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Using Relative Value and Equity Momentum Scorecards for Systematic Investing in Credit

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ESP and EMC Scorecards

- We publish quantitative scorecards for issuer selection in credit markets
 - Relative Value: *Excess Spread over Peers* (ESP)
 - Cross-Asset Momentum: *Equity Momentum in Credit* (EMC)
- Coverage: US IG, US HY, Euro IG, GBP IG/HY



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Quantitative P

Excess Spread over Peers (ESP) Scorecard – December 2019

- Excess Spread over Peers (ESP) is a quantitative filter designed to identify relative value opportunities in corporate bonds while controlling for issuer characteristics and fundamentals.
- In December, the performance of the ESP Scorecard was positive across markets. Top-quintile ESP portfolios outperformed their bottom-quintile peers by 44bp in US IG, by 213bp in US HY and by 30bp in Euro IG.
- Over the past 10 years, top-quintile outperformed bottom-quintile ESP portfolios by 3.79%/yr in US IG, 4.08%/yr in US HY B-Ba and by 2.46%/yr in Euro IG Senior, before transaction costs, with information ratios above 1.8. Performance over the next 12 months has been stronger than the long-term average.

Step 2: In the second step, the issuer fundamental data using Investors can use the ESP Scorecard relative value opportunities in fundamental analysis and in core Momentum Strategies into Credit

QPS Research publishes the scores are made available to investors. Figure 1 provides summary performance of US IG Senior, and US HY B-Ba ESP Score. Figure 1 reports returns

FIGURE 1
ESP Scorecard Performance: Top (Q5) vs. Bottom (Q1) EMC Quintile Portfolios, %

Universe	Portfolio	Cum. Ex. Returns	Avg. Ex. Returns	Volatility	Information Ratio
US IG	Index	1.19	2.44	6.19	2.06
	Q5	1.29	2.92	6.92	3.18
	Q1	1.16	2.15	4.67	-0.04
	Q5-Q1	0.13	0.75	2.15	3.22
US HY	Index	2.02	2.50	8.86	3.66
	Q5	1.80	2.20	9.53	6.11

Equity Momentum in Credit (EMC) Scorecard – December 2019

- The Equity Momentum in Credit (EMC) Scorecard is a quantitative filter designed to differentiate corporate issuers based on stock price momentum.
- In December, the EMC Scorecard performance was positive in the US IG and in the European markets, but negative in US HY. The top EMC portfolios (scores of 9 or 10) outperformed the bottom ones (scores of 1 or 2) by 13bp in US IG, by 8bp in Euro IG, and by 20bp in the sterling market. In US HY, the top EMC portfolio underperformed the bottom one by 81bp.
- Over the past 10 years, top-quintile EMC portfolios outperformed bottom-quintile ones by 4.93%/yr in US IG, by 8.90%/yr in US HY, by 2.65%/yr in Euro IG, and by

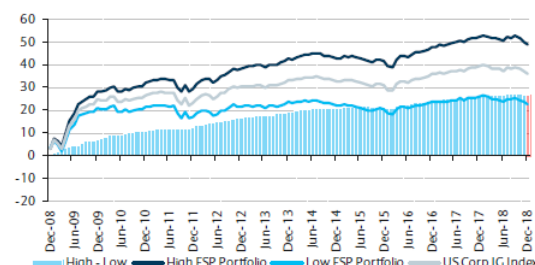
into the top-quintile portfolio (Q5), while bonds with scores of 1 or 2 for quintile portfolio (Q1). Figure 1 reports returns of top (Q5) and bottom portfolios over different periods ending 31 December 2019.

FIGURE 1
EMC Scorecard Performance: Top (Q5) vs. Bottom (Q1) EMC Quintile Portfolios, %

Universe	Portfolio	Cum. Exc. Returns, %			Avg. Exc. Returns, %/yr			Volatility, %/yr			Information Ratio
		1m	3m	12m	3Y	5Y	10Y	3Y	5Y	10Y	
US IG	Index	1.19	2.44	6.19	2.06	1.86	1.75	2.72	2.91	3.33	0.7
	Q5	1.29	2.92	6.92	3.18	3.77	3.65	2.94	3.18	3.46	1.0
	Q1	1.16	2.15	4.67	-0.04	-1.09	-1.28	2.87	3.42	4.01	-0.4
	Q5-Q1	0.13	0.75	2.15	3.22	4.86	4.93	0.80	1.47	1.89	4.0
US HY	Index	2.02	2.50	8.86	3.66	3.99	4.82	4.74	6.04	6.50	0.7
	Q5	1.80	2.20	9.53	6.11	9.35	8.87	3.99	7.69	6.94	1.5

ESP Scorecard for US IG Credit

FIGURE 2
US IG Corporate: Cumulative Excess Returns of Bond Portfolios with High and Low ESP Scores, %



Note: ESP scores are calculated at the beginning of each month for all bonds in Bloomberg Barclays US Corporate Index. The High ESP portfolio includes all bonds with above median scores, while the low ESP portfolio includes bonds with below median scores. Portfolios are rebalanced at the beginning of each month and capitalisation-weighted. All reported returns are in excess of duration-matched Treasury portfolios. Transaction costs are excluded. Source: Bloomberg, Barclays Research

In December, the ESP Scorecard showed negative results in the US IG universe (Figure 3). All rows of Figure 3 report excess returns of High over Low ESP (above

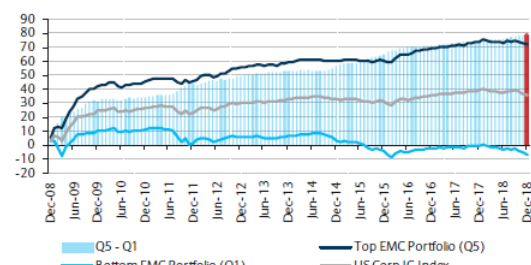
FIGURE 3
US IG Corporate: Performance of High and Low ESP Portfolios, %

	Cumulative Excess Returns (High - Low), %				Avg. Excess Returns, %/yr
	1m	3m	6m	12m	
Total	-0.15	-0.72	-0.16	0.40	1.75
Financial	-0.01	-0.30	-0.17	0.56	0.91
Non-financial	-0.22	-0.95	-0.20	0.27	2.11
By Quality					
AAA-AA	0.00	0.22	0.72	1.23	1.65
A	-0.27	-1.08	-0.54	-0.43	1.41
BAA	-0.08	-0.64	-0.02	0.94	2.31
By Trade Efficiency Score (Liquidity)					
TES1-Liquid	-0.05	-0.55	-0.22	0.41	1.25
TES2	-0.12	-1.08	-0.23	0.34	2.19
TES3	-0.31	-1.07	-0.41	-0.01	1.90
TES4	-0.41	-1.05	-0.30	-0.14	1.47
TES5-Illiquid	-0.17	-0.41	0.08	0.74	2.13
Over US Corporate IG Index					
High - Index	-0.07	-0.35	-0.08	0.20	0.89

Note: All returns are in excess of duration-matched Treasury portfolios. Transaction costs are excluded. Source: Bloomberg

EMC Scorecard for US IG Credit

FIGURE 2
US IG Corporate Bonds: Cumulative Excess Returns of Top and Bottom EMC Bond Portfolios, %



Note: EMC scores are calculated at the beginning of each month for bonds in Bloomberg Barclays US Corporate Index. The top EMC portfolio includes all bonds with EMC scores 9 and 10, while the bottom EMC portfolio includes bonds with scores 1 and 2. Portfolios are rebalanced at the beginning of each month and capitalisation-weighted. All reported returns are in excess of duration-matched Treasury portfolios. Transaction costs are excluded. Source: Bloomberg, Barclays Research

In December, US IG portfolios with top EMC scores (Q5) outperformed their counterparts with bottom (Q1) EMC scores (Figure 3). The performance of the

FIGURE 3
US IG Corporate: Performance of Top (Q5) vs. Bottom (Q1) Portfolios, %

	Cumulative Excess Returns (High - Low), %				Avg. Annualised Excess Returns, %/yr			Annualised Volatility, %/yr			Information Ratio		
	1m	3m	6m	12m	3Y	5Y	10Y	3Y	5Y	10Y	3Y	5Y	10Y
Total	0.30	0.98	2.95	4.32	4.72	5.19	7.74	1.32	1.68	4.00	3.58	3.08	1.94
Financial	0.53	1.35	3.17	4.42	2.65	1.92	5.74	0.80	0.87	4.52	3.31	2.20	1.27
Non-financial	0.27	1.29	3.08	4.52	5.10	6.00	7.40	1.79	2.23	3.13	2.85	2.69	2.36
By Quality													
Aaa-A	0.18	0.32	2.12	3.49	2.73	2.61	5.10	0.99	1.08	4.52	2.76	2.42	1.13
Baa	0.39	1.10	3.00	4.14	5.91	6.80	9.75	1.65	2.31	4.42	3.59	2.95	2.21
By Trade Efficiency Score (Liquidity)													
TES1-3 Liquid	0.19	0.89	3.12	5.57	5.88	6.21	8.19	2.41	2.47	4.53	2.45	2.51	1.81
TES4-7	0.49	1.51	3.09	3.99	4.43	4.83	7.29	1.38	1.57	4.22	3.21	3.07	1.73
TES8-10 Illiquid	0.50	0.61	2.05	2.32	3.73	4.49	7.16	1.87	2.00	3.72	1.99	2.25	1.93
Over US Corporate IG Index													
Top (Q5) - Index	0.03	0.04	0.88	1.19	2.26	1.94	3.48	1.04	0.88	1.99	2.18	2.20	1.75

Note: All returns are in excess of duration-matched Treasury portfolios to remove the rate component. Transaction costs are excluded. Source: Bloomberg, Barclays Research

Source: Barclays Research



ESP – Capturing Relative Value Premium in Credit

- ESP (Excess Spread over Peers) is a relative value scorecard
- Spread to peers after controlling for issuer fundamentals and bond characteristics
- ESP scores range from 1 to 10 with higher score indicating attractiveness

Step 1 – Peer Groups

Peer groups to control for systemic risk

Step 2 – Fundamentals

Spreads unexplained by fundamentals

Rating	<ul style="list-style-type: none"> • Long-term credit risk • Managed by issuers • Followed by investors 	Debt/Assets	<ul style="list-style-type: none"> • Leverage of Firm's BS
Sector	<ul style="list-style-type: none"> • Comparable cycles • RV for sector peers 	Debt/EBITDA	<ul style="list-style-type: none"> • Medium-term solvency • Low quality names
Maturity	<ul style="list-style-type: none"> • Increase in risk • Increase in spread 	EBIT/Interest	<ul style="list-style-type: none"> • Short-term solvency • Low quality names

