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Equity Momentum in Credit (EMC)

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Introduction

- We build equity momentum signal for corporate bonds: Equity Momentum in Credit (EMC)
- Each month we sort corporate bonds on the equity price momentum in the previous period
 - We measure subsequent performance of the sorted portfolios
- US IG and HY universes, issues with no equity data are excluded

Momentum in Equity Markets

- **Momentum in Stocks:** Jegadeesh, Titman (1993)
 - Stocks with high price momentum outperform stocks with low momentum
 - Does not include time (trend component)
- **Time Series Momentum in Stocks:** Moskowitz, et al (2012)
 - Stocks with strong price momentum continue to outperform
- **Momentum and Value across Asset Classes :** Asness, et al (2013)
 - Assets with high price momentum outperform assets with low momentum

Equity Momentum in Credit (EMC)

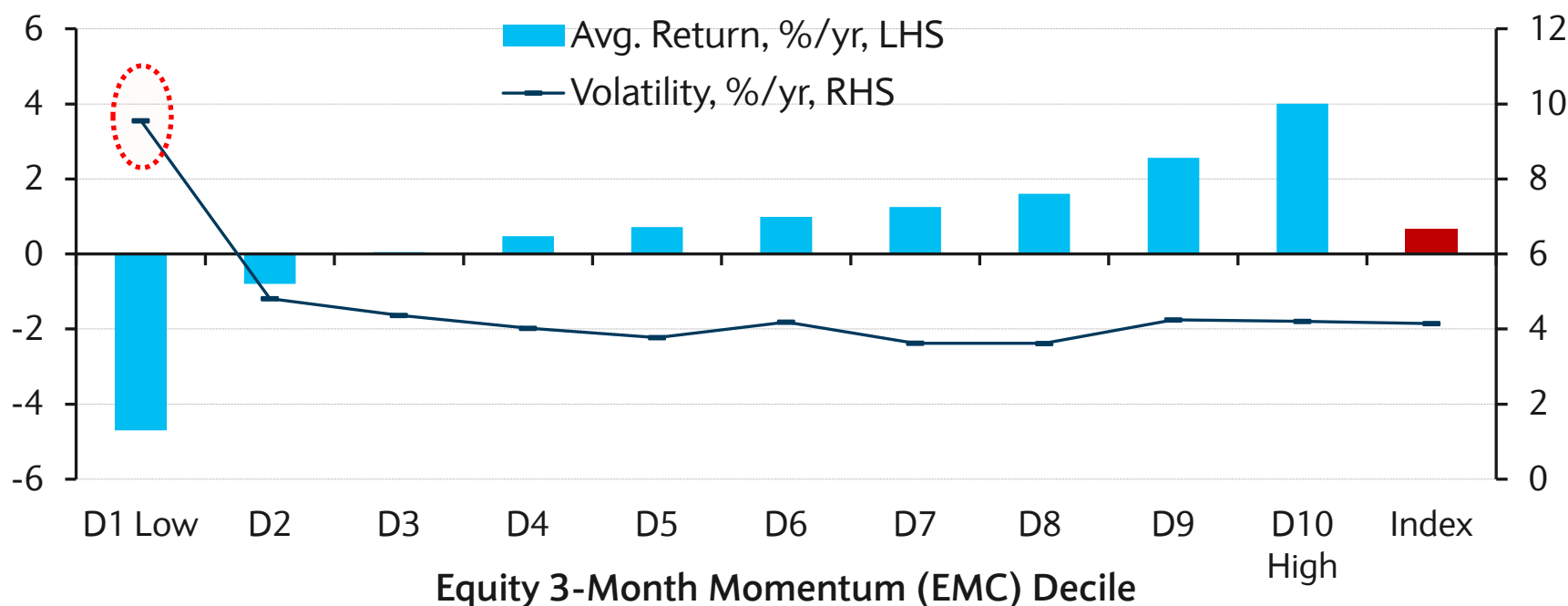
- **Value of Equity Information in Credit:** Haesen et al (2015); Gebhardt et al (2005)
 - Equity momentum in credit

Equity Momentum in Credit (EMC) Strategy

Equity Momentum in Credit (EMC) Seem to Work!

