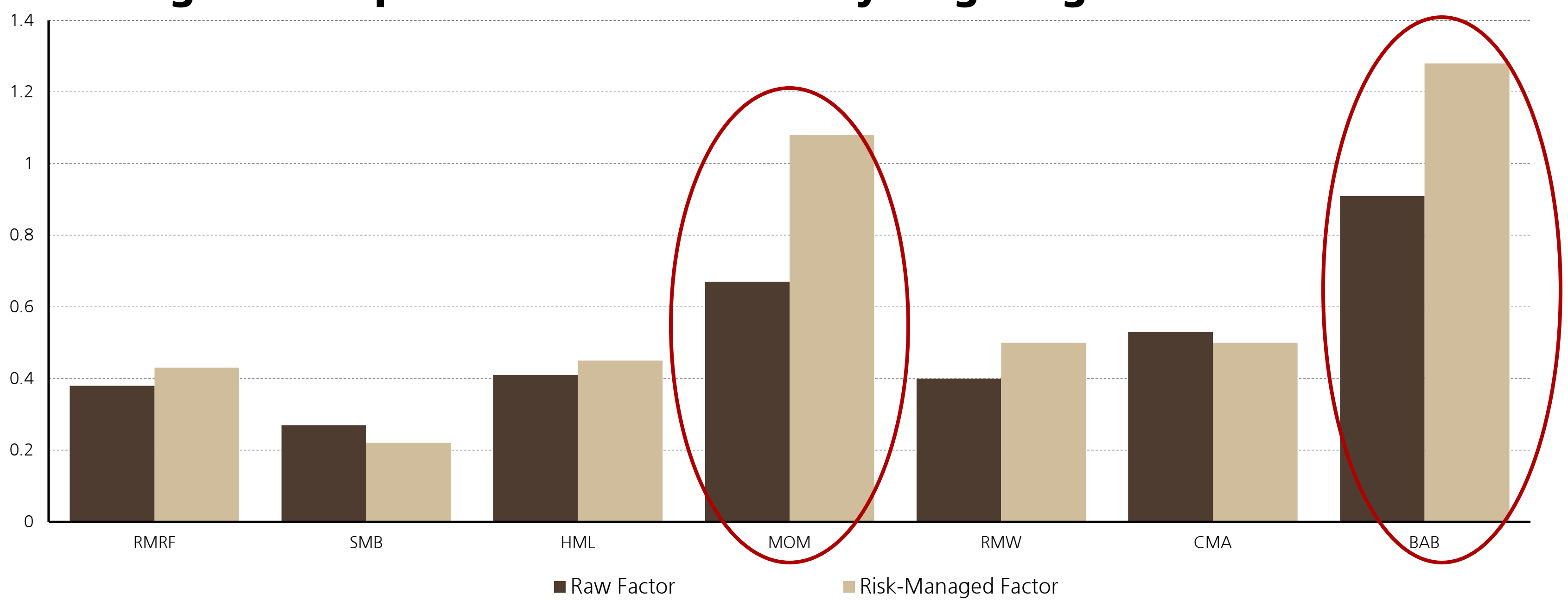


Source: UBS, Ken French Data Library (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). The momentum portfolio is a long / short portfolio based on the large cap "6 portfolios based on size and momentum". The volatility targeted portfolio has its gearing changed monthly to achieve a volatility equal to that of the base portfolio over the whole sample. The average gearing for the portfolio is 1.48.

Other factors

- What about other factors? We wrote on this in our January 2017 Academic Research Monitor where we summarised Barroso & Maio (2016) and Moreira & Muir (2016).
- Both papers look at a similar set of factors and report similar results. We note that the result for betting against beta extends to volatility as opposed to beta based portfolios.

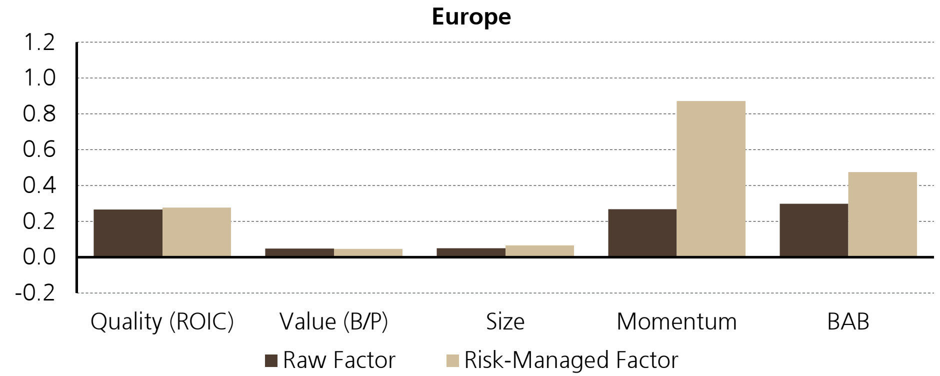
Change in Sharpe ratio due to volatility-targeting

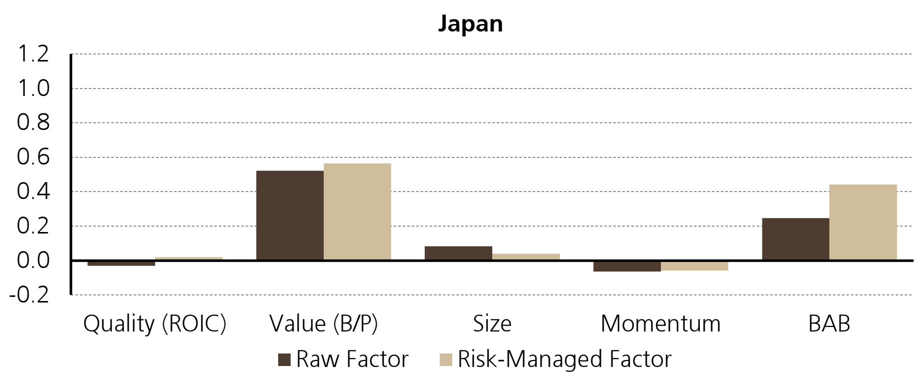


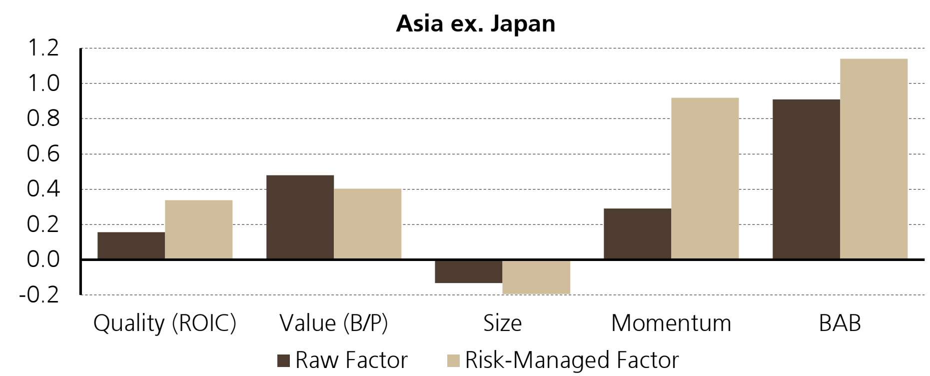
Source: "Managing the Risk of the 'Betting-Against-Beta' Anomaly: Does It Pay to Bet Against Beta?" by P. Barroso & P. Maio; the figure is constructed using data reported in Tables 1 and 3; reproduced with permission. The figure presents the Sharpe ratio of raw (buy and hold) long-short factors and of their risk-managed form using volatility-targeting. Sample period: January 1964 to December 2015.

