



Beats and Misses (Part II)

Trading Beats and Misses

Part I of our Beats and Misses report addressed the issue of predicting earnings beats and misses, yet we also showed that meeting EPS estimates and outperforming on earnings day are not the same thing. In this report, we focus on predicting the price reaction itself, and how to position post results. We present a strategy to trade the earnings season.

Understanding price reaction drivers on results day

We show that the divergences in short-term price momentum and analyst sentiment, as well as historical patterns are stronger predictors of price reaction on results day than beat/miss forecasts.

Evaluating earnings surprises

Earnings surprises can be assessed using 5 metrics – the price reaction on announcement day, the EPS and Sales consensus surprises, the surprise in earnings progress made in the reported period and the surprise in company-issued guidance figures.

A strategy to navigate the earnings season

We present a long-short earnings strategy that covers how to position prior to and post earnings announcements. We also conduct further analysis on how the strategy has fared under different market environments and after controlling for other equity characteristics.

Recommended stocks

Currently, Alibaba and AAC Technologies are in our long earnings surprise portfolio, while Telstra Corp and Lenovo are in our short portfolio. Latest additions to the Japan portfolio include shorts in FamilyMart and Kewpie Corp.

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More Beats and Misses (Part II)

Trading earnings surprises – an overview

Why consider a systematic earnings strategy?

Over the results season, investors often have to process the deluge of announcements from multiple companies releasing on the same day. For example, in a span of 5 business days (9-15 May 2017), 650 companies – two-thirds of the Japanese market capitalization, will report their FY2017 earnings. The bulk of the subsequent out(under)-performance of stocks in the direction of earnings surprises (also termed the Post Earnings Announcement Drift, or the PEAD) is concentrated in the first few days (Figure 2).

The hectic nature of the Japan earnings season is just a case in point. Across a global dataset, we see that timely entry into a PEAD trade is rewarding. A systematic approach to evaluating the relative degree of 'surprise' of the earnings results would aid investors in navigating the results season.

Whilst bottom line beats or misses are what capture headlines, companies may want to emphasize other numbers, and investors may focus on particular metrics. We quantify the extent of earnings surprise with an overall surprise score that captures the price reaction, the EPS surprise, Sales surprise, EPS progress rate surprise and the surprise in Company Guidance numbers. The most promising PEAD trade is one that 'ticks all the boxes'.

This surprise scoring could also be a useful metric for investors to evaluate their positions – whether to 'top-up' on weakness for those that experienced sharp corrections or to go with the momentum established and supported by earnings data.

Price reactions on earnings day

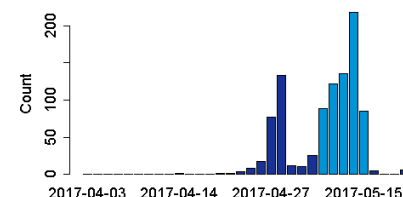
Part I of our report addressed the issue of predicting earnings beats and misses, yet we also showed that meeting EPS estimates and outperformance on earnings day are not the same thing. The big moves tend to come from surprises that are not priced-in by the market. We shift gears in this report and focus on predicting the price reaction itself. What we have found is intuitive – focus on stocks that show discordance in what the price movements are saying and what the analyst sentiment shows or simply, on how past earnings events have played out.

A strategy to navigate the earnings season

We suggest a strategy to navigate the earnings season – positioning ahead of results and evaluating earnings surprises. We carry out an empirical analysis of our strategy's performance to support our conclusions.

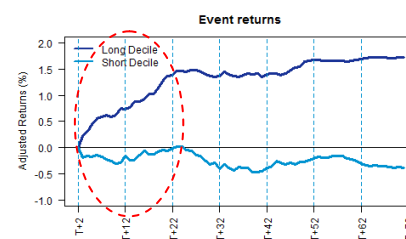
Currently, longs in our Asia ex Japan earnings surprise portfolio include Alibaba and AAC Technologies, while shorts include Telstra Corp and Lenovo. Latest additions to the Japan portfolio include shorts in FamilyMart and Kewpie Corp.

Figure 1: Number of companies reporting in the FY2017 Japan results season by date



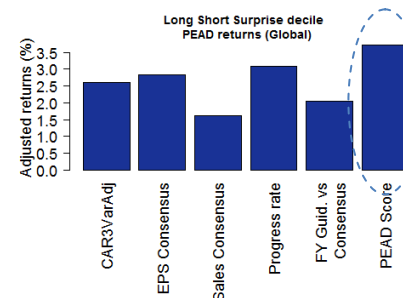
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 2: Event returns of a long short EPS consensus surprise PEAD trade (Japan) – Most of the PEAD occurs in the first 20 days



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 3: The long short PEAD spread for our PEAD score is larger than that for other surprise metrics



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Stock screens from our earnings surprise scores

Screens as of 2017-04-21. Stocks are sorted according to their 21-day average traded value.

Figure 4: Asia ex Japan PEAD strategy portfolio Longs

Market	Ticker	Name	Announce Date	Financial Period	Q	Sector	Market Cap (USDm)	21D ADTV (USDm)	DB Rating	PEAD score
CN	BABA US	Alibaba Group Holding Ltd. Sponsored ADR	1/24/2017	12/31/2016	3	I.T.	213,393	871	Buy	96
CN	NTES US	NetEase, Inc. Sponsored ADR	2/16/2017	12/31/2016	4	I.T.	33,667	222	Buy	90
CN	175 HK	Geely Automobile Holdings Limited	3/22/2017	12/31/2016	4	Consumer Disc.	12,093	93	Hold	94
AU	WES AU	Wesfarmers Limited	2/14/2017	12/31/2016	2	Consumer Staples	34,565	61	Sell	91
CN	MOMO US	Momo Inc Sponsored ADR Class A	3/7/2017	12/31/2016	4	I.T.	3,842	53	-	93
HK	16 HK	Sun Hung Kai Properties Limited	2/28/2017	12/31/2016	2	Real Estate	40,077	52	Hold	96
CN	2018 HK	AAC Technologies Holdings Inc.	3/22/2017	12/31/2016	4	I.T.	12,933	43	Buy	93
IN	HDFC IN	Housing Development Finance Corporation Limited	1/30/2017	12/31/2016	3	Financials	29,484	43	Buy	93
TH	BANPU TB	Banpu Public Co. Ltd.	2/23/2017	12/31/2016	4	Energy	2,720	42	Buy	90
HK	1113 HK	Cheung Kong Property Holdings Limited	3/22/2017	12/31/2016	4	Real Estate	25,849	34	Buy	92

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 5: Asia ex Japan PEAD strategy portfolio Shorts

Market	Ticker	Name	Announce Date	Financial Period	Q	Sector	Market Cap (USDm)	21D ADTV (USDm)	DB Rating	PEAD score
AU	TLS AU	Telstra Corporation Limited	2/16/2017	12/31/2016	2	Telecom Services	45,144	83	Buy	7
AU	NCM AU	Newcrest Mining Limited	2/13/2017	12/31/2016	2	Materials	12,532	49	Sell	6
SG	BN4 SG	Keppel Corporation Limited	4/20/2017	3/31/2017	1	Industrials	8,985	45	Hold	8
IN	TTMT IN	Tata Motors Limited	2/14/2017	12/31/2016	3	Consumer Disc.	22,185	44	Buy	1
CN	992 HK	Lenovo Group Limited	2/16/2017	12/31/2016	3	I.T.	7,316	42	-	7
AU	DUE AU	DUET Group	2/17/2017	12/31/2016	2	Utilities	5,172	41	Hold	9
CN	966 HK	China Taiping Insurance Holdings Co., Ltd.	3/23/2017	12/31/2016	4	Financials	8,417	24	Buy	7
KR	034730 KR	SK Holdings Co., Ltd.	2/9/2017	12/31/2016	4	Industrials	13,108	23	-	6
AU	AWC AU	Alumina Limited	2/23/2017	12/31/2016	4	Materials	4,241	22	Sell	7
IN	DLF IN	DLF Limited	2/14/2017	12/31/2016	3	Real Estate	3,549	18	Hold	7

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 6: Japan PEAD strategy portfolio Longs

Market	Ticker	Name	Announce Date	Financial Period	Q	Sector	Market Cap (USDm)	21D ADTV (USDm)	DB Rating	PEAD score
JP	3436 JP	SUMCO Corporation	2/8/2017	12/31/2016	4	I.T.	4,614	97	Buy	90
JP	4502 JP	Takeda Pharmaceutical Co. Ltd.	2/1/2017	12/31/2016	3	Health Care	33,168	91	Buy	94
JP	6971 JP	Kyocera Corporation	1/31/2017	12/31/2016	3	I.T.	18,817	70	-	95
JP	4005 JP	Sumitomo Chemical Co., Ltd.	1/30/2017	12/31/2016	3	Materials	7,892	64	-	95
JP	1605 JP	Inpex Corporation	2/10/2017	12/31/2016	3	Energy	14,425	56	Buy	98
JP	6479 JP	MinebeaMitsumi Inc.	2/13/2017	12/31/2016	3	Industrials	4,268	46	-	99
JP	8725 JP	MS&AD Insurance Group Holdings, Inc.	2/14/2017	12/31/2016	3	Financials	21,349	46	Hold	94
JP	1928 JP	Sekisui House, Ltd.	3/9/2017	1/31/2017	4	Consumer Disc.	11,389	40	Hold	92
JP	5201 JP	Asahi Glass Co., Ltd.	2/7/2017	12/31/2016	4	Industrials	8,855	37	-	95
JP	5802 JP	Sumitomo Electric Industries, Ltd.	2/2/2017	12/31/2016	3	Consumer Disc.	11,619	36	-	93

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 7: Japan PEAD strategy portfolio Shorts

Market	Ticker	Name	Announce Date	Financial Period	Q	Sector	Market Cap (USDm)	21D ADTV (USDm)	DB Rating	PEAD score
JP	7011 JP	Mitsubishi Heavy Industries, Ltd.	2/2/2017	12/31/2016	3	Industrials	15,251	59	-	6
JP	8028 JP	FamilyMart UNY Holdings Co. Ltd.	4/11/2017	2/28/2017	4	Consumer Staples	7,571	36	Hold	9
JP	4021 JP	Nissan Chemical Industries, Ltd.	2/3/2017	12/31/2016	3	Materials	5,520	24	-	7
JP	8354 JP	Fukuoka Financial Group, Inc.	2/7/2017	12/31/2016	3	Financials	3,819	20	Buy	10
JP	5110 JP	Sumitomo Rubber Industries, Ltd.	2/14/2017	12/31/2016	4	Consumer Disc.	4,124	19	-	1
JP	6773 JP	Pioneer Corporation	2/13/2017	12/31/2016	3	Consumer Disc.	820	15	Sell	2
JP	6366 JP	Chiyoda Corp.	2/8/2017	12/31/2016	3	Industrials	1,760	13	-	4
JP	2579 JP	Coca-Cola Bottlers Japan Inc.	2/6/2017	12/31/2016	4	Consumer Staples	3,233	13	-	7
JP	2809 JP	Kewpie Corporation	4/3/2017	2/28/2017	1	Consumer Staples	4,399	13	-	5
JP	2337 JP	Ichigo Inc.	4/19/2017	2/28/2017	4	Real Estate	1,498	11	Buy	8

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



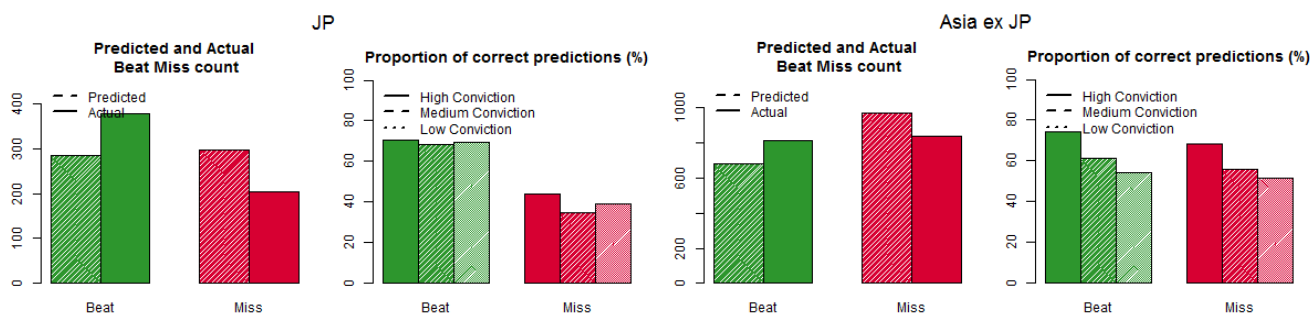
It's not all about the Beat and Miss

In Part I of our report, we outlined a framework to predict earnings beats and misses. We review how our predictions have fared for the FY2016 earnings season.

Proportion of beats and misses and quality of our forecasts

The quality of our forecasts for the FY2016 earnings season was largely in line with historical forecast performance.

Figure 8: The performance of our forecasts for the FY2016 earnings season was in line with their historical forecast performance (As of March end 2017)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

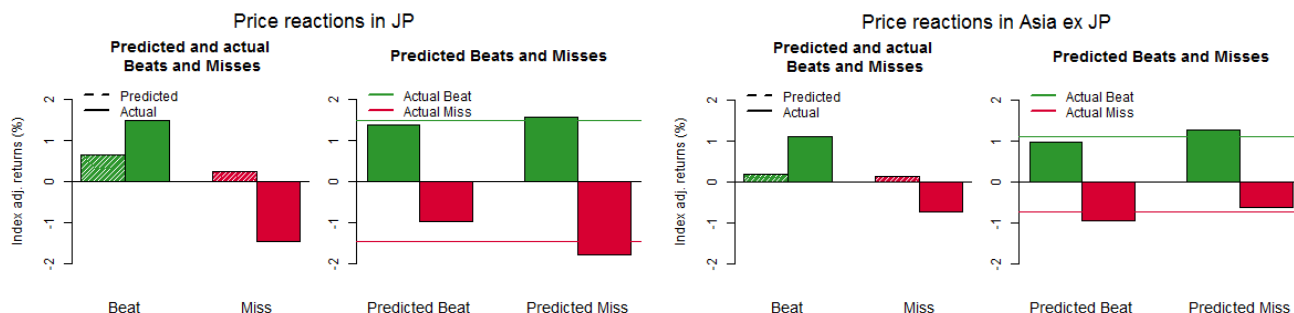
Price reactions to beats and misses

In the FY2016 season in Asia ex Japan, beats have on average gone up by 1.1% on the 3 days over earnings announcements (index adjusted), while misses have underperformed by 0.7%.

As noted in our previous report, the idea of buying (selling) into all predicted beats (misses) is simplistic and potentially damaging to the portfolio, as wrong-way predictions are often met with outsized price reactions.

Our predicted beats have outperformed predicted misses in the FY2016 earnings season, but as expected, the outperformance is slight. There is no meaningful difference in performance of predicted beats and misses in Asia ex Japan.

Figure 9: Predicted beats slightly outperform predicted misses in Japan (As of March end 2017)
No difference in performance of predicted beats and misses in Asia ex Japan



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

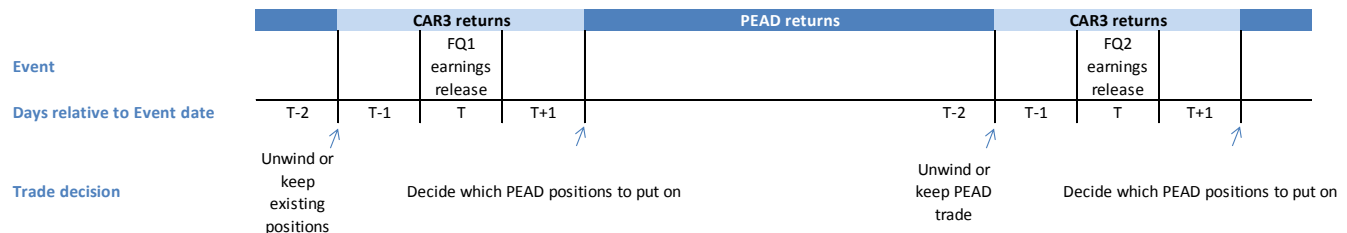


Overview of our strategy

Our Earnings strategy has two parts.

