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Using Credit Information in Equity Markets: Application to European Markets, High Frequency Trading and Earning Announcements

Barclays Fifth Annual US Quantitative Equity Research Conference

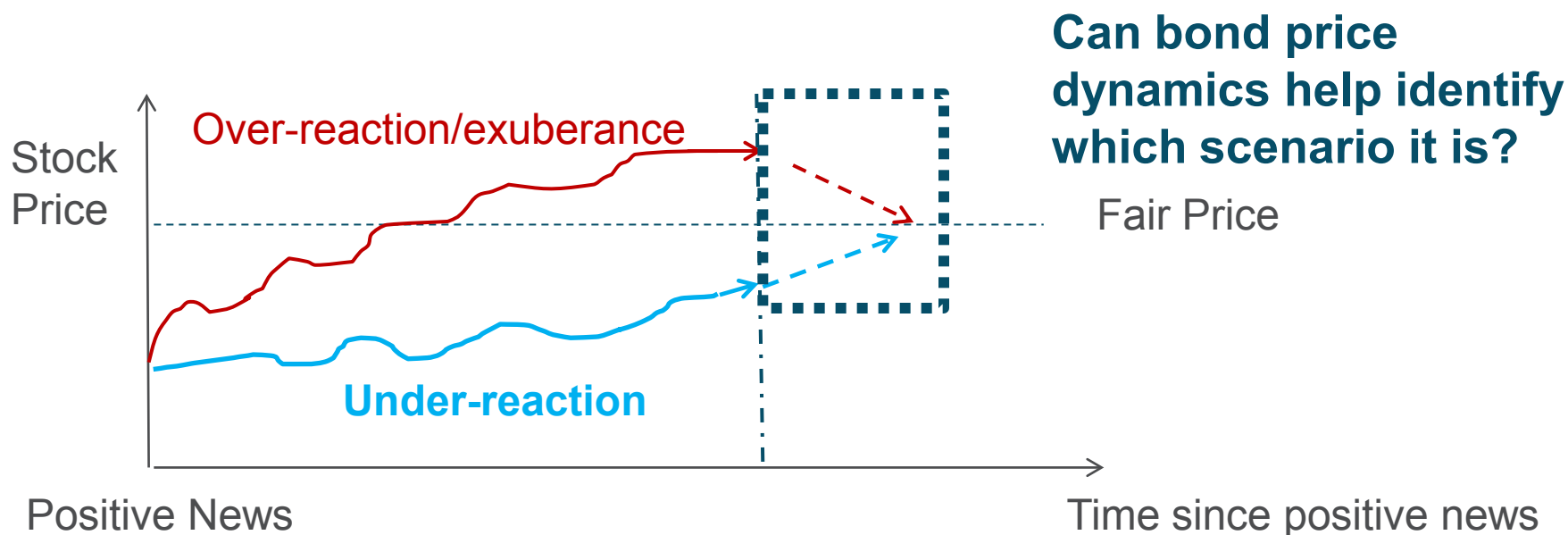
April 25, 2018

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Why would Bond Price Dynamics Improve Equity Momentum?

- ❖ Momentum may reflect investors' under-reaction to news (Shleifer and Vishny 1998), or overreaction driven by investor behavioral biases



- ❖ Bond returns may help identify which trajectory is more likely in the example above (eg, equity momentum may be more likely to mean-revert when observing contradicting bond price dynamics)
- ❖ [Ben Dor and Xu \(2014\)](#) showed that equities with higher past bond returns also have higher future equity returns (**BEAM** - Bonds in Equity Asset Momentum)

Key Features of BEAM

	Description
I. Signal Dynamics	Past three months, inclusion of most recent month
II. Role of Industry-level Momentum	Industry-neutral BEAM retained its strong performance
III. Return Dynamics	Steady performance even during market reversals unlike equity momentum
IV. Volatility	BEAM L-S portfolio had consistently lower vol than equity momentum
V. Hedging Efficacy	BEAM L and S portfolios exhibit similar characteristics
VI. Performance by market states	BEAM L-S portfolios consistently outperformed equity momentum in different fixed market conditions

BEAM Performance Update

BEAM Outperformance Persisted Following the 2014 Publication

- BEAM strategy continued to outperform equity momentum portfolios (EMP) following the results in [Ben Dor and Xu \(2014\)](#)*, delivering
 - ✓ Higher performance (absolute return and information ratio)
 - ✓ Lower risk (vol. and tail measures)
- ✓ BEAM strategy also delivered better performance than a number of equity factors

Performance of BEAM vs. Equity Momentum Portfolio (EMP)
(EW, Top – Bottom Decile, Jan. 2014 – Feb. 2018 based on availability of FF factors)

	BEAM Universe		Fama-French Factors				
	BEAM	EMP	Momentum	Value	Size	Profitability	Investment
Avg Ret (%/Yr)	14.48	9.42	8.61	1.05	7.11	3.43	3.13
Vol. (%/Yr)	11.80	19.77	17.41	11.50	10.81	12.84	9.39
Inf. Ratio	1.23	0.48	0.49	0.09	0.66	0.27	0.33
Worst Month Ret (%/m)	-5.40	-14.86	-12.02	-6.97	-7.77	-12.19	-5.62
Max Drawdown (%)	-9.10	-30.00	-25.15	-20.75	-11.04	-13.09	-15.22

Note: BEAM and EMP portfolios are sorted within industry for the universe of equities with outstanding index bonds. The Fama-French factor are sorted across the CRSP universe. Factor returns and definitions are available on Ken French's web site.

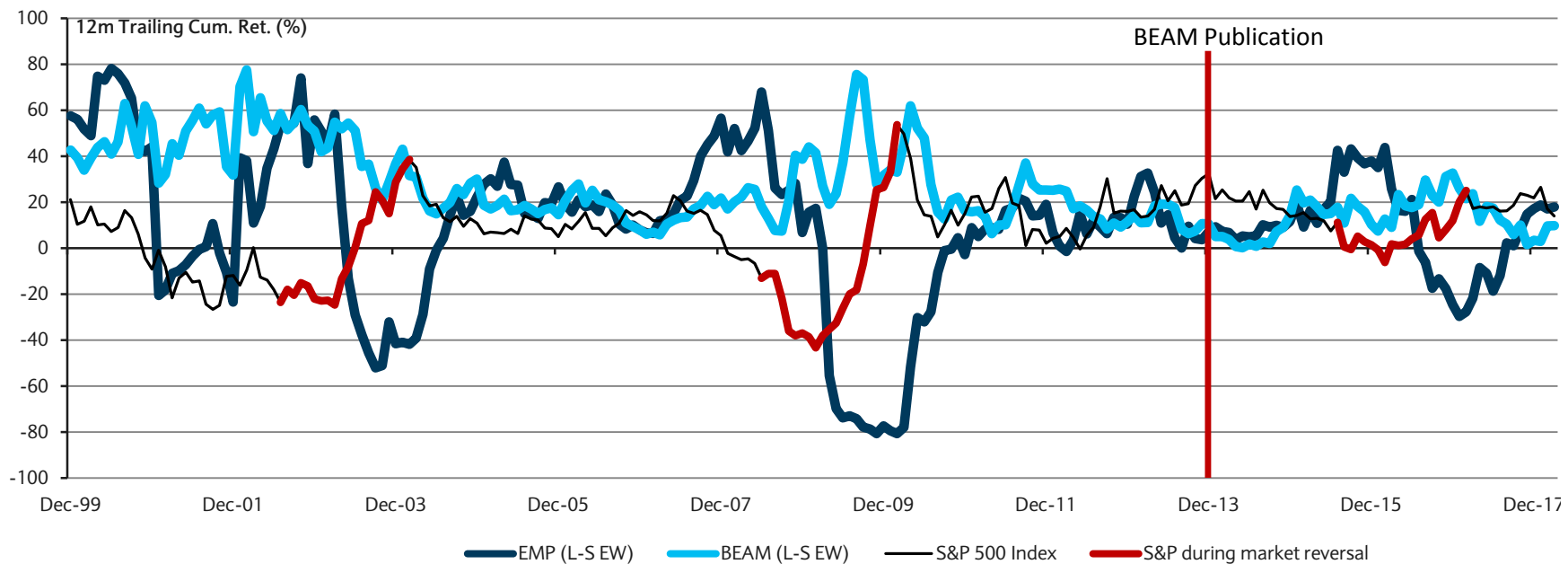
Source: Compustat, Ken French Data Library, Barclays Research

*:Ben Dor, A. and Xu, Z. 2014. BEAM (Bonds in Equity Asset Momentum): Value of Bond Market Information in Equity Momentum Strategies. Barclays live. A shorter version is also published in JPM: Ben Dor, A. and Xu, Z., 2015. Should Equity Investors Care about Corporate Bond Prices? Using Bond Prices to Construct Equity Momentum Strategies. *Journal of Portfolio Management*, 41(4), p.35.

BEAM Behavior during Market Reversal Was Consistent with Our Original Findings

- BEAM return dynamics during a market reversal in the post-publication period were consistent with earlier results

Trailing 12m Cumulative Performance of BEAM and EMP Portfolios (within ind, EW)



Source: Compustat, Barclays Research

Today's Presentation:

Additional Application of Credit Information to Equity Markets

BEAM for
European Markets

D-BEAM:
Using Daily
Corporate Bond
Prices in High-
Frequency Equity
Momentum
Strategies

Using Credit
Information to
improve PEAD
Strategies

BEAM for European Markets

[Link to Full Report](#)

Are European BEAM main findings consistent with U.S. BEAM?

	Key Features in U.S.	Same features in Europe
I. Signal Dynamics	Past three months, inclusion of most recent month	?
II. Role of Industry-level Momentum	Industry-neutral BEAM retained its strong performance	
III. Return Dynamics	Steady performance even during market reversals unlike equity momentum	
IV. Volatility	BEAM L-S portfolio had consistently lower vol than equity momentum	
V. Hedging Efficacy	BEAM L and S portfolios exhibit similar characteristics	
VI. Performance by market states	BEAM L-S portfolios consistently outperformed equity momentum in different fixed market conditions	

I. Same Optimal Ranking Window in European Markets

Performance of Bond-ranked Momentum Portfolios by Ranking Period (Top-Bottom Decile)									
		U.S. (Original Paper)				Europe			
Ranking Window (Past k months)		k=3	6	9	12	k=3	6	9	12
Panel A: Excluding Month t-1									
VW	Avg (%/Yr)	7.87	5.37	6.05	7.65	5.48	3.71	3.39	4.74
	Vol. (%/Yr)	21.24	18.98	19.28	20.78	17.14	19.98	18.38	19.50
	Inf. Ratio (Ann.)	0.37	0.28	0.31	0.37	0.32	0.19	0.18	0.24
EW	Avg (%/Yr)	12.21	12.90	7.57	6.18	7.64	7.07	5.38	6.94
	Vol. (%/Yr)	15.40	18.09	18.39	19.68	12.81	16.67	15.98	16.64
	Inf. Ratio (Ann.)	0.79	0.71	0.41	0.31	0.60	0.42	0.34	0.42
Panel B: Including Month t-1									
VW	Avg (%/Yr)	14.50	10.52	13.47	10.89	10.58	6.20	4.89	6.97
	Vol. (%/Yr)	22.11	19.16	20.86	21.20	18.70	20.38	19.17	20.13
	Inf. Ratio (Ann.)	0.66	0.55	0.65	0.51	0.57	0.30	0.25	0.35
EW	Avg (%/Yr)	17.38	15.69	12.09	9.75	11.40	11.03	5.81	7.72
	Vol. (%/Yr)	14.97	17.13	18.09	20.09	15.36	17.40	17.20	17.71
	Inf. Ratio (Ann.)	1.16	0.92	0.67	0.49	0.74	0.63	0.34	0.44

Note: the U.S. results are from Ben Dor and Xu (2014), based on returns from Jan. 1994 – Dec. 2013. The European results are based on returns from May 2003 – Dec. 2017. Source: Compustat, Barclays Research

✓ Same shorter window works best for bond market signals in Europe

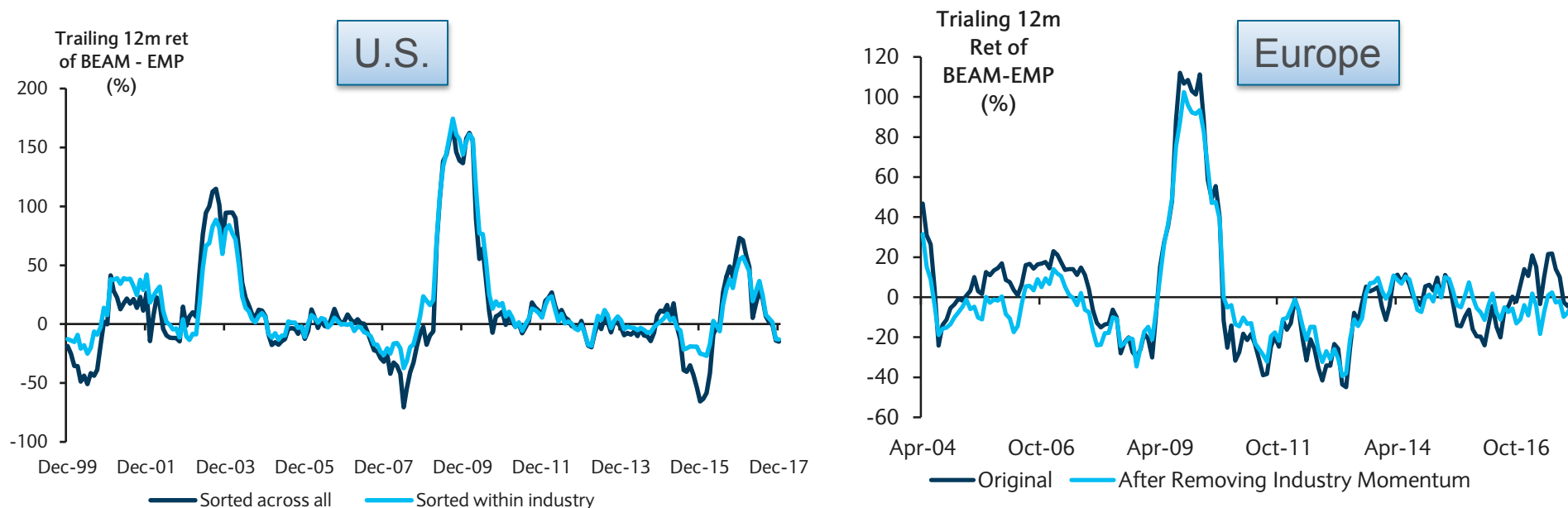
	Bond Market Signal (BEAM)	Same in Europe
Window Length	Shorter (3m)	✓
Most Recent Month	Inclusion	✓