Other regions

- We reproduced these results for three other regions. The factors are constructed on a long-short basis as the spread return between the top and bottom thirds based on the factor The BAB factors are additionally adjusted so as to achieve an ex-ante zero beta
- As in the US, momentum and BAB factors are the strongest winners of volatility-targeting.







Source: UBS Quantitative Research. The figures presents the Sharpe ratio of raw (buy and hold) long-short factors and of their risk-managed form using volatility-targeting across three regions: Europe, Asia ex. Japan and Japan. The long-short factors are rebalanced on a monthly basis and represent the spread between top and bottom thirds of the universe. Sample period: March 1992 (March 1997 for BAB) to December 2016. For illustrative purposes only.

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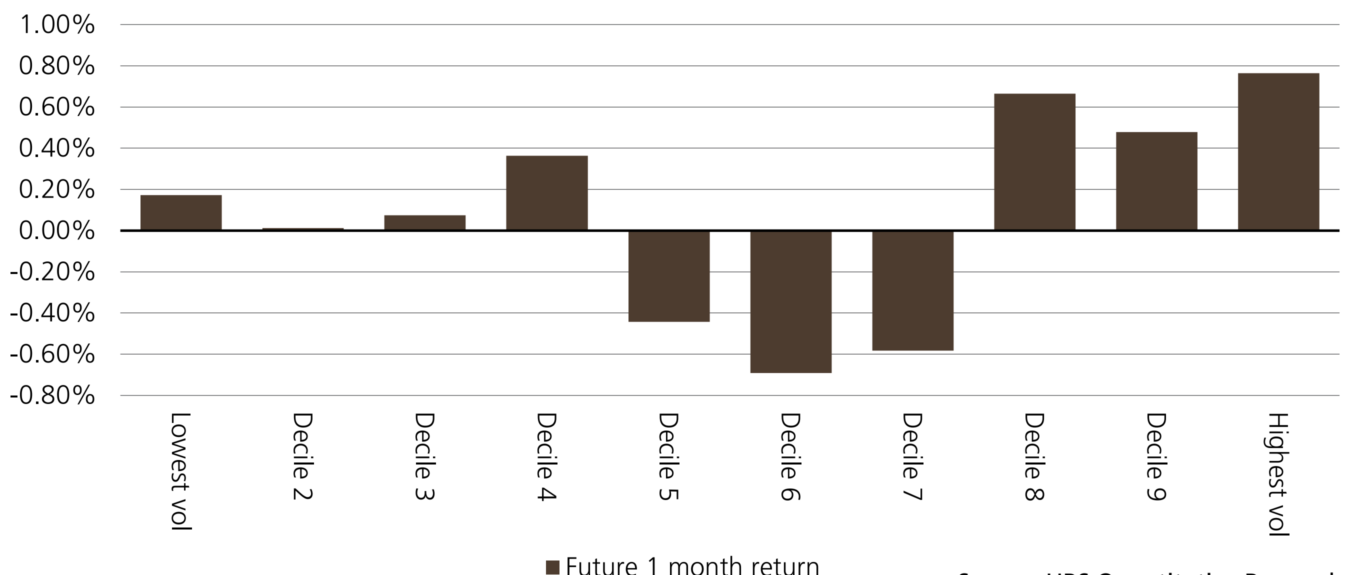
What does this mean?

- How do you improve your Sharpe ratio? You either
  - Increase your exposure if you think future returns are going to be better, or
  - Decrease your exposure if you think future volatility is going to be high
- We know that volatility is persistent, so for all the factors you are doing the second of these; but for the non-price based factors the fact your Sharpe ratio doesn't improve through volatility targeting must mean that high volatility doesn't forecast lower returns for the factor. As an example, the chart shows the relationship between future returns and trailing volatility for our European P/B factor.



Source: UBS Quantitative Research

Section 4

Recessions

Recessions

- The evidence for recessions is somewhat mixed. Using US data we see that Value, Momentum and Small cap do better in Expansions; Div. Yield and Investment in Recessions. Only the Betting against Beta factor has significantly different means.

		Betting against Beta	Momentum	Value (HML)	Small - Big	Cash Flow Yield	Earnings Yield	Op Profit	Div Yield	Invest.
Expansion	Mean	0.79	0.76	0.45	0.25	0.41	0.50	0.23	0.11	0.24
	Std Dev	2.90	3.66	3.04	3.21	3.10	3.09	2.23	3.20	1.90
Recession	Mean	0.23	0.23	0.20	0.05	0.38	0.56	0.35	0.39	0.75
	Std Dev	3.88	7.93	5.08	3.24	4.28	4.27	2.28	5.38	2.58
Difference	Mean	0.67	0.53	0.25	0.20	0.04	-0.06	-0.13	-0.28	-0.51
(Exp – Rec)	Std Dev	0.99	-4.27	-2.04	-0.03	-1.19	-1.18	-0.06	-2.17	-0.68
Data start		1931	1927	1926	1926	1951	1951	1963	1927	1963
# recessions		14	15	15	15	10	10	7	15	7

Source: UBS Quantitative Research. Data shows the average monthly return and standard deviation in expansion and recessionary periods in the US. None of the differences in means is significant.

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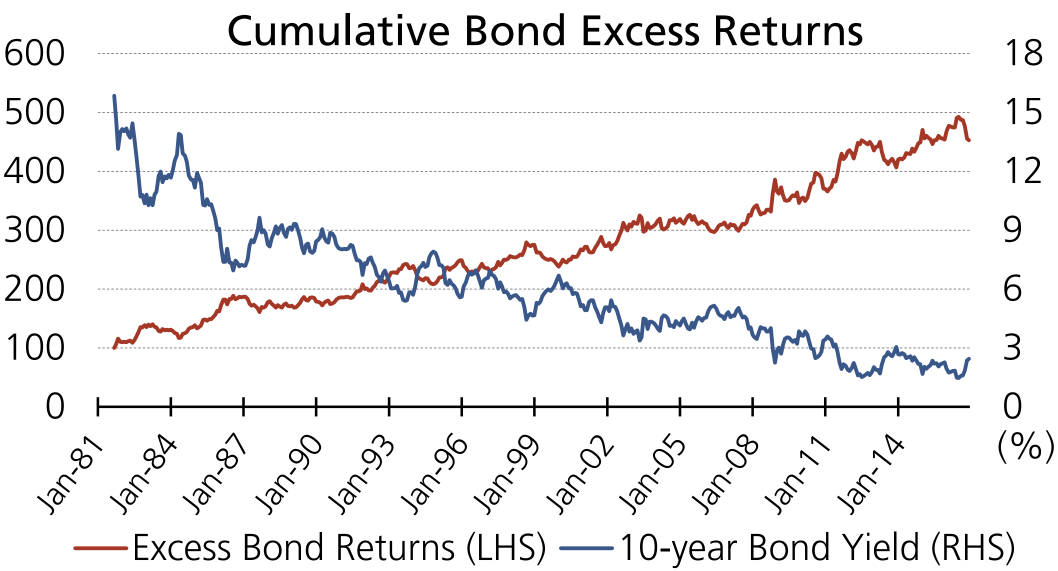
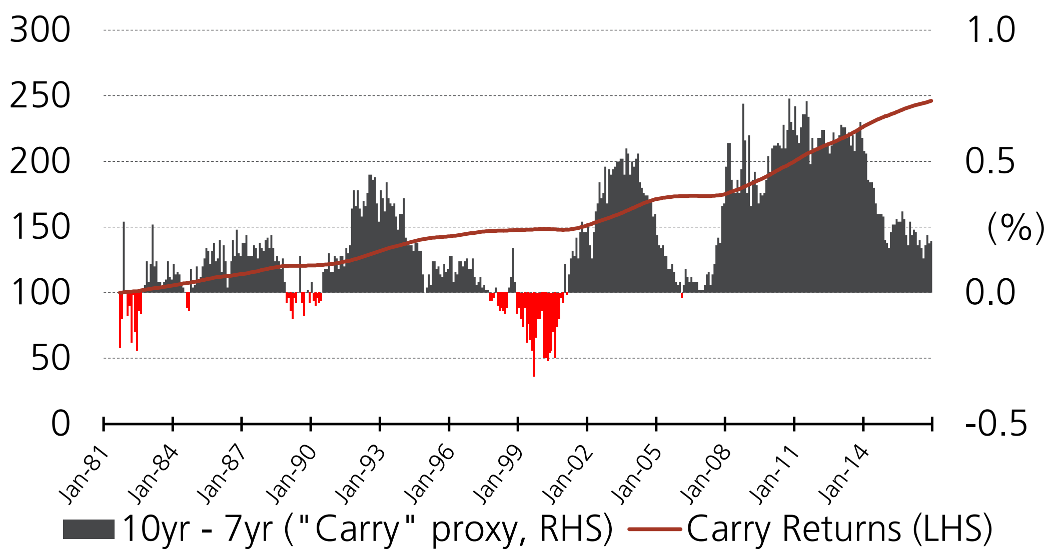
Section 5