- Universe: *Bloomberg Barclays US Corporate Investment Grade Index*
- Issuers with unavailable equity information are excluded (e.g. private companies)
- Bonds are sorted into decile portfolios by 3-month stock price momentum
- Bond returns increase with the strength of the EMC signal
 - Bonds in the bottom EMC decile are more volatile

Return and Volatility by Equity Mom Deciles, Jan 1993 – May 2017



Source: Barclays Research

Formation Period for Equity Momentum

- Does formation period for the equity momentum signal affect the performance of the strategy?
- We consider equity price momentum measure over 6, 3, and 1 months
- Combined momentum signal equally weights individual momentum signals
- Results are broadly comparable

Performance EMC Strategy by Signal Formation Period, Jan 1993 – May 2017

EMC Formation Period	Q1 (Bottom)	Q2	Q3	Q4	Q5 (Top)	EMC Strategy: Q5 – Q1
Annualised Avg. Excess Return, %/yr						
6 months	-1.78	0.30	0.73	1.58	2.58	4.36
3 months	-2.46	0.23	0.78	1.43	3.13	5.59
1 month	-2.15	0.25	0.96	1.52	2.71	4.85
Combined	-2.83	0.09	1.08	1.64	3.50	6.34
Annualised Volatility, %/yr						
6 months	7.18	4.12	3.91	3.63	3.57	5.15
3 months	6.79	4.11	3.99	3.58	3.96	4.75
1 month	5.80	3.97	3.88	4.14	4.55	3.78
Combined	6.54	4.24	3.75	3.98	4.54	4.07
Information Ratio						
6 months	-0.25	0.07	0.19	0.44	0.72	0.85
3 months	-0.36	0.06	0.20	0.40	0.79	1.18
1 month	-0.37	0.06	0.25	0.37	0.59	1.28
Combined	-0.43	0.02	0.29	0.41	0.77	1.56

Source: Barclays Research

Lagged Equity Momentum Signal

- Does using lagged stock prices in the EMC signal (*combined*) change the results?
- EMC performance seem to be robust with regards to daily lags in equity momentum signal

Performance EMC Strategy with Lagged Stock Prices, Jan 1993 – Sep 2016

EMC Signal Lag	Q1 (Bottom)	Q2	Q3	Q4	Q5 (Top)	EMC Strategy: Q5 - Q1
Annualised Avg. Excess Return, %/yr						
0 days	-3.00	-0.01	1.00	1.56	3.43	6.43
1 days	-2.57	-0.04	0.72	1.77	3.26	5.83
2 days	-2.47	0.10	0.69	1.52	3.41	5.89
3 days	-2.68	0.14	0.82	1.45	3.40	6.08
Annualised Volatility, %/yr						
0 days	6.63	4.29	3.80	4.03	4.60	4.12
1 days	6.35	4.41	3.86	3.95	4.54	3.88
2 days	6.42	3.99	4.10	4.07	4.28	4.29
3 days	6.40	3.98	4.04	4.18	4.14	4.25
Information Ratio						
0 days	-0.45	0.00	0.26	0.39	0.75	1.56
1 days	-0.40	-0.01	0.19	0.45	0.72	1.50
2 days	-0.39	0.02	0.17	0.37	0.80	1.37
3 days	-0.42	0.04	0.20	0.35	0.82	1.43

Source: Barclays Research

Is Equity Momentum in Credit a Liquidity Phenomenon?

- Autocorrelation (AC) of bond excess returns is related to liquidity, e.g., due to stale pricing
- We double-sort bonds by autocorrelation of their excess returns (Low, Medium, High) and equity momentum (five quintiles)
- Overall, performance of the EMC strategy (Q5-Q1) remains robust across AC sorting
 - But higher returns across all EMC quintiles when AC is higher – momentum in credit returns?