ESP Score ⇔ Spread over Peers *Unexplained by Fundamentals*

EMC – Capturing Equity Momentum Premium in Credit

- EMC (Equity Momentum in Credit) is a cross-asset momentum scorecard
- Measures relative momentum in issuer past equity returns
- EMC scores range from 1 to 10 with higher score indicating attractiveness

Relative Performance of Issuer Stocks

EMC sorts issuers on the relative strength of equity momentum

Equity Returns	<ul style="list-style-type: none">• Map bonds to equity tickers• Calculate stock returns over• One, three, and six month horizons
Combine Signals	<ul style="list-style-type: none">• Adjust returns for horizon lengths• Equally weight signals
Confirmation	<ul style="list-style-type: none">• Trending stocks have stronger signal• Differentiates trending and volatile stocks

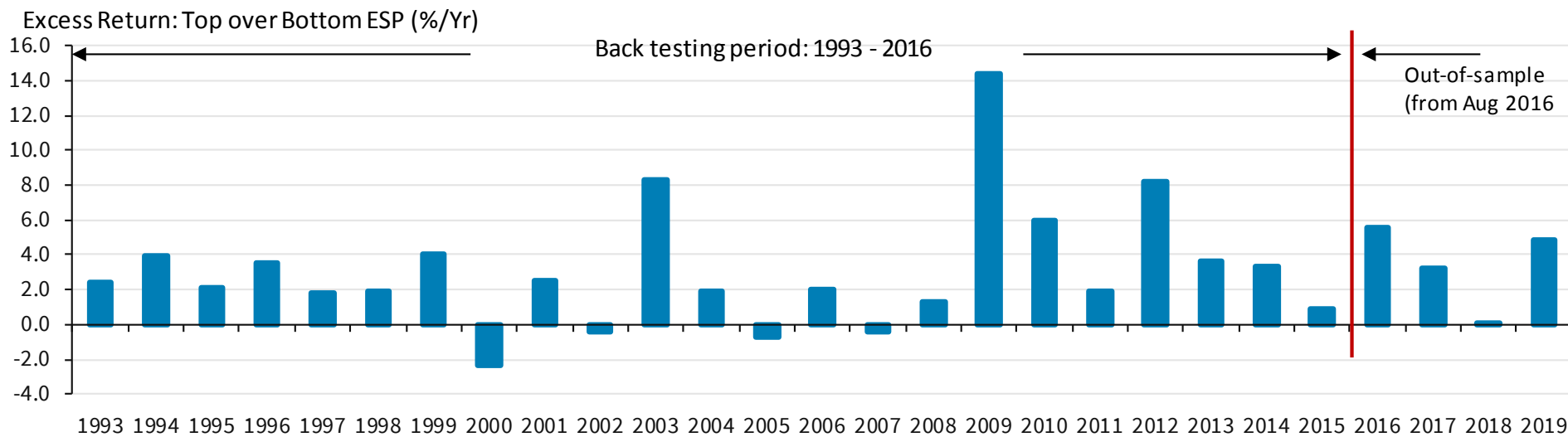
EMC Score ⇔ Relative Strength of Issuer Equity Momentum

ESP Performance in US IG

- We sort corporate bonds by ESP into Top (ESP = 9,10) and Bottom (ESP = 1,2) portfolios
- Portfolios are market value-weighted
- Top ESP portfolios exhibit persistent outperformance before transaction costs

Performance of the Top (Score = 9, 10) and Bottom (Score = 1, 2) ESP Portfolios

	Backtesting period			Out-of-sample period		
	January 1993 - July 2016			August 2016 - December 2019		
	Top ESP	Bottom ESP	Top-Bottom	Top ESP	Bottom ESP	Top-Bottom
Avg. Ret (%/Yr)	2.14	-0.97	3.11	4.26	1.08	3.18
Vol. (%/Yr)	5.14	4.06	2.35	2.99	1.90	1.26
Inf. / Sharpe Ratio	0.42	-0.24	1.32	1.43	0.57	2.53
Worst Month Ret (%/m)	-9.51	-7.60	-2.95	-1.68	-1.18	-0.85
Max Drawdown (%)	-27.69	-40.29	-6.64	-4.01	-3.33	-1.72



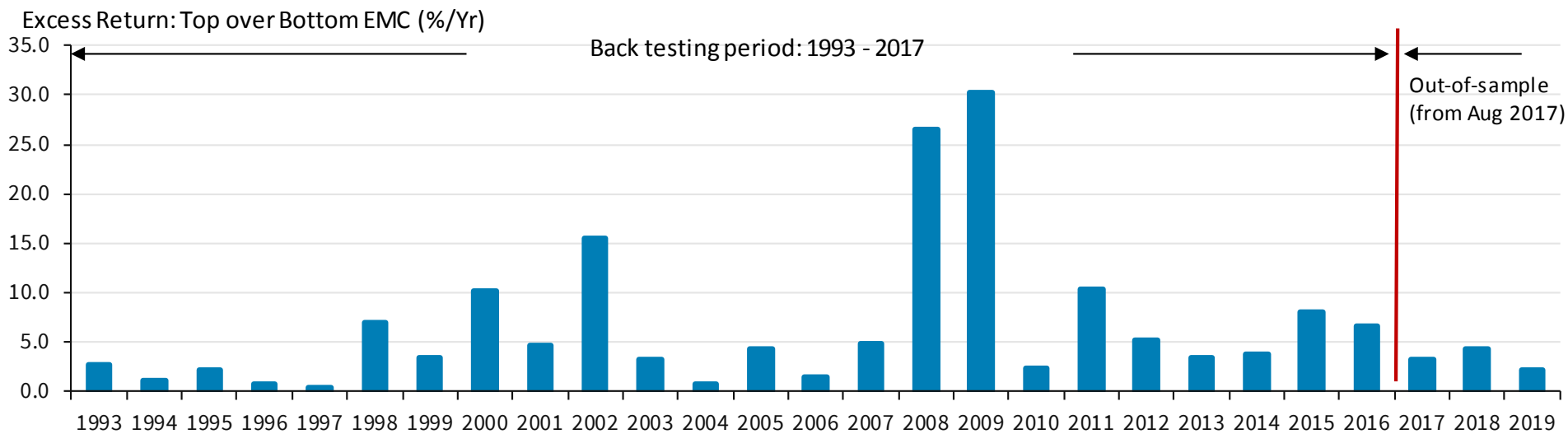
Source: Bloomberg, Barclays Research

EMC Performance in US IG

- We sort corporate bonds by EMC into Top (EMC = 9,10) and Bottom (EMC = 1,2) portfolios
- Portfolios are market value-weighted
- Top EMC portfolios exhibit persistent outperformance before transaction costs

Performance of the Top (Score = 9, 10) and Bottom (Score = 1, 2) EMC Portfolios

	Backtesting period January 1993 - July 2017			Out-of-sample period August 2017 - December 2019		
	Top EMC	Bottom EMC	Top-Bottom	Top EMC	Bottom EMC	Top-Bottom
Avg. Ret (%/Yr)	3.52	-3.01	6.53	2.84	-0.29	3.13
Vol. (%/Yr)	4.57	6.38	3.94	3.24	3.16	0.86
Inf. / Sharpe Ratio	0.77	-0.47	1.66	0.88	-0.09	3.65
Worst Month Ret (%/m)	-9.84	-20.16	-1.77	-1.46	-1.50	-0.16
Max Drawdown (%)	-20.96	-82.53	-1.77	-3.17	-6.82	-0.16



Source: Bloomberg, Barclays Research

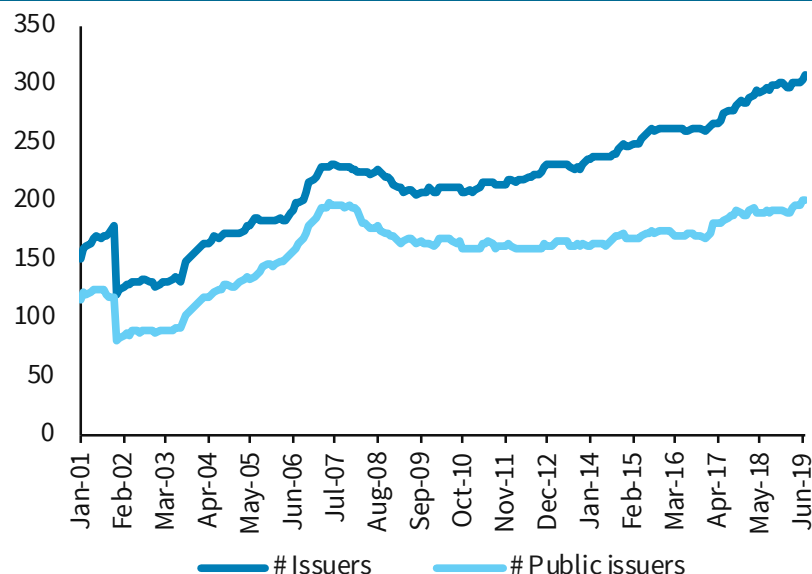
Coverage, Data, and Performance Updates

- ESP and EMC Scorecards cover US and European corporate bond markets
- Detailed performance reports are published monthly
- Bond-level scores are made available to subscribed client at the beginning of each month
- We recently added GBP IG and HY credit to EMC coverage