160 years of bond trend and carry

The motivation: the 35-year Bond Rally





Source: UBS Quantitative Research

Note: For illustrative purposes only.

- The 35-bond year rally has benefitted **equally** from:
  - Rising yields (positive bond trends)
  - Upward-sloping curves (positive carry)
- *Q: What would be the impact of rising rates in the profitability of trend and carry premia?*
- Breakings this down to two sub-questions:
  - *Q1: Are trend and carry genuine premia, or simply the lucky outcome of backtests during the 35-year bond rally?*
  - *Q2: How impactful is the current trend-carry signal disagreement? Is it here to stay or it is a transient state?*

Data: *let's go as far back as possible*

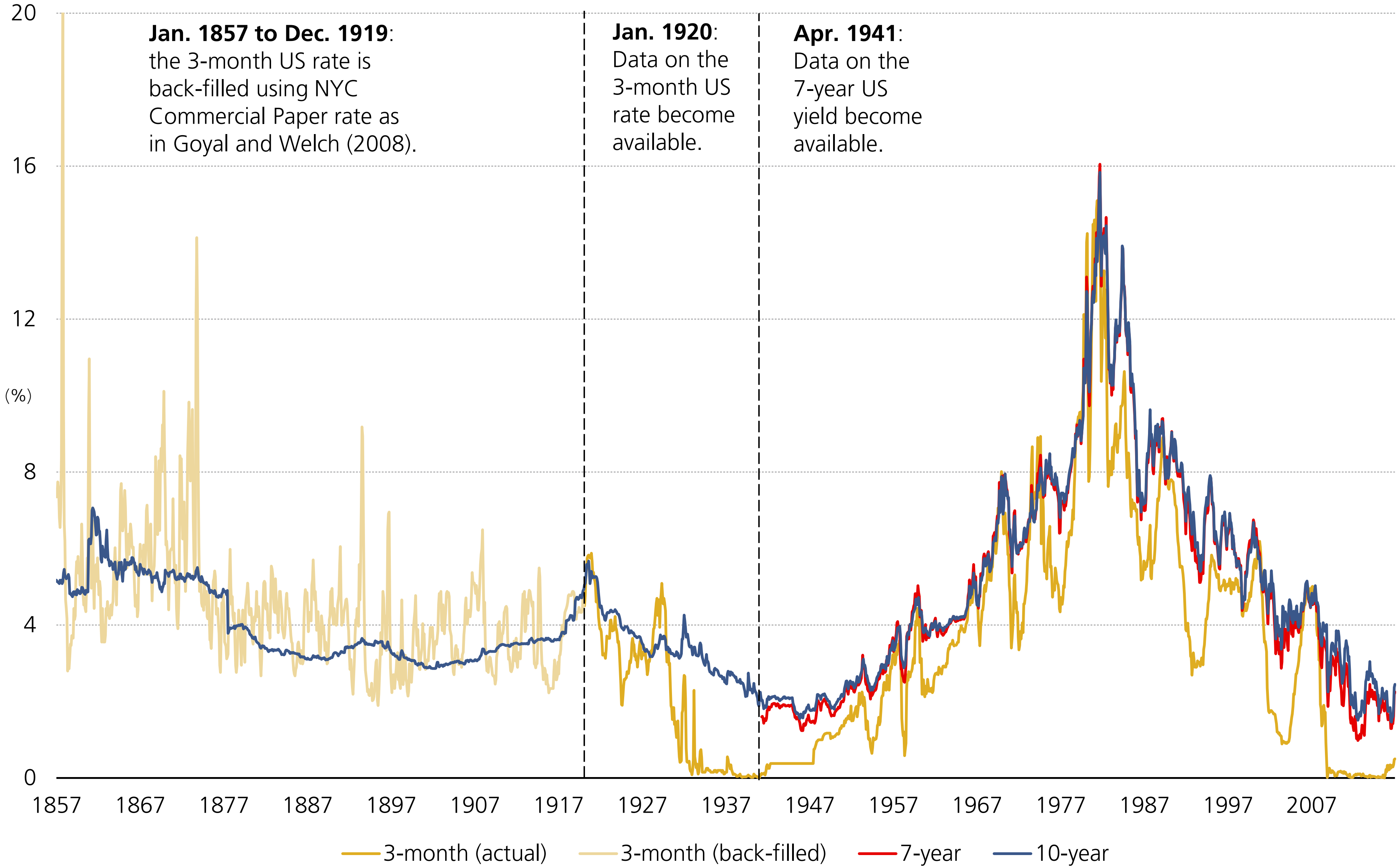
- 160 years of data:
  - 10-year US Bond constant maturity yield: Jan. 1857 to Dec. 2016
  - 7-year US Note constant maturity yield: Apr. 1941 to Dec. 2016
  - 90-day (3-month) US T-bill rate: Jan. 1920 to Dec. 2016
  - Monthly frequency
  - Source: Global Financial Data (GFD)

- Backfilling the short-term rate:
  - Follow the methodology by Goyal and Welch (2008)
  - Use NYC Commercial Paper rate (data available Jan. 1857 and Dec. 1971).
  - Fit a linear model, 3m T-bill rate vs. CP rate, for the period of overlap (Jan. 1920 – Dec. 1971)

$$i_t^{3m} = -0.0041^{**} + 0.8815^{**} \cdot i_t^{CP} + \epsilon_t, \qquad \text{with} \quad R^2 = 95.4\%$$

  - Use this fit to back-fill the short-term rate before 1920.