✓ In addition, BEAM outperformed EMP (information ratio of 0.74 vs. 0.26)

II. Industry Momentum did not drive BEAM Outperf. in US or Europe

- Controlling for industry-level momentum in the US increased BEAM outperformance over EMP
- √ In Europe, removing industry momentum, led to similar returns, lower volatility and slightly higher I.R. for BEAM, indicating the strategy performance was *not* driven by sector effect

Trailing 12m Outperformance of BEAM over EMP
(EW, Jan.1999 – Dec. 2017 for U.S., Apr. 2004 – Dec. 2017 for Europe)



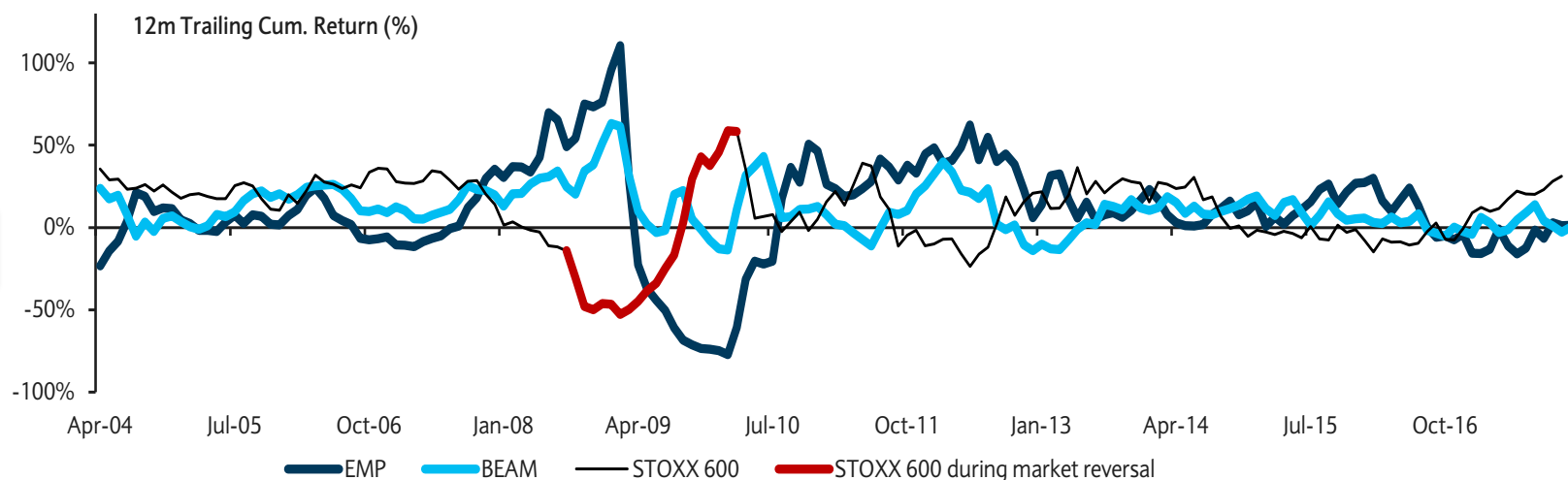
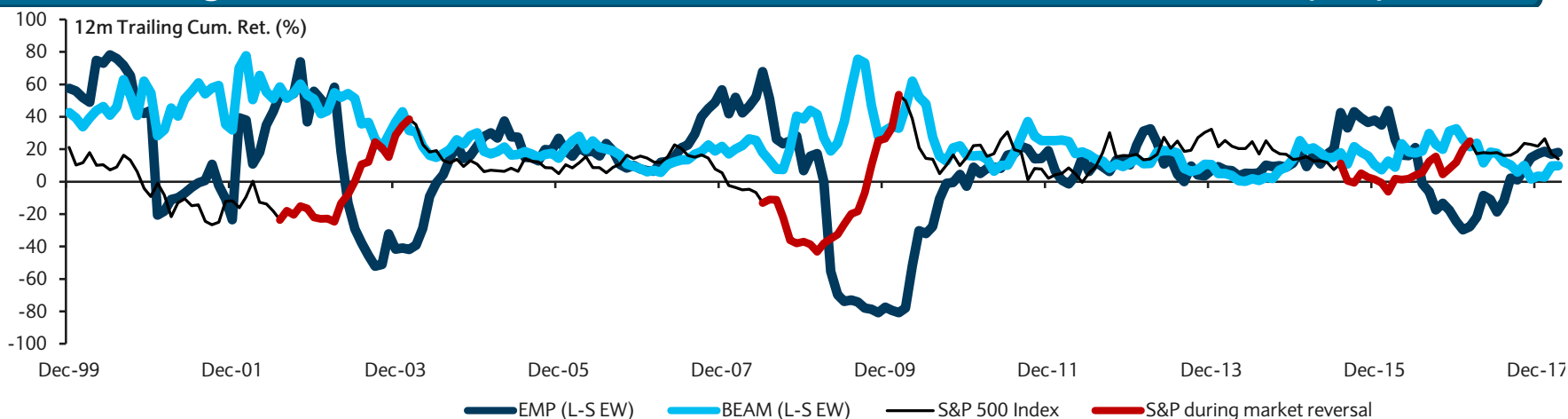
Note: U.S. BEAM and EMP constituents were ranked within fixed income and GICS sectors respectively. In Europe, industry level-effects are removed by standardizing signals using contemporaneous sector returns because of the smaller sample size.

Source: Compustat, Barclays Research

III. BEAM and EMP Exhibited Different Dynamics in Market Reversals

- BEAM outperforms in volatile periods, when market rebounds swiftly from a trough in US (2003, 2009) and Europe (2009)
- Trailing 12m returns of BEAM stayed positive in most of the sample period in both markets

Trailing 12m Cumulative Performance of EMP and BEAM Portfolios (EW)

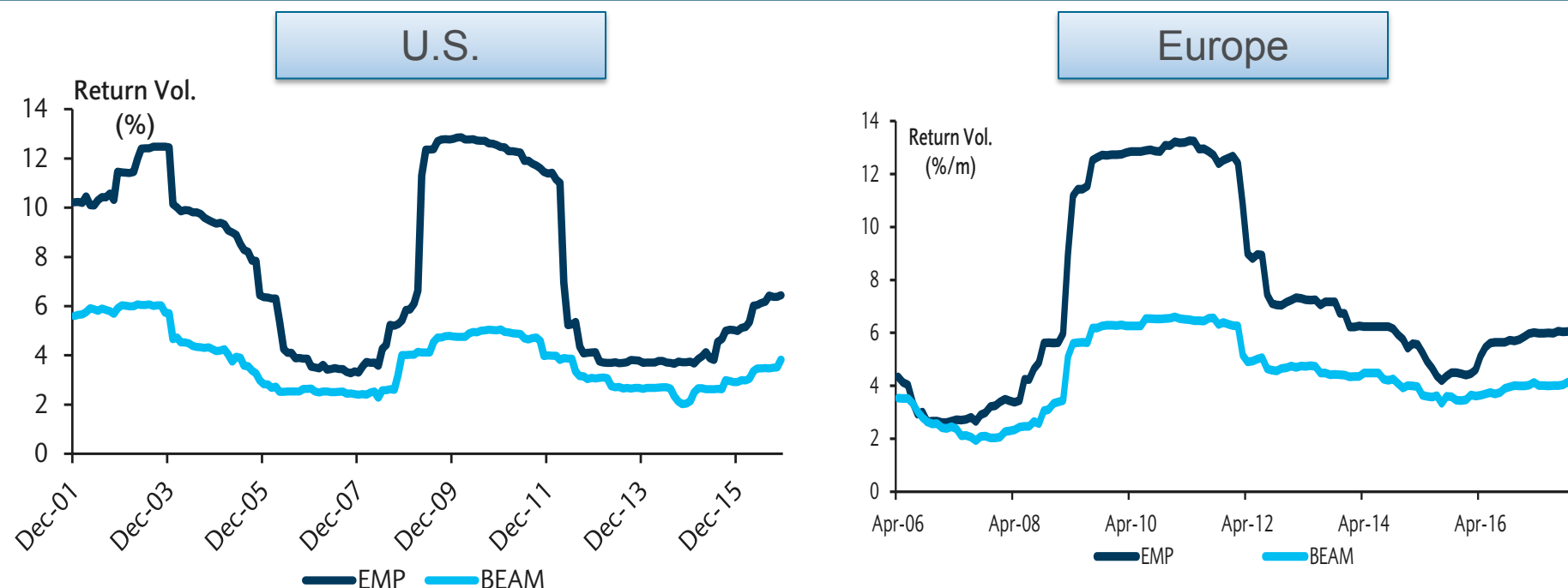


Note: the U.S. BEAM and EMP are sorted within industry. BEAM and EMP in European markets are sorted across all. Source: Kenneth French Data Library, Bloomberg, Barclays Research

IV. BEAM Volatility Is Consistently Lower than EMP's

- BEAM strategy exhibited consistently lower volatility than EMP (despite shorter ranking window)

Trailing 36-Month Return Volatility of *EMP* and *BEAM* Portfolios (EW)

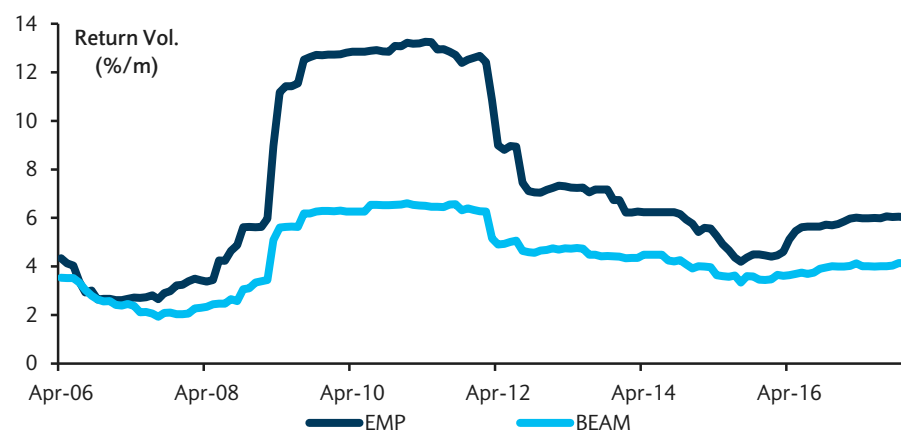


Note: In the US, stocks were sorted within industries and returns are from Jan. 1999 – Dec. 2016. In Europe, the returns are from May 2003 to Dec. 2017. The industry components were not removed in Europe. Source: Compustat, Barclays Research

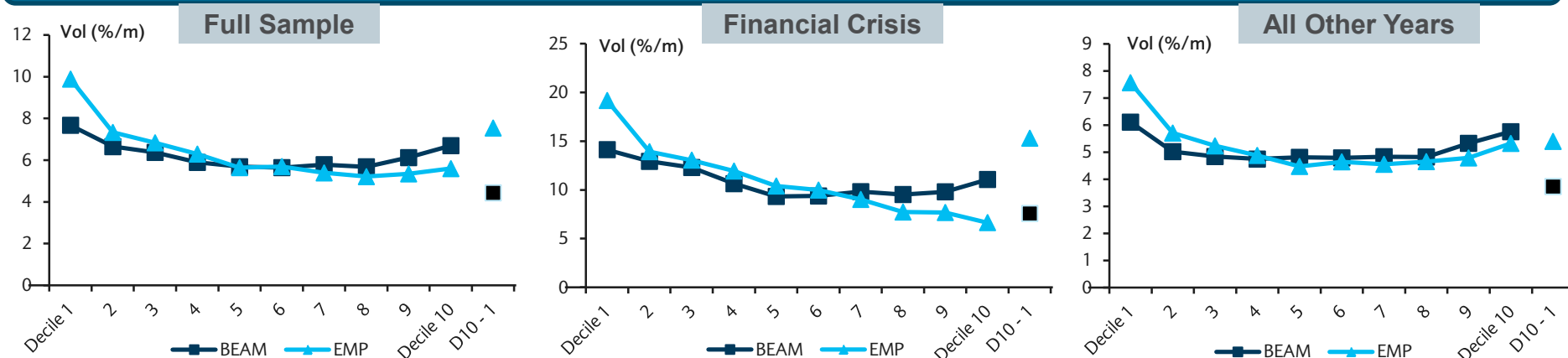
Bond-Based Deciles Have Similar Vol. Unlike Equity Based Deciles

- The vol. of BEAM decile 10 ('winners') is higher than the corresponding EMP decile, while the reverse is true for decile 1. BEAM deciles vol. is also more uniform
- Combining BEAM L and S legs lowers vol. due to better hedging unlike for EMP
- During the Crisis, stocks in BEAM L and S legs had similar characteristics -> higher correlation and more balanced volatilities of the two decile portfolios-> better hedging

Trailing 36m Return Volatility of EMP and BEAM Portfolios (EW, 4/2006 – 12/2017)



Monthly Volatility of Decile Portfolios by Ranking Method and Period (EW)



Note: The full sample is May 2003- December 2017. The financial crisis are months during January 2008-December 2009. All other years is the full sample excluding the financial crisis. Source: Compustat, Barclays Research

V. BEAM L and S Legs in Europe Exhibit Similar Characteristics

- BEAM L and S port. betas showed little difference over time
- During the Financial Crisis, the beta of the EMP S leg was much higher than the L leg, contributing to large losses
- The credit rating of BEAM L leg is worse than that of BEAM S leg
- BEAM portfolio is also tilted toward smaller firms
- BEAM winners and losers have smaller diff. in leverage and beta than EMP
- US BEAM L and S legs also exhibit similar characteristics

European Stock Characteristics of EMP and BEAM Portfolio by Time Period (EW, May 2003 – Dec. 2017)