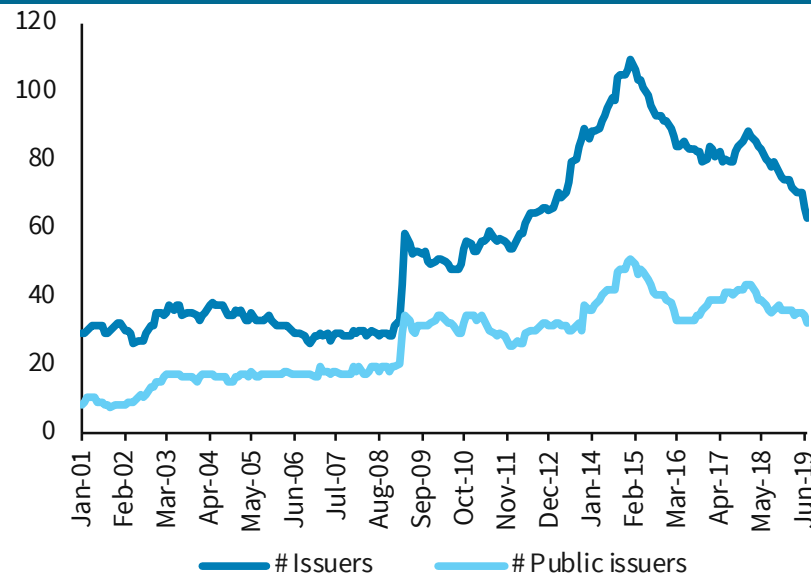
Coverage of ESP and EMC Scorecards

	US IG	Euro IG	GBP IG	US HY	Euro HY	GBP HY
ESP Scorecard	+	+	-	+	-	-
EMC Scorecard	+	+	+	+	-	+

Issuers in GBP IG



Issuers in GBP HY



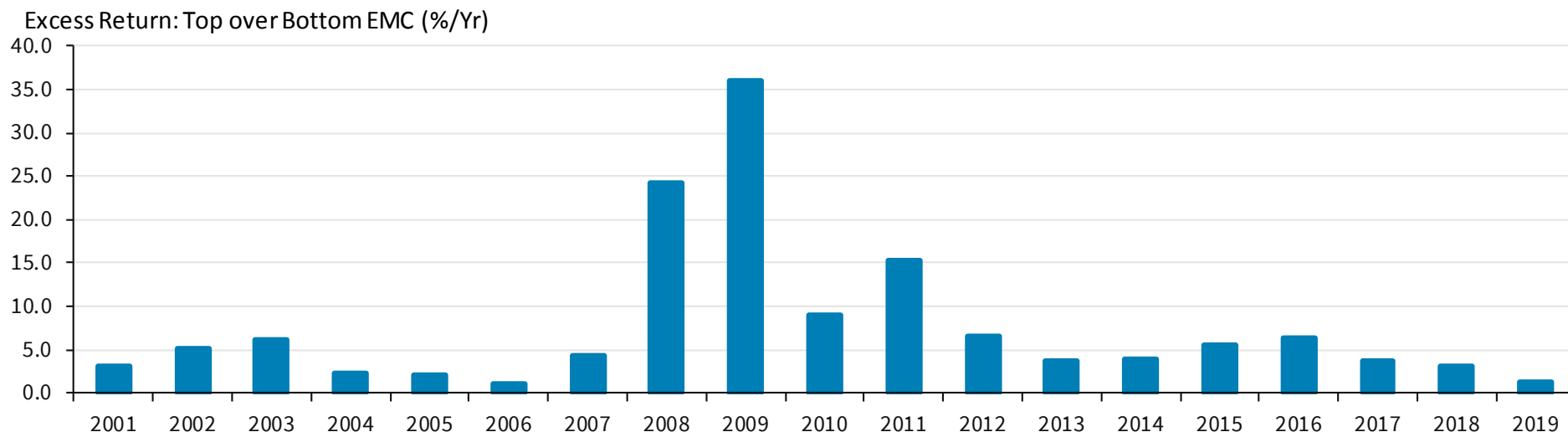
Source: Bloomberg, Barclays Research

EMC Performance in £ Credit – New!

- We sort corporate bonds by EMC into Top (EMC = 9,10) and Bottom (EMC = 1,2) portfolios
- Portfolios are market value-weighted
- Top EMC portfolios exhibit persistent outperformance before transaction costs

Performance of the Top (Score = 9, 10) and Bottom (Score = 1, 2) EMC Portfolios

	February 2001 - December 2007			January 2008 - December 2019		
	Top EMC	Bottom EMC	Top-Bottom	Top EMC	Bottom EMC	Top-Bottom
Avg. Ret (%/Yr)	2.16	-1.32	3.48	6.38	-3.50	9.89
Vol. (%/Yr)	2.97	3.44	2.29	6.65	9.35	6.16
Inf. / Sharpe Ratio	0.73	-0.38	1.52	0.96	-0.37	1.60
Worst Month Ret (%/m)	-1.97	-4.09	-1.94	-5.91	-16.88	-3.46
Max Drawdown (%)	-5.15	-12.22	-3.04	-15.64	-58.66	-4.26



Source: Bloomberg, Barclays Research

EMC Performance in £ Credit by Rating

- We form EMC portfolios in each rating category: 20 issuers in Aaa-A ; 20 issuers in Baa; and 5 issuers in HY
- Bonds are first aggregated at the issuer level using market weights
- Issuers in top and bottom portfolios are equally weighted

Performance of EMC Portfolios in £ Credit by Rating Category

Feb 2001 - Aug 2019				Feb 2001 - Dec 2009			Jan 2010 - Aug 2019		
Aaa-A-Rated Bonds	Top 20	Btm 20	<i>Top - Btm</i>	Top 20	Btm 20	<i>Top - Btm</i>	Top 20	Btm 20	<i>Top - Btm</i>
Avg. Exc. Return, %/yr	2.75	-2.85	5.60	2.57	-5.38	7.95	2.91	-0.52	3.43
Volatility, %/yr	4.40	6.92	4.42	5.33	8.50	5.62	3.36	4.98	2.79
Information Ratio	0.62	-0.41	1.27	0.48	-0.63	1.41	0.87	-0.10	1.23
Baa-Rated Bonds	Top 20	Btm 20	<i>Top - Btm</i>	Top 20	Btm 20	<i>Top - Btm</i>	Top 20	Btm 20	<i>Top - Btm</i>
Avg. Exc. Return, %/yr	3.05	-1.54	4.59	1.67	-4.18	5.85	4.32	0.90	3.42
Volatility, %/yr	6.20	6.71	4.35	8.09	8.31	5.80	3.67	4.71	2.32
Information Ratio	0.49	-0.23	1.05	0.21	-0.50	1.01	1.18	0.19	1.48
HY Bonds	Top 5	Btm 5	<i>Top - Btm</i>	Top 5	Btm 5	<i>Top - Btm</i>	Top 5	Btm 5	<i>Top - Btm</i>
Avg. Exc. Return, %/yr	14.92	1.97	12.95	15.62	4.38	11.24	14.28	-0.25	14.53
Volatility, %/yr	11.72	17.65	15.75	14.69	21.29	19.42	8.13	13.51	11.44
Information Ratio	1.27	0.11	0.82	1.06	0.21	0.58	1.76	-0.02	1.27

Source: Bloomberg, Barclays Research

EMC Performance in £ Credit by Sector

- We form EMC portfolios in each sector by selecting top and bottom 10 issuers by EMC in each sector
- Bonds are first aggregated at the issuer level using market weights
- Issuers in top and bottom portfolios are equally weighted

Performance of EMC Portfolios in £ Credit by Sector

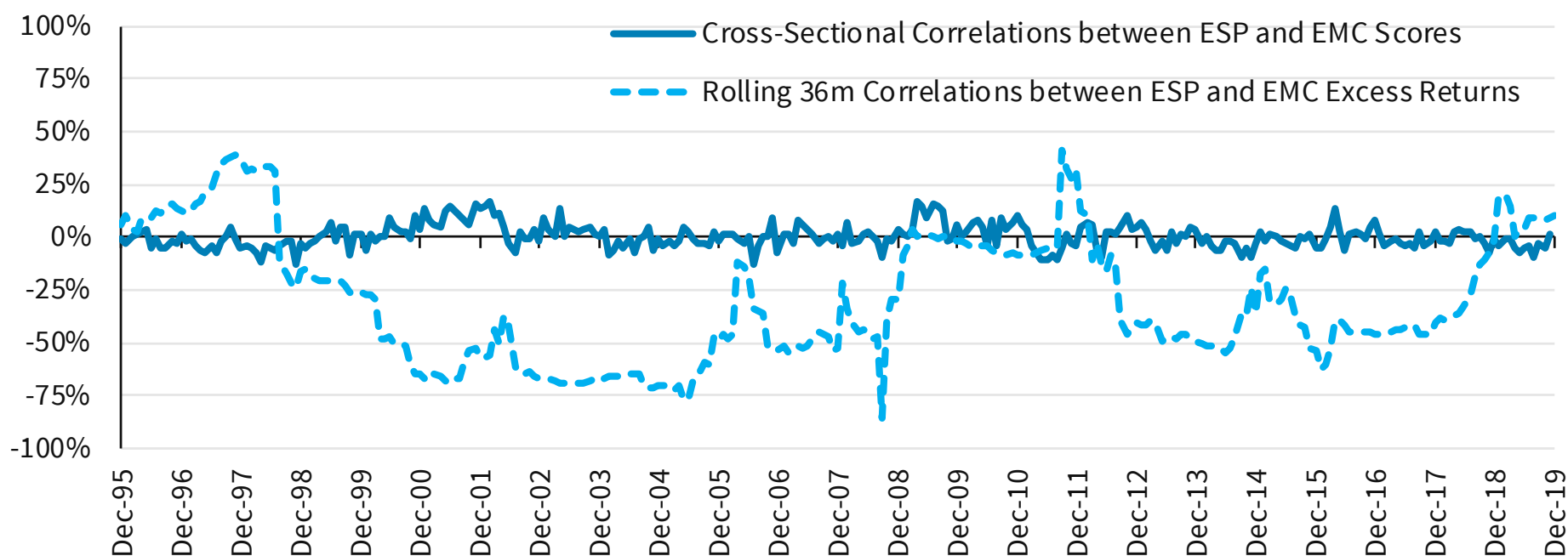
	Cyclicals	Non-Cyclicals	Banks & Brokerage	Financial Other	All Sectors	Overall in £IG	Sector Alloc.
# Issuers in Top/Btm Portfolios	10	10	10	10	40	40	40
Feb 2001 - Aug 2019							
Avg. ExcRet, %/yr	3.38	3.12	6.33	1.92	3.71	5.20	1.49
Volatility, %/yr	3.02	2.91	8.63	3.78	2.79	3.86	1.90
Inf. Ratio	1.12	1.07	0.73	0.51	1.33	1.35	0.79
Feb 2001 - Dec 2009							
Avg. ExcRet, %/yr	3.83	3.71	9.77	0.79	4.56	7.11	2.54
Volatility, %/yr	3.96	3.51	11.81	3.92	3.63	5.03	2.42
Inf. Ratio	0.97	1.06	0.83	0.20	1.26	1.41	1.05
Jan 2010 - Aug 2019							
Avg. ExcRet, %/yr	2.96	2.57	3.16	2.97	2.91	3.44	0.53
Volatility, %/yr	1.76	2.23	3.68	3.63	1.65	2.22	1.17
Inf. Ratio	1.68	1.15	0.86	0.82	1.77	1.55	0.45

Source: Bloomberg, Barclays Research

Why Combine ESP & EMC Signals?