160 years of Bond market data



Source: UBS Quantitative Research, Global Financial Data

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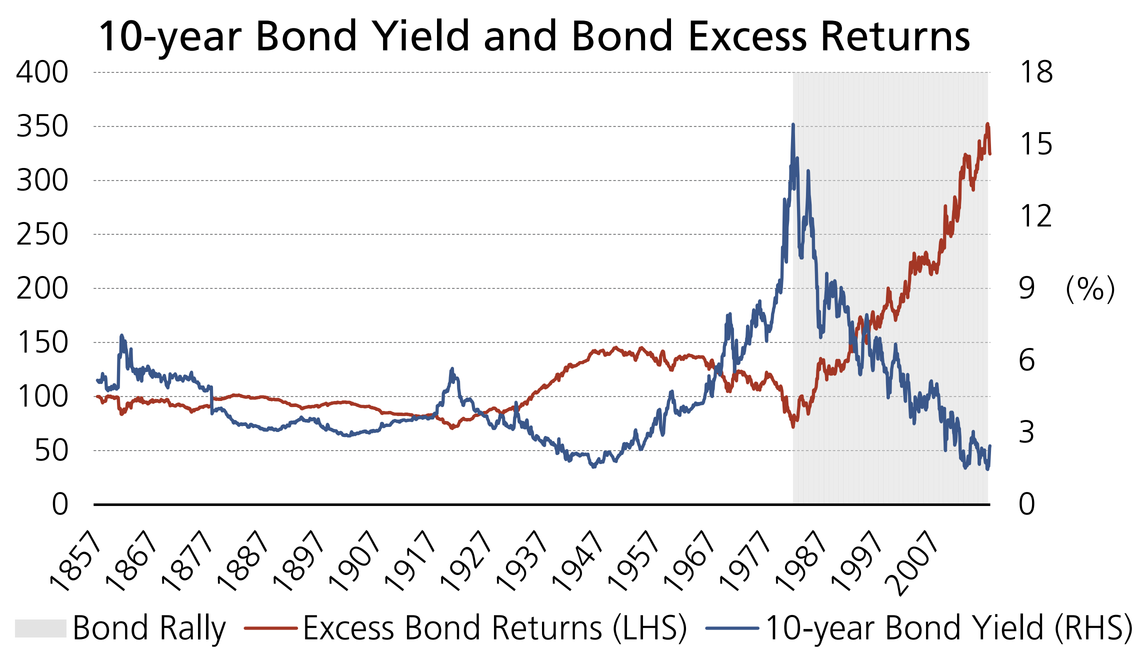
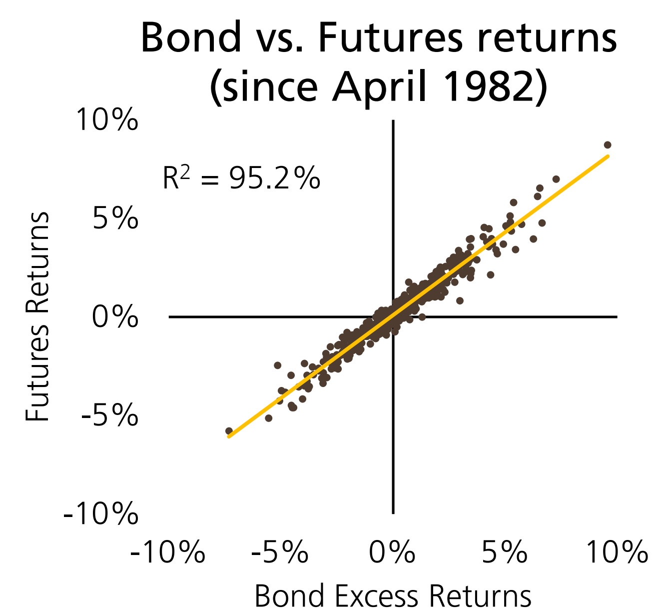
Calculating Bond Returns

Assumptions for the estimation of bond returns (Morningstar, 2008):

- Bonds trade at par upon purchase [coupon rate = bond yield → bond price = 100]
- Semi-annual coupon payment.
- Yield curve (YC) is flat between 9y11m and 10y
- A new 10yr bond is purchased at the beginning of the month and held for a month.





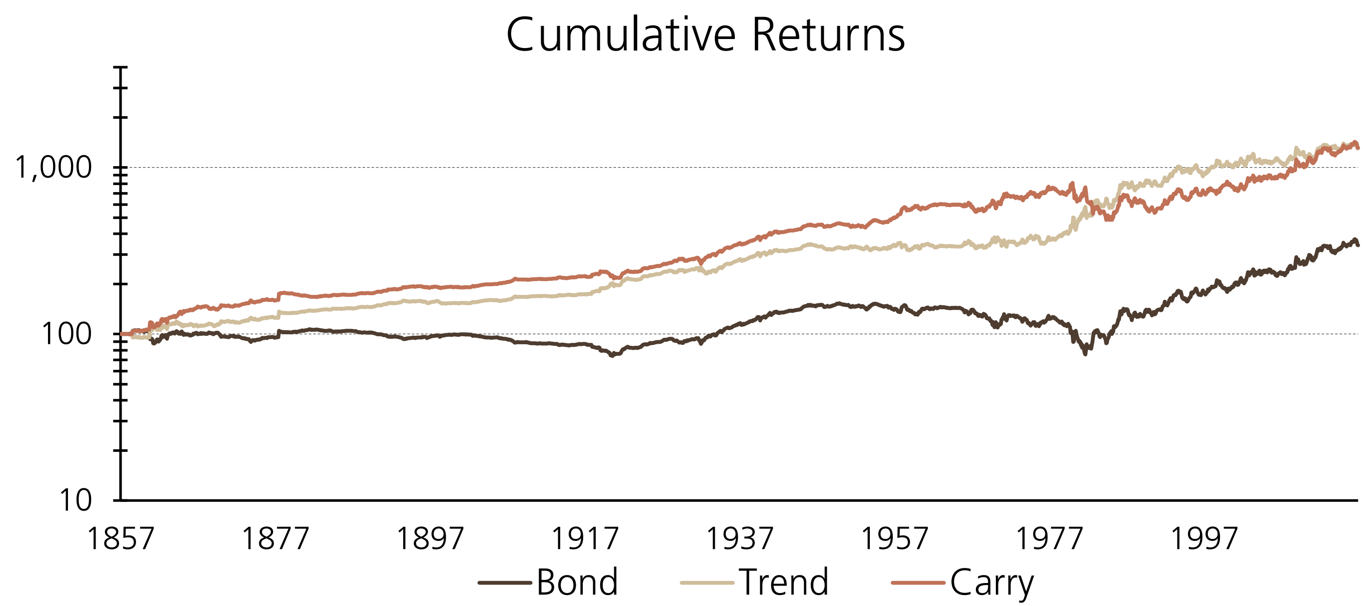
Source: UBS Quantitative Research, Global Financial Data, Bloomberg.

Trend & Carry signals

- Binary Signals: +1 or -1.
- Trend:
  - Long, if past 12-month Bond Excess Return > 0
  - Short, if past 12-month Bond Excess Return < 0
- Carry:
  - Long, if current slope of the YC at the 10yr > 0
  - Short, if current slope of the YC at the 10yr < 0
  - Slope of the curve:
    - Yield differential 10yr – 3m, Jan. 1857 to Mar. 1941
    - Yield differential 10yr – 7yr, Apr. 1941 to Dec. 2016

❖ A more simplistic nature of "carry" would be to just buy-and-hold (as long as 10Yr yield >0)

The timing ability of Trend and Carry signals



1857 - 2016	Bond	Trend	Carry
Geometric Mean (%)	0.77	1.63	1.63
Arithmetic Mean (%)	0.91	1.75	1.75
Newey-West t-statistic	2.03	4.77	4.20
Volatility (%)	5.19	5.18	5.16
Skewness	0.42	0.31	0.00
Kurtosis	11.86	11.95	12.18
Max Drawdown (%)	**50.80**	**15.88**	**40.34**
Sharpe Ratio	**0.17**	**0.34**	**0.34**
Sortino Ratio	0.26	0.53	0.51
Calmar Ratio	0.02	0.10	0.04