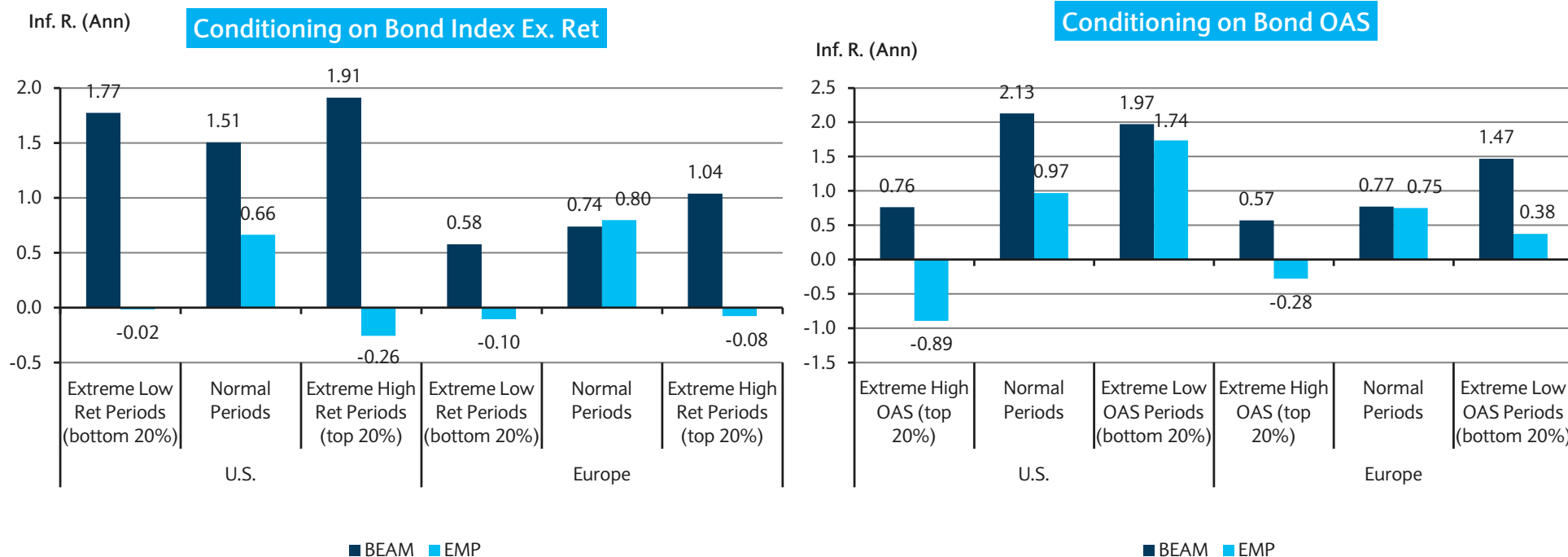
	EMP			BEAM		
	Losers	Winners	Winners-Losers	Losers	Winners	Winners-Losers
	Full Sample, 5/2003 - 12/2017					
Ratings	4.13	4.08	-0.05	3.86	4.66	0.79
Book-to-Market Ratio	0.97	0.65	-0.32	0.70	0.86	0.16
Leverage (BV of Debt/(Debt+Equity Market Cap.))	55%	34%	-20%	41%	42%	1%
Market Cap (\$Bn)	5.16	9.68	4.53	10.04	5.34	-4.70
Beta to STOXX 600	1.23	1.16	-0.07	1.04	1.24	0.20
	Financial Crisis 1/2008-12/2009					
Ratings	3.85	3.62	-0.24	3.72	4.00	0.28
Book-to-Market Ratio	1.18	0.56	-0.61	0.80	0.89	0.08
Leverage (BV of Debt/(Debt+Equity Market Cap.))	72%	30%	-42%	52%	44%	-8%
Market Cap (\$Bn)	3.48	14.67	11.19	6.94	8.07	1.13
Beta to STOXX 600	1.39	0.86	-0.53	1.04	1.17	0.13
	All Other Sample Years					
Ratings	4.17	4.15	-0.02	3.89	4.76	0.87
Book-to-Market Ratio	0.94	0.67	-0.27	0.68	0.85	0.17
Leverage (BV of Debt/(Debt+Equity Market Cap.))	52%	35%	-17%	39%	42%	3%
Market Cap (\$Bn)	5.42	8.89	3.47	10.53	4.91	-5.63
Beta to STOXX 600	1.21	1.21	0.00	1.04	1.26	0.21

Note: Outstanding bonds ratings are converted to a numeric scale, and then aggregated by market values to produce a firm's rating. The conversion scale is: AAA=1, AA=2, A=3, BAA=4, BA=5, B=6, CAA=7, CA=8, C=8, D=9: the better the rating the lower the value. Source: Bloomberg, Compustat, Barclays Research

BEAM Outperformed EMP following Extreme FI Market States

- Conditional on the previous month's fixed income market conditions (excess return or OAS), BEAM outperformed EMP even more when
 - FI market had extremely high or low returns, regardless of the direction
 - OAS were at extremely high levels

Information Ratio of BEAM and EMP Conditional on FI market State in Previous Month (EW)



Note: In the US, BEAM and EMP were sorted within industries from Jan. 1999 – Mar. 2018. For Europe, BEAM and EMP were not adjusted for industry momentum, and returns are from May 2003 – Mar. 2018. Source: Compustat, Barclays Research

European BEAM main findings are consistent with U.S. BEAM

	Key Features in U.S.	Same features in Europe?
I. Signal Dynamics	Past three months, inclusion of most recent month	✓
II. Role of Industry Momentum	Industry-neutral BEAM retained its strong performance	✓
III. Return Dynamics	Steady performance even during market reversals unlike equity momentum	✓
IV. Volatility	BEAM L-S portfolio had consistently lower vol than equity momentum	✓
V. Hedging Efficacy	BEAM L and S portfolios exhibit similar characteristics	✓
VI. Persistent Performance by market state	BEAM L-S portfolios consistently outperformed equity momentum in different fixed market conditions	✓

D-BEAM

Using Daily Corporate Bond Prices in High-Frequency Equity Momentum Strategies

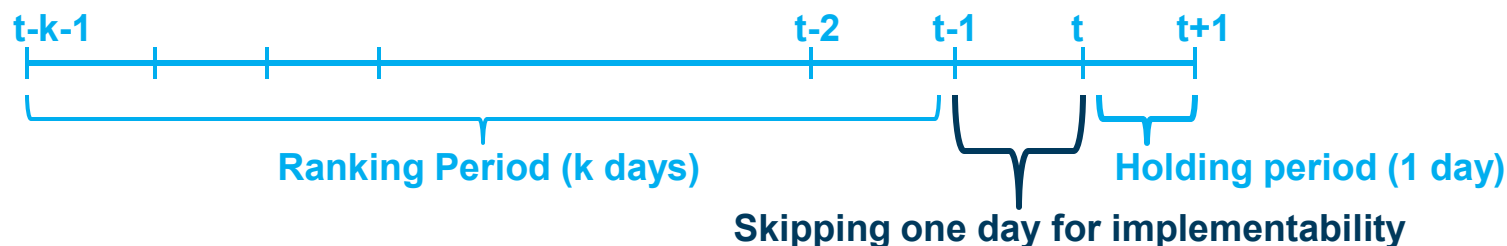
[Link to Full Report](#)

Differences in Monthly and Daily Bond Return Signals

- Signal Existence?
 - ❖ Equity price dynamics switch from momentum at a medium horizon to ‘short-term reversal’ (ST Rev.) at a daily frequency
 - ❖ Does BEAM strategy reverse at daily frequency?
 - ❖ Or do the same BEAM patterns persist from monthly to daily?
- Corporate bonds are relatively illiquid compared with the equity market and may not incorporate new information into their prices on a daily basis
- The cross-sectional dispersion in price movements at a higher frequency is more limited and requires higher accuracy from the signal in order to identify cross-sectional variation

Momentum: Portfolio Construction

- At the end of each day, we form 10 equity momentum portfolios on the basis of prior $(t-k-1, t-1)$ bond excess returns:



- Over the one-day holding period, we evaluate the return of the top and bottom ("winner" and "loser") deciles. We also consider the long-short portfolio that invests \$1 in the winner portfolio and shorts \$1 of the loser portfolio
- Weighting scheme: Equal Weighted (EW) or Value Weighted (VW), with a 2% cap on any individual company

Bond and Equity-Based Momentum Perf. by Ranking Window

- **Note:** Given the short-run mean reversion in equity markets, the comparable equity strategy is based on buying losers and selling winners (**Short-term Reversal**)
- All bond-based signals are superior (higher return and lower vol) to the portfolios based on equity signals
- Improved performance from ranking within industries reflects lower vol, rather than higher return
- Unlike equity, bond-ranked signals do not display short-term reversal

Bond- and Equity-Ranked Mom. Performance by Ranking Period (top-bottom or bottom-top deciles, Jan. 2001 – Dec. 2017)

		Bond-ranked Momentum Portfolio					Short-term Reversal				
		Buy Winners and Selling Losers: Top - Bottom					Buy Losers and Selling Winners: Bottom - Top				
Ranking Window (Past k days)		k=1	3	5	9	20	k=1	3	5	9	20
Panel A: Ranking Across Universe											
EW	Avg (%/Yr)	13.2	15.6	15.9	16.6	20.5	3.4	9.2	5.4	2.0	-1.0
	Vol. (%/Yr)	11.7	13.4	14.5	15.8	17.7	20.7	22.2	23.2	23.4	24.0
	Inf. Ratio (Ann.)	1.13	1.17	1.09	1.05	1.16	0.16	0.41	0.24	0.09	-0.04
VW	Avg (%/Yr)	8.8	8.0	7.6	8.5	11.5	9.1	16.6	15.0	7.8	4.5
	Vol. (%/Yr)	11.5	13.5	14.6	15.6	17.4	21.4	22.8	23.9	24.3	25.1
	Inf. Ratio (Ann.)	0.80	0.60	0.50	0.50	0.70	0.40	0.70	0.60	0.30	0.20
Panel B: Ranking Within Industries											
EW	Avg (%/Yr)	12.7	18.2	17.1	15.6	18.0	4.5	9.8	7.3	5.2	3.0
	Vol. (%/Yr)	9.1	9.9	10.4	10.9	11.9	14.4	15.8	16.8	16.7	17.7
	Inf. Ratio (Ann.)	1.39	1.83	1.65	1.43	1.52	0.31	0.62	0.44	0.31	0.17
VW	Avg (%/Yr)	8.90	10.5	9.8	8.0	9.6	7.9	13.5	12.7	8.5	6.5
	Vol. (%/Yr)	8.90	9.7	10.1	10.6	11.3	14.2	15.6	16.4	16.3	17.5
	Inf. Ratio (Ann.)	1.00	1.10	1.00	0.80	0.90	0.60	0.90	0.80	0.50	0.40

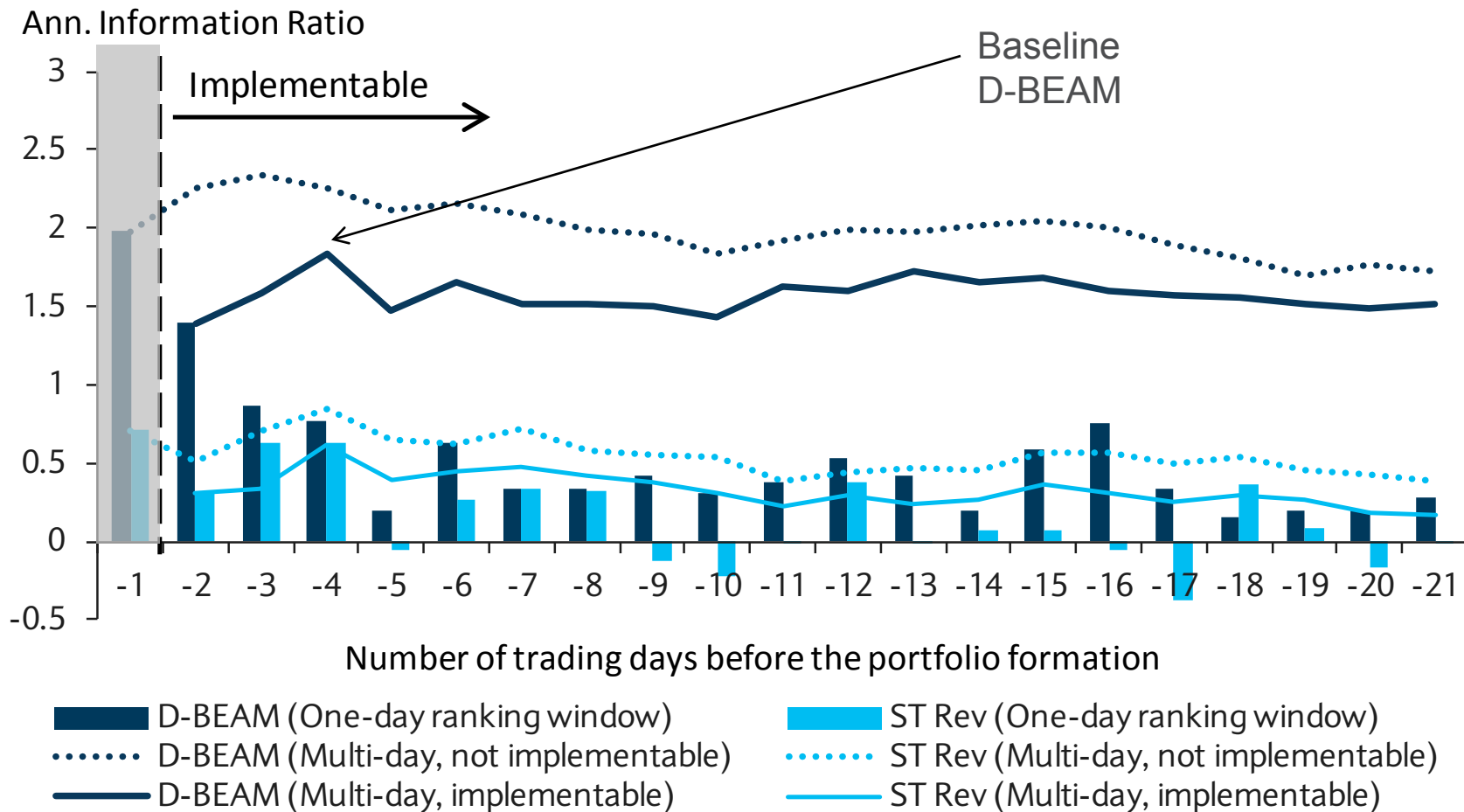
Source: Compustat, Barclays Research

**Baseline
D-BEAM**

**Short-term
Reversal**

The Informational Content of Bond and Equity Signals by Ranking Window

L/S Portfolio performance by Signal and Construction Method (EW, Within Industries, top-bottom deciles, Jan. 2001 – Dec. 2017)