- Cross-sectional rank correlations between ESP and EMC signals are low
=> Consistent with the typical relationship between value and momentum signals
- Rolling correlations between returns of ESP and EMC long/short strategies are usually negative
- Combining ESP and EMC signals could be a very good idea

Correlations Between ESP and EMC Scores or Returns



Source: Barclays Research

OneScore and the Role of Expert's Opinions

- OneScore is a publication that contrasts quantitative signals with fundamental outlook
- ESP and EMC scores are combined into and reported within each sector
 - The combined quantitative score is called OneScore
- Issuers ranked at the top or at the bottom of their sector are highlighted alongside recommendations by fundamental analysts
- Barclays fundamental research analysts provide commentaries when they agree or disagree with the quantitative scores

OneScore for US IG - December 2019 Quantitative and Fundamental View in Credit

- The OneScore report provides a quantitative framework for combining relative value and equity momentum characteristics of credit issuers within industry sectors.
- Fundamental and quantitative analysis complement each other in a “quantamental” research process. Quantitative models allow for a systematic coverage of broad investment universes while fundamental analysis provides deeper insights and helps mitigate selection risk.
- The report highlights top and bottom OneScore issuers by sector in USD investment grade credit, alongside views and commentary from Barclays’ fundamental research analysts.
- The report also includes a summary of OneScore performance in individual sectors and for the overall IG universe considered.

OneScore for US HY – December 2019 Quantitative and Fundamental Views in Credit

- We expand the OneScore framework to the US high yield market. This report covers non-distressed US dollar-denominated bonds with index ratings between B3 and Ba1.
- OneScore provides a quantitative framework for combining relative value and equity momentum characteristics of credit issuers within industry sectors.
- Fundamental and quantitative analysis complement each other in a “quantamental” research process. Quantitative models allow for systematic coverage of broad investment universes, while fundamental analysis provides deeper insights and helps mitigate selection risk.
- This report highlights bonds with top or bottom OneScores across major industry sectors of the US high yield market alongside views and commentary from Barclays’ fundamental credit research team.
- It also includes a summary of OneScore performance in individual sectors and for the overall high yield universe considered.

10 December 2019

Quantitative Portfolio Strategy
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Source: Barclays Research

Example: Energy Sector in US HG

- Fundamental Research (US Energy):** “Our *overweight* rating on **Energy Transfer (ETP)** reflects the partnership’s large and diversified asset base, management’s stated intention to gradually de-leverage toward 4.5x, and high distribution coverage that provides a meaningful amount of retained cash flow to help fund growth capex....”

Top and Bottom Scores Based on OneScore, 29 November 2019

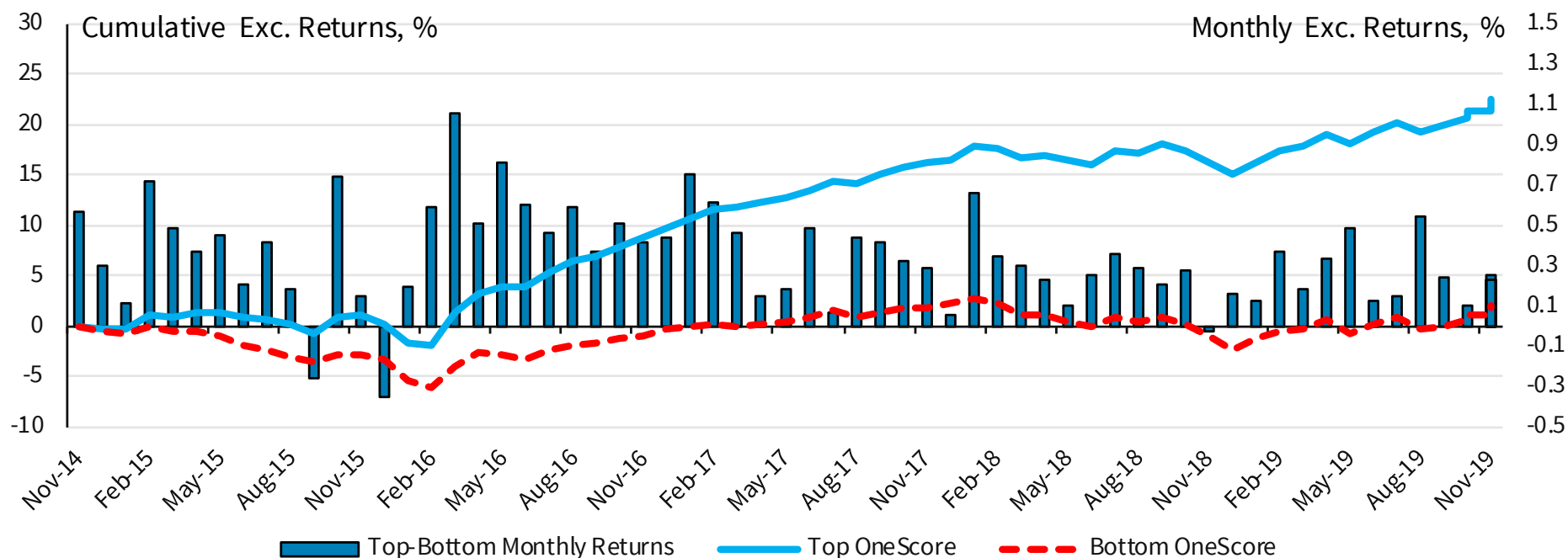
Ticker	Issuer Name	OAS	ESP Norm	EMC Norm	OneScore	Analyst Rating
Top Scores						
PTEN	PATTERSON-UTI ENERGY INC	3.18	9.8	9.8	10	-
HFC	HOLLYFRONTIER CORP	1.98	9.1	8.7	10	-
SEP	TEXAS EASTERN TRANSMISSI	1.84	8.7	9.0	10	-
VLO	VALERO ENERGY CORP	1.53	5.7	10.0	10	Underweight
BWP	BOARDWALK PIPELINES LP	1.91	8.3	7.3	10	Market Weight
ENBCN	ENBRIDGE INC	1.38	6.5	9.0	10	Underweight
XEC	CIMAREX ENERGY CO	1.79	7.3	7.8	9	Underweight
APA	APACHE CORP	3.01	7.9	6.8	9	Market Weight
CNQCX	CANADIAN NATL RESOURCES	1.58	5.1	9.5	9	Overweight
Bottom Scores						
CVX	CHEVRON CORP	0.28	1.2	2.7	1	-
SPLLLC	SABINE PASS LIQUEFACTION	1.43	2.6	1.8	1	-
EOG	EOG RESOURCES INC	0.61	1.6	3.2	1	Market Weight
FANG	DIAMONDBACK ENERGY INC	1.33	4.0	1.2	1	Market Weight
ETP	ENERGY TRANSFER OPERATNG	2.33	2.7	2.9	1	Overweight
CHCOCH	CHENIERE CORP CHRISTI HD	1.66	3.2	3.4	2	-
MMP	MAGELLAN MIDSTREAM PARTN	1.63	3.8	3.1	2	Underweight
CXO	CONCHO RESOURCES INC	1.58	1.5	5.6	2	Market Weight
PXD	PIONEER NATURAL RESOURCE	0.98	2.4	4.9	2	Underweight
WMB	WILLIAMS COMPANIES INC	1.89	2.1	5.4	2	Market Weight

Source: Barclays Research, [OneScore for US IG – December 2019](#), 6 December 2019 Note: Ratings and views shown were valid at the time of original publication and are shown here for purely for illustrative purposes. They may not reflect current Barclays Research fundamental views.

OneScore Performance in US HG

- We form Top and Bottom equally-weighted portfolios based on OneScore
 - Top OneScore portfolio: issuers with top OneScores in each sector (max 10 issuers per sector)
 - Bottom OneScore portfolio: issuers with bottom OneScores in each sector (max 10 issuers per sector)
- The Top OneScore portfolios have outperformed the bottom OneScore portfolios over the past five years

Cumulative Excess Returns of Top and Bottom OneScore Portfolios

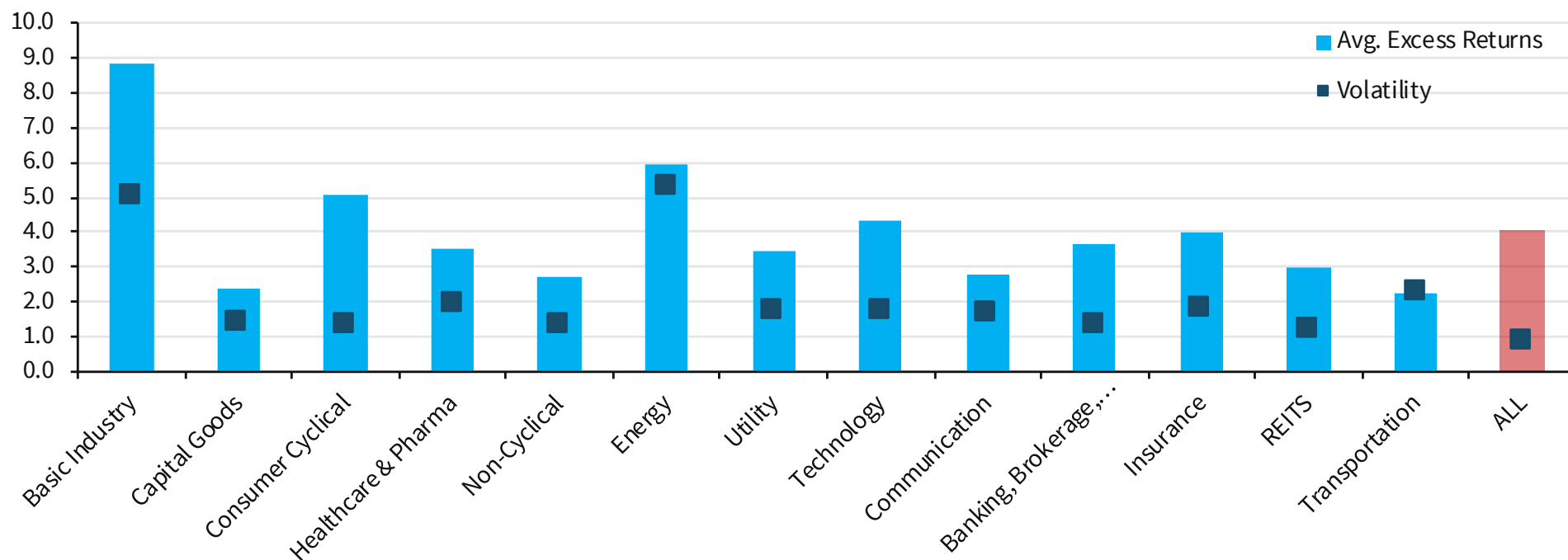


Source: Barclays Research

OneScore Performance in US HG by Sector

- Top have outperformed Bottom OneScore portfolios in each sector
- Results are particularly strong in Basic, Consumer Cyclical, end Energy sectors