- **Short-term positioning** for earnings announcement, covering the 3-day return over earnings results (Cumulative Abnormal Returns **CAR3**)
- **Medium-term positioning** post earnings announcements until the next earnings release (Post Earnings Announcement Drift **PEAD**)

Figure 10: Time-line of our Earnings Strategy



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Positioning for earnings announcement

2 days prior to each earnings announcement, we calculate a CAR3 score. The CAR3 score is the average of the two following scores:

- **A Price-Sentiment Discrepancy score:** The difference between analyst sentiment ranking and 10 day price momentum ranking.
- **A Price-Surprise Momentum Discrepancy score:** The difference of previous year's CAR3 surprise ranking and the 10 day price momentum ranking

For long positions in the incumbent portfolio, we keep the positions in the top 1/3 of CAR3 scores through earnings. For short positions, we keep positions in the bottom 1/3 of CAR3 scores for the 3 days over earnings results. We unwind remaining positions 2 days before the next earnings announcement.

Positioning post earnings announcements

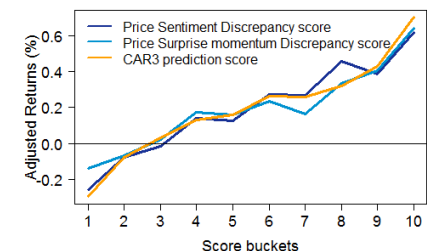
On the close of the day after earnings announcements, we calculate a PEAD score.

- For **Annual** results, we take a simple average of the percentile rankings of the CAR3 surprise, EPS Consensus surprise, Sales Consensus surprise, Full Year Guidance Surprise and Progress rate surprise
- For **Non-annual** results, we take a simple average of the percentile rankings of the CAR3 surprise and Progress rate surprise

Percentile rankings are calculated with a look-back of all earnings announcements in the past 12 months.

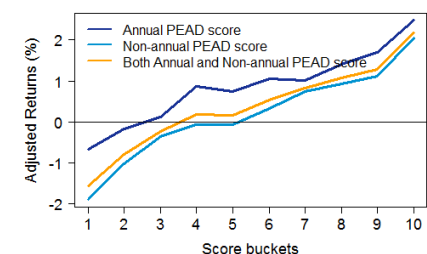
We go long (short) the top (bottom) 1/10 of our PEAD scores, hedging all positions dollar-for-dollar with the appropriate Market Index.

Figure 11: CAR3 returns for each bucket of our CAR3 prediction score (Global)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 12: PEAD returns for each bucket of our PEAD prediction score (Global)

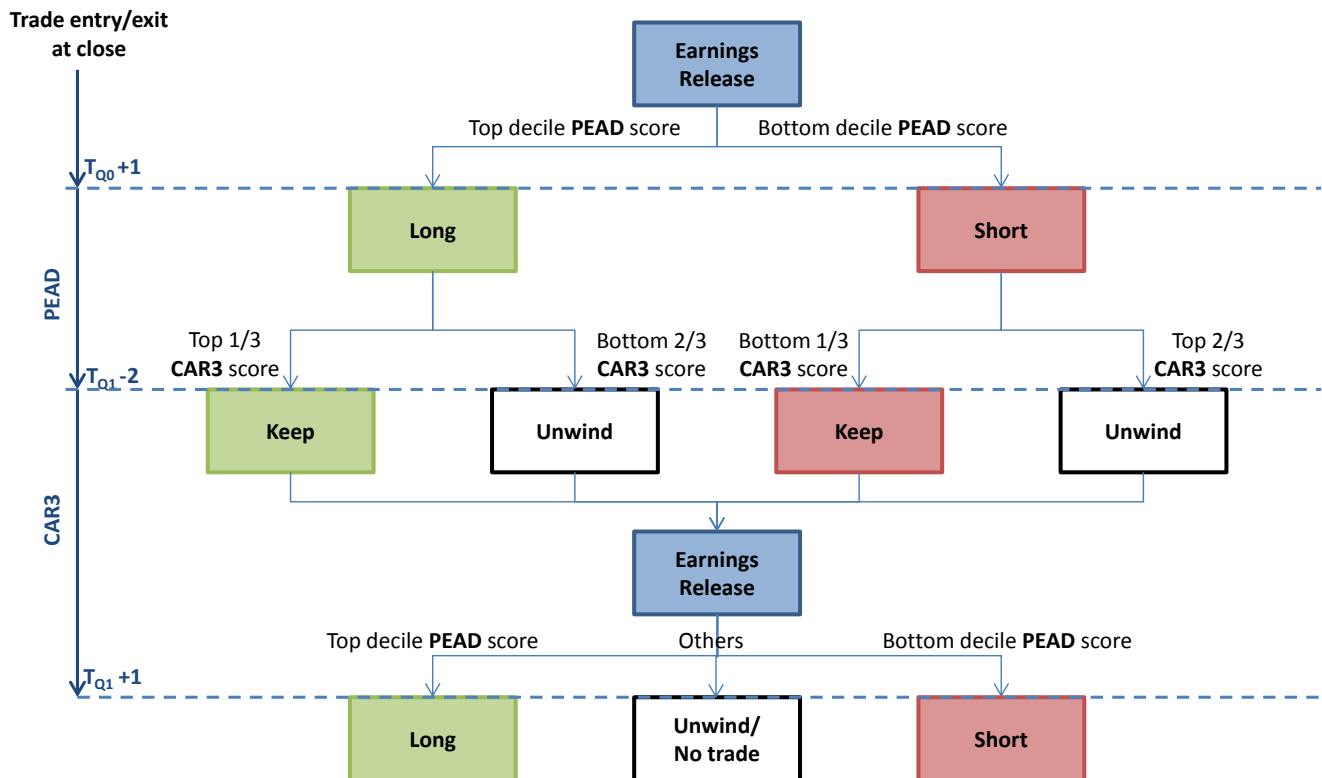


Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



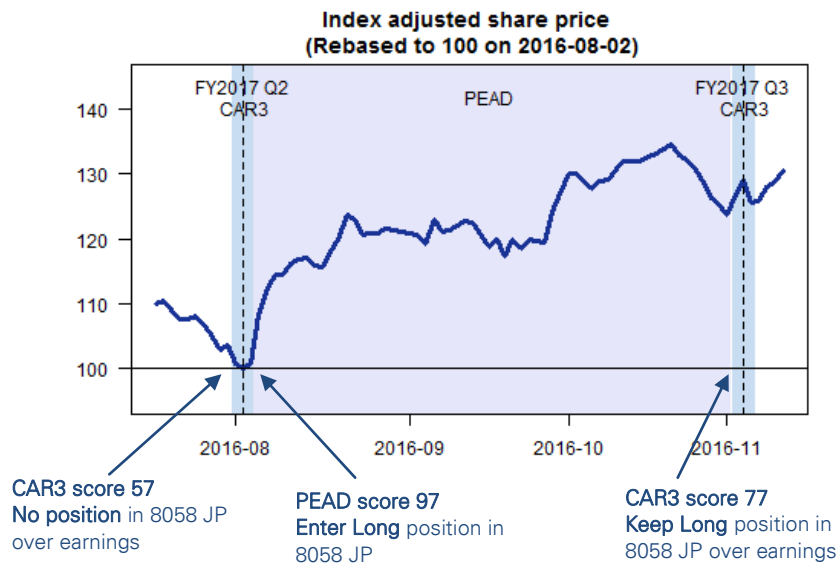
A full-fledged earnings strategy

Figure 13: Flow chart of trade decisions at each stage of the earnings season



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 14: Trade entry/exit example for Mitsubishi Corp (8058 JP)



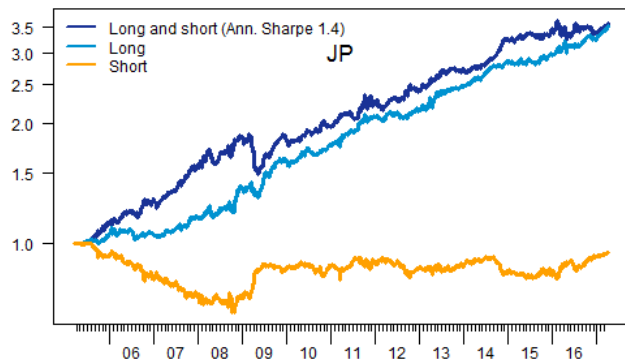
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Recent strategy performance (As of March end 2017)

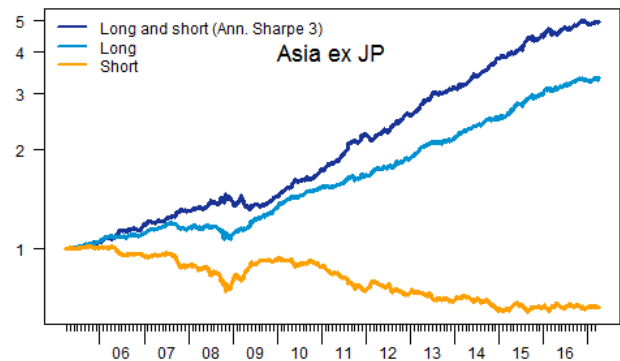
- 2016 was a challenging year for the strategy in Japan due to the outperformance of the shorts. The strategy has a strong showing in 2017 so far
- The reverse is true for Asia ex Japan, with both longs and shorts showing relatively tepid returns so far this year

Figure 15: Cumulative Strategy performance (Japan)



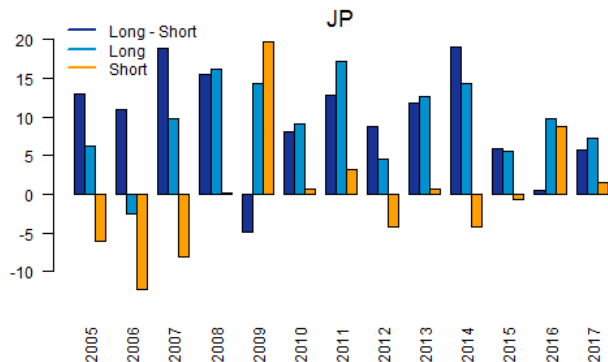
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 16: Cumulative Strategy Performance (Asia ex Japan)



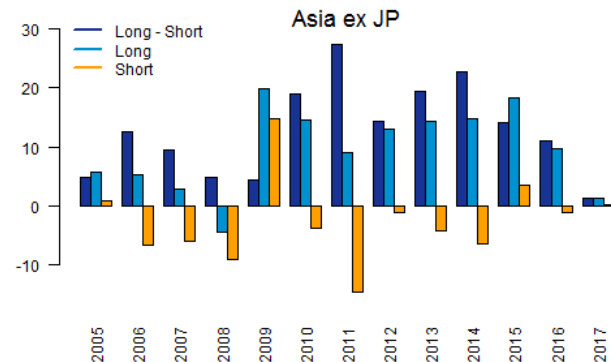
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 17: Strategy Performance by Year (Japan)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 18: Strategy Performance by Year (Asia ex Japan)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Beat miss predictions vs. price returns predictions

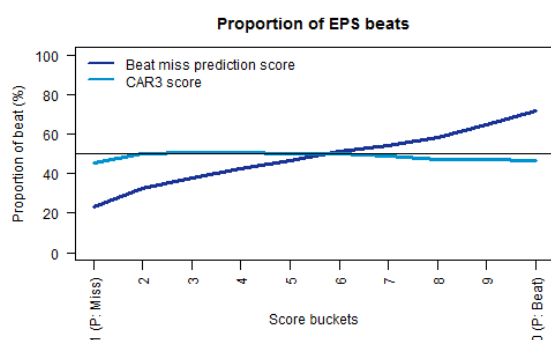
We compare the Beat Miss prediction score from our report “Beats and Misses (Part I)” with the CAR3 score from this report.

Price reactions over earnings announcements

While the Beat Miss prediction score is effective in predicting EPS beats and misses, the **CAR3 score is better at predicting price reactions over earnings announcements.**

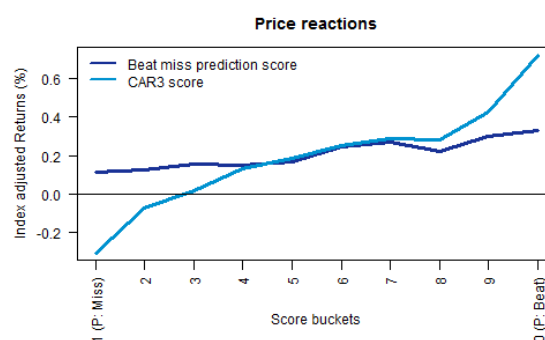
Conversely, the CAR3 score does a poor job of predicting EPS beats or misses.

Figure 19: Our beat miss prediction score is more effective in predicting EPS beats (Global)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 20: Our CAR3 score is more effective in predicting price reaction to earnings announcements (Global)



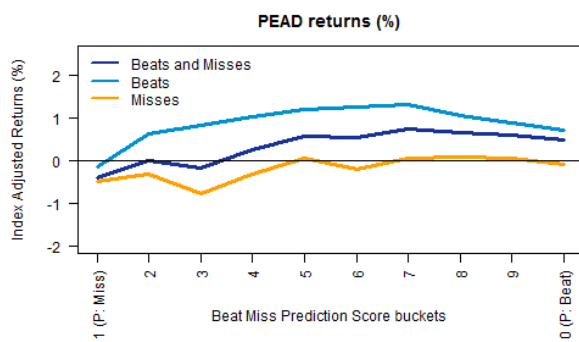
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Price returns post earnings announcements

Conditioning PEAD returns on whether the different buckets of Beat Miss predictions beat or miss on results day do not yield clear-cut observations.

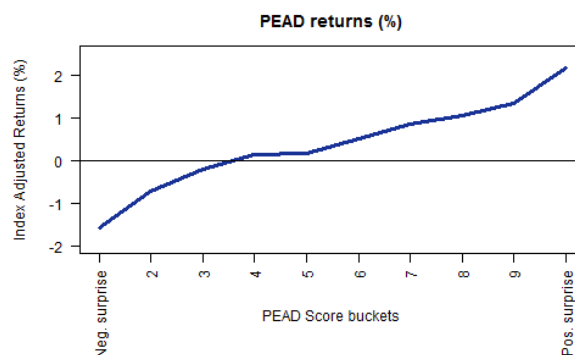
Our PEAD score incorporates more information released over earnings than just the bottom line beat or miss – the magnitude of EPS and Sales beat miss, the EPS progress rate surprise and price reaction over earnings. **The PEAD score gives a better signal in predicting PEAD returns.**

Figure 21: The variation in PEAD returns across beat miss prediction score buckets is small



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 22: We observe a clear monotonic relationship between PEAD score buckets and PEAD returns



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

To dig further into the methodology behind our scores, please read on.



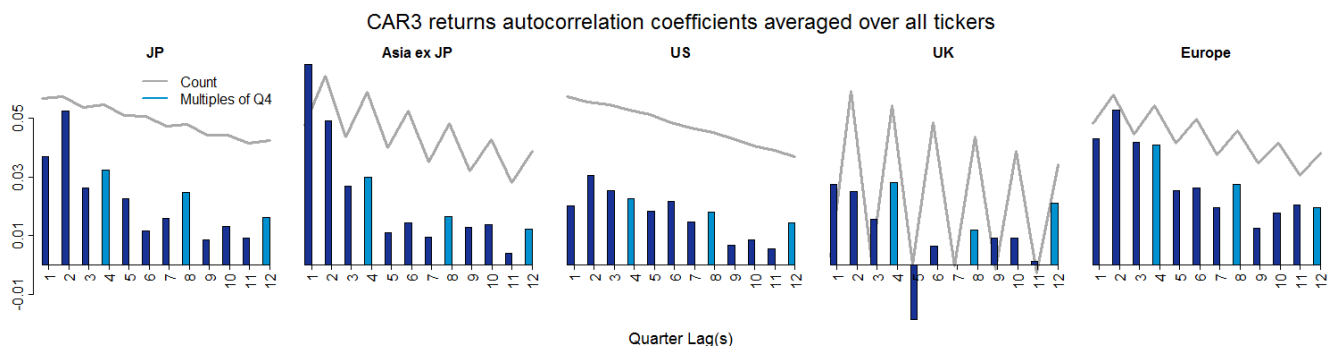
How to position for the earnings season?