Source: Compustat, Barclays Research

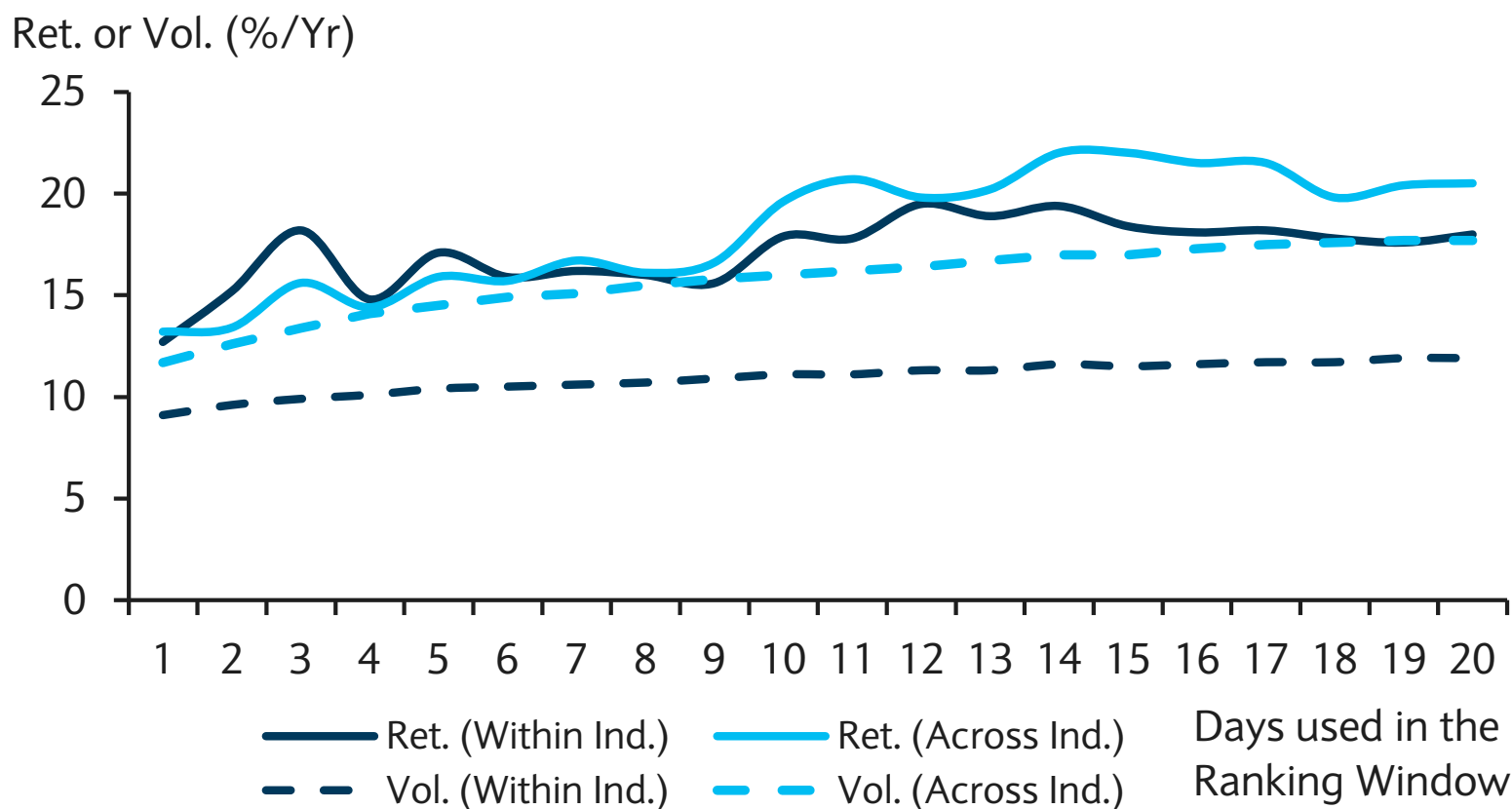
The Informational Content of Bond and Equity Signals by Ranking Window: Key Findings

- Similar to monthly BEAM, the most recent period (day) is the most important
- The signal efficacy decays gradually
- Ranking windows based on multiple days are better than any single-day ranking window
- D-BEAM is based on a three-day ranking window immediately preceding the most recent day and generates an information ratio of 0.8

Ranking Within Industries Leads to Better Performance

- Ranking firms within industries results in similar average returns to ranking across industries, but with lower vol

Returns and Vol of Long-Short Daily EW Bond-Ranked Mom. (across and within Industries, Jan. 2001 – Dec. 2017)

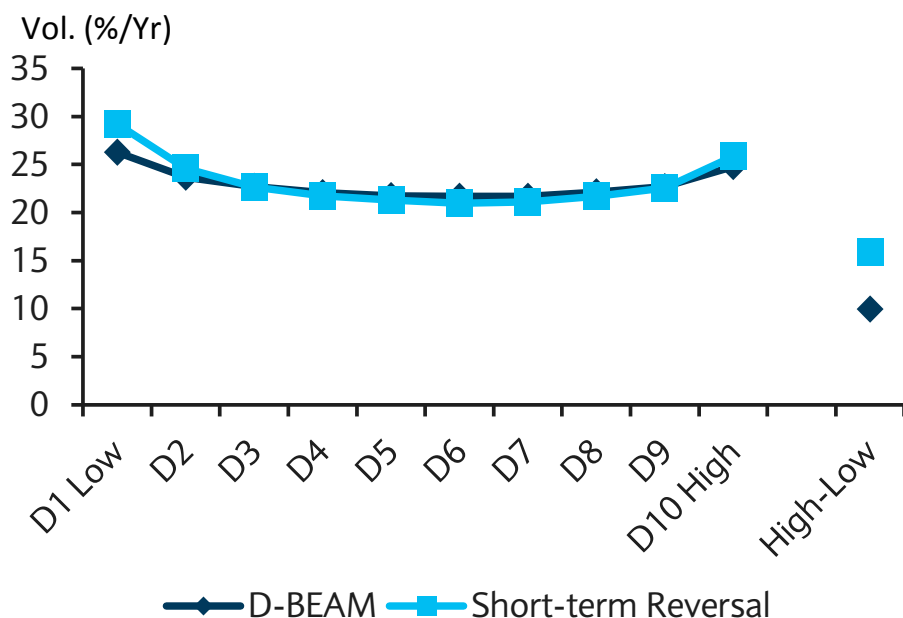


Source: Compustat, Barclays Research

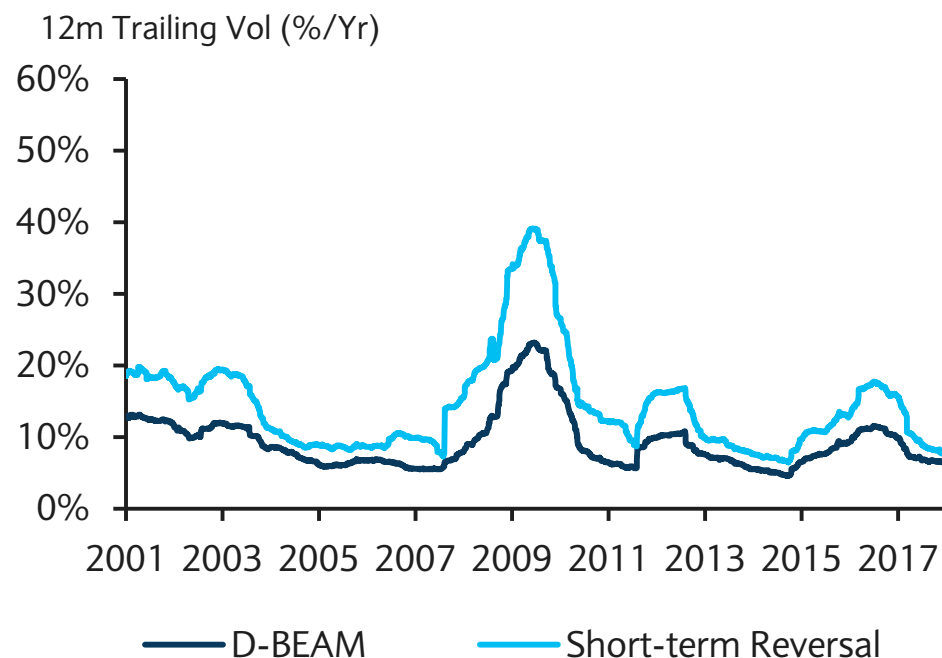
D-BEAM Volatility is Consistently Lower than ST Rev. Vol.

- The vol. of the decile portfolios is similar irrespective of the signal source
- However, D-BEAM vol. is about half that of the L/S ST REV port. not only on avg. but in each 36-month period
- D-BEAM consistent lower vol. reflects the tendency of the bond signal to generate long and short portfolios with similar factor exposures

**D-BEAM and Short-term Rev. Vol. by Decile
(EW, Within Industries, Jan. 2001 – Dec. 2017)**



**D-BEAM and Short-term Rev. 12-m Vol. of daily returns
(EW, Within Industries, Jan. 2001 – Dec. 2017)**

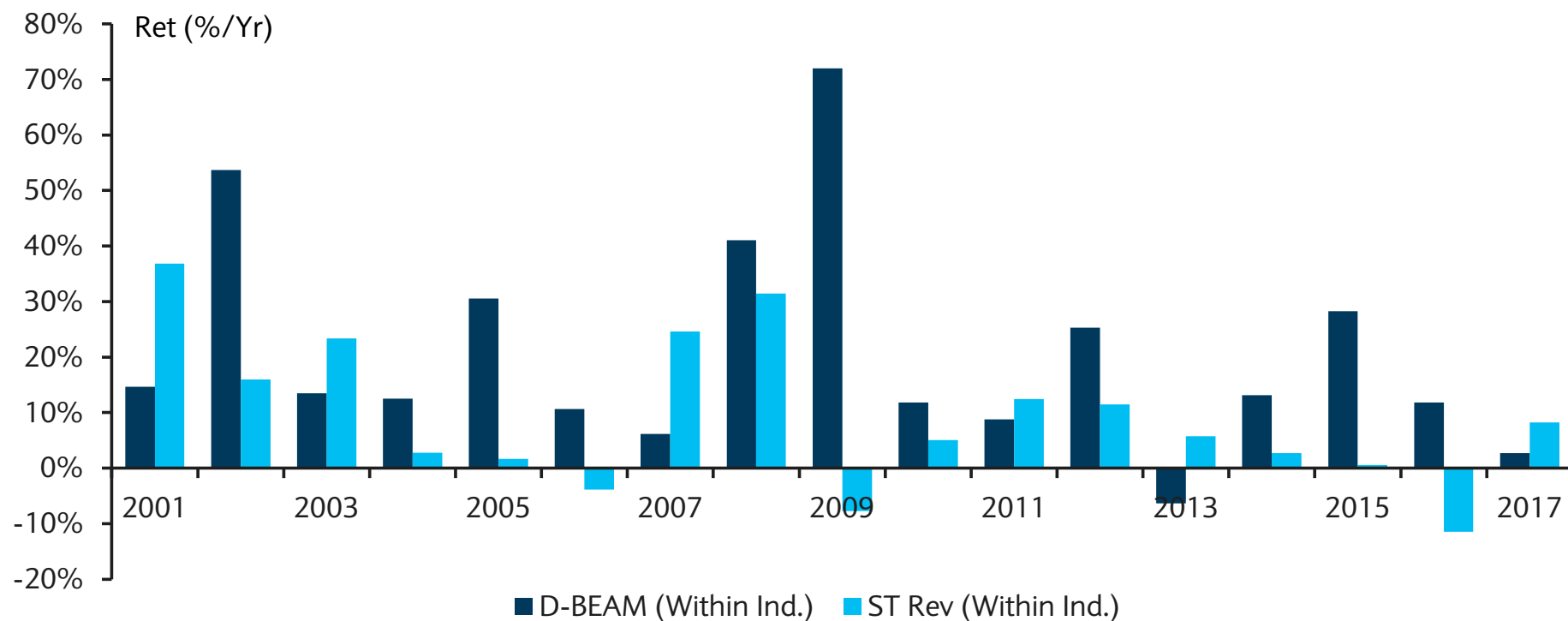


Note: D-BEAM is defined as D10-D1, whereas Short-term Reversal is defined as D1-D10. Source: Compustat, Barclays Research

D-BEAM Annual Returns Dynamics

- D-BEAM avg. returns have been positive almost every year since 2001 (the only exception was in 2013)

D-BEAM and ST Rev Ret. (EW, Within Industries, Jan. 2001 - Dec. 2017)