Performance of OneScore in US HG by Sector, Nov 2014 – Nov 2019

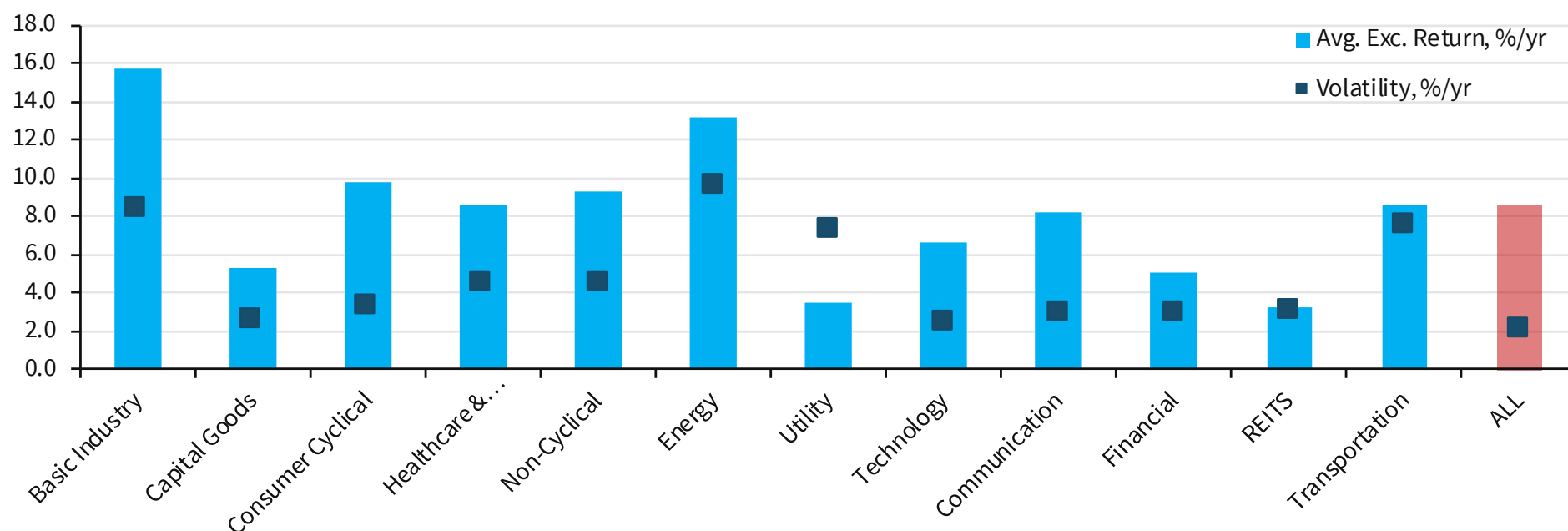


Source: Barclays Research

OneScore Performance in US HY by Sector

- Result are qualitatively similar in US HY Ba-B (non-distressed)

Performance of OneScore in US HY Ba-B by Sector, Nov 2014 – Nov 2019



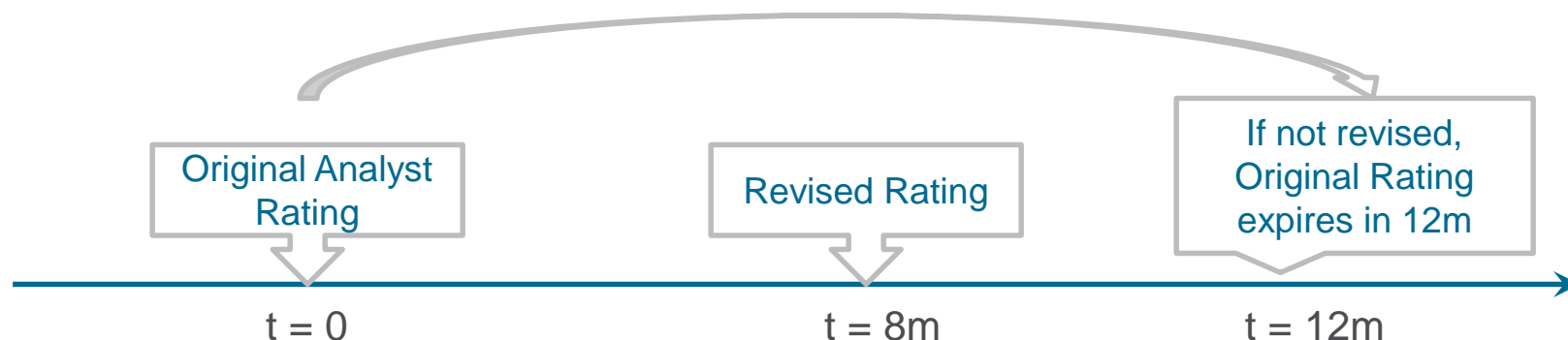
Source: Barclays Research

Combining Quantitative and Fundamental Views

- The OneScore report provides combined quantitative signals (OneScores) based on relative value (Excess Spread to Peers – ESP) and equity momentum (Equity Momentum in Credit) alongside views of fundamental research
- We can investigate whether OneScores and views expressed by fundamental research analysts complement each other
- In a pilot study we use historical ratings of fundamental analysts in the US HG Energy sector
- **Advantages of a quantitative framework:**
 - Broad coverage universe
 - Ability to compare individual names with a broad set of peers
 - Consistent approach across different issuers
- **Potential weaknesses of a quantitative framework:**
 - Does not have the depth of fundamental analysis
 - Backward-looking as usually uses historical data
 - Does not understand corporate actions such as splits, mergers, buy-backs
 - Does not easily incorporate management guidance / announcements

OneScores and Analyst Views in US HG Energy

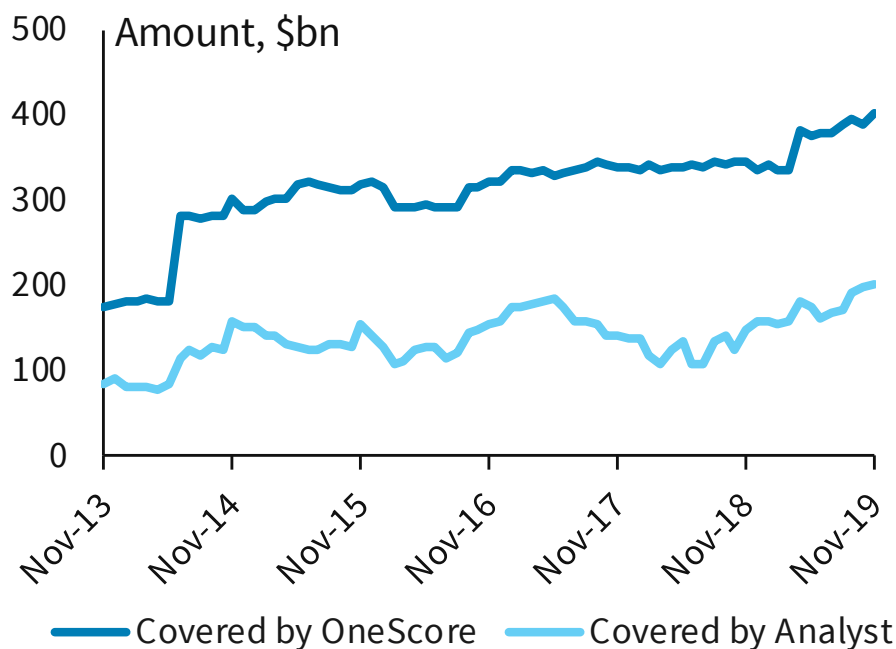
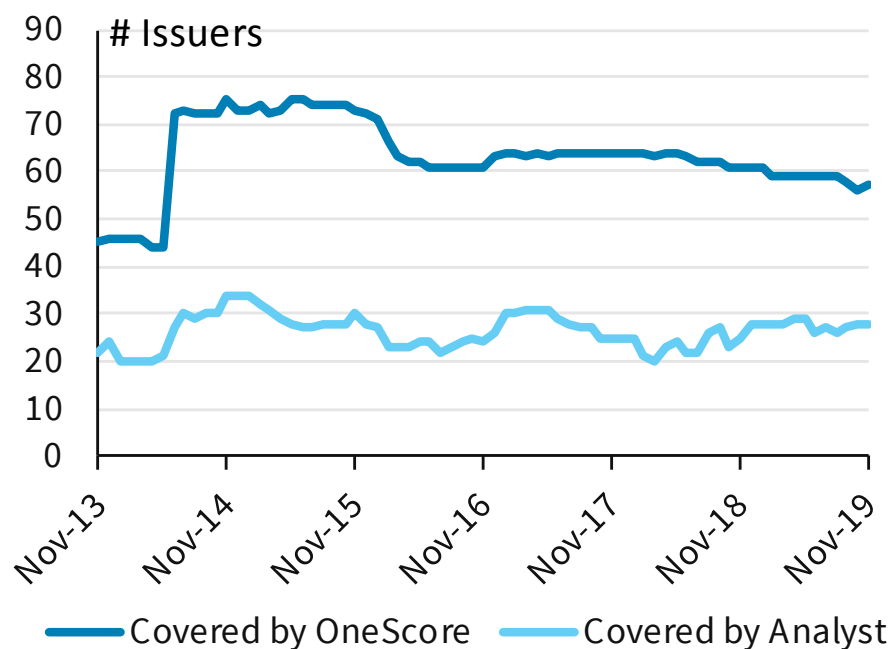
- We form equally-weighted portfolios based on OneScores and Analyst recommendations in the US Energy HG sector
 - Portfolios are equally-weighted and are rebalanced monthly
 - OneScore signals are updated every month-end (which does not always lead to rebalancing)
 - Analyst recommendations are also collected every month-end
- We track changes in the views of Barclays fundamental analysts
 - Analyst recommendations are updated periodically
 - We assume that, in the absence of an update, an analyst view expires after 12 months
- Bloomberg Barclays index bond excess returns over duration-matched Treasuries are used to measure the performance of corporate bond portfolios
- Sample period: November 2013 – November 2019