What drives returns on announcement day?

Earnings results day is often a culmination of the meeting of investor expectations and the 'reckoning' of the expectations. In examining what drives returns on announcement day, we considered the following:

- **Stock Valuation:** The outperformance of value stocks over 'glamour' stocks around earnings announcements is a documented effect in the U.S. (Port et al., 1997)
- **Technical:**
 - Market cap** – We expect small stocks to benefit more from heightened investor attention on earnings announcement day
 - Price momentum** – 10, 20, 60-day price momentum are included to check for medium and short-term momentum or reversal effects
 - Short interest** – If short positions are more 'informed', we expect companies with high short interest to underperform over announcement
 - Stock volatility** – High volatility stocks are associated with a high degree of uncertainty and primed for big moves over results day
- **Analyst sentiment** – NTM Earnings yield, FY1 EPS growth and Earnings revisions capture analyst sentiment in the run-up to earnings
- **Surprise momentum** – Earnings surprises display seasonality (Chang et al., 2017). In our dataset, we observe correlation between price returns over earnings announcements and price reactions over lagged quarters across the regions. We include the previous year price surprise as a predictor in our CAR3 prediction model.

Figure 23: Seasonality in earnings surprises: Across the regions, we see large positive auto-correlation coefficients at lags of 1 to 4 quarters and at multiples of 4 quarters



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Exploring relationships between predictors and price reaction

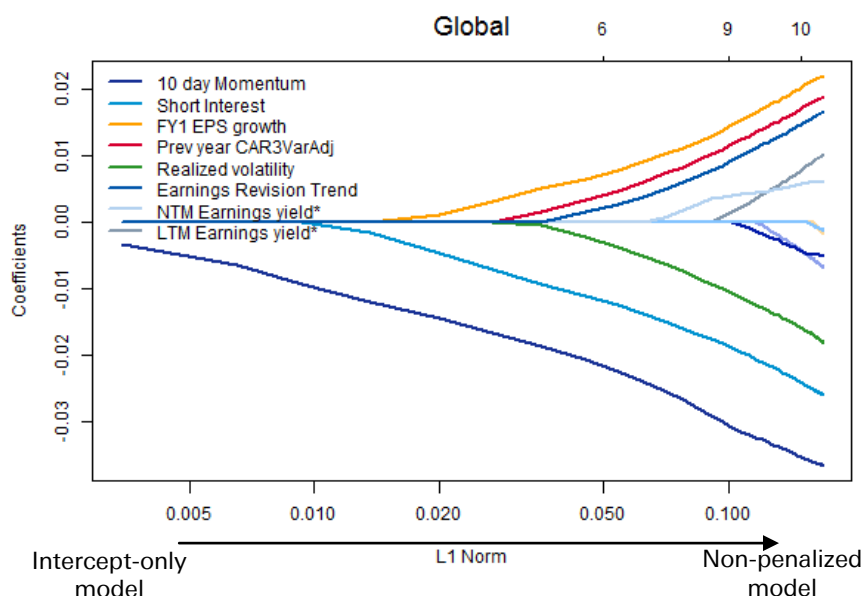
We dip into our Quant team's toolbox¹ to explore the relationships between the chosen factors and 3-day returns over earnings announcements.

Penalized Generalized Linear Models (GLMs)

Penalized generalized linear models enable us to highlight which predictors are the most significant.

The way to read the regularization path plot below is to look at the order in which variables enter the model – from the intercept-only model on the left, to the non-penalized model on the right. Variables enter the model one at a time and their coefficients progressively increase in magnitude.

Figure 24: Regularization coefficients – The first 8 variables to enter the model are labeled in order (Global)



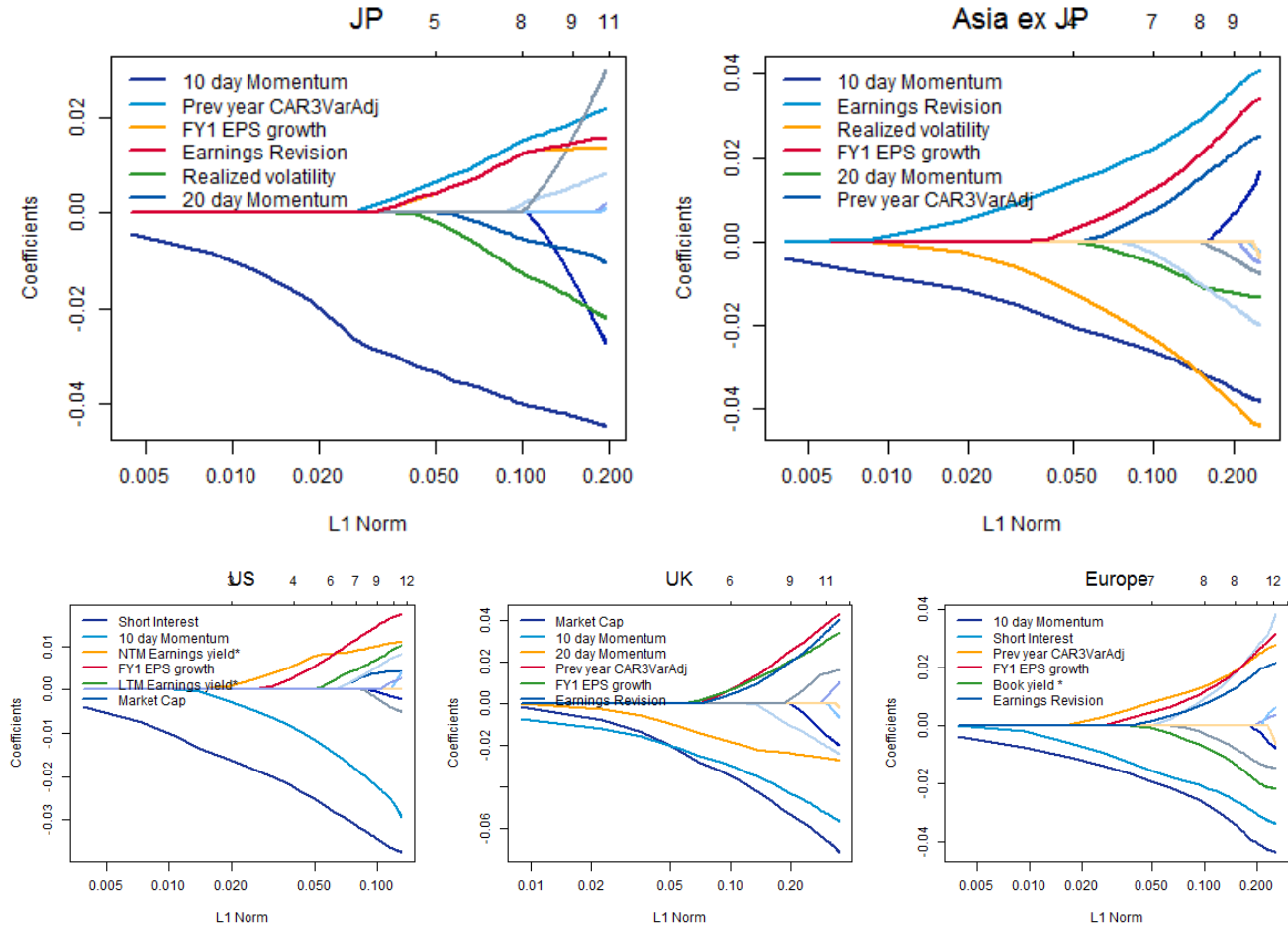
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

- **Strong predictors of CAR3 returns across regions:**
 - Short-term price reversal (10-day momentum), serial earnings surprise momentum and Analyst sentiment
- **Specific to select regions, we see that:**
 - **Short interest** is a significant predictor of negative price moves in US and Europe, while **realized volatility** is significant in Japan, Asia ex Japan
 - **Value** is a significant predictor in the U.S. and **Market Cap** is a strong negative predictor in the UK

¹ For more details on the models used, please refer to our Machine Learning report [12]



Figure 25: Regularization coefficients – The first 6 variables to enter the model are labeled in order



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Boosted Generalized Additive Model (Boosted GAM)²

The boosted GAM captures nonlinear relationships. Here we also considered factor pairwise interactions.

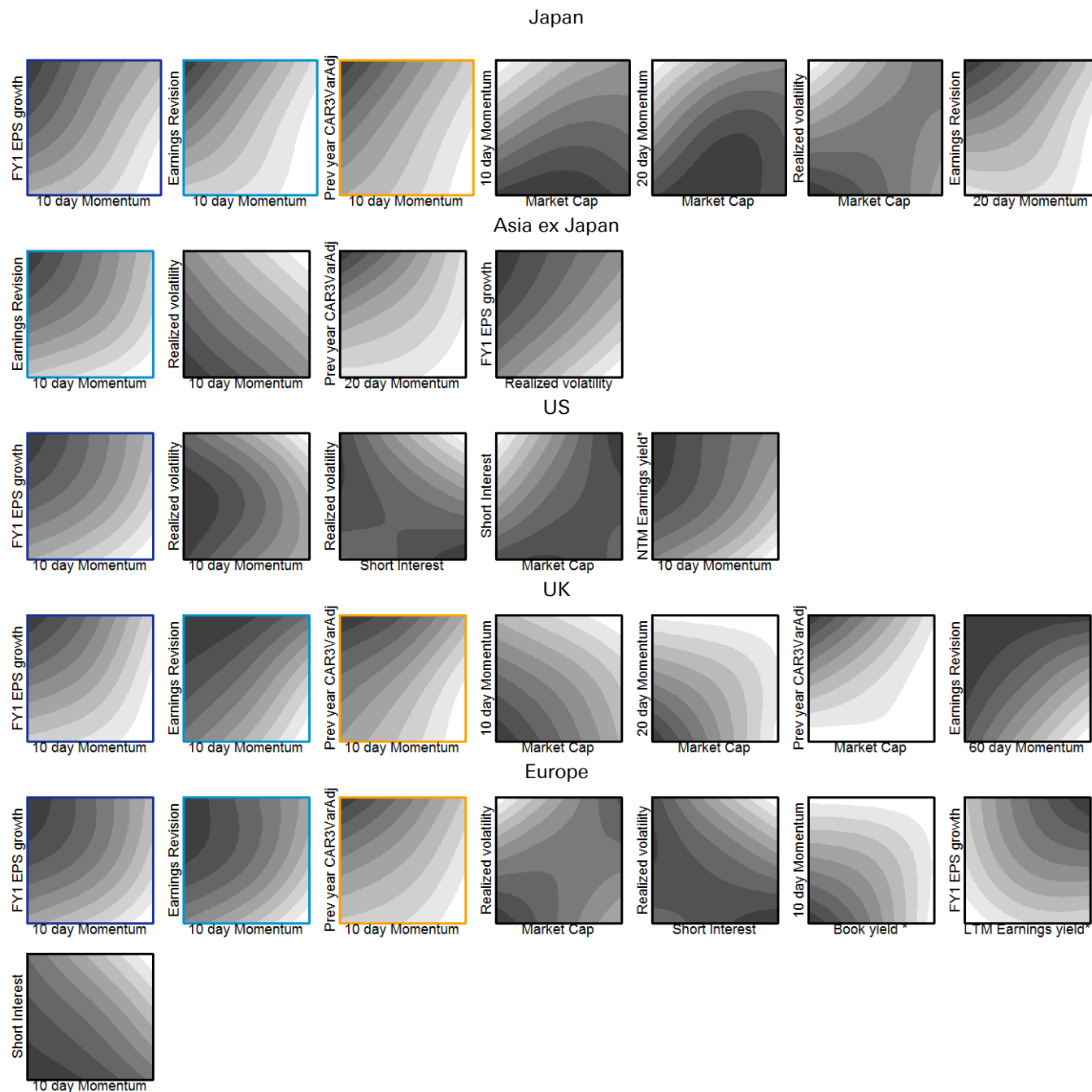
Partial dependency plots enable us to visualize a smoothed relationship between CAR3 returns and the variable in question. In the plots that follow, the color gradient is representative of the magnitude of predicted returns.

- Across the regions, we see that the reversal of 10 day price momentum, coupled with measures of analyst sentiment and previous year CAR3VarAdj surprise produce stronger returns
- In Japan and Europe, we observe that among small caps, high volatility stocks have stronger tendency to underperform, while low volatility stocks tend to outperform
- Small caps in the UK which have had low short-term price momentum or outperformed strongly in previous earnings announcements tend to outperform

² Refer to our Appendix for a primer on Generalized Additive Models



Figure 26: CAR3 returns prediction – Partial dependency plots with factor pairwise interactions. A darker shade indicates higher returns



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Our CAR3 prediction score

Why are there price reversal effects?

The literature (Jansen and Nikiforov, 2016) attributes the short term price reversal effect over earnings announcement to the phenomenon where information asymmetry before earnings announcements subjects prices to excessive sentiment-driven moves, and the announcement acts as a “reality check” on that sentiment.

Thomas and Zhang (2007) suggests this could be an effect of the overreaction to earnings of early announcers in the same industry. Investors engaged in ‘false equivalence’ and overreact to implications from peers.

In this strategy, we have chosen earnings revision trend and analyst growth expectations as proxy to analyst sentiment to serve as a reference on whether the pre announcement price moves are justified.

Why are there seasonality patterns in earnings surprises?

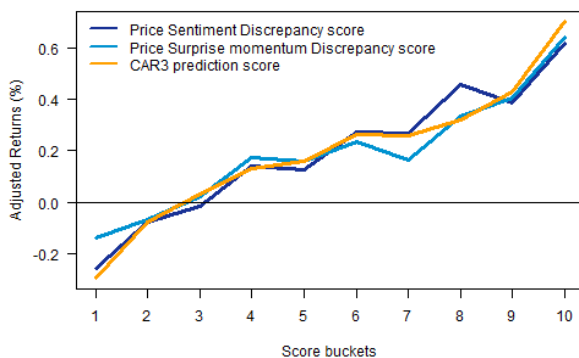
A suggested explanation for serial correlation in surprises in the last 4 quarters is the inability of markets to “adequately revise expectations for successive quarters upon receipt of news for the current quarter” (Bernard and Thomas, 1990). The subsequent 4-quarter lag correlations are attributed to the inability of investors to fully incorporate the serial correlation in seasonally differenced earnings. (Soffer et al., 2000). We have decided to focus on the 4-quarter lagged price surprise as a predictor.

We capture these findings in a CAR3 prediction score

- **Our Price-Sentiment Discrepancy score** is the difference between the 10 day price momentum rank right before earnings announcement and the average of IBES FY1 Growth Estimate rank and IBES NTM 3M EPS revision rank, both taken at the month end preceding earnings announcement
- **Our Price-Surprise Momentum Discrepancy score** is the difference of the previous year’s CAR3VarAdj surprise ranking and the 10 day price momentum ranking

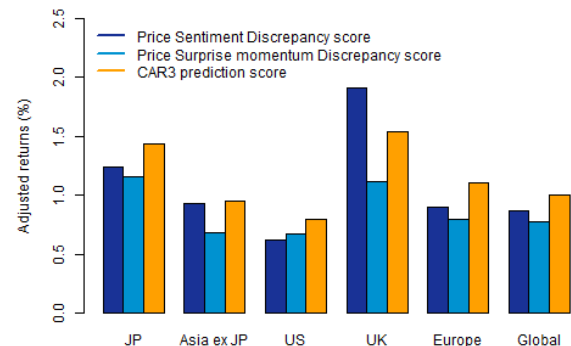
Our CAR3 prediction score is the average of the two scores.

Figure 27: CAR3 returns for each bucket of our CAR3 prediction score (Global)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 28: Decile long short CAR3 returns for our CAR3 prediction score



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



How to trade the post earnings announcement drift?