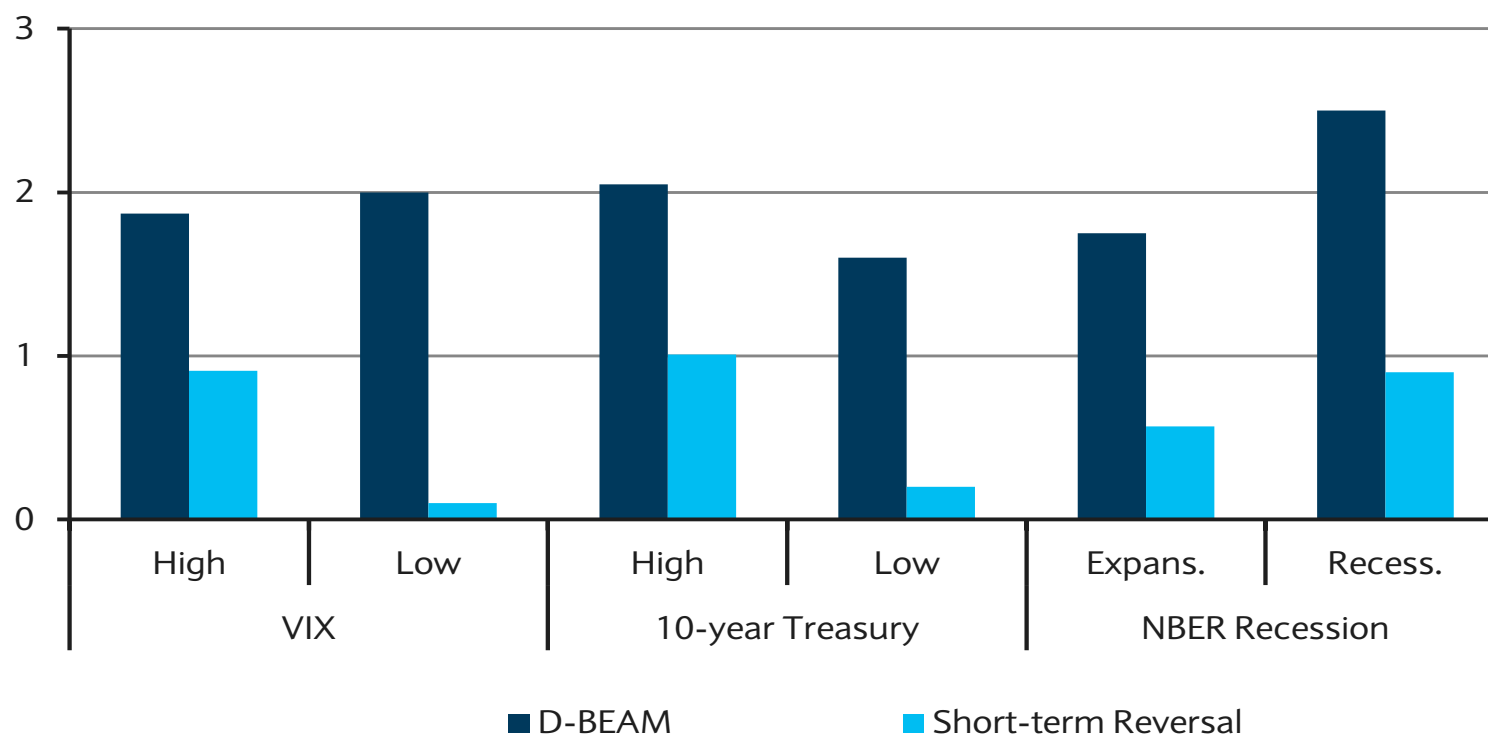
Source: Compustat, Barclays Research

D-BEAM Inf. Ratio is higher than ST Rev Irrespective of Market State

- BEAM information ratio is higher than ST Rev information ratio irrespective of market conditions

D-BEAM and ST Rev Return by Market state (EW, Within Industries, Jan. 2001 - Dec. 2017)

Inf. Ratio (ann.)



Note: The High (Low) level of VIX is above (below) its median (17.2% in the sample 2001-17). The High (Low) level of the 10-year Treasury rate is above (below) its median (3.47% in 2001-17). The recession and expansion are classified by the NBER. Source: Compustat, NBER, Barclays Research

D-BEAM Has Low Correlation with Daily Risk Factors

- D-BEAM factor has
 - Very low (level and rank) correlation with other existing factors
 - moderately positive correlation with equity momentum
 - negative correlation w/ short-term reversal
- Equity momentum has negative correlation w/ short-term reversal factor

Pair-wise Correlation of Daily Factor Returns
 (Top Triangle – Pearson/Level, Bottom Triangle: Spearman/Rank)
 (EW, Jan. 2001 - Dec. 2017)

	Mkt - Rf	SMB	HML	CMA	RMW	MOM	ST Rev	Daily ST Rev	D-BEAM
Mkt - Rf		0.16	0.19	-0.20	-0.43	-0.40	0.30	0.19	-0.14
SMB	0.27		0.12	0.09	-0.25	0.00	0.01	0.02	0.03
HML	0.05	0.06		0.35	-0.14	-0.29	0.03	0.03	-0.07
CMA (Investment)	-0.08	0.07	0.39		0.11	0.24	-0.23	-0.09	0.09
RMW (Profitability)	-0.39	-0.27	-0.10	-0.07		0.38	-0.18	-0.13	0.10
MOM (Monthly)	-0.17	0.06	-0.09	0.08	0.25		-0.22	-0.07	0.08
Short-term Reversal	0.14	0.01	-0.03	-0.08	-0.09	-0.14		0.44	-0.33
Daily ST Rev (EW, Within Ind.)	0.10	0.05	0.00	-0.02	-0.09	-0.04	0.28		-0.37
D-BEAM (EW, Within Ind.)	-0.03	0.05	0.00	0.05	0.00	0.05	-0.18	-0.25	

Note: The sample period is Jan. 2001 – Dec. 2017. The ranking window for D-BEAM and Daily ST Rev is 3 days. “Short-term Reversal” factor is based on 21-day ranking window. The level (Pearson) correlation is reported in the upper triangular matrix, the rank (Spearman) correlation is reported in the lower triangular matrix. Source: Compustat, Ken French data library, Barclays Research

D-BEAM Generated Significant Alpha Even after Controlling for Other Risk Factors

- D-BEAM Alpha was significant and economically meaningful (about 20% per year)
- ST Rev. generated lower Alpha that was only marginally significant

**Alpha (%/y) of D-BEAM and ST Rev Portfolios
(EW, Across and Within Industries, top-bottom deciles, Jan. 2001 – Dec. 2017)**

	Across industries		Within industries	
	D-BEAM	ST Rev	D-BEAM	ST Rev
Raw returns	15.6***	9.2*	18.2***	9.8**
CAPM	16.4***	7.6	18.8***	8.5**
FF3	16.1***	7.7	18.6***	8.6**
FF3+Mom+ST_Rev	20.9***	-1.7	21.5***	2.1
FF5	15.5***	9.4*	17.8***	9.8**

Note: The sample period is Jan. 2001 – Dec. 2017. The ranking window is three days. The superscripts ***, **, and * indicate statistical significance at the 1%, 5% and 10% level. Source: Compustat, Ken French data library, Barclays Research

D-BEAM Factor Loadings are Small

- D-BEAM did not exhibit significant loadings on the Fama-French risk factors
- Small negative loading on Equity Short-Term Reversal factor

Daily regression of D-BEAM on various risk factors (EW, Within Industries, top-bottom deciles, Jan. 2001 - Dec.2017)

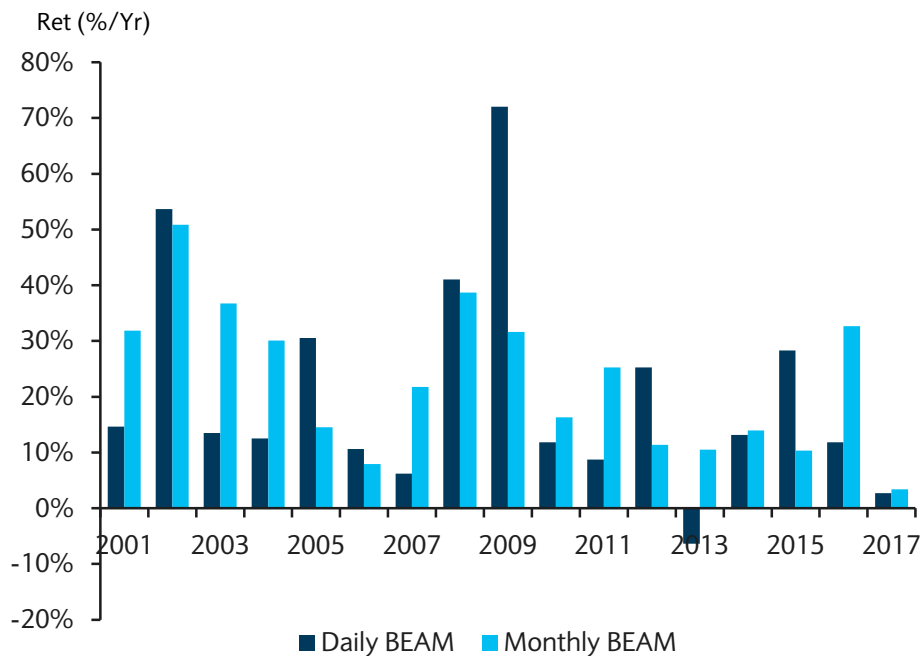
Intercept	18.8***	18.6***	21.5***	17.8***
Mkt - Rf	-0.07***	-0.07***	-0.03	-0.05**
SMB		0.07*	0.06*	0.07**
HML		-0.05	-0.06*	-0.08
Mom			-0.02	
Short-Term Rev.			-0.12***	
CMA				0.15**
RMW				0.08*
Adj. R ²	1.9%	2.4%	11.3%	3.3%

Note: The sample is Jan. 2001 - Dec. 2017. The ranking window is three days. The superscripts ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.. Source: Compustat, Ken French data library, Barclays Research

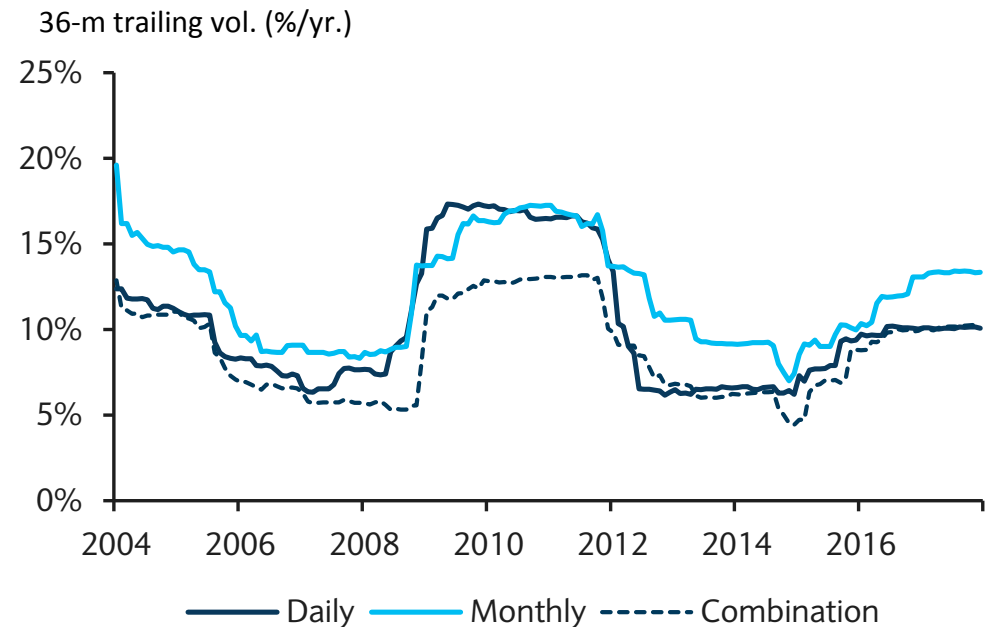
Combining Monthly and Daily BEAM Led to Lower Vol

- D-BEAM returns were high when monthly beam returns were low
- The correlation between daily and monthly BEAM (based on monthly returns) was 22%
- 36-month trailing vol. of the combined factor (half daily + half monthly) is usually lower than daily or monthly BEAM trailing vol. in isolation

Ret. of Daily and Monthly BEAM by year
(EW, within ind., Jan. 2001 – Dec. 2017)



Trailing 36-month Vol. of Daily and Monthly
BEAM returns (EW, Within industries, top-
bottom deciles)



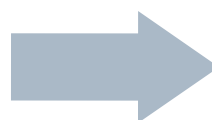
Source: Compustat, Barclays Research

Is the efficacy of the BEAM signal affected by Bond Liquidity?

- To quantify bonds' liquidity, we employ **Trade Efficiency Scores (TES)**

Bond Trading Volume (TRACE)

Decile 1 – Highest Decile 10- Lowest



Sum is Mapped to
Trade Efficiency Scores
(TES: bond-level liquidity ranking)
1 – Best Trading Efficiency
10 – Worst Trading Efficiency

LCS (Liquidity Cost Score)

The cost of an immediate, institutional-size, round-trip transaction, expressed as a percent of the bond's price*)

Quintile 1 – Lowest bid/ask

Quintile 5 – Highest bid/ask

* Note: LCS is calculated as

- $OASD \times (\text{Bid spread} - \text{Ask spread})$ *if quoted on spread*
- $(\text{Ask price} - \text{Bid price}) / \text{Bid price}$ *if quoted on price*

LCS was launched in October 2009 for USD IG and HY corporate bonds, with history available from January 2007. Currently, LCS is computed for ~20,000 bonds, published by Barclays QPS Research (see [Konstantinovsky, Ng, and Phelps, 2015](#); [Konstantinovsky, 2017](#) for more details)

LSC Quintile + Volume Decile	TES
2 and 3	1
4 and 5	2
6	3
7	4
8	5
9	6
10	7
11	8
12	9
13 to 15	10

Restricted - External

BEAM Performance Is Better for More Liquid Bonds

We construct three TES categories:

1. “Low TES” (the most liquid segment of IG and HY bonds)
 2. “Medium TES”
 3. “High TES” (the least liquid bonds)
- BEAM performance increases with the liquidity of the bond, with an ann. return of 9.5%, and an ann. inf. ratio close to 1 for the most liquid bonds
 - Including other bonds in the universe still improved BEAM performance

Conditional Double Sort (EW, within industries, Feb. 2007 - Dec. 2017)

TES x D-BEAM						D-BEAM Performance (EW, Within industry, Top - Bottom Decile, Feb. 2007 -Dec. 2017)	
		Conditional Sort on D-BEAM					
	First Sorting Dimension	Low	Medium	High	H-L		
Avg. Ret (%/Yr)	Low TES (liquid)	6.2	10.5	15.7	9.5	Avg. Ret (%/Yr)	17.1
Vol. (%/Yr)		27.8	24.6	25.9	10.1	Vol. (%/Yr)	10.5
Sharpe (Inf.) Ratio (Ann.)		0.12	0.33	0.49	0.94	Inf. Ratio (Ann.)	1.62
Avg. Ret (%/Yr)	Medium TES	11.4	10.9	16.0	4.6		
Vol. (%/Yr)		26.1	23.9	25.4	7.5		
Sharpe (Inf.) Ratio (Ann.)		0.33	0.37	0.54	0.62		
Avg. Ret (%/Yr)	High TES (illiquid)	13.2	17.2	17.2	4.0		
Vol. (%/Yr)		26.3	25.0	25.7	6.9		
Sharpe (Inf.) Ratio (Ann.)		0.42	0.59	0.58	0.58		