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

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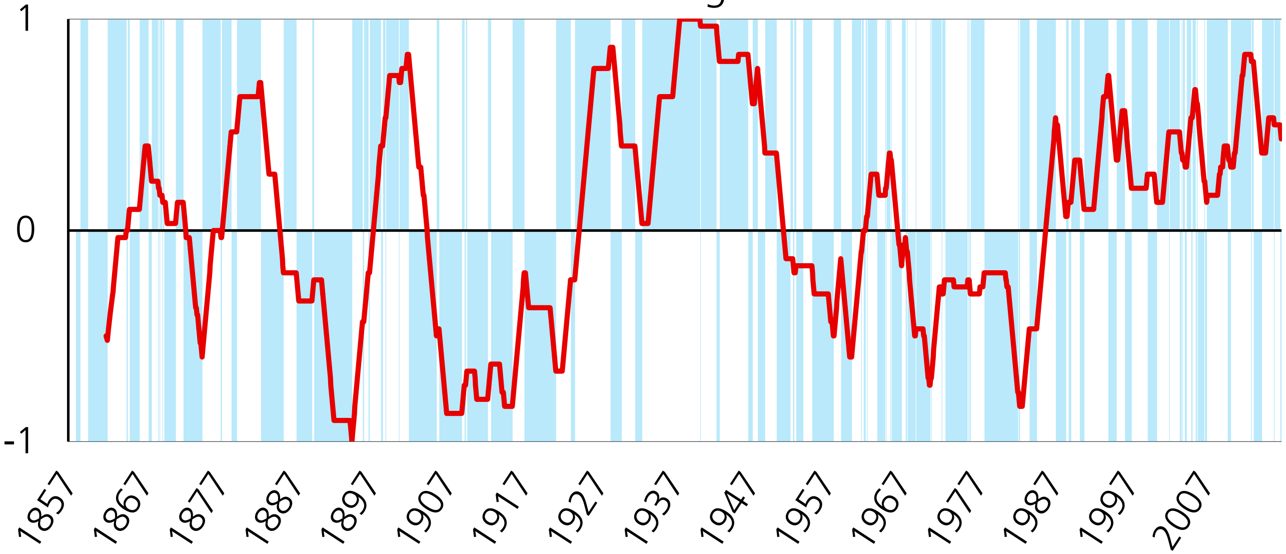
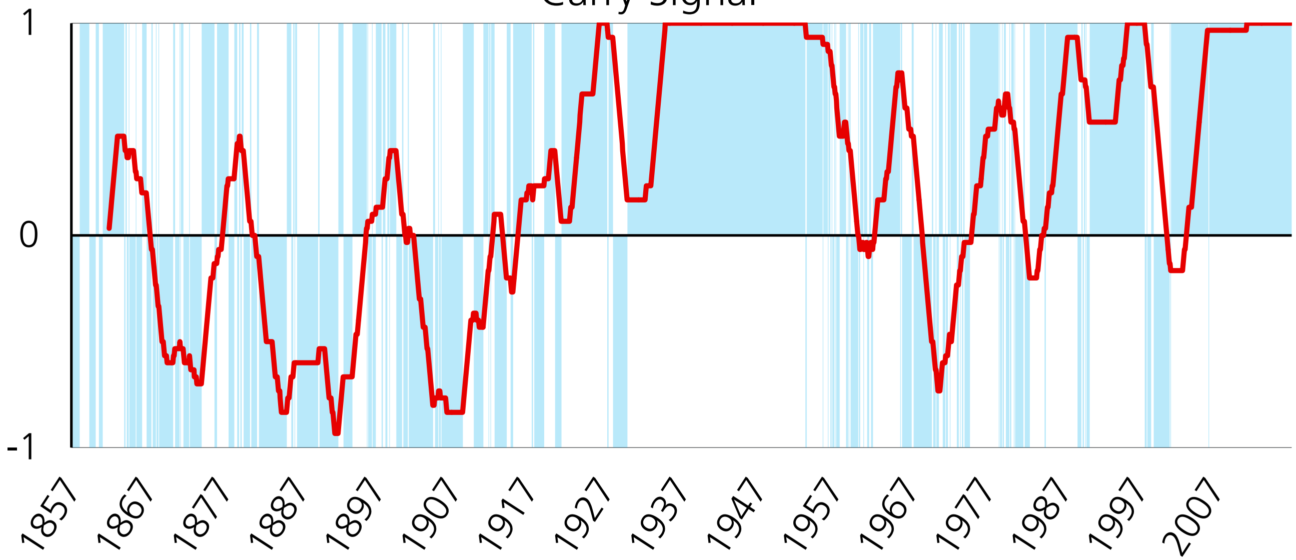
Trend and Carry Signals

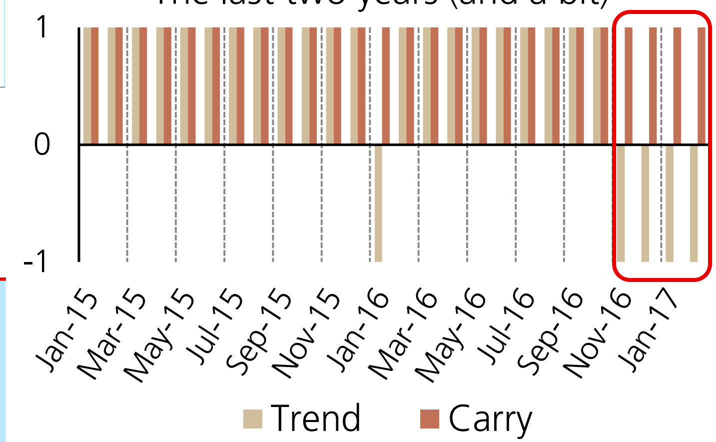
Trend Signal



Carry Signal



The last two years (and a bit)



- **What are the implications of the current signal disagreement?**

Source: UBS Quantitative Research

Note: For illustrative purposes only

Favourable & Challenging Environments

		Yield Curve	
		Upward-sloping	Downward-sloping
Bond Price	Up-trend	Positive Trend Positive Carry	Positive Trend Negative Carry
	Down-trend	Negative Trend Positive Carry	Negative Trend Negative Carry

Full Sample: 1857M01 – 2016M12 [Bond Rally: 1981M09 – 2016M07]		**Carry**		
		Long	**Short**	**Sum**
Trend	**Long**	42.6% [60.6%]	10.6% [7.6%]	53.2% [68.3%]
	Short	21.3% [24.6%]	25.5% [7.2%]	46.8% [31.7%]
	Sum	63.9% [85.2%]	36.1% [14.8%]	68.1% [67.8%]

Source: UBS Quantitative Research

Note: For illustrative purposes only.

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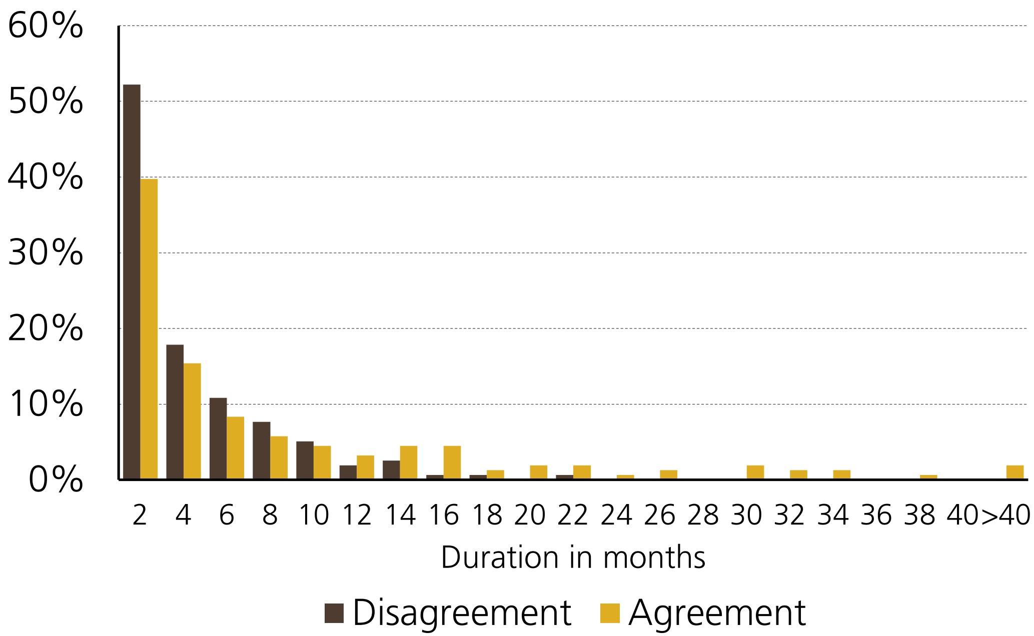
Properties of signal agreement and disagreement



- Signal agreement occurs more often than possibly expected (two thirds of the time) and lasts on average for 8 months.
- Signal disagreement periods are less persistent, occur roughly one third of the time, and last on average 3 to 4 months.