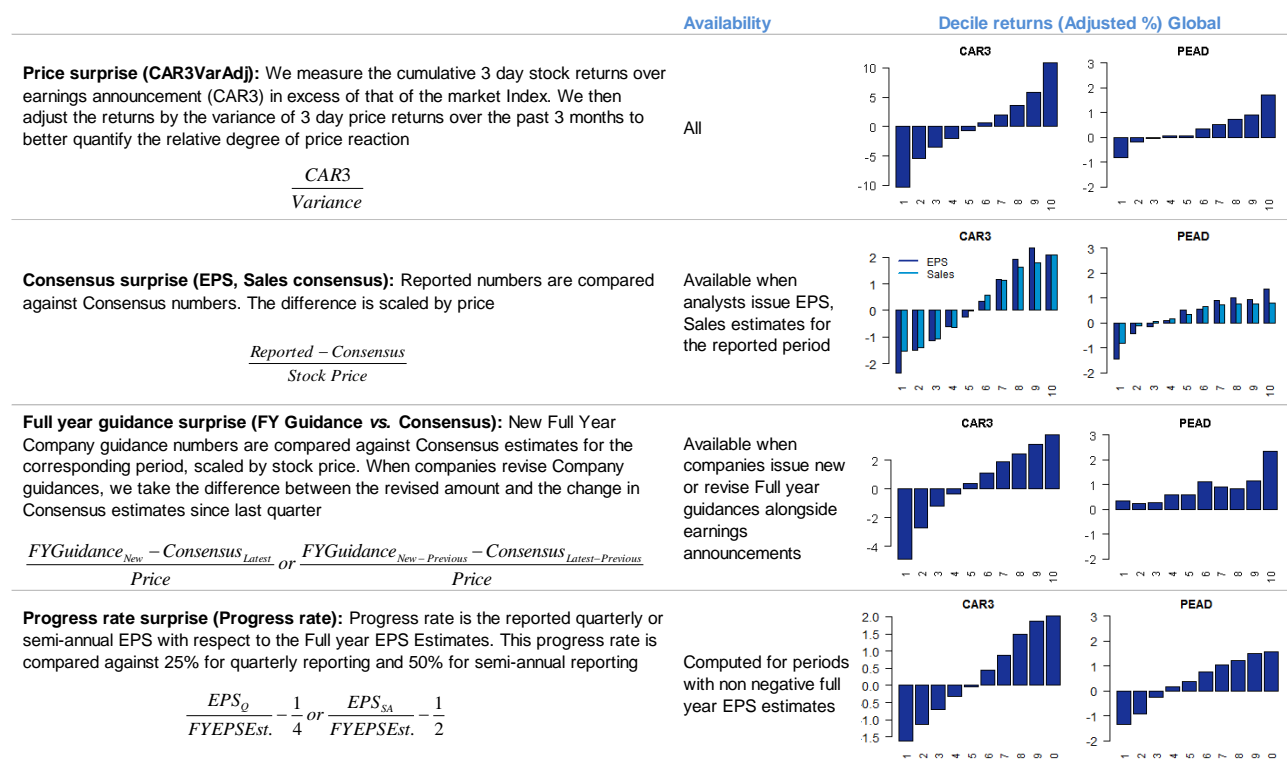
Earnings surprise metrics

We have decided to capture earnings surprise with 4 metrics that are easy to calculate and complement each other.

In the exploration that follows, all returns are adjusted for Market, Value, Size effects for comparability. CAR3 refers to the returns from T-1 to T+1 around earnings release. PEAD refers to returns between T+2 and the earlier of the next earnings and T+70 (T+140 for semi-annual reporting).

Universes are the respective S&P broad market indices with analyst coverage, with minimum volume and minimum price constraints to avoid liquidity and wide bid-ask spread issues.³

Figure 29: Summary of Earnings Surprise definitions and returns to surprise buckets sorted on the surprise



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

³ Please refer to the section on Real life Considerations in our Appendix for implementation details and assumptions (Page 37)



■ Price surprise

- The 3-day index-adjusted price returns over earnings announcement captures the market's reactions to financials (along with other information) released on announcement day
- We went a step further to **adjust the returns by the average price returns variance** to better quantify the relative degree of price reaction

■ Consensus earnings surprise

- A widely adopted measure of earnings surprise, and also the focus of our Beat Miss prediction model in Part I of our report. Typical denominators in the consensus earnings surprise calculation are Consensus EPS or the standard deviation of the EPS estimate. The former is not defined for companies with negative EPS estimates, while the latter is not available for estimates with only one contributing analyst estimate to the consensus number. **We used share price as the denominator**
- We also include Sales Consensus surprise to lend a perspective in capturing surprises of companies where investors have a greater focus on the top line

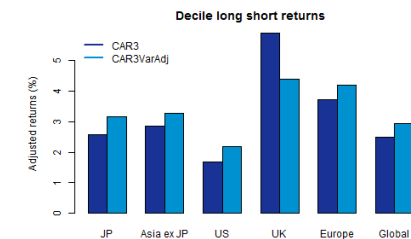
■ Progress rate surprise

- We measure the progress of the quarterly/semi-annual EPS towards the full year estimate. The surprise is the difference between the reported quarterly (semi-annual) EPS with 25% (50%) completion⁴

■ Company guidance surprise

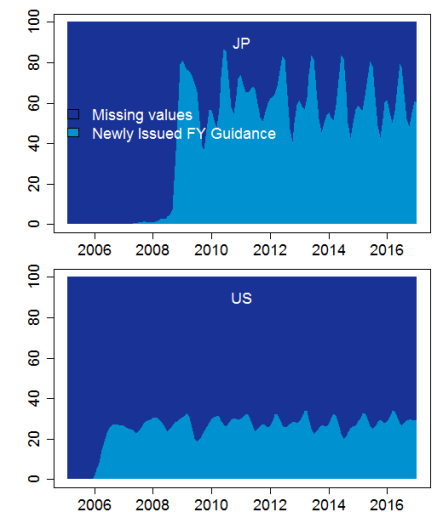
- The disclosure of earnings forecasts is voluntary, but company guidance numbers are widely available in the dataset for Japan since 2009 and to a lesser extent, the US. We compare the company Full Year EPS guidance against analysts' Full Year EPS estimates
- While these forward looking estimates might grant investors invaluable insight into the management's outlook for the rest of the year, investors also look askance at the guidance numbers, being well aware of management's incentives to issue 'beatable' targets or optimistic forecasts when they release poor earnings at the same time

Figure 30: Decile long-short PEAD returns – CAR3VarAdj is a better measure than CAR3



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 31: Company guidance numbers are widely available in the dataset for Japan since 2009



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

⁴ A more refined approach might consider seasonal variations in EPS progress of certain sectors and compare the "run-rate" with the same period in previous years

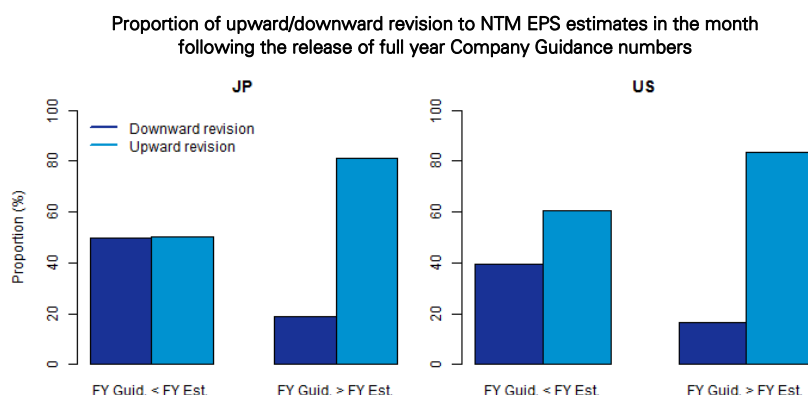


- In the sample period (2009-2016), Japanese company guidance was regularly below analyst full year estimates, while US company guidance was generally above analyst full year estimates.

When company guidance is above full year consensus estimates, the majority of analysts revise their numbers upwards in the following month.

Fewer revised their forecast downwards to track the guidance numbers.

Figure 33: Analysts tend to revise their numbers upwards when Company Guidance is above estimates



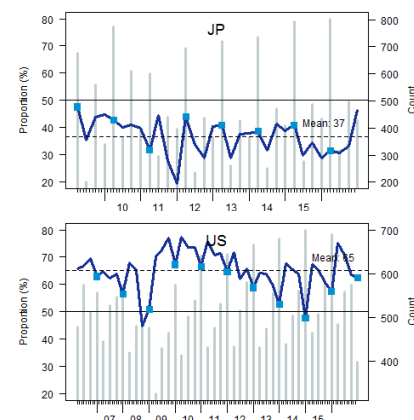
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

- In our definition of Guidance surprise, we compare first-time issued guidance numbers with Full Year EPS estimates.

For companies issuing revisions to Full Year Guidance numbers, we compare the revised amount in guidance numbers to changes in Full year EPS estimates in the intervening period

An example of the surprise calculations is given in the Appendix for Toyota Motor.

Figure 32: Proportion of FY Company guidance above FY ests.



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

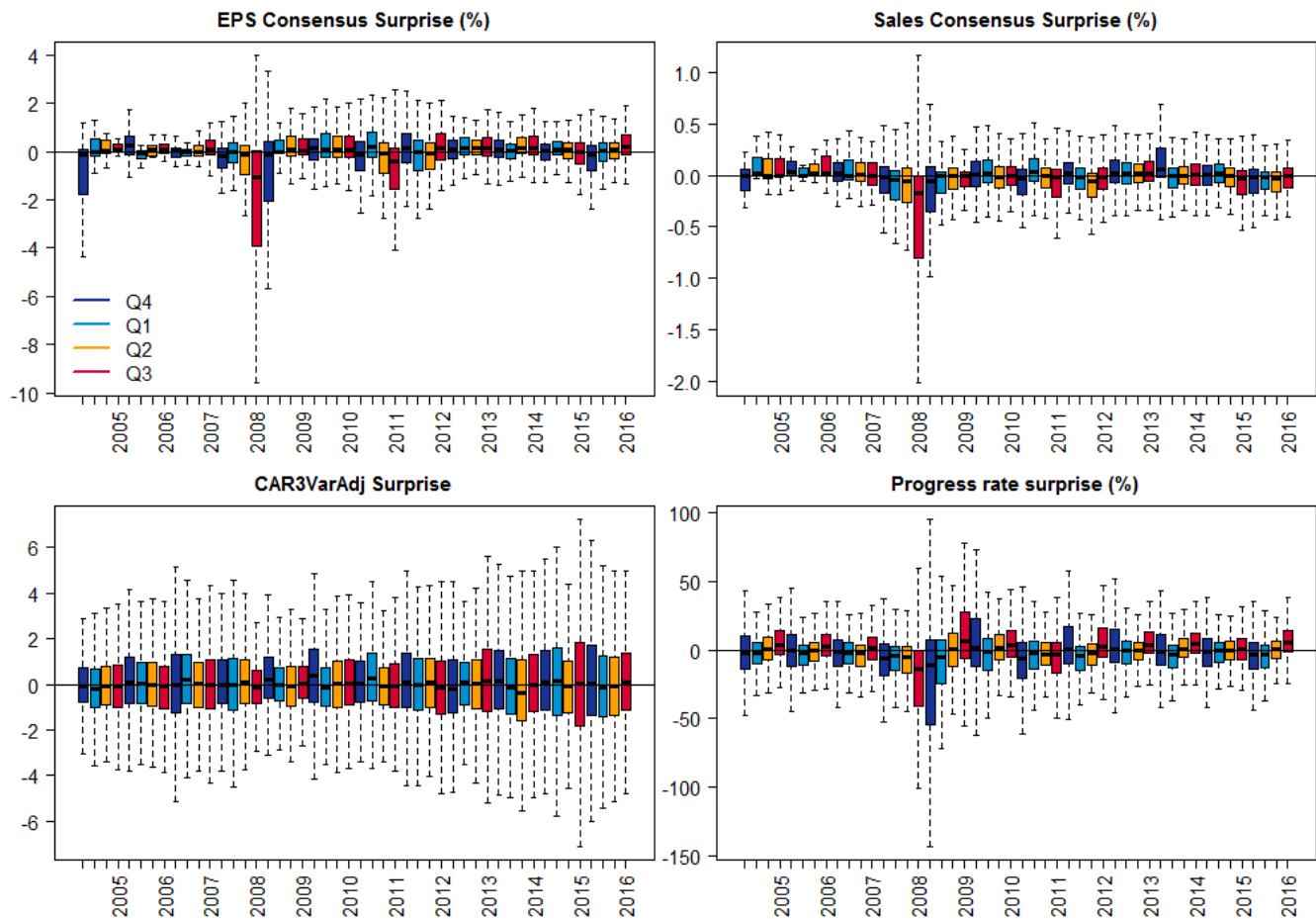


Distribution of earnings surprises over time

The distribution of each surprise metric varies over time. In the illustrative example below for Japan, the distribution of EPS surprises widened around 2008 but most surprises remain in a steady range otherwise.

As such, in our strategy, we have chosen to assign percentile ranks for each surprise measure using a look-back of 12 months

Figure 34: Distribution of surprises (Japan) – Surprises generally fall within a steady range



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Relationships between our earnings surprise metrics

One would expect some degree of overlap in the various earnings surprise metrics. EPS consensus and Progress rate surprise show higher degree of correlation, while the correlations among the other surprise factors are surprisingly low, suggesting there is value in combining the various measures of surprise.

We are also interested in the pairwise distribution of surprise metrics and in particular, the behavior at the tails of the distribution.

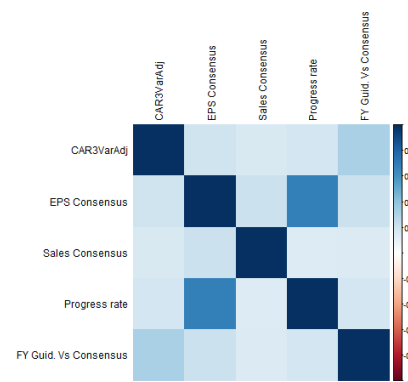
The tail concentration function of the copula of pairwise surprise metrics looks at the variation in probability of surprises being near the lower and upper tails, i.e. (0,0) and (1,1).

$$\text{Lowertail function} = \frac{P(U \leq t/V \leq t)}{t}, \text{Uppertail function} = \frac{P(U \geq t/V \geq t)}{1-t}$$

t ranges from 0 to 1 and U and V are the uniformized surprise measures.

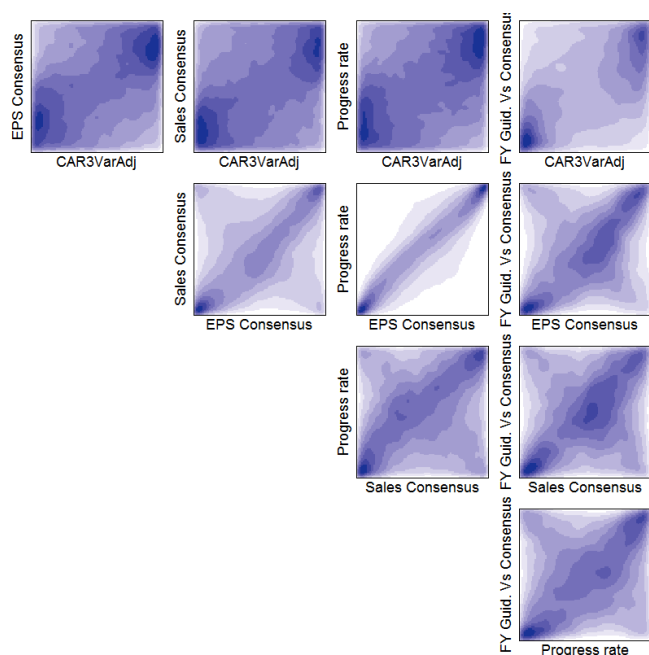
The tail dependency plots suggest that negative EPS Consensus surprises are often associated with negative Progress rate surprises and negative Guidance surprises. There is little tail dependency among the other surprise pairs.