Analyst and OneScore Coverage Universes

- The OneScore framework covers most issuers in the US HG Energy
- Analyst coverage represents 30-50% of the OneScore universe
- OneScore coverage is significantly broader than that of fundamental research

Comparing OneScore and Analyst Coverage over Time in US HG Energy



Source: Barclays Research

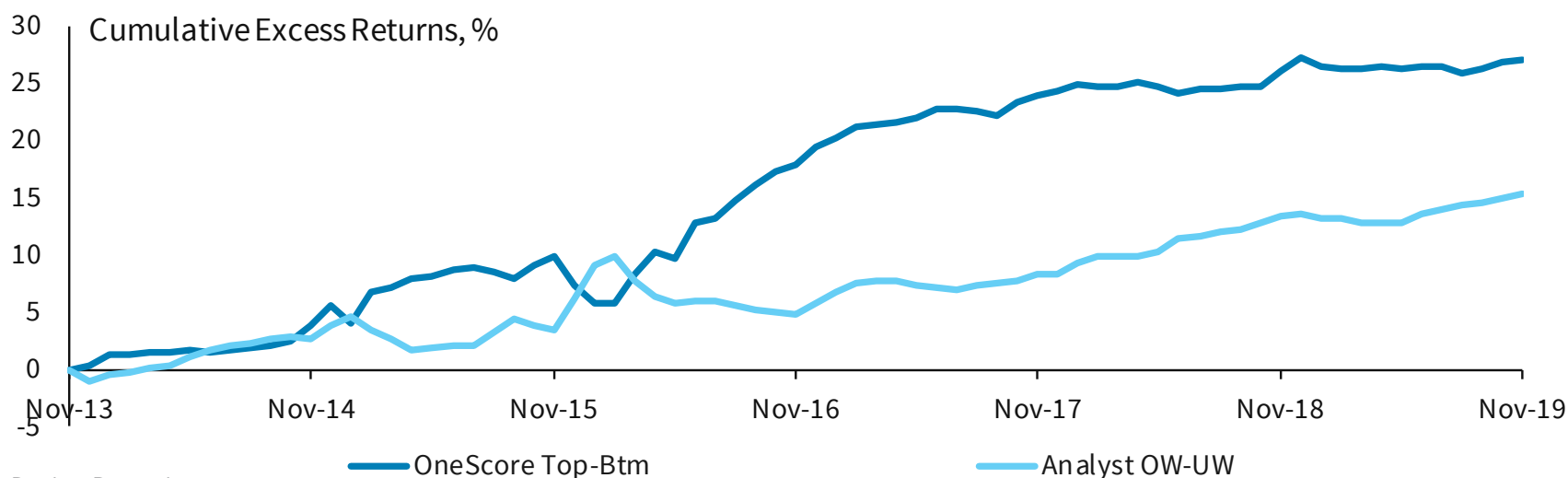
Restricting OneScore to the Analyst Coverage Universe

- We restrict OneScore to the universe of names covered by Analysts
- We form equally-weighted portfolios based on OneScore and Analyst recommendations
 - OneScore Top (Bottom) portfolios: 10 equally-weighted issuers with Top (Bottom) OneScores
 - Analyst Overweight (Underweight) portfolios: all issuers with Overweight (Underweight) ratings

Performance of OneScore and Analyst Portfolios in the Same Coverage Universe

December 2013 - November 2019

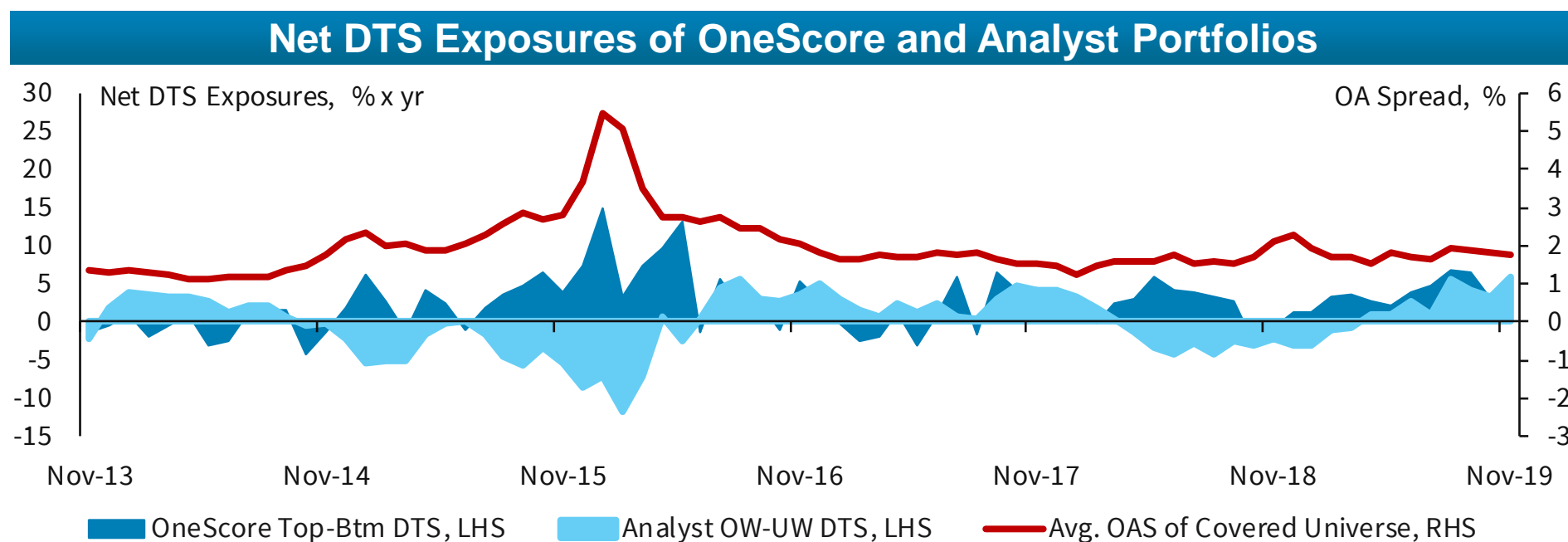
	OneScore Portfolios			Analyst Portfolios		
	Top 10	Bottom 10	Top-Bottom	Overweight	Underweight	OW-UW
Avg. Ret (%/Yr)	3.45	-1.05	4.50	3.66	1.10	2.56
Vol. (%/Yr)	9.88	8.13	3.11	7.50	9.32	2.58
Inf. Ratio	0.35	-0.13	1.45	0.49	0.12	0.99
Worst Month Ret (%/m)	-12.25	-10.67	-2.40	-8.21	-11.17	-2.15
Max Drawdown (%)	-26.2	-30.5	-4.1	-19.6	-26.7	-4.9



Source: Barclays Research

Exposures of OneScore and Analyst OW/UW Portfolios

- Net credit exposures (DTS) of the analyst OW/UW strategy are very different from those of the OneScore Top/Btm strategy
 - OneScore Top/Btm strategy has a positive average DTS exposure
 - Analyst OW/UW strategy has a average DTS close to zero
 - During credit down-cycles OneScore strategy tends to have a positive DTS exposure (aggressive name selection), while the Analyst strategy tends to have a negative DTS exposure (defensive name selection)
- Performance statistics need to be adjusted for differences in DTS



Source: Barclays Research

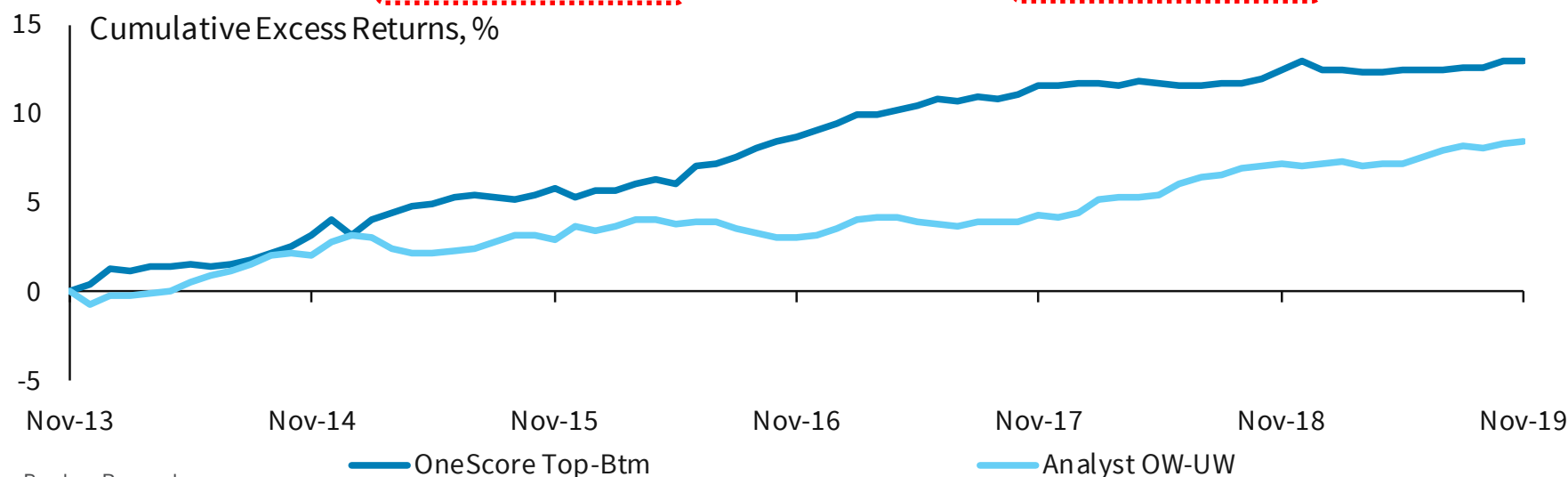
DTS-Adjusted Returns of OneScore and Analyst Portfolios