Source: Compustat, Barclays Research

Summary of Key Results

- Bond information is useful for equity momentum strategies at a daily frequency
- **Unlike equities, there is no mean-reversion in equity returns based on daily bond signals**
- The use of daily bond signals delivered:
 - + Annual avg. return of 18% and inf. ratio of 1.8 starting in 2001
 - + Positive returns in all years but one (2013) during the sample period
 - + Diversification to standard risk factors with highly significant alpha
 - + Possible enhancement to monthly BEAM when combined in a portfolio setting
- Consistent with prior results, ranking within industries leads to better performance compared with ranking across industries
- D-BEAM (L/S portfolio) vol is half that of the long or short portfolios in isolation, unlike when using equity signals to construct an equity momentum strategy
- Bond signal efficacy improves with bonds' liquidity

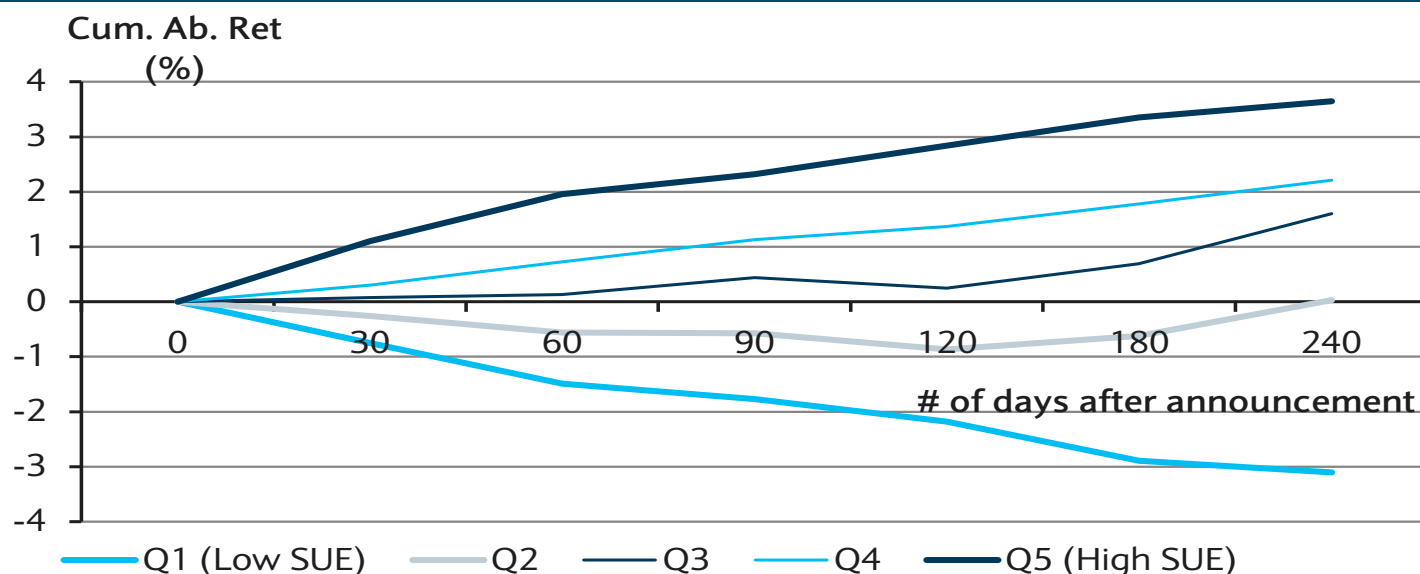
Using Credit Information to Improve PEAD Strategies

(Work in Progress)

The Post-Earnings Announcement Drift (PEAD)

- Ball and Brown (1968): sort firms on **SUE** (**S**tandardized **U**nexpected **E**arnings) as a measure of earnings surprise
$$= \frac{(EPS_{i,q} - EPS_{i,q-4}) - \mu(\Delta EPS)_{i,q-1_to_q-8}}{\sigma(\Delta EPS)_{i,q-1_to_q-8}}$$
- Firms with large pos. SUEs outperform in the subsequent 9-12 months, and vice versa
- A port. long (short) in stocks with the highest (lowest) earnings surprises provides a monthly return of 90bp/month [Chordia and Shivakumar (2006)]
- Widely confirmed in subsequent studies, including outside the US [Liu, Strong, Xu (2003), Gerard (2012), Griffin, Kelly, and Nardari (2010)]

Cum. Abnormal Returns of SUE Quintiles (1989-2004, EW, adj. for size and B/M)

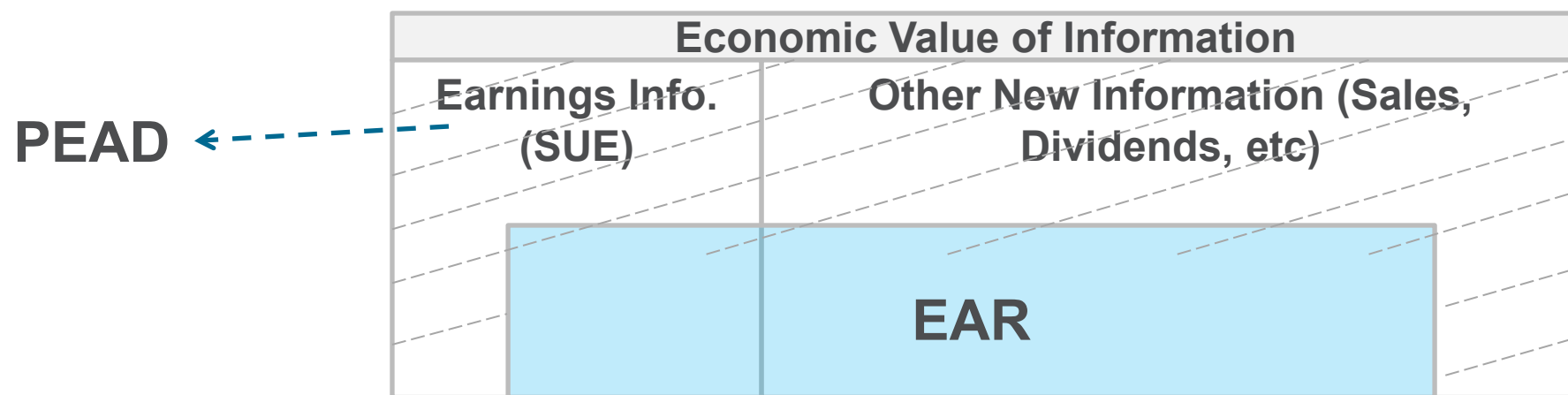


Note: Universe includes all CRSP stocks (excluding OTC and ADR) with price ≥ 5 the day before the announcements. SUE are computed as the current year-to-year earnings change minus the average earnings change in the past eight quarters, standardized by the std. of earnings change in the past eight quarters. Quintile breakpoints were determined based on previous quarter SUE values.

Source: Barclays Research, Compustat

Earning Announcement Return (EAR): An Alternative Measure

- Financial reports also include information on items only partially related to innovation in earnings (sales, free cash flow), as well as possibly future guidance, changes in dividend policy, and business strategy
- Jegadeesh and Livnat (2006): Combining earnings and sales surprises leads to stronger post-earnings announcement drift
- Brandt, Kishore, Santa-Clara, and Venkatachalam (2008) use EAR to measure market reaction to all new information during announcements
- $EAR_{i,q} = \prod_{d=t-1}^{t+1} (1 + R_{i,d}) - \prod_{d=t-1}^{t+1} (1 + FF_d)$, cumulative returns during earnings announcement window $[-1, 1]$ using the 25 Fama-French size and B/M portfolios



EAR and SUE Capture Different Information

- Firms were divided into 5x5 EAR-by-SUE buckets (SUE and EAR quintile breakpoints were determined independently from previous-quarter distribution)
- SUE and EAR measures exhibit low correlation: the overall rank correlation is 0.16
- Within SUE quintiles, sorting on EAR lead to positive subsequent abnormal ret spread over all horizons

Subsequent Cumulative Abnormal Return of EAR Q5 – EAR Q1 In each Independently sorted SUE Quintiles (1989-2004, EW)

	SUE Q1	SUE Q2	SUE Q3	SUE Q4	SUE Q5
30 days	1.23	0.99	1.02	1.77	2.28
60 days	2.21	2.68	2.34	3.3	3.86
90 days	2.21	3.12	2.32	3.01	4.33
120 days	2.66	3.02	2.95	3.85	5.35
180 days	4.3	4.47	4.36	5.11	7.08
240 days	3.89	5.91	6.51	6.67	8.14

Source: Compustat, Barclays Research

Magnitude of PEAD Has Declined in Recent Years

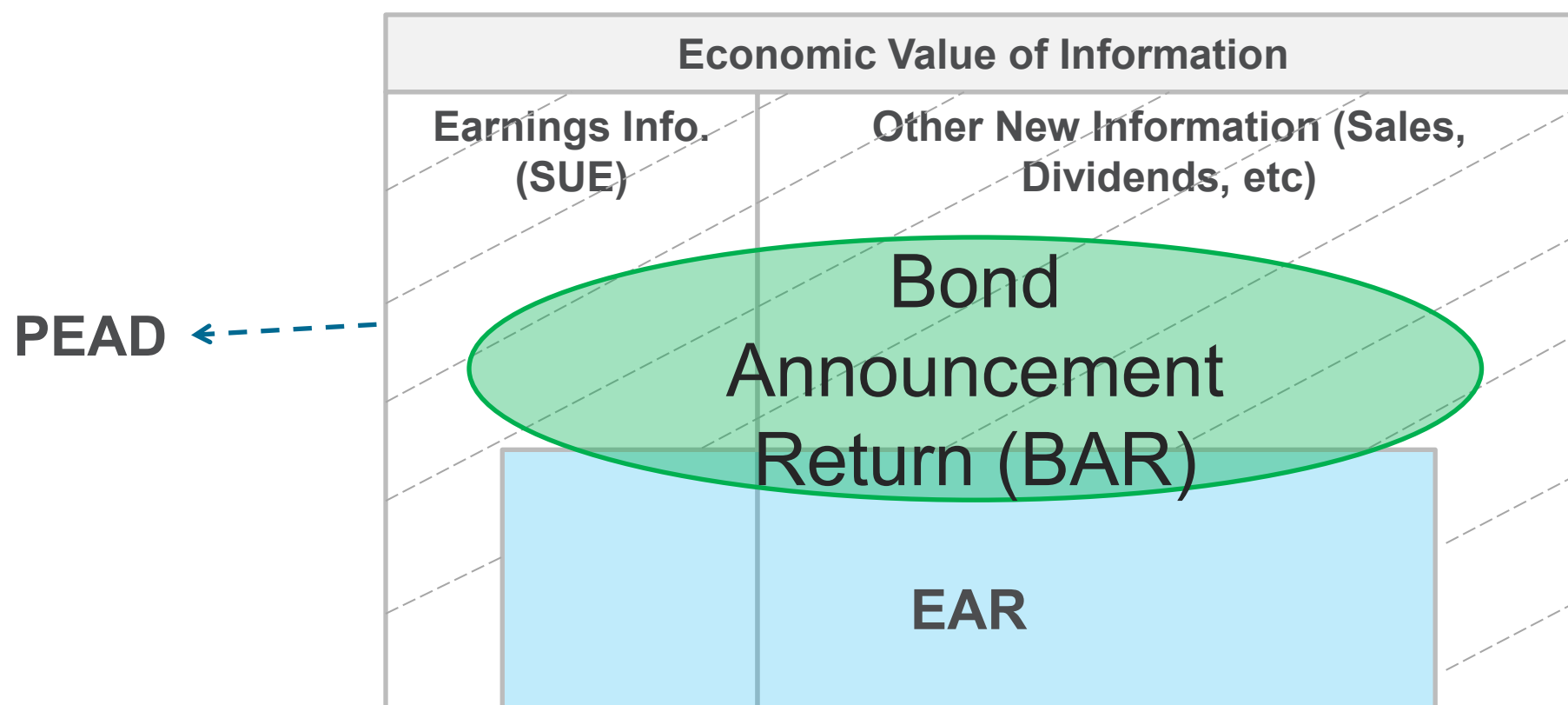
- The PEAD in the recent period (2005-16) has weakened significantly compared with the earlier one (1989-2004), particularly for horizons beyond 30 days after the earnings announcement, regardless of the measure

PEAD Abnormal Returns (EW) by Period and Measure									
PEAD Abnormal Returns (%) Based on SUE QUINTILES									
2005-2016							1989-2004		
Trading days following earnings announcement	Q1 (Low SUE)	Q2	Q3	Q4	Q5 (High SUE)	Q5-Q1	Q1	Q5	Q5-Q1
30	-0.9	-0.5	-0.1	0.1	0.6	1.5	-0.8	1.1	1.9
60	-1.1	-0.6	0.0	0.2	0.8	1.9	-1.5	2.0	3.5
90	-1.7	-0.9	-0.1	0.1	0.6	2.3	-1.8	2.3	4.1
120	-2.0	-0.7	-0.1	0.3	0.8	2.7	-2.2	2.8	5.0
180	-2.4	-0.7	-0.2	0.3	0.5	2.9	-2.9	3.4	6.2
240	-2.6	-0.7	-0.1	0.3	0.6	3.2	-3.1	3.7	6.8
PEAD Abnormal Returns (%) Based on EAR QUINTILES									
Trading days following earnings announcement	Q1 (Low EAR)	Q2	Q3	Q4	Q5 (High EAR)	Q5-Q1	Q1	Q5	Q5-Q1
30	-0.7	-0.4	-0.3	0.0	0.5	1.1	-0.7	1.1	1.7
60	-1.0	-0.3	-0.2	0.2	0.6	1.5	-1.5	1.9	3.4
90	-1.3	-0.7	-0.5	0.2	0.4	1.6	-1.4	2.3	3.7
120	-1.4	-0.7	-0.5	0.4	0.5	1.9	-1.9	2.6	4.4
180	-1.8	-0.7	-0.8	0.5	0.4	2.2	-2.5	3.6	6.1
240	-2.3	-0.8	-0.6	0.5	0.6	2.9	-2.6	4.7	7.2

Source: Compustat, Barclays Research

Using Bond Announcement Return (BAR) as another indicator

- Similar to equity markets, bond markets react to all new information during earnings announcements
- Just as bond market signals have predictive power of future equity returns in BEAM at various frequencies, we expect bond investors to have valuable insights and incorporate the new information into bond prices during earnings announcements