EMC performance by AC of Bond Excess Returns, Jan 1993 – May 2017

Autocorrelation of Corp Excess Returns	Q1 (Bottom)	Q2	Q3	Q4	Q5 (Top)	EMC Strategy: Q5 - Q1
Annualised Avg. Excess Return, %/yr						
Low (-33%)	-3.74	0.24	0.96	1.57	2.82	6.55
Med (-4%)	-2.24	0.08	1.11	1.65	3.61	5.85
High (25%)	-1.92	0.52	1.59	2.14	4.26	6.18
Annualised Volatility, %/yr						
Low (-33%)	8.40	4.02	3.82	4.05	4.77	5.70
Med (-4%)	5.33	4.13	3.76	3.90	4.62	3.69
High (25%)	6.32	4.52	3.81	3.99	4.33	4.90
Information Ratio						
Low (-33%)	-0.44	0.06	0.25	0.39	0.59	1.15
Med (-4%)	-0.42	0.02	0.29	0.42	0.78	1.58
High (25%)	-0.30	0.12	0.42	0.54	0.98	1.26

Source: Barclays Research

Is EMC a Liquidity Phenomenon? (cont'd)

- We double-sort bonds by Trade Efficiency Score (TES) and equity momentum
 - TES ranks bonds by trading volume and liquidity cost score (LCS)
 - Bonds with lower TES are more liquid
- EMC seems to perform similarly across TES partition, including most liquid bonds

EMC performance by Trade Efficiency Scores (TES), Feb 2007 – May 2017

Trade Efficiency Score (TES) Range	Q1 (Bottom)	Q2	Q3	Q4	Q5 (Top)	EMC Strategy: Q5 - Q1
Annualised Avg. Excess Return, %/yr						
TES 1-3 (liquid)	-4.89	-0.44	2.09	2.25	4.31	9.20
TES 3-7	-3.85	0.30	2.15	2.64	5.81	9.66
TES 7-10 (illiquid)	-4.08	0.17	1.85	3.01	4.68	8.75
Annualised Volatility, %/yr						
TES 1-3 (liquid)	10.05	6.52	5.71	5.92	7.03	6.05
TES 3-7	10.00	5.93	5.09	5.84	7.17	6.70
TES 7-10 (illiquid)	7.49	5.80	5.25	5.74	5.79	4.44
Information Ratio						
TES 1-3 (liquid)	-0.49	-0.07	0.37	0.38	0.61	1.52
TES 3-7	-0.38	0.05	0.42	0.45	0.81	1.44
TES 7-10 (illiquid)	-0.54	0.03	0.35	0.52	0.81	1.97

Source: Barclays Research

Performance of EMC Strategy - Summary

- EMC Strategy (Q5-Q1) performed well in different sub-periods
- Top EMC Portfolio (Q5) also persistently outperformed the US Corp Index

EMC Performance in Different Periods

				EMC Strategy:	
	US Corp IG Index	Q1 (Bottom)	Q5 (Top)	Q5 - Q1	Q5 - Index
January 1993 - May 2017					
Avg. Exc. Return, %/yr	0.67	-2.83	3.50	6.34	2.84
Volatility, %/yr	4.15	6.54	4.54	4.07	1.74
Information Ratio	0.16	-0.43	0.77	1.56	1.63
January 1993 - June 2007					
Avg. Exc. Return, %/yr	0.41	-1.50	2.53	4.03	2.11
Volatility, %/yr	2.09	3.28	2.25	2.34	1.20
Information Ratio	0.20	-0.46	1.12	1.72	1.77
July 2007 - May 2017					
Avg. Exc. Return, %/yr	1.04	-4.78	4.93	9.71	3.89
Volatility, %/yr	6.01	9.47	6.58	5.59	2.28
Information Ratio	0.17	-0.51	0.75	1.74	1.71