Panel A: Duration Statistics

	Disagreement	Agreement
Average	3.87	8.33
Median	2	4
75^{th} pct.	5	12

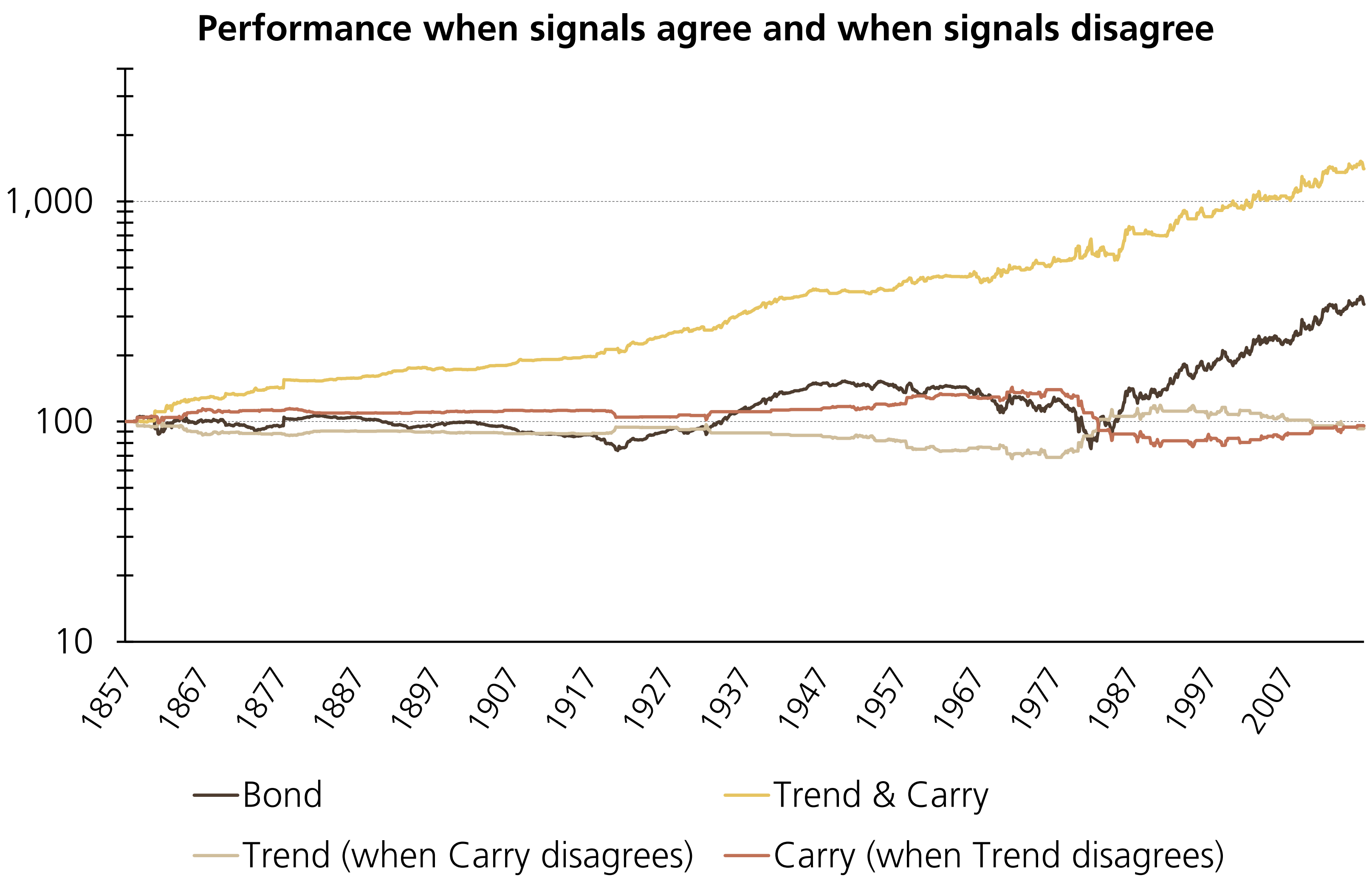
Panel B: Transition Matrix

	Disagreement	Agreement
Disagreement	74%	26%
	[71%, 78%]	[24%, 28%]
Agreement	12%	88%
	[11%, 13%]	[85%,91%]

Source: UBS Quantitative Research

Note: For illustrative purposes only.

Performance is superior when the signals agree!



Source: UBS Quantitative Research

Note: For illustrative purposes only.

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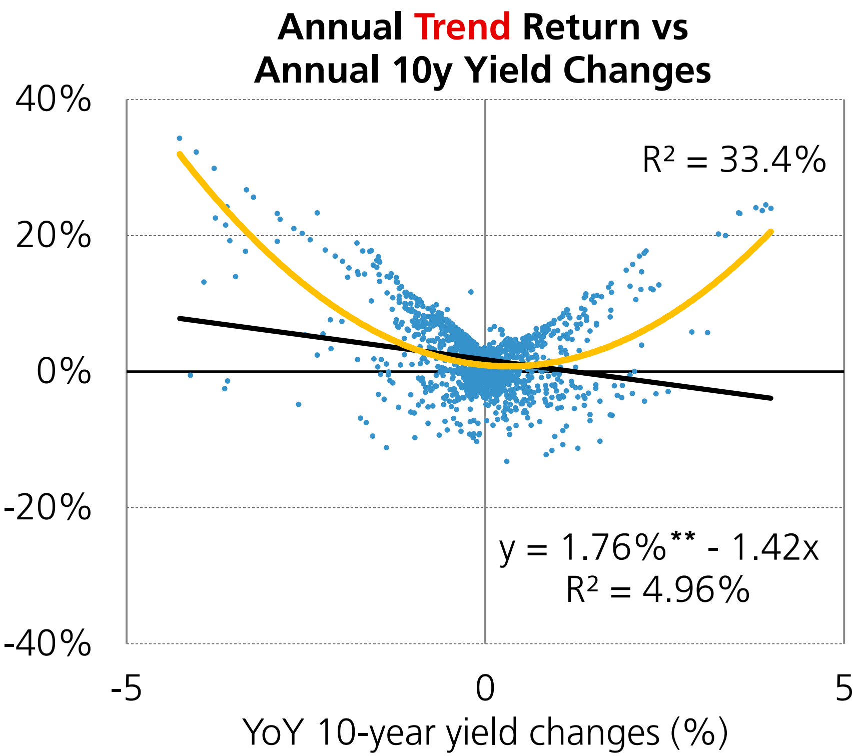
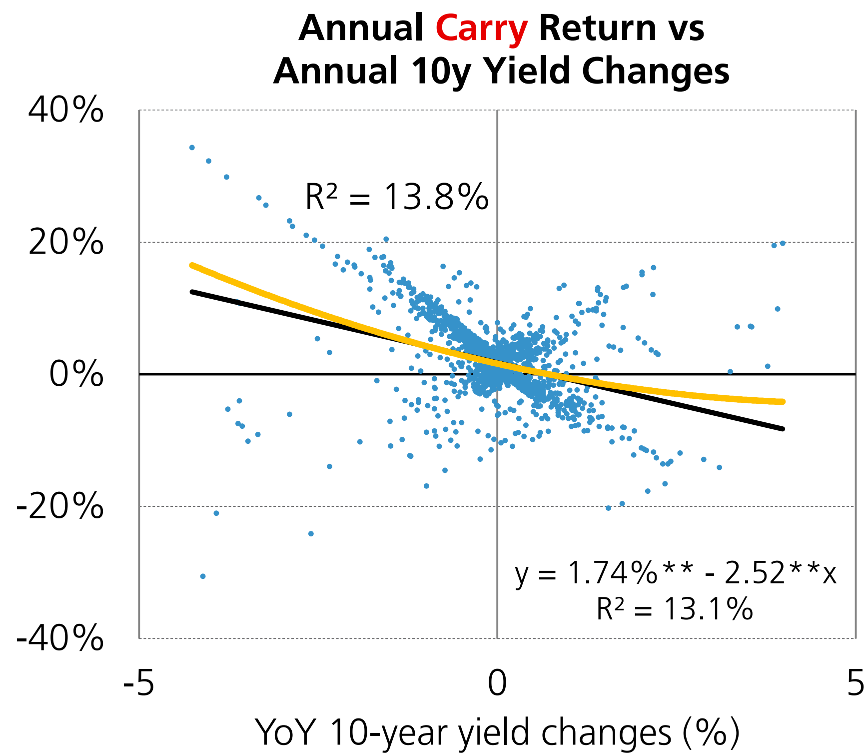
Premia and Interest Rate Changes