PEAD For Stocks in Bond Universe Using EAR and SUE

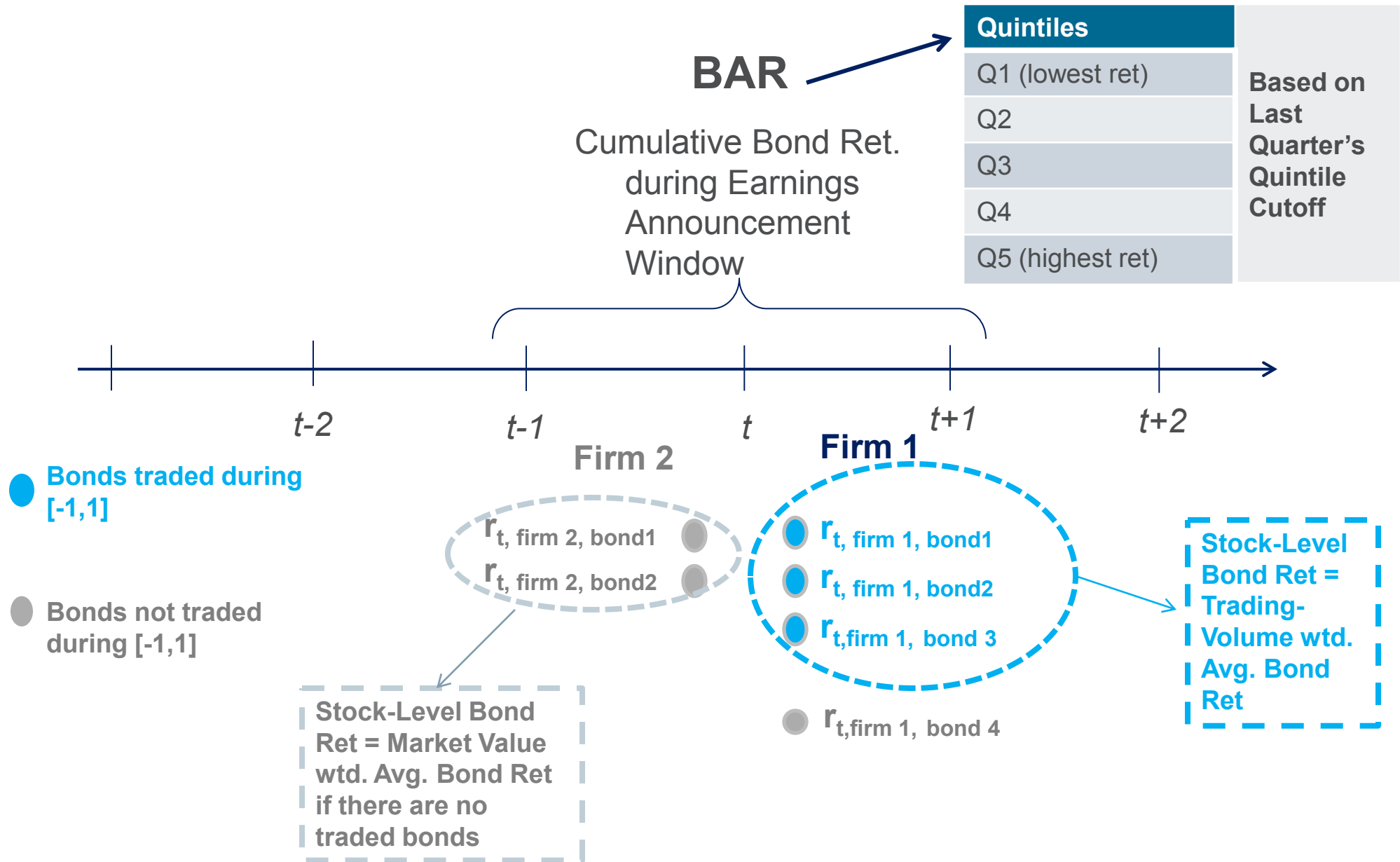
- Bond Universe: RUSSELL3000 stocks with outstanding debt (avg. 720 firms per quarter)
- EAR quintiles in the bond universe produced similar results as in the Russell 3000
- SUE quintiles in the bond universe produced less pronounced PEAD at longer horizon
- Consistent with [Ben Dor and Guan \(2017\)*](#), the degradation of PEAD is more evident for large caps and there is little drift after 90 days
- EAR results in stronger PEAD compared with SUE in the Bond Universe, similar to Brandt et al (2008), who find similar effects for large cap stocks

PEAD based on EAR and SUE in Bond vs. Russell 3000 Universe (%, subsequent abnormal ret. adj. for size and B/M, 2005 – 2017)												
	Q5-Q1				Q1				Q5			
	30d	90d	180d	240d	30d	90d	180d	240d	30d	90d	180d	240d
EAR Quintiles												
Russell 3000	0.84	0.62	1.37	1.96	-0.23	-0.40	-1.48	-2.33	0.62	0.22	-0.11	-0.36
Bond Universe	0.97	0.93	1.13	1.28	-0.25	0.08	0.36	0.17	0.72	1.01	1.50	1.44
SUE Quintiles												
Russell 3000	1.23	1.25	1.34	1.58	-0.49	-0.92	-1.64	-2.16	0.73	0.75	0.33	0.20
Bond Universe	0.86	0.68	-0.21	-0.69	-0.43	-0.40	0.33	0.65	0.43	0.27	0.12	-0.04

Source: Compustat, Barclays Research

* Note: Ben Dor, A. and J. Guan (2017). [The Post-Earnings-Announcement Drift \(PEAD\): Has the Market Finally Caught Up?](#) Barclays Live , May 2017

Constructing Bond Announcement Return (BAR)



Bond and Equity Market Reactions Had Low Correlations

- BAR and EAR quintile ranks have low correlation of 0.11
- Within each BAR quintile, EAR's Q5-Q1 have a small but positive BAR spread – consistent with low correlation between the two signals

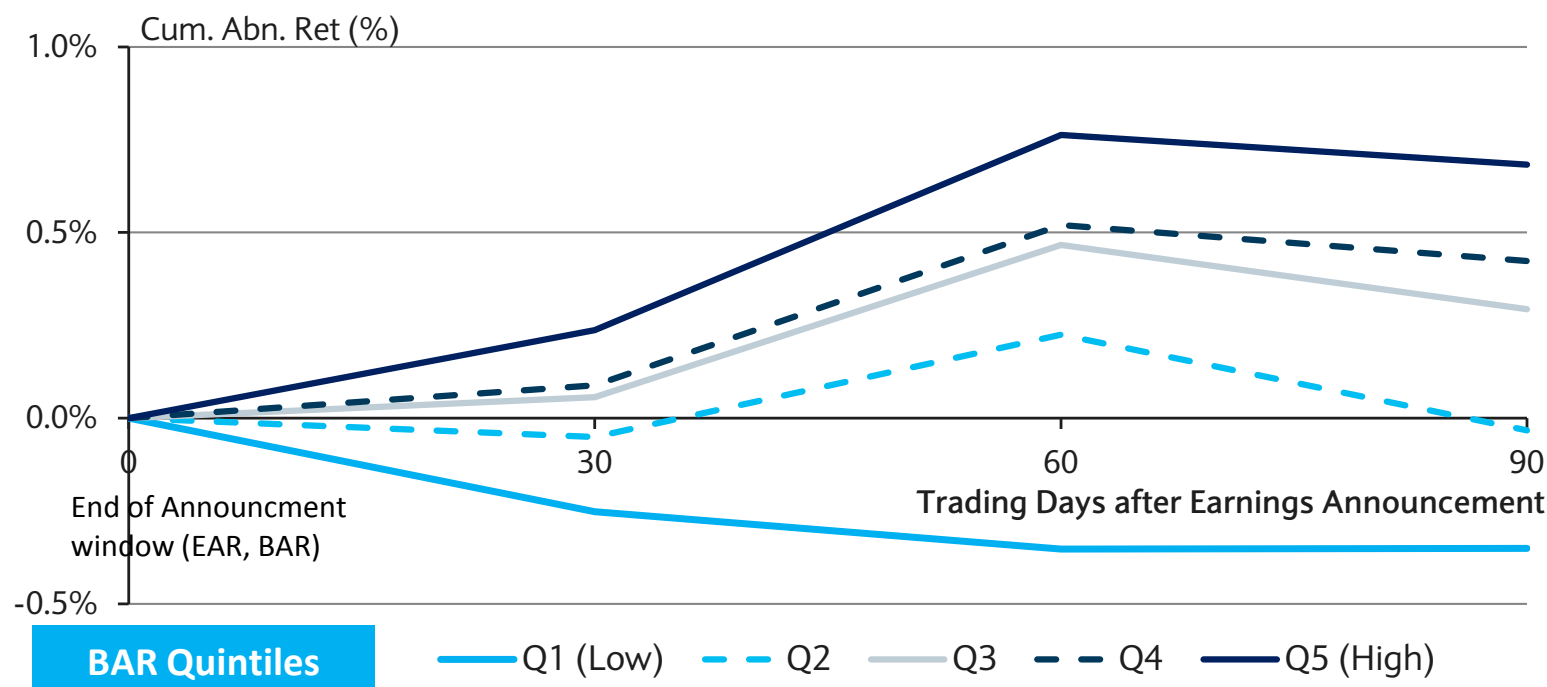
Average BAR [-1,1] during announcement window in 5x5 BAR-by-EAR Buckets (% , EW, 2005-2017)						
	EAR Q1 (Low)	Q2	Q3	Q4	EAR Q5 (High)	EAR Q5-Q1
BAR Q1 (Low)	-1.1	-0.6	-0.6	-0.6	-0.6	0.5
Q2	-0.1	-0.1	-0.1	-0.1	-0.1	0.0
Q3	0.1	0.0	0.0	0.0	0.1	0.0
Q4	0.3	0.2	0.2	0.2	0.3	0.0
BAR Q5 (High)	0.9	0.7	0.7	0.8	1.2	0.3
BAR Q5 - Q1	2.0	1.3	1.3	1.4	1.8	

Source: Compustat, TRACE, Barclays Research

The Relation between BAR and PEAD

- Due to the degradation of PEAD in recent years, especially in large cap stocks, the analysis was focused on 30/60/90 day post announcement horizon
- Cumulative abnormal return generated by BAR Q5 is 1.03% higher than that of BAR Q1 in the 90 subsequent trading days after earnings announcements
- PEAD increased monotonically with the level of BAR over the 90 days following earnings announcements

Subsequent Cum. Abnormal Ret. based on BAR Quintiles (% , EW 2005 – 2017)



Source: Compustat, TRACE, Barclays Research

BAR Improved the Efficacy of SUE and EAR

- **Composite Score** = Average of EAR, SUE, and BAR quintile ranks
- Stocks were assigned into quintiles based on their Composite Scores using previous quarter's Composite Score cutoffs
- Employing the Composite Score generated higher Q5-Q1 returns than using only individual earnings surprises measures or a composite score based only on EAR and SUE (EAR+SUE)*

PEAD Cum. Abnormal Returns (%) Based on Composite Score (EW, 2005-2017)				
Trading Days After Earnings Announcement				
		30	60	90
EAR	Q5-Q1	0.97***	0.72	0.93
SUE	Q5-Q1	0.86**	1.21*	0.68
EAR+SUE	Q5-Q1	1.24***	1.04	0.49
BAR	Q5-Q1	0.49	1.12***	1.03**
Composite Score (EAR+SUE+BAR)	Q5-Q1	1.19***	1.65**	1.55
	Q1 (Low)	-0.64	-0.80	-0.73
	Q2	-0.07	0.19	0.11
	Q3	0.08	0.44	0.11
	Q4	0.16	0.58	0.11
	Q5 (High)	0.56	0.85	0.82

*Note: EAR+SUE is the Avg. (EAR & SUE Quintile Ranking). Stocks are sorted into quintile buckets based on last quarter's EAR+SUE quintile cutoffs. The superscripts ***, **, and * indicate statistical significance at the 1%, 3% and 5% level. Source: Compustat, TRACE, Barclays Research

PEAD in Dynamic Portfolio Setting

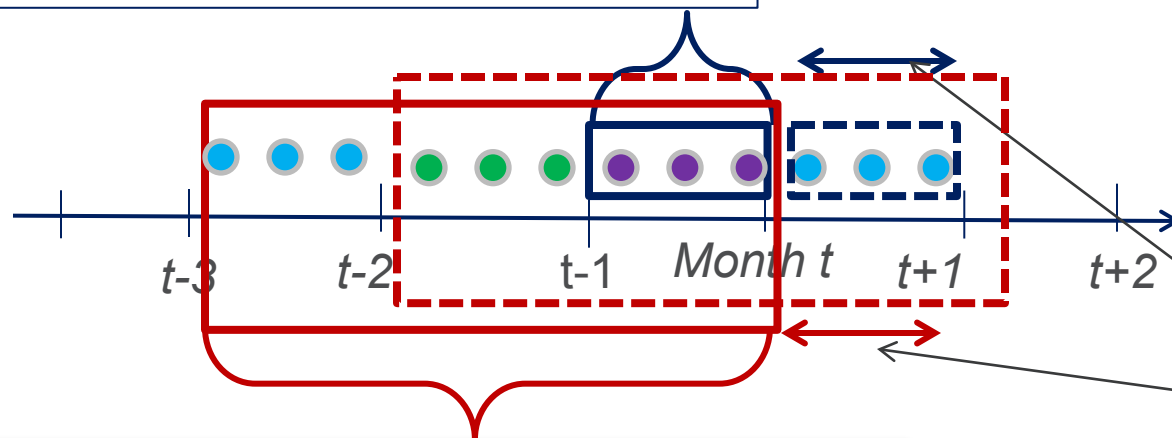
- Each month, there are different sets of firms making earnings announcements
- We investigated three look-back windows to determine stocks to include in the universe: 1M, 2M, and 3M
 - 1M: use more recent information, high turnover
 - 3M: use more stale information, lower turnover

Composition of L/S Portfolios formed on Composite Score (2005 – 2017)			
	1M	2M	3M
Turnover	200%	124%	70%
Avg. # of stocks (L+S)	107	213	310

Source: Compustat, TRACE, Barclays Research

1M Lookback Portfolio

At end month t , look at stocks that announced earnings in **that month**



3M Look-back Portfolio

At end month t , look at stocks that announced earnings in the **last 3 month ($t-2$ to t)**

Portfolio formation

- Assign stocks into buckets based on previous quarter's quintile cutoff of earnings measure
- **Construct L /S portfolios (Q5 – Q1)**
 - EW portfolios
 - Holding Period = 1M
- **Monthly Rebalancing** at the end of each month