Figure 35: Correlations among earnings surprise metrics (Global)



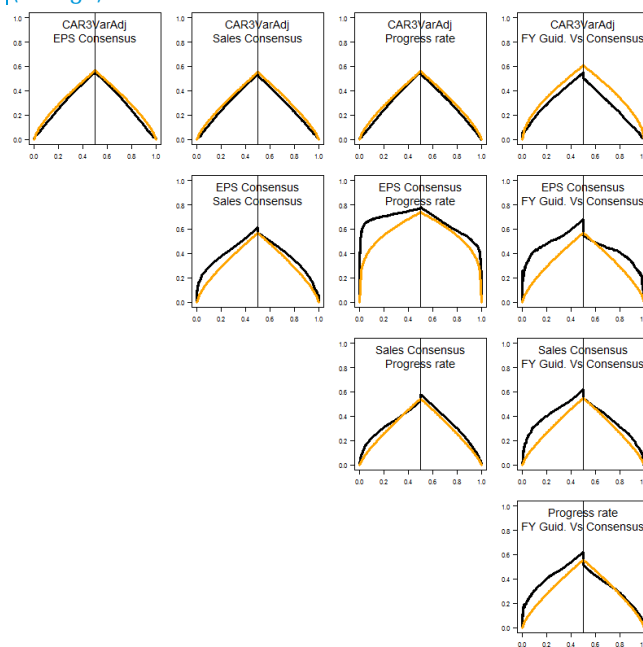
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 36: Pairwise Distribution of uniformized surprises



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 37: Tail dependency plot – Pairwise surprise copula (black) and the theoretical Gaussian copula (orange)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Exploring relationships between earnings surprise metrics and the PEAD

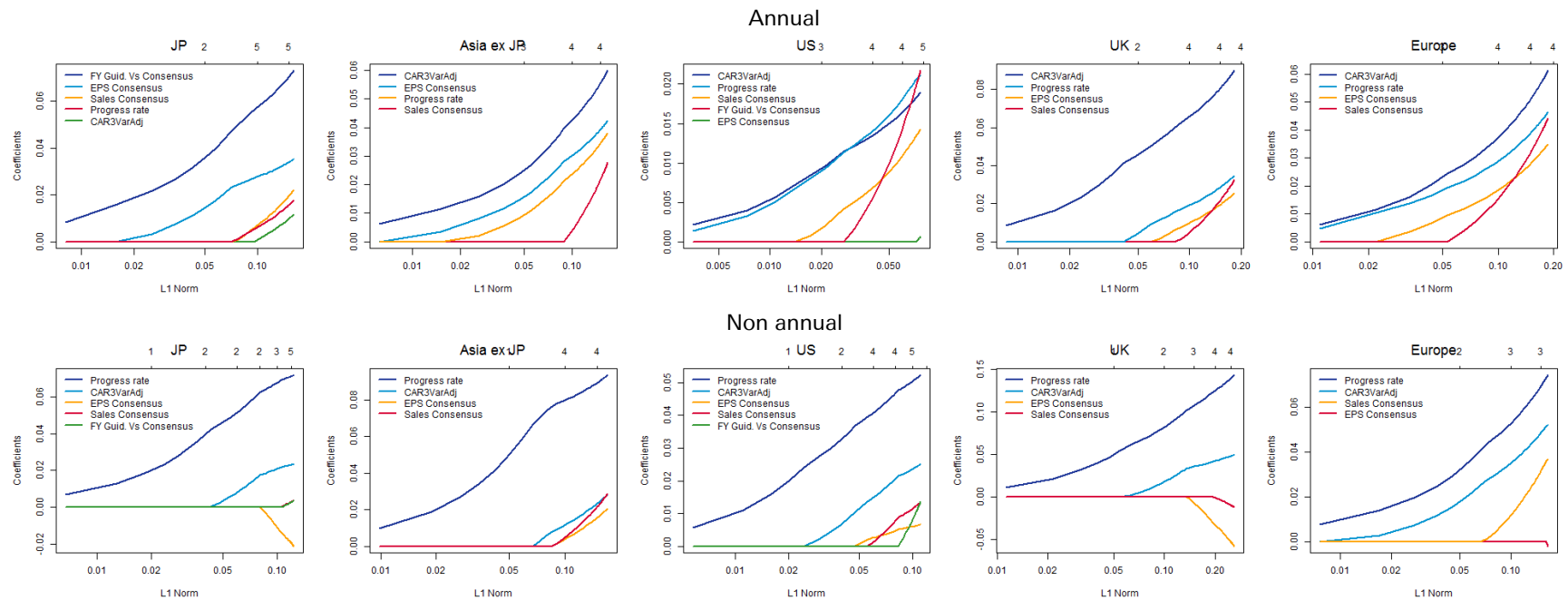
We analyze annual and non-annual earnings announcements separately to see if they display the same behavior.

Penalized Regression Models

Given that some pairs of surprise measures are highly correlated, we used **penalized regressions** to show us the order in which factors enter the model.

- For **Annual** earnings surprises, we observe that Full Year Guidance surprise enters the model first in Japan, while it is CAR3VarAdj surprise for the other regions. This is generally followed by EPS Consensus surprise or Progress rate surprise
- For **Non-annual** earnings surprises, Progress Rate surprise and CAR3VarAdj surprises are the first to enter the model

Figure 38: Regularization coefficients – Variables are labeled in the order they entered the model



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Boosted Generalized Additive Models (Boosted GAMs)

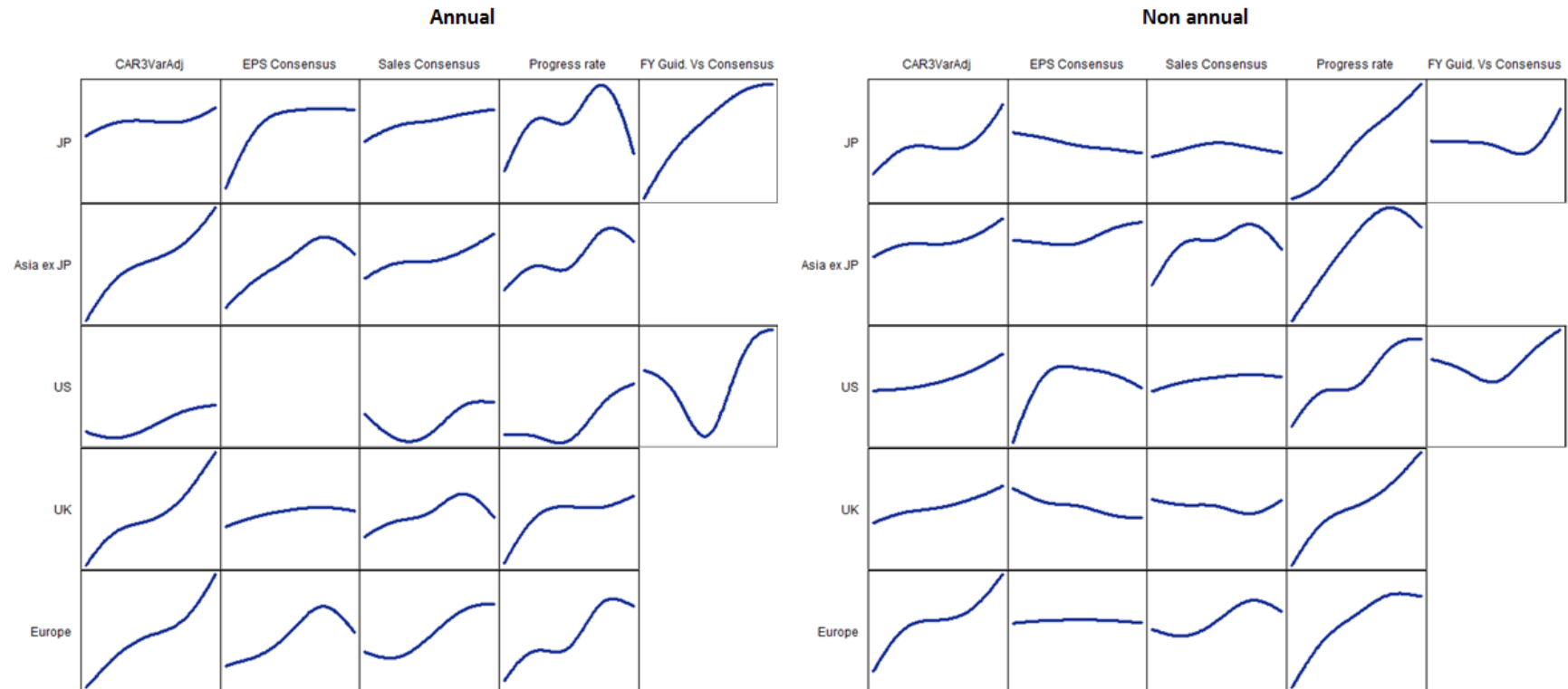
From the partial dependency plots between the surprise metrics and PEAD returns, we observe

- For **Annual earnings** results, most surprise metrics display linear positive relationship with the PEAD
Exceptions include reversal for the largest progress rate surprise in Japan, and the lowest Full Year Guidance surprises in the U.S.
- For **Non-annual earnings** results, CAR3VarAdj and Progress Rate surprises display linear positive relationship with the PEAD
Relationships between the PEAD and the other surprise measures are less monotonic.

Figure 39: Partial dependency plots

Annual surprises – Positive relationship between most surprise metrics and the PEAD

Non-annual surprises – Positive relationship between CAR3VarAdj and Progress Rate surprise with the PEAD



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Boosted Generalized Additive Models (Boosted GAMs) with interactions

We also check for relationships between the PEAD and pairwise surprises using boosted GAMs.

- For **Annual** surprises across the regions, **surprises in the same direction generally produce stronger PEAD returns**.

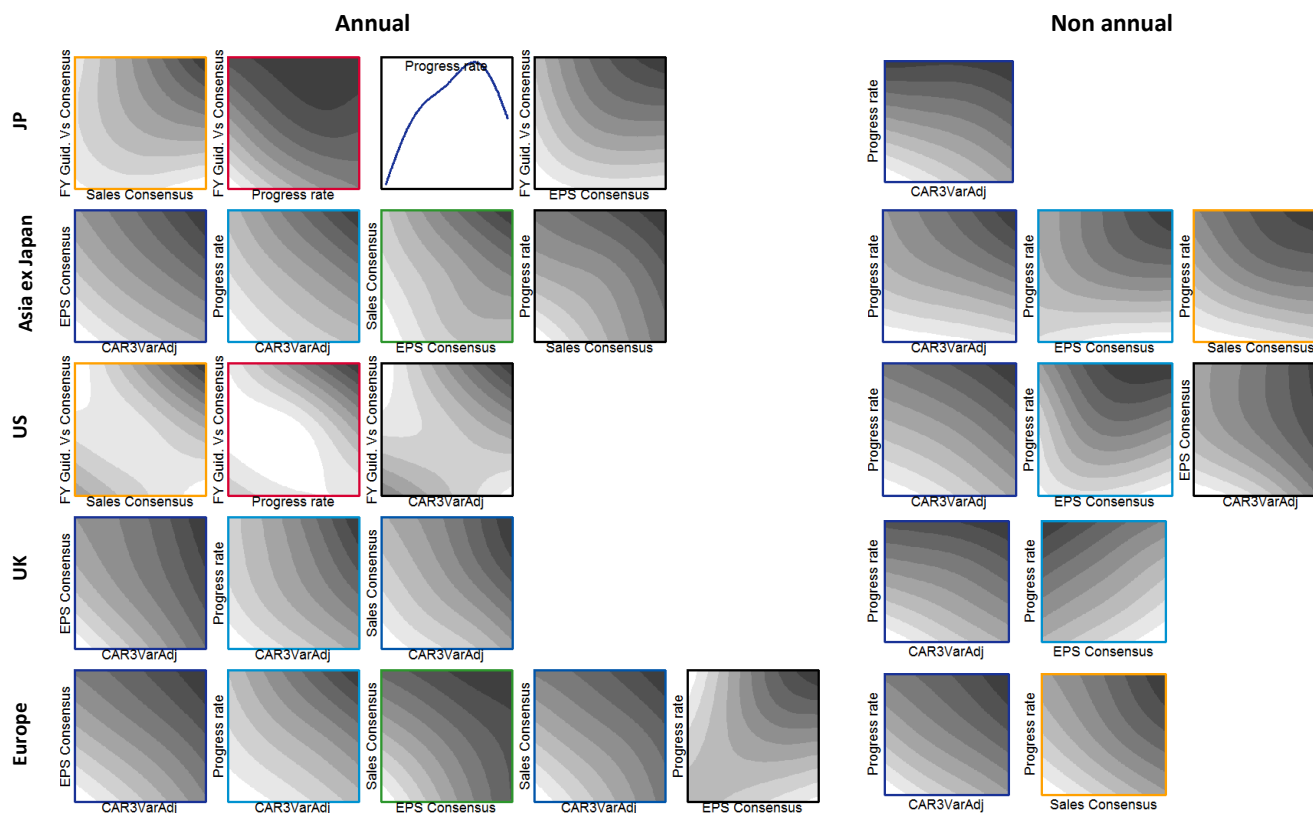
We also observe reversals at the extremes, such as the largest progress rate surprises in Japan, and the lowest Full Year Guidance surprises in the U.S.

- For **Non-annual** surprises, most pairwise agreements in surprises produce stronger PEAD returns. **Progress rate surprises feature heavily in the pairs**

Interestingly in the UK, the highest progress rate and lowest EPS consensus surprise produces the highest PEAD returns, although it is hard to read too much into it

Figure 40: Partial dependency plots with pairwise surprise interactions

Surprise pairs appearing more than once across regions are highlighted in the same color



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy





Our PEAD prediction score

Separating the wheat from the chaff

Each surprise metric has its shortcomings. Prices could overreact and EPSs reported throughout the year could be lumpy or one-offs. Overall, surprises in agreement produce stronger PEAD, though select measures of earnings surprise work better for specific regions. We use a unified approach across all regions for simplicity. For our PEAD scores, we only calculate a score if more than 1 measure of surprise is available.

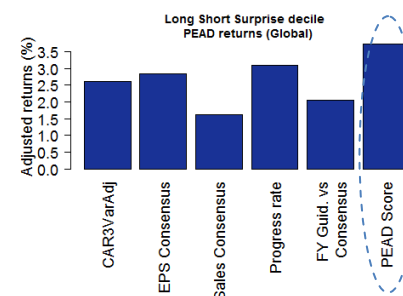
Given that most surprises display linear relationship with PEAD returns, we are comfortable with taking **simple averages of the surprise measures**. Results from the study also support the fact that more measures of surprises are better.

For **Non Annual periods**, we take an average of the **CAR3VarAdj** and **progress rate surprise** rankings as our PEAD score. EPS and Sales consensus are excluded as investors appear to focus more on the run-rate than meeting interim consensus numbers which less sell-side analysts provide.

For **Annual periods**, we take an average of **all 5 surprise measure rankings** for our composite PEAD score, where available.

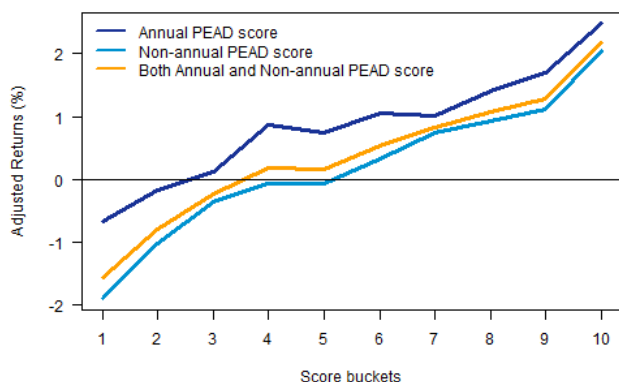
The long short decile returns of our PEAD score are superior to that of any single surprise measure (Figure 41). We observe a monotonic increase in PEAD returns across the PEAD score buckets (Figure 42).