- We normalise excess returns of OneScore and Analyst portfolios by dividing them by BoM DTS and setting the target DTS at 10 for all portfolios in all periods throughout
 - Adjusted OneScore and Analyst portfolios have very similar risk characteristics
 - Adjusted long/short portfolios are now DTS-neutral
- Both OneScore and Analyst OW/UW recommendations generate high risk-adjusted returns

Performance of OneScore and Analyst Exposure-Adjusted Portfolios

December 2013 - November 2019

	OneScore DTS-Adjusted Portfolios			Analyst DTS-Adjusted Portfolios		
	Top 10	Bottom 10	Top-Bottom	Overweight	Underweight	OW-UW
Avg. Ret (%/Yr)	1.06	-1.10	2.16	0.97	-0.44	1.40
Vol. (%/Yr)	3.72	3.73	1.05	3.61	3.86	1.01
Inf. Ratio	0.29	-0.29	2.06	0.27	-0.11	1.39
Worst Month Ret (%/m)	-3.58	-3.96	-0.78	-3.94	-3.79	-0.69
Max Drawdown (%)	-11.3	-15.6	-0.8	-11.5	-13.8	-1.1



Source: Barclays Research

Combining OneScore and Analyst Portfolios

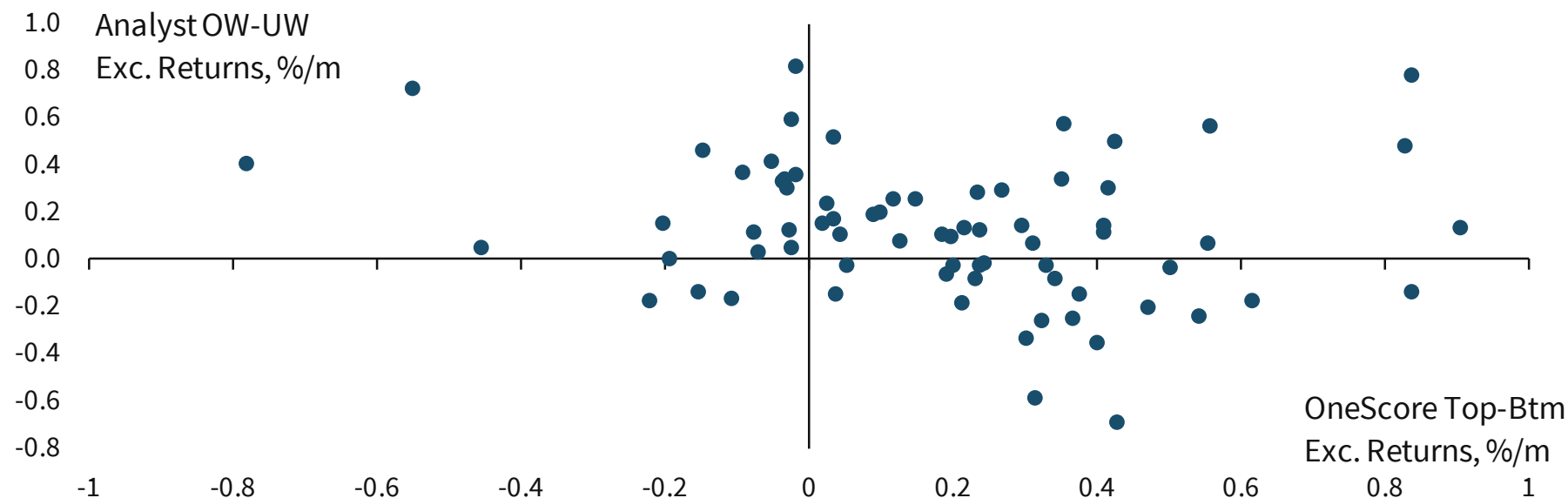
- Exposure-adjusted returns of OneScore and Analyst recommendations tend to be uncorrelated
- => Quantitative signals and fundamental views tend to complement each-other

Combining OneScore and Analyst Portfolios

December 2013 - November 2019

	Original Unadjusted Portfolios			DTS-Neutral (Adjusted) Portfolios		
	OneScore Top-Btm	Analyst OW-UW	Combined 50/50	OneScore Top-Btm	Analyst OW-UW	Combined 50/50
Avg. Ret (%/Yr)	4.50	2.56	3.53	2.16	1.40	1.78
Vol. (%/Yr)	3.11	2.58	1.37	1.05	1.01	0.65
Inf. Ratio	1.45	0.99	2.57	2.06	1.39	2.72
Worst Month Ret (%/m)	-2.40	-2.15	-0.60	-0.78	-0.69	-0.21
Max Drawdown (%)	-4.1	-4.9	-0.8	-0.8	-1.1	-0.3

Monthly DTS-Neutral Returns of OneScore and Analyst L/S Portfolios



Source: Barclays Research

Implementing Strategy Portfolios in Practice

- Practical strategy portfolios should include liquid bonds and limit turnover
- Portfolio turnover can be controlled by introducing an explicit *turnover budget*:
 - Advantage: turnover is targeted precisely
 - Disadvantage: rebalancing due to changes in signal can be hampered by turnover constraints

Portfolio Optimisation with Turnover Budget

Replace x% lowest score bonds with highest score bonds

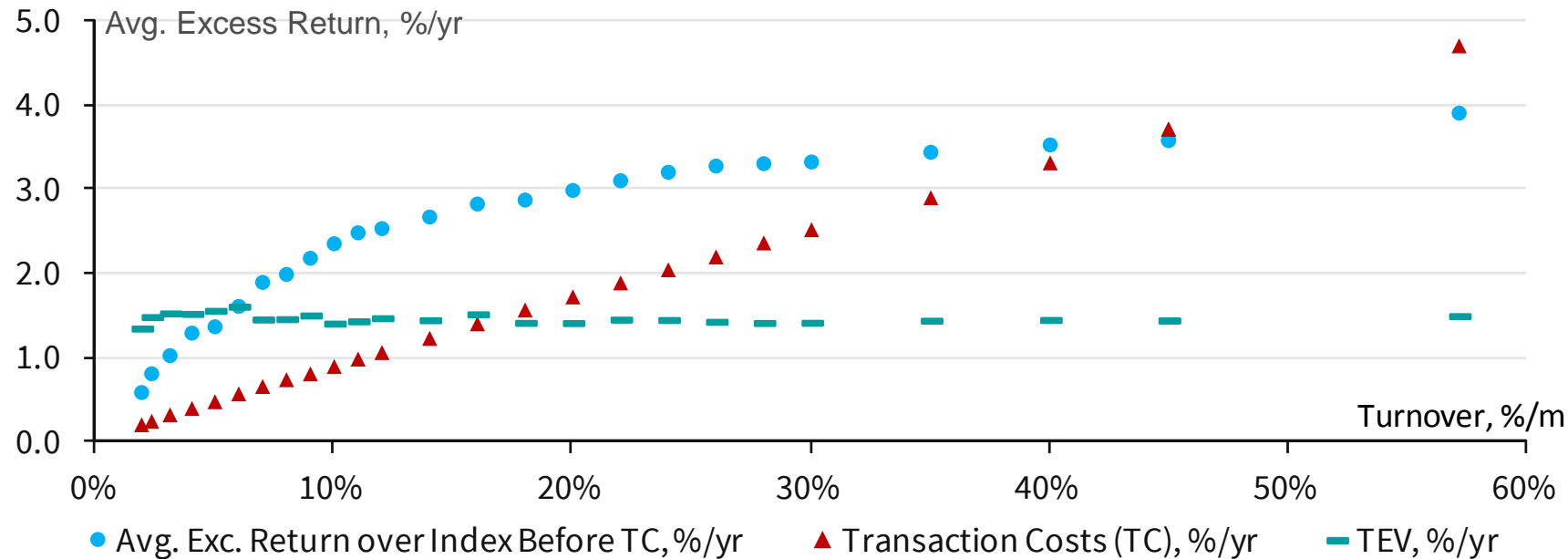
Max. Combined Score	<ul style="list-style-type: none">• Combined Score = $0.5 \times \text{ESP} + 0.5 \times \text{EMC}$• Select bonds to maximize Combined Score• Bonds should be liquid: $\text{TES} \leq 3$
Exposure Constraints	<ul style="list-style-type: none">• OAS, OAD, and DTS vs Index• Sector weights, OAD, DTS vs Index• Issuer concentration vs Index
Turnover Budget	<ul style="list-style-type: none">• Only x% can be rebalanced each month

Source: Barclays Research

Trade-off Between Turnover and Performance

- As the monthly turnover *budget increases*, so does
 - Average excess return over index (before TC) and
 - Transaction costs due to monthly rebalancing
- Transaction costs are measured using bond-level Liquidity Cost Scores (LCS) published by Barclays
- LCS is a conservative measure of transaction costs, costs are likely to be lower in reality

Outperformance over US Corp IG Index and Rebalancing Costs vs Turnover March 2007 – July 2019