Source: UBS Quantitative Research

Note: For illustrative purposes only.

- The trend signal generates a convex payoff with respect to the contemporaneous changes in the yield.

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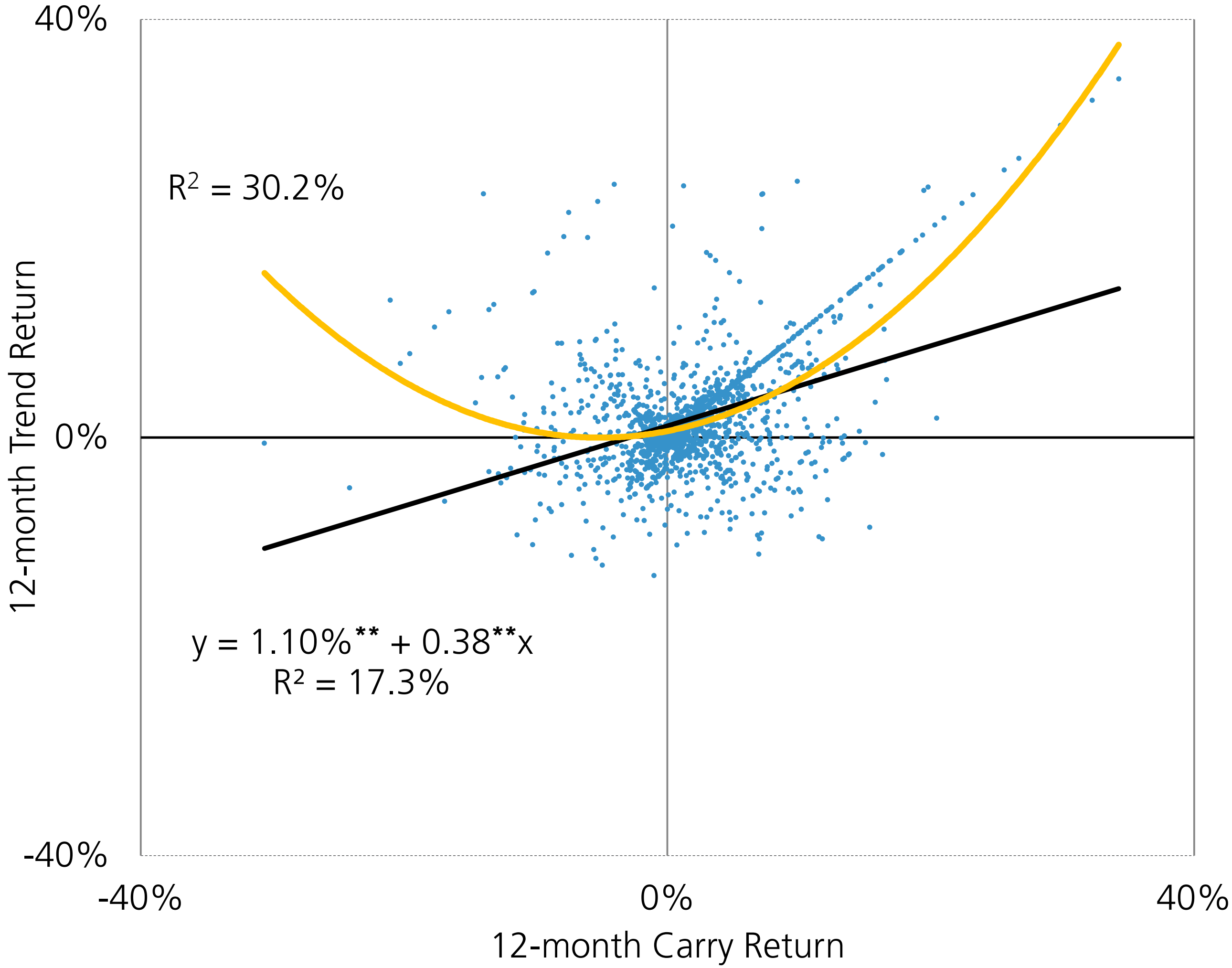
Signal diversification

Trend versus Carry 12-month returns

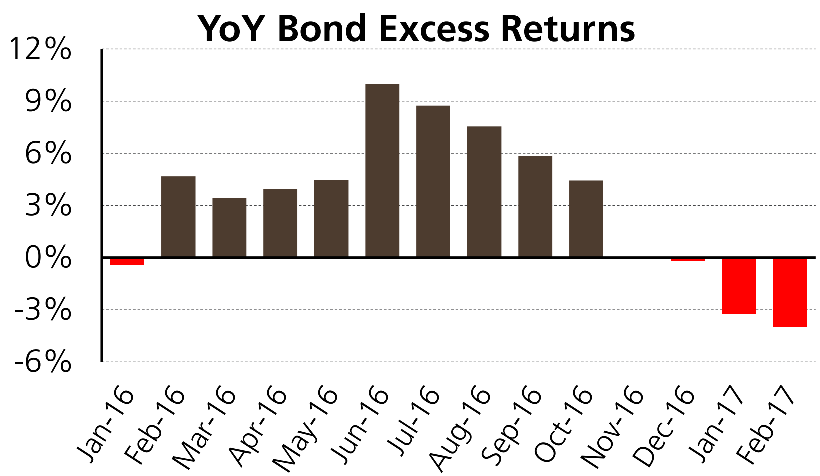


Source: UBS Quantitative Research

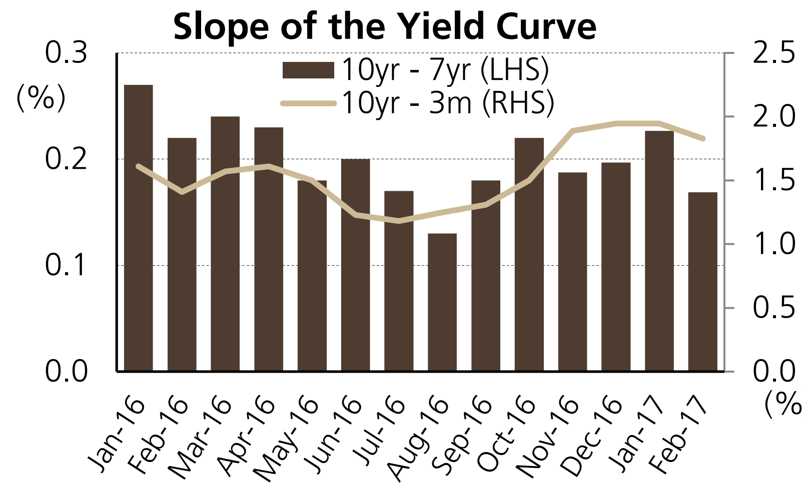
Note: For illustrative purposes only.