Figure 41: The long short PEAD spread for our PEAD score is larger than that for other surprise metrics (Global)



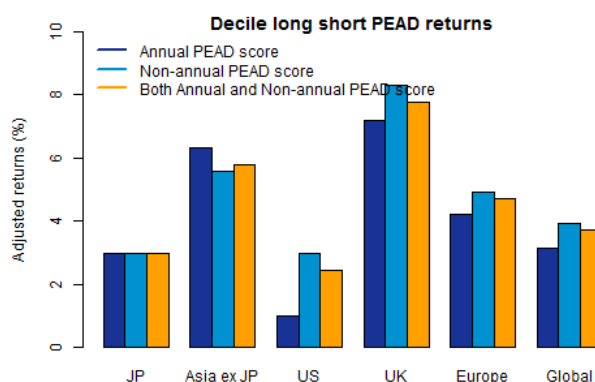
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 42: PEAD returns for each bucket of our PEAD prediction score (Global)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 43: Our PEAD score adds value across regions



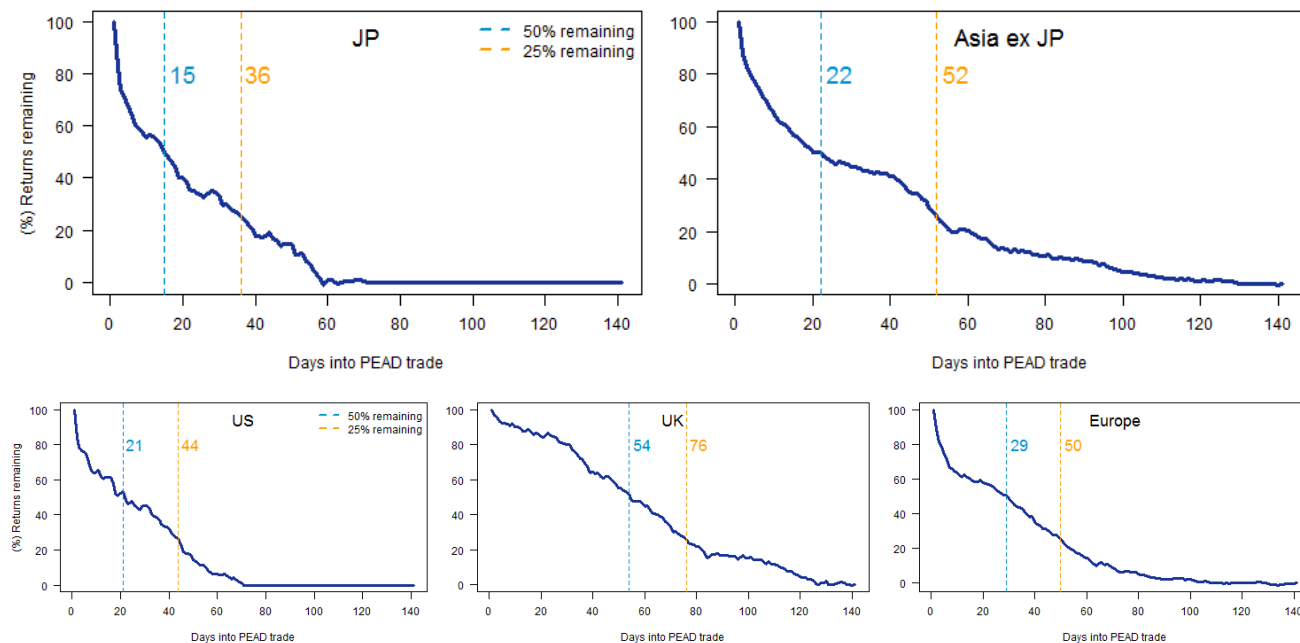
Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



On the importance of a timely entry

Event returns of the long short PEAD trade show that entering a PEAD trade in a timely fashion is advantageous. This is especially important for Japan and the US where the returns are more ephemeral.

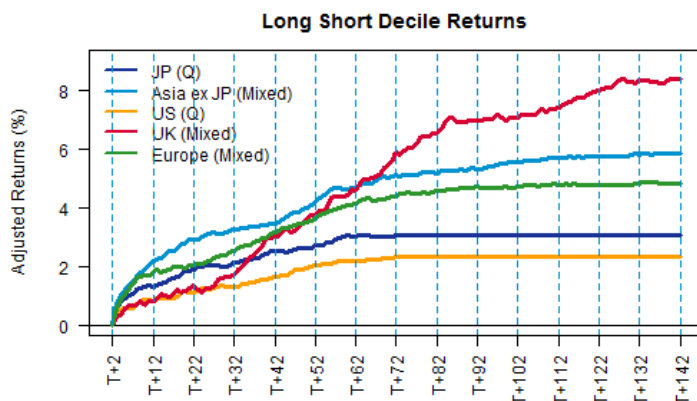
Figure 44: Percentage of PEAD profits remaining at various entry points to the PEAD trade – returns dissipate quicker in Japan



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

However, this does not suggest that one should unwind the trade too early either, as some of the drift is still present right in the run up to the next earnings announcement.

Figure 45: Long short decile event returns of our PEAD score (the reporting frequency of each region is in brackets)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

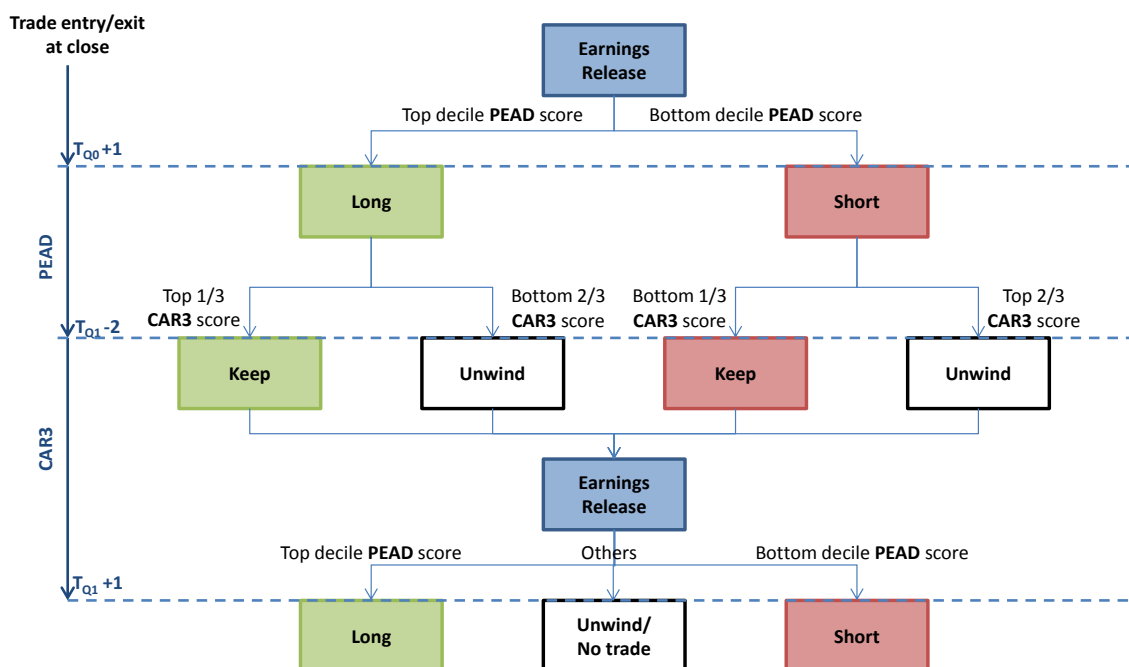


A strategy to trade earnings

A step-by-step approach

The average returns for a standalone CAR3 prediction strategy with a holding period of 3 days might not justify the round-trip costs. Here we suggest a combined PEAD and CAR3 strategy that unwinds individual PEAD trades either before or after the next earnings announcements depending on whether they are likely to outperform over the next announcement.

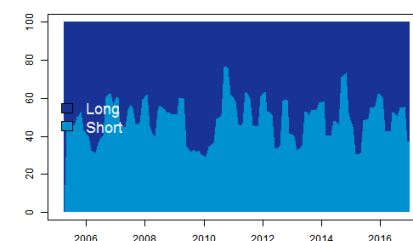
Figure 46: Flow chart of trade decisions at each stage of the earnings season



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

- Sizing the trades:** The long-short strategy goes long and short approximately a tenth of the rated universe during each earnings season. For the strategy shown in this report, we target a leverage of 1 on either side. Each trade is sized as 10 divided by the size of the rated universe at each month-end.
- A cash-neutral strategy:** The proportion of longs and shorts varies for each season, depending on how the surprises compare against announcements in the 12-month look-back window. For the results shown here, each trade is hedged dollar-for-dollar with the market index.

Figure 47: Proportion of long short trades in the PEAD portfolio in Japan



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



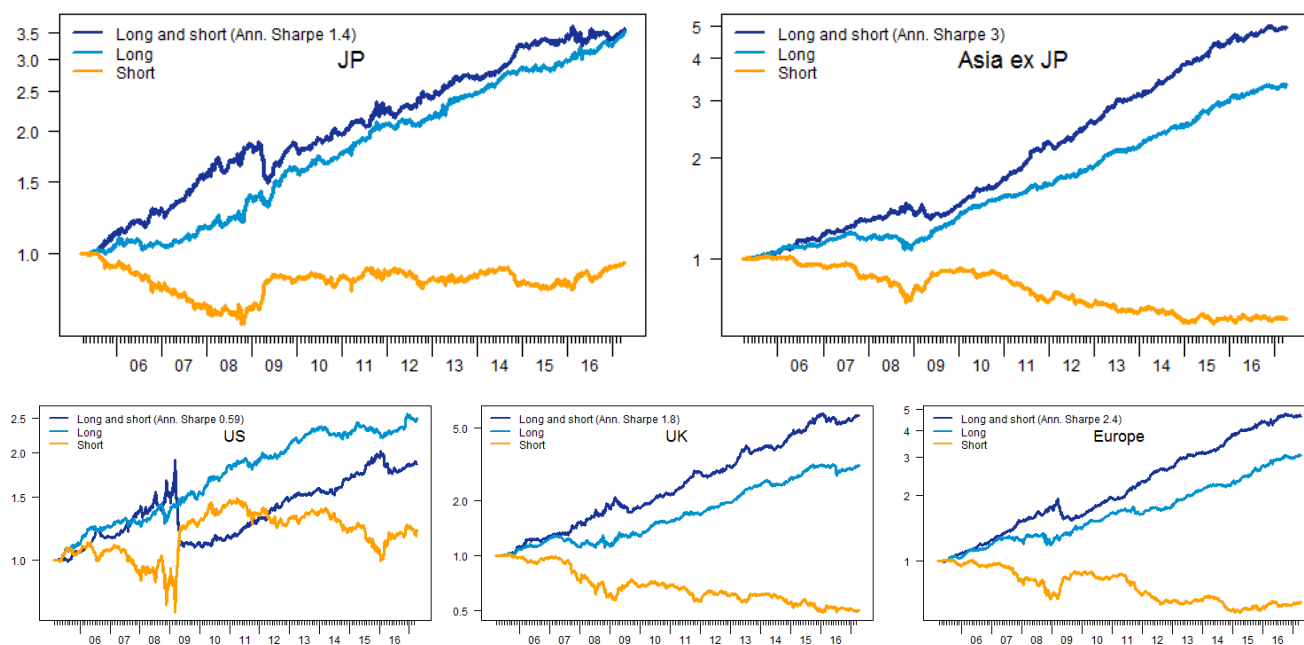
Performance metrics of our combined strategy

We present the performance for our PEAD strategy covering earnings announcements with period end dates ranging from January 2005 to December 2016.

A few observations:

- Returns from the strategy come predominantly from the long side
- In most regions, the PEAD strategies have better risk adjusted and per-trade returns than the single surprise measure PEAD strategies
- Regional strategies (Asia ex Japan, Europe) perform better – potentially benefiting from market diversification
- The biggest drawdowns in the strategy are due to the outperformance of the shorts, e.g. during the 2009 H1 “junk rally” in Japan and the US and the rebound in energy stocks in the US in 2016 H1.

Figure 48: Cumulative Strategy performances of PEAD + CAR3 strategies



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Figure 49: Performance metrics for PEAD strategies vs. Single Surprise measure PEAD strategy (Japan)

	Ann. Return (%)	Ann. Vol (%)	IR	MaxDD (%)	Hit Ratio (%)	Long trades	Short trades	Avg. long return (%)	Avg. short return (%)
PEAD + CAR3 Strategy	11.1	7.7	1.4	-21.0	55.9	4,332	4,189	2.9	-0.6
PEAD Strategy	10.2	7.6	1.4	-21.3	55.3	4,332	4,189	2.6	-0.5
CAR3VarAdj	10.7	8.3	1.3	-12.3	53.7	5,425	5,402	2.2	-0.4
EPS Consensus	2.2	4.4	0.5	-20.6	53.2	1,905	1,883	2.6	0.8
Sales Consensus	1.3	4.2	0.3	-18.4	51.5	2,253	2,538	1.9	1.0
Progress rate	6.1	6.9	0.9	-32.9	53.8	3,589	3,842	2.3	0.2
FY Guid. Vs Consensus	3.3	6.4	0.5	-24.0	53.4	1,611	1,596	4.7	2.1

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 50: Performance metrics for PEAD strategies vs. Single Surprise measure PEAD strategy (Asia ex Japan)

	Ann. Return (%)	Ann. Vol (%)	IR	MaxDD (%)	Hit Ratio (%)	Long trades	Short trades	Avg. long return (%)	Avg. short return (%)
PEAD + CAR3 Strategy	14.3	4.7	3.0	-10.5	58.0	5,357	5,280	4.3	-2.0
PEAD Strategy	13.5	4.7	2.9	-11.1	57.6	5,357	5,280	4.0	-1.8
CAR3VarAdj	10.2	5.0	2.0	-22.8	54.6	7,761	7,127	2.9	-0.6
EPS Consensus	5.6	3.3	1.7	-7.0	55.4	3,196	2,521	3.1	-1.2
Sales Consensus	3.4	3.4	1.0	-11.7	52.3	3,866	4,102	1.8	-0.3
Progress rate	9.9	4.5	2.2	-10.3	55.2	4,870	4,079	3.1	-1.7

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 51: Performance metrics for PEAD strategies vs. Single Surprise measure PEAD strategy (US)

	Ann. Return (%)	Ann. Vol (%)	IR	MaxDD (%)	Hit Ratio (%)	Long trades	Short trades	Avg. long return (%)	Avg. short return (%)
PEAD + CAR3 Strategy	5.2	8.8	0.6	-43.1	54.0	11,807	11,661	2.2	0.1
PEAD Strategy	6.1	8.6	0.7	-41.1	53.9	11,807	11,661	2.2	-0.1
CAR3VarAdj	6.3	6.7	0.9	-21.4	52.6	14,128	14,183	1.7	-0.1
EPS Consensus	5.1	11.9	0.4	-53.0	52.7	12,202	11,773	2.0	-0.1
Sales Consensus	1.2	8.3	0.1	-40.8	50.8	11,538	12,290	1.4	0.5
Progress rate	4.4	9.8	0.4	-50.5	53.2	11,003	11,274	1.9	0.1
FY Guid. Vs Consensus	0.8	2.1	0.4	-10.3	52.5	2,346	2,393	2.4	0.7

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 52: Performance metrics for PEAD strategies vs. Single Surprise measure PEAD strategy (UK)

	Ann. Return (%)	Ann. Vol (%)	IR	MaxDD (%)	Hit Ratio (%)	Long trades	Short trades	Avg. long return (%)	Avg. short return (%)
PEAD + CAR3 Strategy	15.7	8.7	1.8	-17.9	58.5	909	891	4.7	-2.7
PEAD Strategy	15.0	8.6	1.7	-18.7	58.2	909	891	4.5	-2.7
CAR3VarAdj	13.2	8.7	1.5	-25.5	56.1	1,126	1,118	4.6	-1.0
EPS Consensus	3.9	8.5	0.5	-26.2	54.2	650	438	2.7	-0.2
Sales Consensus	0.6	5.9	0.1	-17.2	52.7	628	507	1.8	1.6
Progress rate	11.1	10.7	1.0	-27.0	57.2	856	692	3.4	-2.6

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 53: Performance metrics for PEAD strategies vs. Single Surprise measure PEAD strategy (Europe)

	Ann. Return (%)	Ann. Vol (%)	IR	MaxDD (%)	Hit Ratio (%)	Long trades	Short trades	Avg. long return (%)	Avg. short return (%)
PEAD + CAR3 Strategy	13.5	5.6	2.4	-19.9	57.2	3,580	3,572	3.1	-1.7
PEAD Strategy	13.2	5.4	2.4	-17.8	56.5	3,580	3,572	3.0	-1.6
CAR3VarAdj	14.2	6.3	2.3	-8.9	55.9	4,550	4,621	3.0	-1.0
EPS Consensus	2.6	5.2	0.5	-26.6	53.1	2,453	2,140	1.4	-0.2
Sales Consensus	3.2	4.1	0.8	-8.7	52.1	2,514	2,479	1.5	-0.1
Progress rate	8.7	5.5	1.6	-26.4	55.0	3,336	3,316	2.1	-1.1

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Sensitivity checks

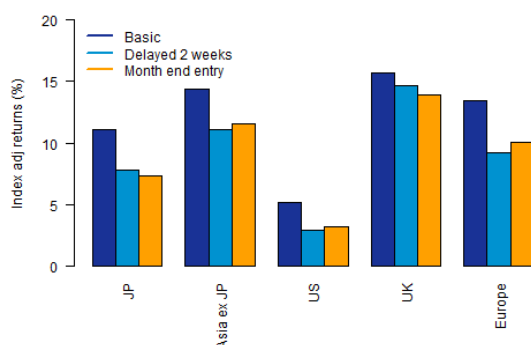
Do we need to apply the strategy straight away?