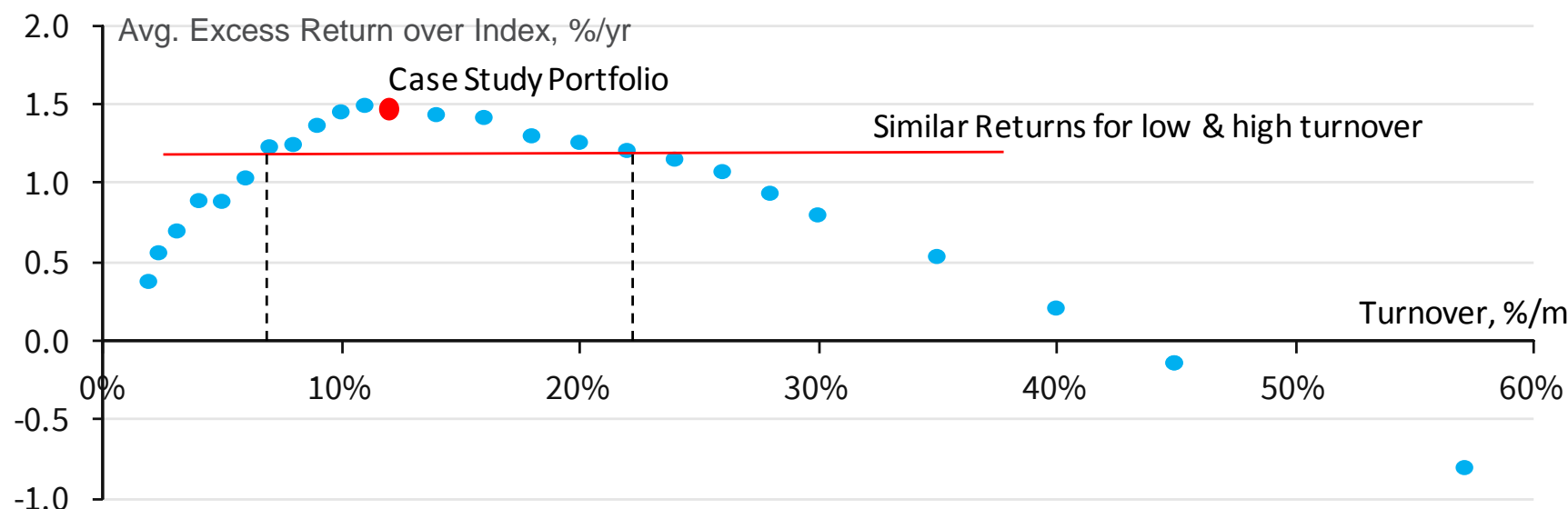


Source: Bloomberg, Barclays Indices, Barclays Research

Optimal Turnover Budget

- Average outperformance over the index after TC form a bell-shaped curve depending on turnover
- Lower net returns for low turnover:
 - Portfolio's ability to implement the strategy is constrained by the turnover budget
- Lower net returns for high turnover:
 - Transaction costs due to excess rebalancing create a significant performance drag
- There are two strategy portfolios with equivalent returns ex TC with low and high turnover
- It may be more prudent to implement portfolios with lower turnover

Outperformance After TC over US Corp IG Index vs Turnover March 2007 – July 2019

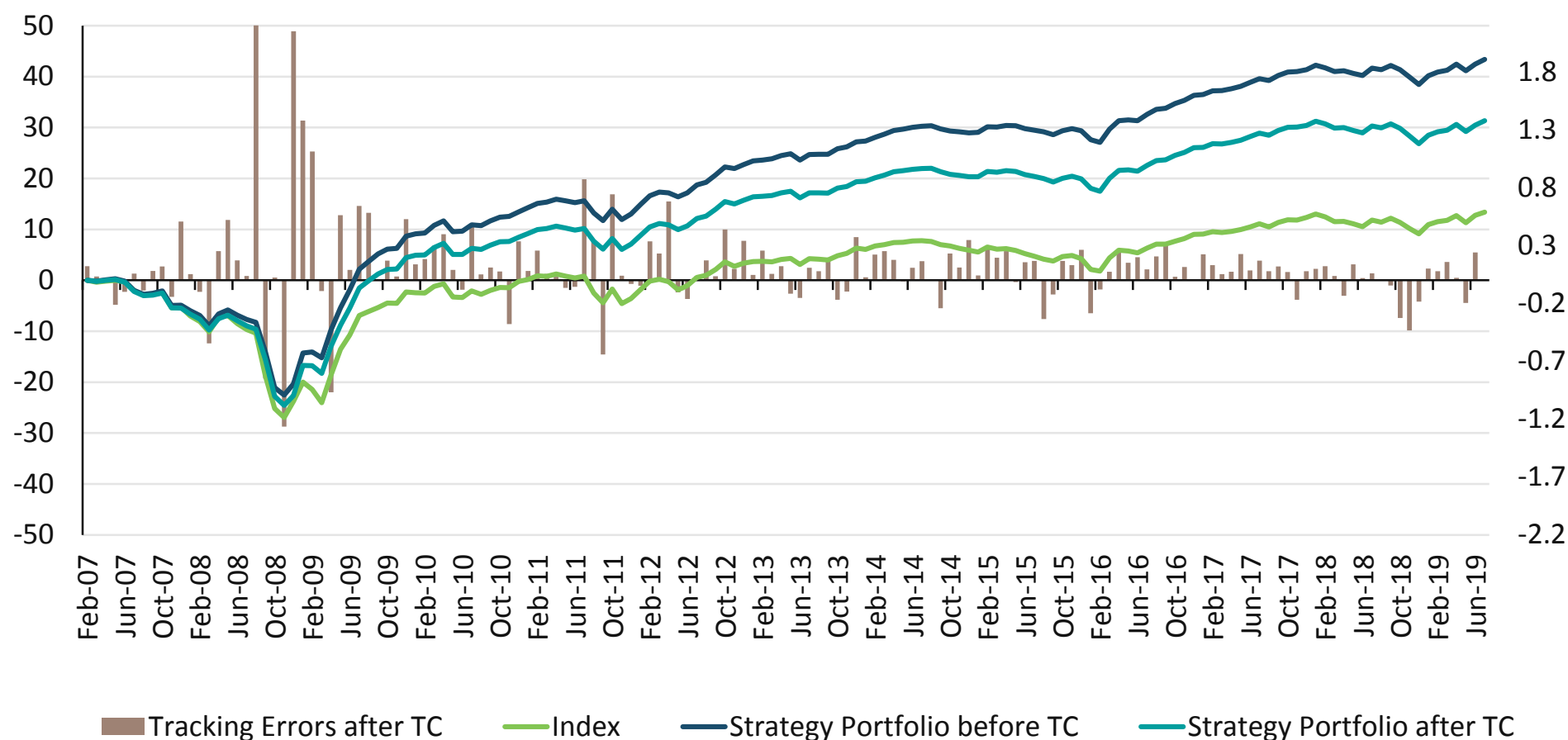


Source: Bloomberg, Barclays Indices, Barclays Research

Portfolio Performance with Turnover Budget

- After transaction costs, the portfolio has outperformed the index with an IR of 1.05 since 2007

Cumulative Excess Returns (%) of Strategy Portfolio with T/O Budget



Source: Bloomberg, Barclays Indices, Barclays Research

Performance after Transaction Costs with Turnover Budget

- We measure the performance of the strategy portfolio with a turnover budget of 11%/month
 - Strategy portfolio is based on the combined ESP and EMC signal
 - Performance is measured *after* transaction costs using bond-level LCS
 - Strategy portfolio consistently outperformed the index after TC

Relative Performance of the Strategy Portfolio with Turnover Budget

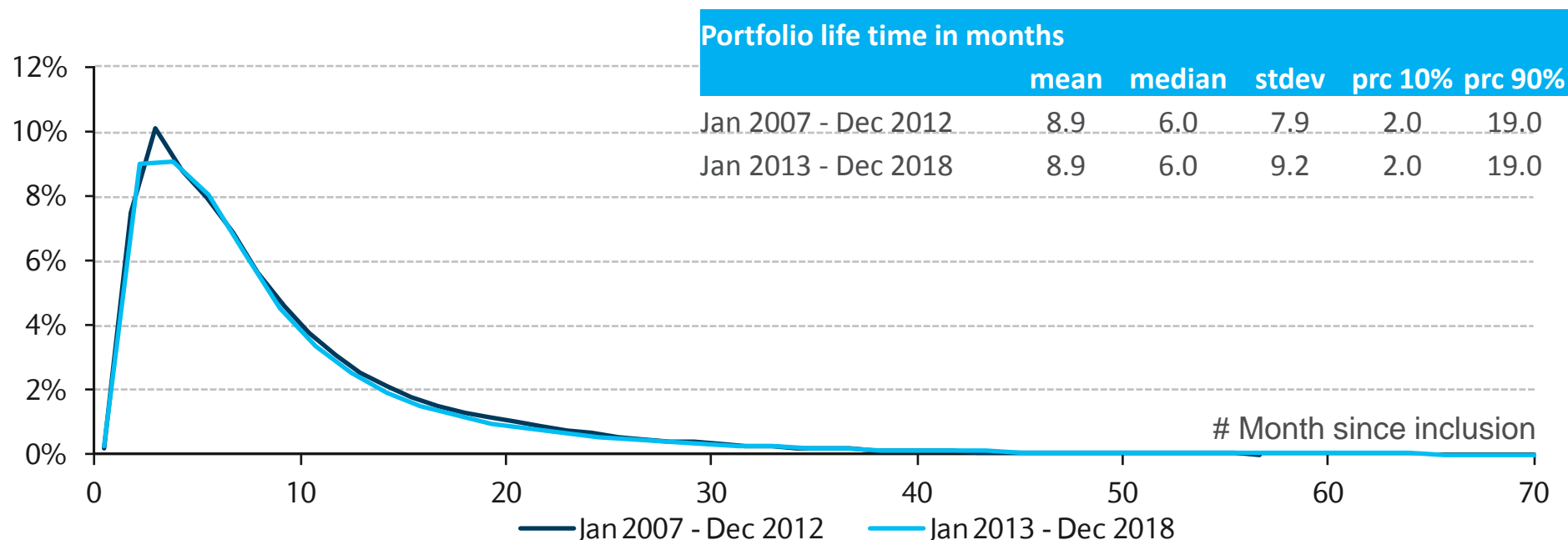
	Avg. ExcRet, %/y	Volatility, %/y	Inf. Ratio	Avg. ExcRet, %/y	TEV, %/y	Inf. Ratio
Portfolios	Absolute			Over US Corp Index		
March 2007 – July 2019						
Bloomberg Barclays US Corp IG	1.08	5.49	0.20	-	-	-
Portfolio w. Turn. Budget after TC	2.52	5.16	0.49	1.45	1.38	1.05
March 2007 - December 2012						
Bloomberg Barclays US Corp IG	0.57	7.51	0.08	-	-	-
Portfolio w. Turn. Budget after TC	2.69	6.98	0.39	2.12	1.90	1.12
January 2013 – July 2019						
Bloomberg Barclays US Corp IG	1.52	2.64	0.58	-	-	-
Portfolio w. Turn. Budget after TC	2.37	2.67	0.89	0.85	0.57	1.50

Source: Bloomberg Barclays Indices, Barclays Research

What is the Optimal Rebalancing Frequency?

- How long do bonds spend in the strategy portfolio?
- Measure # of months each bond spent in the portfolio and plot the distribution
 - Average life in the portfolio is 8.9 months
 - Median life in the portfolio is 6 months

Distribution of # Months a Bond Spends in the Strategy Portfolio



Source: Bloomberg Barclays Indices, Barclays Research

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