The Composite Score Generated Better Performance

- The Composite Score generated
 - ✓ Higher returns
 - ✓ Higher information ratio
 - ✓ Better maximum DD
 than any individual earnings surprises measures and EAR + SUE combined
- Performance decreased as lookback horizon increased and information got more stale

Portfolio Performance (EW, 2005 – 2017)						
Lookback Window		Composite Score	EAR	SUE	BAR	EAR+SUE
1M	Avg. Ret (%/Yr)	9.88	4.67	8.60	4.77	4.46
	Vol. (%/Yr)	14.11	12.23	12.75	12.08	13.75
	Inf. Ratio (Ann.)	0.70	0.38	0.67	0.39	0.32
	Max. DD (%)	-19.10	-24.45	-36.69	-31.75	-43.03
2M	Avg. Ret (%/Yr)	5.68	0.73	4.20	2.88	-0.58
	Vol. (%/Yr)	10.43	10.01	8.67	6.45	12.67
	Inf. Ratio (Ann.)	0.54	0.07	0.48	0.45	-0.05
	Max. DD (%)	-30.46	-33.63	-28.30	-17.18	-51.00
3M	Avg. Ret (%/Yr)	3.56	0.31	2.10	2.36	-0.14
	Vol. (%/Yr)	10.06	9.22	8.17	6.56	11.09
	Inf. Ratio (Ann.)	0.35	0.03	0.26	0.36	-0.01
	Max. DD (%)	-30.09	-33.61	-32.85	-16.72	-41.92

Source: Compustat, TRACE, Barclays Research

BAR Added Value Even after Controlling for Risk

- Composite Score produces highest and most statistically significant alphas, regardless of the lookback period

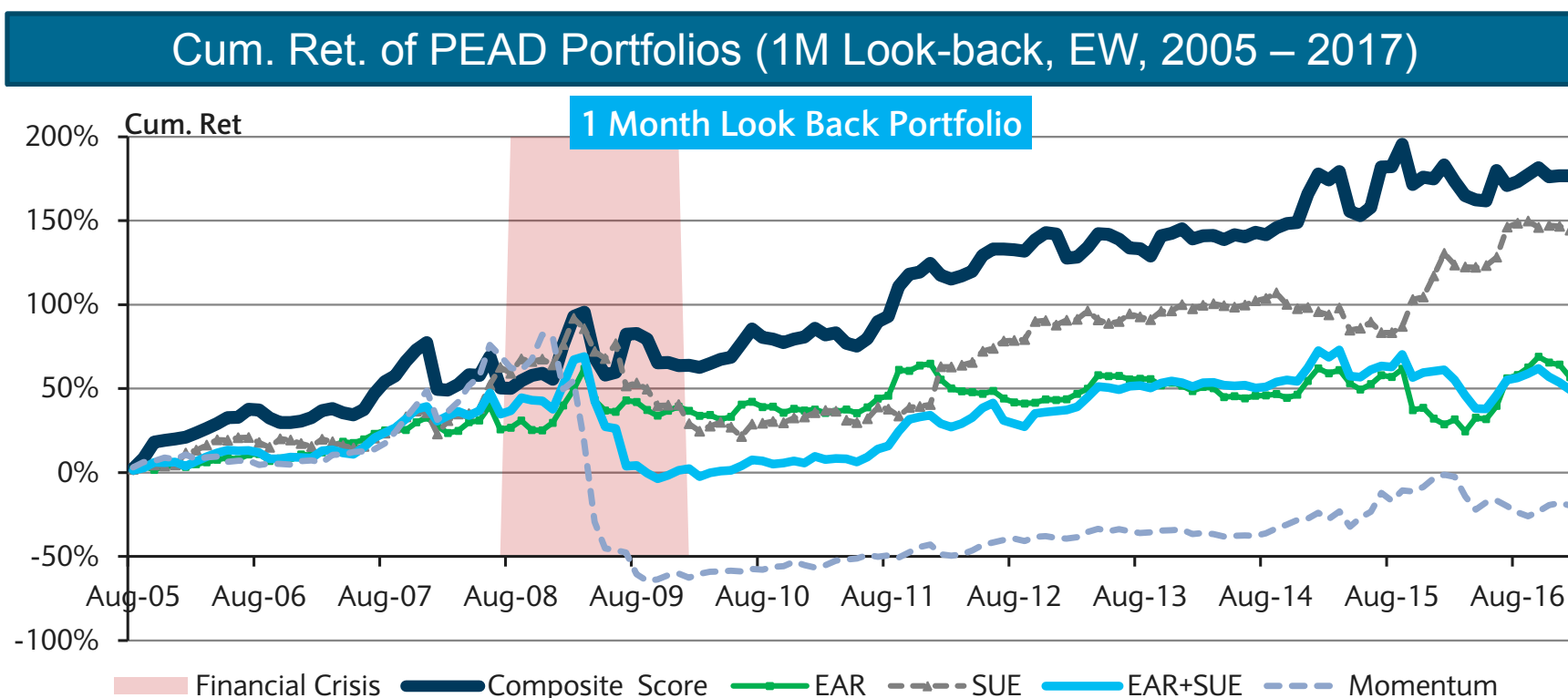
Risk Model Regressions for PEAD Portfolios
(Dep. Var.: monthly PEAD portfolio ret (%), EW, 2005 – 2017)

LookBack Period	Composite Score			SUE			EAR			BAR			EAR+SUE		
	1M	2M	3M	1M	2M	3M	1M	2M	3M	1M	2M	3M	1M	2M	3M
Alpha	0.99***	0.7***	0.46**	0.81**	0.45***	0.22	0.53	0.24	0.20	0.57	0.34**	0.27	0.61*	0.22	0.20
MKT-Rf	-0.12	-0.18***	-0.15***	-0.05	-0.07	0.00	-0.15	-0.13*	-0.14***	-0.15	-0.09	-0.1**	-0.25***	-0.26***	-0.2***
SMB	-0.16	-0.09	-0.06	0.26	0.07	0.05	0.08	-0.10	-0.10	-0.23	-0.03	-0.04	0.09	-0.04	-0.08
HML	-0.17	-0.07	-0.07	-0.08	-0.05	-0.10	-0.10	-0.03	-0.02	0.16	0.11	0.05	-0.18	-0.12	-0.10
RMW	-0.34	-0.39**	-0.29*	-0.11	-0.19	-0.15	-0.12	-0.23	-0.22	-0.20	-0.14	-0.07	-0.26	-0.27	-0.26
CMA	0.18	0.04	0.18	-0.07	-0.06	0.02	-0.14	-0.01	-0.03	-0.02	-0.08	0.15	-0.12	-0.22	-0.09
MTM	0.34***	0.36***	0.38***	0.26***	0.36***	0.33***	0.15	0.28***	0.3***	0.18***	0.13***	0.13***	0.35***	0.41***	0.39***

Note: The superscripts ***, **, and * indicate statistical significance at the 1%, 3% and 5% level. Source: Compustat, TRACE, Barclays Research

BAR Inclusion Led to Consistent Performance over Time

- The 1M portfolio constructed from **Composite Score** consistently produced higher and less volatile returns than each individual earnings surprises measures or EAR+SUE combined score over time
- The portfolio based on Composite Score also had lower DD in the financial crisis
- The Composite Score portfolio had more steady performance than the standard momentum portfolio*

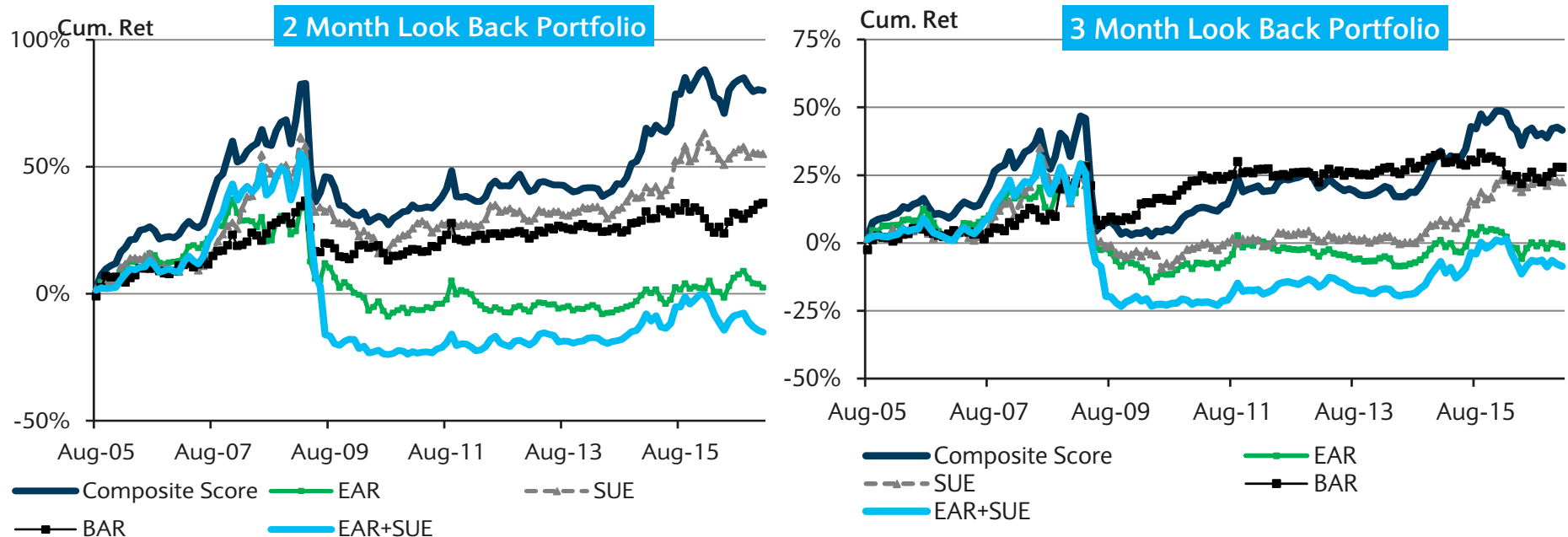


Note: The momentum portfolio return are the EW top –bottom decile momentum portfolio from Ken French's data library. Source: Compustat, TRACE, Ken French Data Library, Barclays Research

Performance Deteriorated for Longer Look-Back

- With 2M and 3M lookback windows, the portfolio constructed from **Composite Score** still produced higher returns than each individual earnings surprises measures or EAR+SUE combined score over time, but the overall cumulative returns were much smaller

Cumulative Return of PEAD Portfolios (2M and 3M Lookback, EW, 2005 – 2017)



Source: Compustat, Barclays Research

Composite Score Retained Its Efficacy after Controlling for Size

- The Composite Score also had larger and more significant alpha than the other two measures in the large cap sub-sample (members of bond universe that are constituents of Russell 1000)

Risk Model Regressions for **Large Cap** (Russell 1000) PEAD Portfolios
(Dep. Var.: monthly PEAD portfolio ret (%), EW, 2005 – 2017)

	Composite Score			SUE			EAR		
LookBack Period	1M	2M	3M	1M	2M	3M	1M	2M	3M
Alpha	0.96***	0.57***	0.33*	0.64	0.44**	0.25	0.72**	0.27	0.12
MKT-Rf	0.01	-0.16**	-0.11*	-0.04	-0.08	-0.02	-0.08	-0.12	-0.10
SMB	-0.05	-0.09	-0.09	0.24	0.03	-0.01	0.09	-0.12	-0.09
HML	-0.16	0.00	-0.02	-0.02	-0.04	-0.10	0.01	0.04	0.02
RMW	-0.10	-0.35**	-0.29*	-0.05	-0.29*	-0.31*	-0.13	-0.20	-0.13
CMA	0.18	0.02	0.11	-0.03	-0.06	0.03	0.04	0.00	-0.13
MTM	0.32***	0.37***	0.38***	0.22*	0.37***	0.36***	0.21***	0.29***	0.3***

Note: The superscripts ***, **, and * indicate statistical significance at the 1%, 3% and 5% level. Source: Compustat, TRACE, Barclays Research

Credit Signal Added Value in Recent Period

- For 2010-17, EAR, SUE, or the combined score (EAR+SUE) did not show statistically significant alphas
- Composite Score still generated economically and statistically significant alpha in this period

Risk Model Regressions for PEAD Portfolios in Recent Period (Dep. Var.: monthly PEAD portfolio ret (%), EW, 2010 – 2017)

LookBack Period	Composite Score			SUE			EAR			BAR			EAR+SUE		
	1M	2M	3M	1M	2M	3M	1M	2M	3M	1M	2M	3M	1M	2M	3M
Alpha	0.74**	0.51**	0.45**	0.40	0.11	0.16	0.49	0.20	0.22	0.23	0.33	0.27	0.60	0.24	0.29
MKT-Rf	-0.2**	-0.19***	-0.15***	0.21	0.03	0.03	-0.32***	-0.21***	-0.15***	-0.02	-0.1*	-0.07	-0.21**	-0.24***	-0.19***
SMB	-0.08	-0.02	0.05	0.05	0.05	0.09	0.28	0.08	0.06	-0.05	0.03	-0.01	0.20	0.05	0.08
HML	0.02	-0.23	-0.26**	-0.04	-0.04	-0.13	-0.11	-0.38***	-0.33***	0.28	0.07	0.05	-0.09	-0.31**	-0.28**
RMW	0.02	-0.09	-0.03	0.19	-0.03	0.04	0.03	-0.03	-0.09	0.17	0.00	-0.08	0.08	-0.10	0.01
CMA	0.20	0.22	0.4**	0.25	0.06	0.24	0.04	0.20	0.20	-0.40	-0.07	0.05	0.11	0.16	0.28
MTM	0.44***	0.24***	0.2***	0.06	0.33***	0.27***	0.13	0.06	0.07	0.28**	0.03	0.05	0.36***	0.29***	0.24***

Note: The superscripts ***, **, and * indicate statistical significance at the 1%, 3% and 5% level. Source: Compustat, TRACE, Barclays Research

Concluding Remarks

Summary

- ❖ BEAM strategy outperformed Equity Momentum out of sample since its introduction in 2014
- ❖ All the main features of the BEAM strategy are also evident in European markets
- ❖ The use of daily bond signals delivered an annual average return of 18% and an information ratio of 1.8 starting in 2001. Moreover, they continued to generate momentum patterns, while equity returns exhibited mean-reversion at higher frequency
- ❖ Using bond signals also improved the efficacy of traditional PEAD measures

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