Source: Barclays Research

Performance of Equity Momentum in Credit by Rating

- We sort bonds into quintile portfolios by EMC for three rating categories: Aaa-A, Baa, and HY
- We added US HY bonds for the purpose of this exercise
 - Performance improves as bond quality declines – strongest in HY
 - Weakest performance for Aaa-A rated bonds

EMC performance by Rating, Jan 1993 – May 2017

Rating Buckets	Q1 (Bottom)	Q2	Q3	Q4	Q5 (Top)	EMC Strat: Q5 - Q1
Annualised Avg. Excess Return, %/yr						
Aaa-A	-1.88	0.08	0.86	1.25	2.02	3.9
Baa	-4.11	0.09	1.42	2.36	4.74	8.8
HY	-5.50	2.57	3.66	5.52	10.38	15.9
Annualised Volatility, %/yr						
Aaa-A	7.26	3.86	3.25	3.56	4.57	4.72
Baa	6.94	5.10	4.92	4.93	5.35	4.72
HY	12.95	8.31	7.83	7.80	9.47	9.11
Information Ratio						
Aaa-A	-0.26	0.02	0.26	0.35	0.44	0.83
Baa	-0.59	0.02	0.29	0.48	0.89	1.87
HY	-0.42	0.31	0.47	0.71	1.10	1.74

Source: Barclays Research

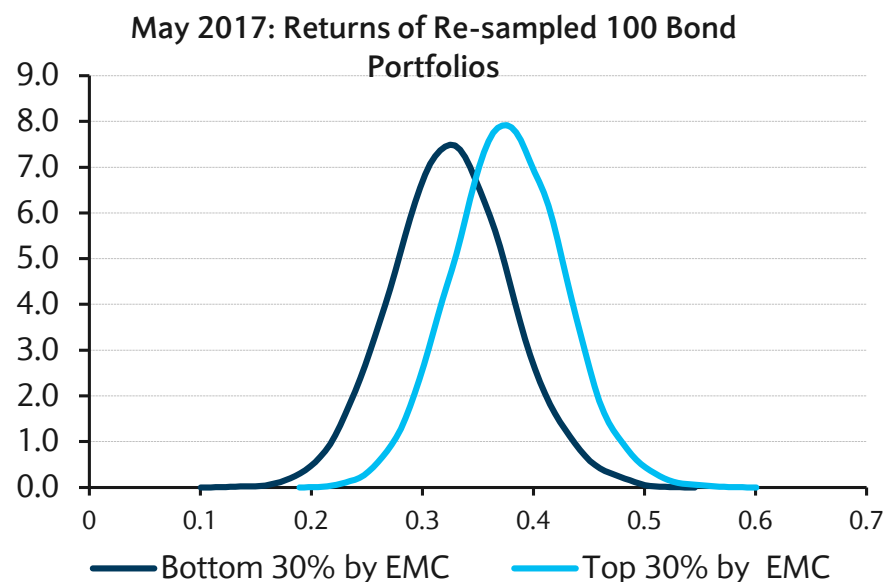
Selection Risk, Turnover and Transaction Costs

Strategy Selection Risk Declines with Horizon

- EMC strategy has worked well for broad portfolios (1000+ securities)
- Realistic portfolios would be much more concentrated
- Can we quantify selection risk of the EMC Strategy?
 - Randomly select 100 bonds into portfolios with top 30% and bottom 30% by equity momentum
 - Control for the broad market structure of the Index
 - Measure portfolio realised returns in the subsequent period
 - Repeat 5000 times to obtain distributions