Apart from CAR3VarAdj surprise, the calculations of other surprise measures require the use of fundamental data, which might be challenging to collect in a prompt manner. We present two variations of our strategy

- Trade entries are delayed by 2 weeks
- Trade entries are delayed until month-end

We observe that delayed entry is more forgiving in Asia ex Japan, the UK and Europe, while the reduction in returns is greater in Japan and the U.S.

Figure 54: Annualized returns of our PEAD + CAR3 strategy with different trade entry delays



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

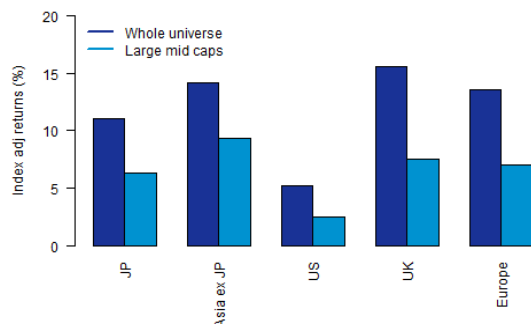
How profitable is the strategy across the market cap spectrum?

Having imposed liquidity constraints on our universe, we further restrict it to the respective large and mid cap universes.

- The reduction in returns by restricting the universes by market cap is significant, especially in the UK, suggesting that the richer pickings are in the small caps.

In Asia ex Japan, two-thirds of the returns are preserved even after reducing the universe to large/ mid caps.

Figure 55: Annualized returns of our PEAD + CAR3 strategy with different universes



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Strategy performance sorting on equity factor characteristics

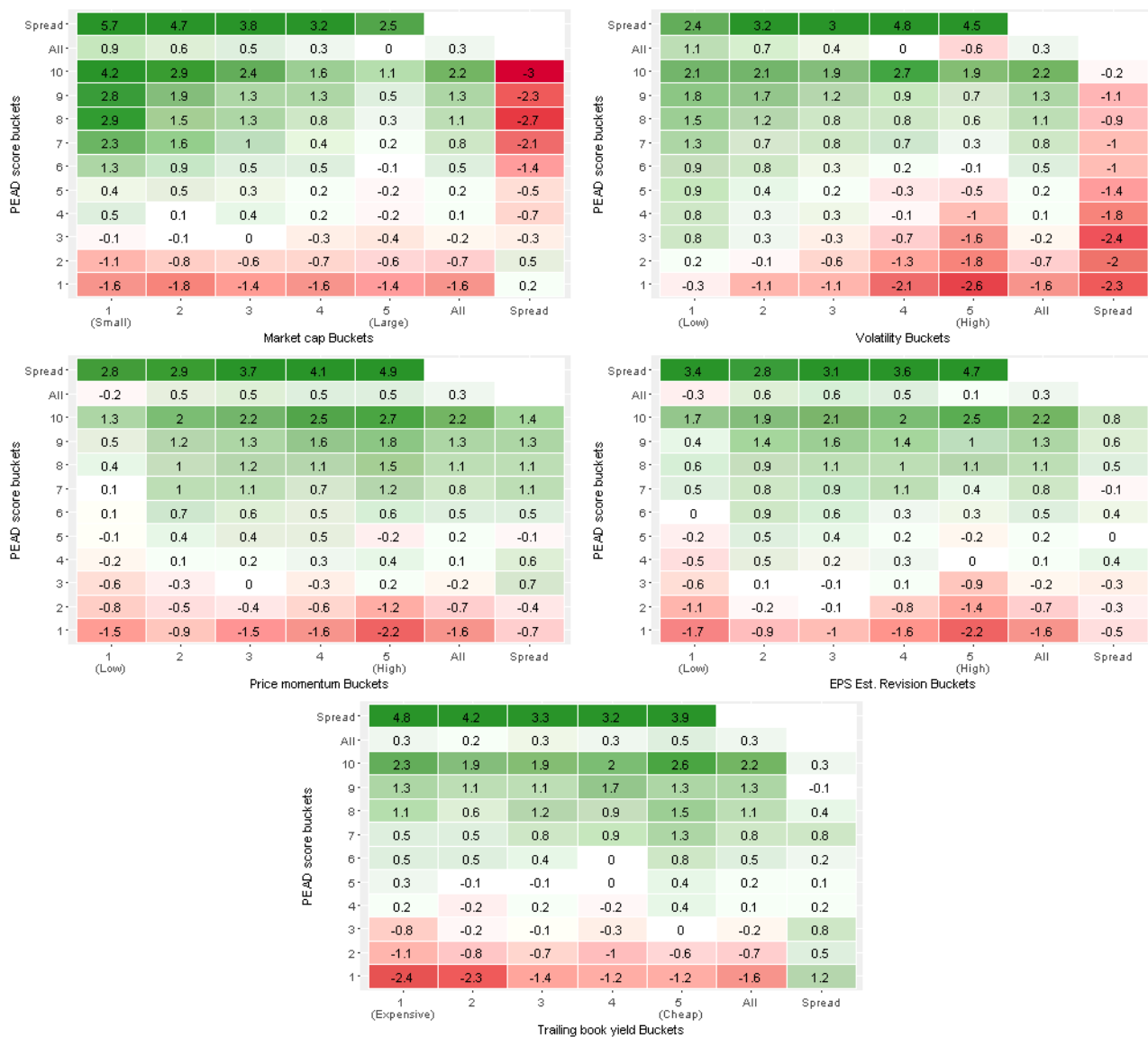
We further check for whether the PEADEffect is present when we take Size, Price volatility, Price momentum, EPS Estimate Revision and Valuation factors into consideration.

Within each factor bucket, we still observe near monotonic behavior across the PEADEffect score buckets. In particular,

- The PEADEffect spread is highest among small caps, highly volatile, high price momentum, most positive EPS Estimate Revision and most expensive (by trailing book yield) stocks

It is reassuring to see positive PEADEffect returns spreads across the various factor buckets.

Figure 56: Index adjusted PEADEffect returns of intersecting PEADEffect score buckets and factor buckets (Global)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Is our PEAD strategy superior to momentum strategies?

The PEAD strategy brings together price momentum (from the price surprise measure) and earnings momentum (from the other EPS surprise measures). One would expect a certain degree of correlation of our PEAD scores with traditional earnings revision momentum (IBES NTM EPS Revision, 3m) and price momentum (12-1 month Total return) signals.

- The PEAD scores displays slightly higher correlation to price momentum scores than to earnings revision scores. Rank correlations are not high

Next, we compare returns of our PEAD strategy with the long short decile returns of earnings revision and price momentum strategies.

- Returns to the PEAD strategy and the price and earnings revision momentum strategies are correlated, the extent of which varies across regions. Correlation is higher in Japan and the US and lower elsewhere

Figure 57: Rank Correlations among month end PEAD and momentum scores

	PEAD Score	Earnings revision	Price momentum
PEAD Score	1	0.23	0.32
Earnings revision	0.23	1	0.36
Price momentum	0.32	0.36	1

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 58: Returns correlations: PEAD strategy, Earnings revision and Price momentum

	JP				Asia ex JP		
	PEAD Strategy	Earnings revision	Price momentum		PEAD Strategy	Earnings revision	Price momentum
PEAD Strategy	1	0.49	0.42	PEAD Strategy	1	0.25	0.22
Earnings revision	0.49	1	0.65	Earnings revision	0.25	1	0.52
Price momentum	0.42	0.65	1	Price momentum	0.22	0.52	1

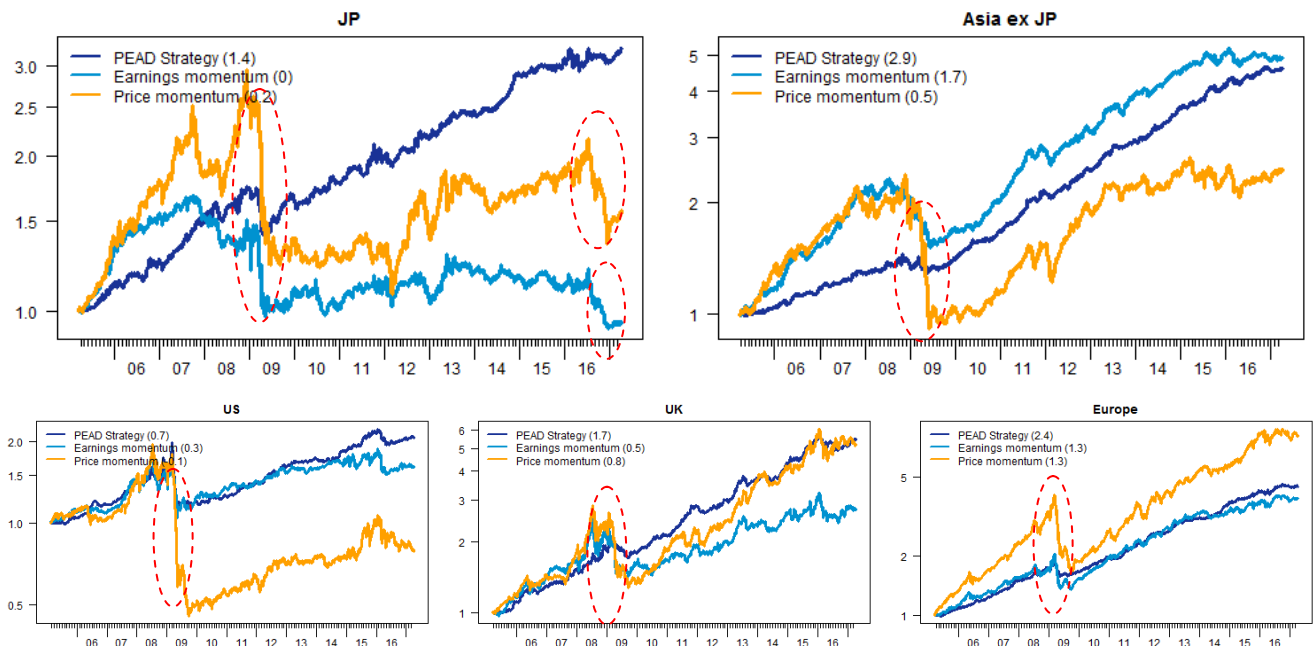
	US				UK				Europe		
	PEAD Strategy	Earnings revision	Price momentum		PEAD Strategy	Earnings revision	Price momentum		PEAD Strategy	Earnings revision	Price momentum
PEAD Strategy	1	0.6	0.52	PEAD Strategy	1	0.35	0.36	PEAD Strategy	1	0.39	0.39
Earnings revision	0.6	1	0.8	Earnings revision	0.35	1	0.73	Earnings revision	0.39	1	0.71
Price momentum	0.52	0.8	1	Price momentum	0.36	0.73	1	Price momentum	0.39	0.71	1

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



- Returns to the price momentum strategy are large and volatile, while returns to the earnings revision strategy have somewhat flat-lined in recent years
- While periods of underperformance in the PEAD strategy generally coincides with those of price and earnings momentum strategies, the drawdowns are much more muted
- The risk-adjusted returns of the PEAD strategy are higher than those of the price and earnings revision momentum strategies across the regions
- In Japan, where both price and earnings momentum strategies have struggled, the PEAD strategy has continued to deliver positive returns

Figure 59: Cumulative Strategy performances of PEAD strategy vs. earnings momentum and price momentum strategies (Annualized IR in brackets)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



When does the strategy work best?

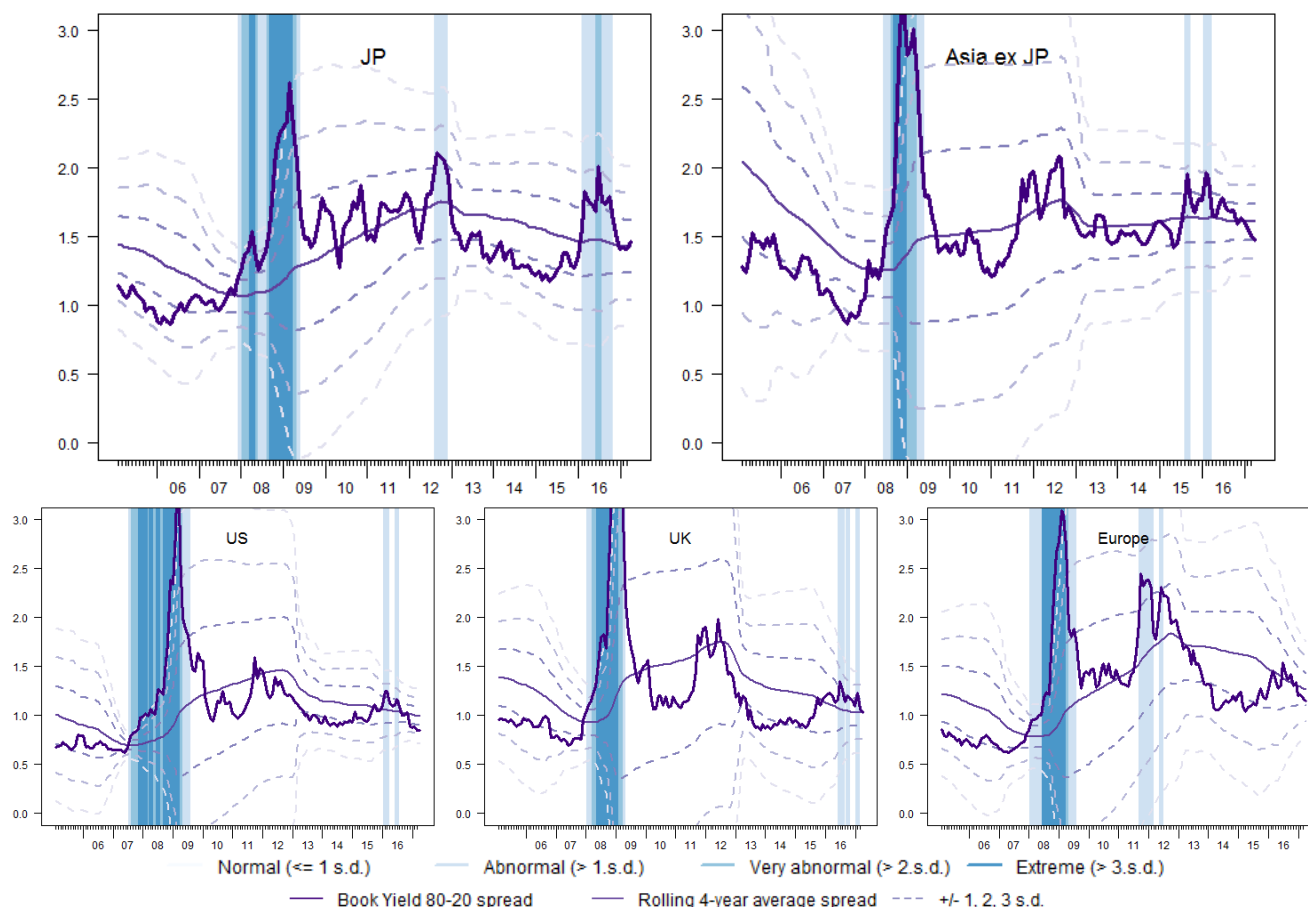
As with most momentum strategies, this earnings strategy is not spared from occasional “crashes”. For most regions, the largest drawdown came about in the ‘junk rally’ in 2009 when the shorts staged a strong rebound. The same phenomenon, though to a lesser extent, played out in 2016.

Taking market valuations into account

There are times when markets are more macro-driven, where decisions are more about being in the market or not rather than stock selection. One idea is to look at market valuation spreads. We define these as **periods when market valuations deviate strongly from historical norms**. Specifically, we compute the long-short spread of the top and bottom quintiles of the market according to the trailing book yield. We look at the number of standard deviations the spread is from the 4-year moving average.