Where do we currently stand? 4 charts

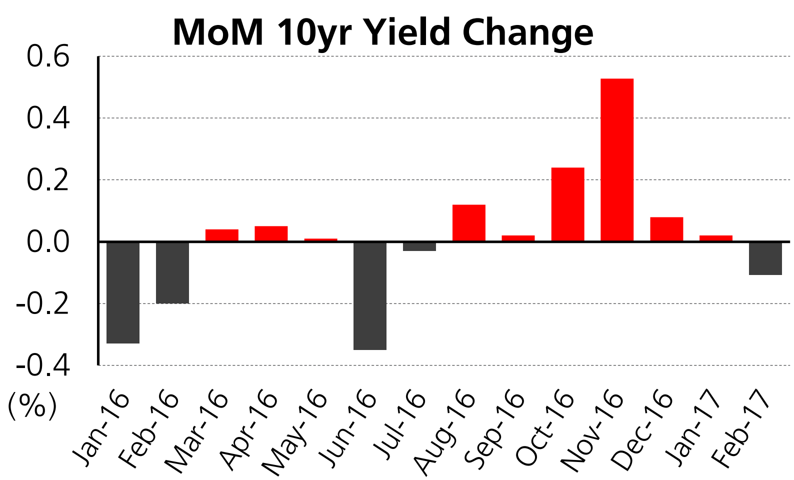
- 4th consecutive month of negative trend



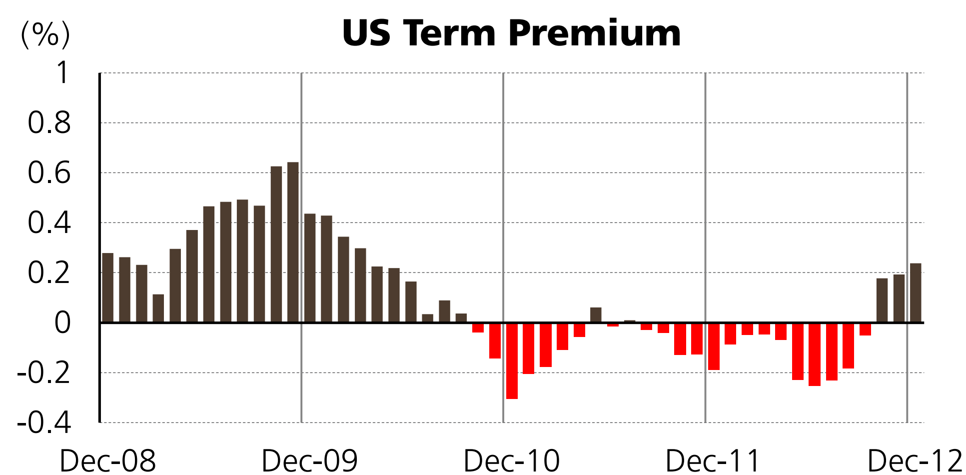
- Carry remains positive



- Yield has relatively stabilised



- Term premia have turned positive post-QE



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→ **Overweight the (long) carry signal.**

Source: UBS Quantitative Research,
UBS Global Macro Strategy

Section 6

Do bond factors influence equity factors?

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Do bond factors affect the equity factors?

- As before, we divided the time period into four groups based on the trend and carry signals. For each of the US factors we show the mean return, the standard deviation and the Sharpe ratio over the following month.

Market (excess return)

			Carry	
			Positive	Negative
Trend	Positive	Mean	11.50	5.31
		t-stat	(3.91)	(0.74)
		Stdev	18.85	16.75
		Sharpe	0.61	0.32
	Negative	Mean	8.06	-4.69
		t-stat	(2.27)	(-1.02)
		Stdev	19.03	17.37
		Sharpe	0.42	-0.27

Source: UBS Quantitative Research.

Do bond factors affect the equity factors – value

Value (Book Yield High minus Low)

			Carry	
			Positive	Negative
Trend	Positive	Mean	3.11	5.54
		t-stat	(1.55)	(1.01)
		Stdev	11.86	10.33
		Sharpe	0.26	0.54
	Negative	Mean	8.90	3.82
		t-stat	(2.40)	(1.21)
		Stdev	13.59	11.21
		Sharpe	0.66	0.34

Dividend Yield

			Carry	
			Positive	Negative
Trend	Positive	Mean	2.06	3.47
		t-stat	(1.07)	(0.62)
		Stdev	12.10	11.68
		Sharpe	0.17	0.30
	Negative	Mean	4.12	-2.66
		t-stat	(1.15)	(-0.69)
		Stdev	13.01	14.83
		Sharpe	0.32	-0.18

Earnings Yield

			Carry	
			Positive	Negative
Trend	Positive	Mean	6.62	6.32
		t-stat	(3.32)	(0.72)
		Stdev	10.36	13.33
		Sharpe	0.64	0.47
	Negative	Mean	7.47	2.53
		t-stat	(3.08)	(0.60)
		Stdev	11.09	13.17
		Sharpe	0.67	0.19

Cash Flow Yield

			Carry	
			Positive	Negative
Trend	Positive	Mean	5.12	4.10
		t-stat	(2.58)	(0.51)
		Stdev	10.41	12.77
		Sharpe	0.49	0.32
	Negative	Mean	6.52	2.27
		t-stat	(2.82)	(0.56)
		Stdev	10.94	13.62
		Sharpe	0.60	0.17

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Do bond factors affect the equity factors – others

Size (Small - Big)

			Carry	
			Positive	Negative
Trend	Positive	Mean	5.39	-5.71
		t-stat	(3.11)	(-1.10)
		Stdev	11.21	9.94
		Sharpe	0.48	-0.57
	Negative	Mean	0.17	-0.37
		t-stat	(0.08)	(-0.10)
		Stdev	9.24	13.55
		Sharpe	0.02	-0.03

Momemtum

			Carry	
			Positive	Negative
Trend	Positive	Mean	5.94	8.53
		t-stat	(2.78)	(1.45)
		Stdev	15.65	16.27
		Sharpe	0.38	0.52
	Negative	Mean	5.08	19.03
		t-stat	(1.05)	(4.46)
		Stdev	18.75	14.60
		Sharpe	0.27	1.30

Betting against Beta

			Carry	
			Positive	Negative
Trend	Positive	Mean	10.52	13.55
		t-stat	(5.54)	(2.69)
		Stdev	11.06	12.97
		Sharpe	0.95	1.04
	Negative	Mean	6.13	1.21
		t-stat	(2.74)	(0.35)
		Stdev	9.23	10.69
		Sharpe	0.66	0.11

Operating Profitability (Robust minus Weak)

			Carry	
			Positive	Negative
Trend	Positive	Mean	3.55	11.52
		t-stat	(2.39)	(1.53)
		Stdev	6.73	10.43
		Sharpe	0.53	1.10
	Negative	Mean	3.30	-2.62
		t-stat	(1.96)	(-0.97)
		Stdev	5.38	10.96
		Sharpe	0.61	-0.24

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Neutral	FSR is between -6% and 6% of the MRA.	39%	27%
Sell	FSR is > 6% below the MRA.	15%	16%
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