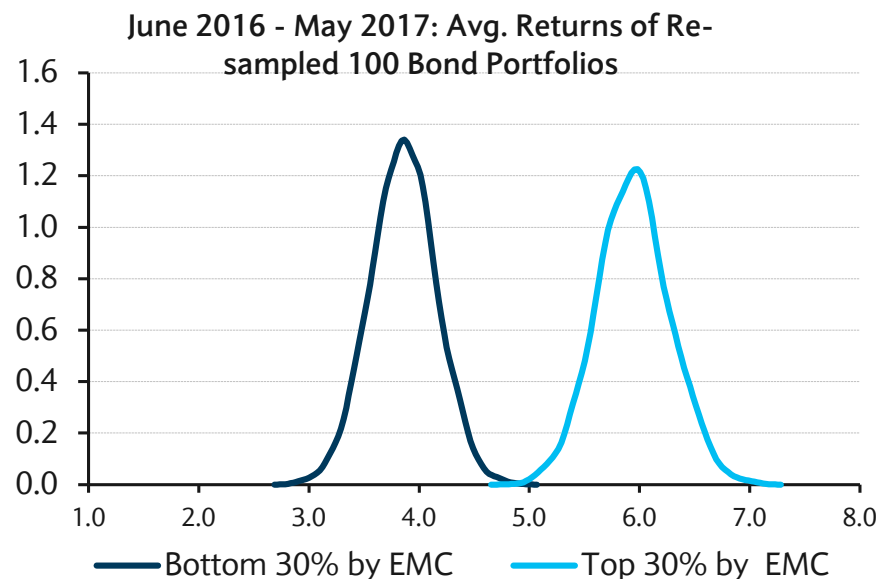
Return Distribution of EMC Portfolios with 100 Randomly Selected Bonds

1 Month: May 2017



Source: Barclays Research

1 Year: Jun 2016 – May 2017



Turnover and Transaction Costs

- We construct transition probability matrices for EMC signal over a 3-month horizon
- Transition frequencies are calculated over rolling 3 month periods and then averaged
- EMC signal seem to experience high transitions

=> *Investors should expect high portfolio turnover and transaction costs*

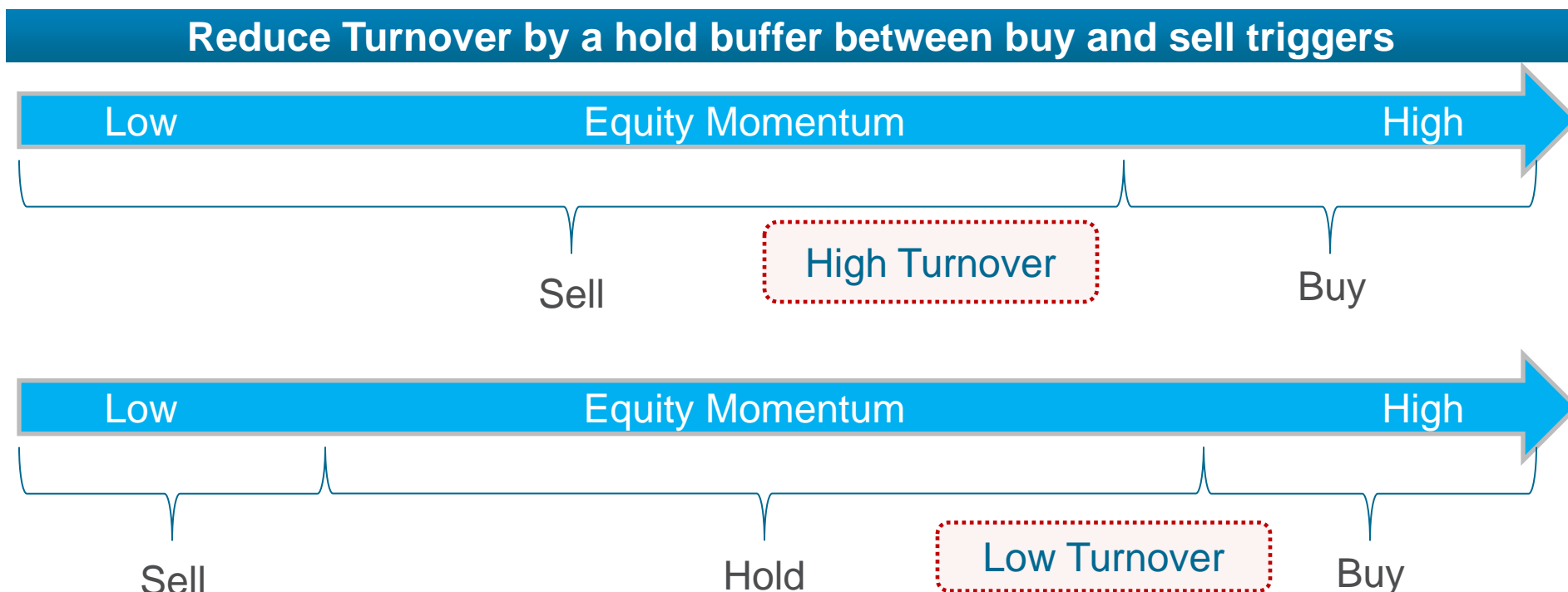
Average 3-Month EMC Transition Frequencies, Dec 1992 – May 2017