These ‘extraordinary’ times were concentrated around 2008 H2 to 2009 Q1 globally (the GFC), 2011 Q4 in Europe (Europe sovereign debt crisis) and more recently 2016Q1 in the US (oil price rout), 2016 Q2-Q3 in Japan (NIRP) and 2016 Q3 in the UK (Brexit).

Figure 60: Historical trailing book yield dispersion (Top-bottom quintile yield spreads)

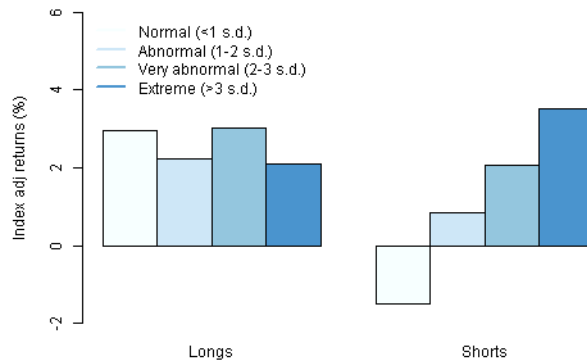


Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



We look at the average returns of the PEAD strategy when market valuations deviate from historical norms.

Figure 61: Long trades are profitable under the various market valuation environments. Short trades are only profitable under 'normal' market conditions (<1 s.d. from historical valuation averages)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Taking market and stock valuations into account

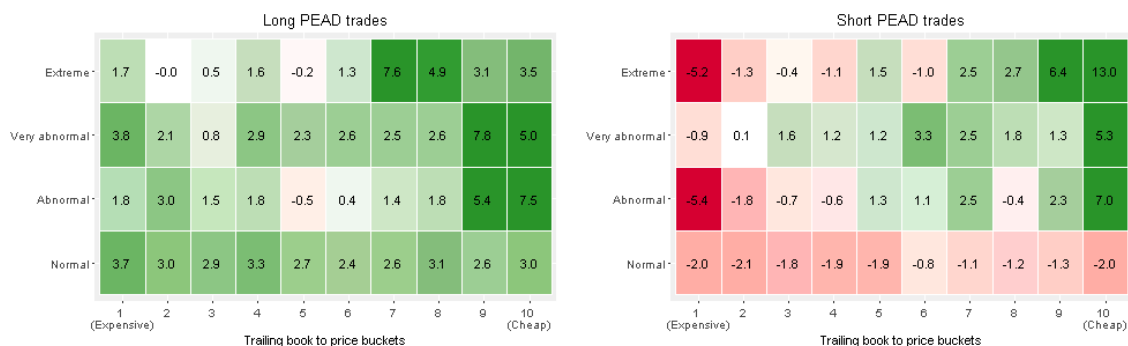
The rationale of taking valuations into account doesn't have to apply only to the market itself. We also take a look at stock relative valuations under the different market valuation environments.

Under normal market conditions (< 1 s.d.), PEAD returns behave as expected, and stock valuations have little bearing on the profitability of the trades.

As markets spreads move above one standard deviation from the average, the PEAD effect is overshadowed by the subsequent out(under) performance of cheap (expensive) stocks.

Staying away from shorting the cheapest stocks and longing stocks with "toppy" valuations when spreads are above 1 standard deviation from the average is advisable and reduces the drawdowns of the strategy.

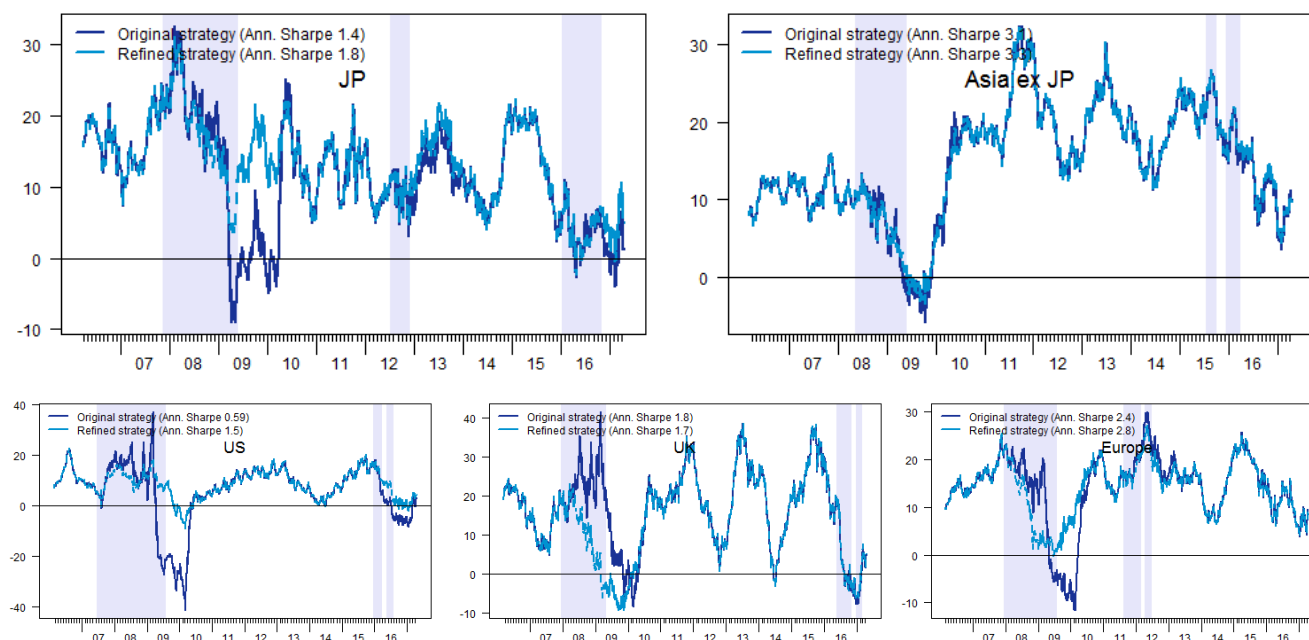
Figure 62: Average per trade returns of PEAD Strategy trades in trailing book yield buckets under different market valuation environments (Index-adjusted returns %)



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Figure 63: 1-year rolling cumulative returns (%) – Refining the strategy (by avoiding shorts in cheapest third or longs in most expensive third by trailing book yield when market valuations are more than 1 s.d. from historical averages) leads to improved performance



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Where are we now?

The analysis of our earnings strategy historical performance has shown that

- The best performance can be captured with timely execution
- The strategy can be applied in the large, mid cap space and still remains profitable, especially in Asia ex Japan
- Compared to price and earnings momentum strategies, our strategy has better risk adjusted returns and lower draw-downs
- The macro environment influences strategy returns. Taking stock valuations into account when market valuations deviate from historical norms can reduce the drawdowns of the strategy

Right now, across the regions examined, the market valuation spreads suggest a benign environment for the strategy.



Next steps

In this report, we have presented a strategy for positioning ahead of earnings announcements and trading the subsequent drift.

Fine-tuning our scores

As demonstrated in the study, there are region-specific variations in what drives returns over announcement day, e.g. in Asia ex Japan, stock valuations, short interest and stock price volatility are significant predictors.

At the stock level, there is potential incremental value in incorporating data on historical trends in earnings surprises in individual stocks to assess the extent of "real" surprise in the released numbers.

Constructing the portfolio

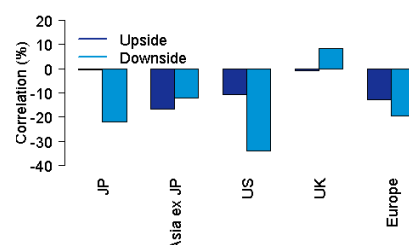
In the strategy we showed, we have chosen to **equal-weight** all our positions. There is room for improvement. Given that one explanation for the PEAD effect is grounded on investors' behavioral biases, one can consider weighting stocks in the portfolios according to investor's limited attention and visibility of the companies. (Luo et al. 2014).

Including a PEAD strategy as part of a wider portfolio

We have shown that the PEAD strategy compares favorably to either price or earnings revision momentum strategies, by offering a different all-rounded measure of momentum. Together with the valuation related market-timing overlay, investors could minimize the volatile returns often associated with momentum strategies.

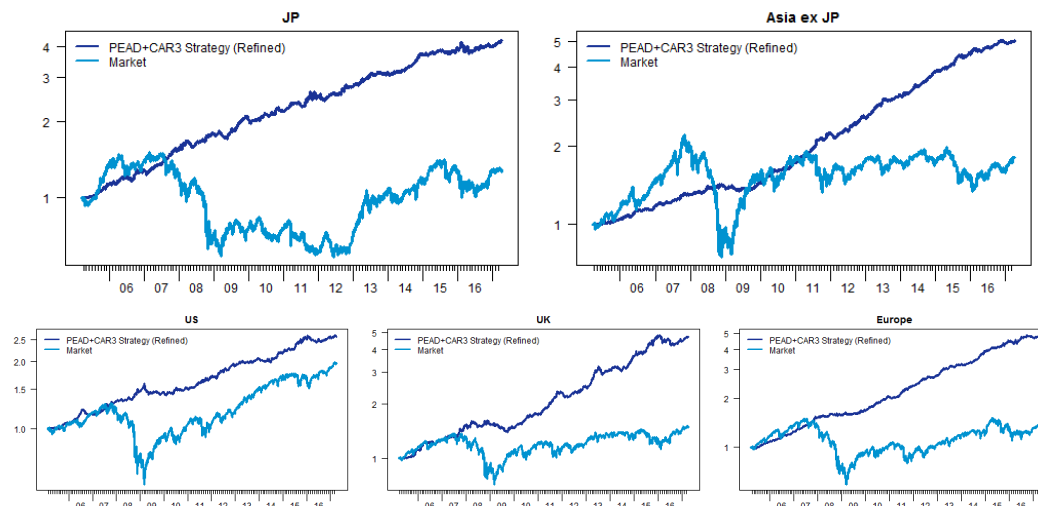
The returns of our long short PEAD+CAR3 strategy have low correlation with that of the Market. Investors can consider allocating to our Earnings strategy as a diversifier to overall portfolio returns.

Figure 64: Returns correlation of the PEAD+CAR3 strategy with the Market is low



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

Figure 65: Cumulative Strategy performances of PEAD+CAR3 strategies (Refined) vs. the Market



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Appendix

A surprise calculation example for Toyota Motor

Figure 66: Surprise calculation example for Toyota Motor (7203 JP)

	2016 Q1	2016 Q2	2016 Q3	2016 Q4
Period end	30-Jun-15	30-Sep-15	31-Dec-15	31-Mar-16
CAR3 returns (%)	-4.28%	-0.82%	-3.22%	-2.31%
Avg. 3 month var (%)	0.86%	1.60%	1.39%	1.70%
CAR3VarAdj	-4.98	-0.51	-2.31	-1.35
Percentile in sample	1%	38%	12%	24%
Price	8,121	7,495	6,625	5,634
Reported EPS (Ann.)	-	-	-	741
Est EPS (Ann.)	-	-	-	755
Consensus Est surprise/Price (Ann.)	-	-	-	-0.23%
Percentile in sample	-	-	-	31%
Reported EPS (Q)	205	194	202	139
Est EPS (Q)	195	201	196	155
Consensus Est surprise/Price (Q)	0.13%	-0.09%	0.09%	-0.29%
Percentile in sample	53%	32%	53%	28%
FY2016 EPS guidance	715	714	724	-
FY2016 EPS Consensus Est	787	779	778	-
FY2017 EPS guidance	-	-	-	491
FY2017 EPS Consensus Est	-	-	-	725
Full Year Guidance surprise/Price	-0.22%	0.09%	0.15%	-4.17%
Percentile in sample	38%	60%	66%	5%
Reported EPS (Q)	205	194	202	139
FY2016 EPS Consensus Est	787	779	778	755
Progress rate (%)	26.11%	24.92%	25.97%	18.41%
Progress rate surprise (%)	1.11%	-0.08%	0.97%	-6.59%
Percentile in sample	52%	47%	53%	31%

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



Real life considerations

To provide realistic returns, we have taken the following into account:

- **Limit moves in Japan** – In our Japan dataset, 1.3% of the earnings surprises have limit moves on earnings announcement, rendering entry/exit impossible on that day
- **Liquidity requirement** – although we are aware that earnings are generally liquidity events for small-caps, we have imposed a minimum 21-day average daily traded volume of USD100,000 constraint on our universe
- **Minimum price requirement** – We have imposed a minimum share price requirement on the universe. There are a few reasons for this:
 - As a denominator in the surprise measures, a minimum price requirement avoids assigning extreme surprise measure values to low price stocks that would dominate the portfolios
 - Shorting low price stocks would have proved especially costly for the strategy (e.g. resources stocks in 2009 for Australia)
 - The bid ask spreads for less liquid/ low-priced stocks often mean per trade returns do not compensate for slippage. Investors can consider replacing these minimum price and liquidity requirements with bid ask spread constraints

Figure 67: Minimum price requirement in different markets

Region	Currency	Min. Price
Japan	JPY	100
	AUD	1
Asia ex Japan	HKD	2
	IDR	500
	INR	50
	KRW	1000
	MYR	2
	PHP	5
	SGD	0.5
	THB	5
	TWD	20
	USD	1
US	USD	1
UK	GBP	1
	EUR	1
	CHF	1
	SEK	5
	NOK	5

Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy

What have we not considered?

We outline further details to bear in mind when implementing the strategy:

- **Slippage** is not incorporated in the returns stream of the strategy. Having shown the per-trade returns of the strategy as well as a version of the strategy for the large mid universe, we believe the returns will not be completely cannibalized by the slippage.
- We also have not considered the **availability of shorts**, but we also note that longs contribute the majority of the returns of the strategy.
- We have stressed the benefits of a timely trade entry for our strategies. For the strategy returns shown, **daily execution during earnings seasons is required**, as is real-time availability of the information used in score calculations.

The section on delayed trade entry demonstrates that there are still substantial returns to be had with slight delays in trade execution, especially so in Asia ex Japan.



A primer on Generalized Additive Models

The Generalized Additive Model features heavily in our factor relationship exploratory sections. We have chosen it for its ability to account for non-linear and pairwise interactions.

How does a Generalized Additive Model work?

First assume there is only one predictor and we want to fit a model of the form $y = f(x) + e$, where f is unknown, i.e. we want to smooth a cloud of points.

Local regression fits a linear model on a moving window: the envelope of the resulting lines give a smooth approximation of the cloud of points.

Generalized additive models (GAM) generalize smoothing to several predictors by smoothing one variable at a time. The model is of the form

$$y = \sum_i f_i(x_i) + \varepsilon$$

where the f_i are unknown functions of one variable. Those models are usually estimated by backfitting:

- Assume that all the functions, except one, are known;
- Estimate that function, f_j , by smoothing the residuals,

$$f_j \leftarrow \text{Smooth} \left(y - \sum_{i \neq j} f_i \right)$$

- Iterate until convergence.

It is possible to add interactions, e.g., by considering models of the form

$$y = \sum_i f_i(x_i) + \sum_{i \neq j} g_{ij}(x_i, x_j) + \varepsilon.$$

To avoid over-fitting the data when there are too many or collinear variables, we have used a boosted GAM instead. This implementation has the following advantages:

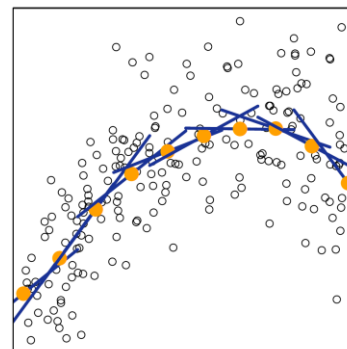
- They can model non-linear relations and even pairwise interactions;
- They remain linear: they are easy to interpret;
- They are sparse.

There is still one limitation, though:

- As the number of boosting steps increases, the computations can become very time-consuming.

For further details, please refer to our Machine Learning Report [12].

Figure 68: Local regression: for each x , fit a weighted linear model, with more weight for observations close to x



Source: S&P, FactSet, Thomson Reuters, Bloomberg Finance LP, IHS Markit, Deutsche Bank Quantitative Strategy



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Appendix 1

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