		Equity Momentum Deciles - End of Period									
		D1 Low	D2	D3	D4	D5	D6	D7	D8	D9	D10 High
Equity Momentum Deciles Beginning of Period	D1 Low	16%	15%	13%	10%	11%	9%	8%	7%	6%	6%
	D2	9%	15%	13%	13%	12%	11%	10%	7%	6%	4%
	D3	7%	12%	13%	13%	13%	13%	11%	8%	7%	3%
	D4	6%	12%	13%	13%	13%	12%	12%	9%	7%	3%
	D5	4%	10%	12%	13%	13%	13%	12%	11%	8%	4%
	D6	4%	10%	12%	12%	13%	13%	12%	11%	9%	4%
	D7	4%	8%	11%	12%	12%	13%	13%	11%	11%	5%
	D8	4%	8%	10%	11%	11%	13%	13%	12%	11%	6%
	D9	3%	6%	9%	9%	11%	12%	12%	14%	13%	9%
	D10 High	4%	5%	7%	8%	8%	9%	11%	14%	16%	17%

Source: Barclays Research

Controlling Turnover via Hold Buffer

- Prudent way to design an EMC strategy with lower turnover:
 - Buy bonds if equity momentum in the top 10%
 - Sell bonds if equity momentum in the bottom 10%
 - Hold otherwise



Source: Barclays Research

Controlling Turnover via Hold Buffer (cont'd)

- EMC1: Buy top 10% by equity momentum / sell otherwise
- EMC2: Buy top 10% by equity momentum / sell if below bottom 10% / hold otherwise
- EMC3: Buy *liquid* top 10% by equity momentum / sell if below bottom 10% / hold otherwise
 - EMC3 only buys bonds with trade efficiency scores (TES) in the top half of the Index
- We use Liquidity Cost Scores to estimate transaction costs in excess of those of the Index

Performance of EMC Strategies After Transaction Costs, Feb 2007 – May 2017

	US Corp IG	Buy Top 10% sell Otherwise	Top 10%, sell if bottom 10%	Liq Top 10%, sell if bottom 10%	Buy Top 10% sell Otherwise	Top 10%, sell if bottom 10%	Liq Top 10%, sell if bottom 10%
	Index	EMC1	EMC2	EMC3	EMC1 - Index	EMC2 - Index	EMC3 - Index
Avg. Turnover, %/m	-	73.3	8.9	8.9	73.3	8.9	8.9
Avg. Trans. Costs, %/m	-	76.8	8.4	7.4	76.8	8.4	7.4
Before Transaction Costs							
Avg. Return, %/y	0.97	7.31	2.76	2.77	6.34	1.79	1.79
Volatility, %/y	5.89	6.40	5.10	5.26	3.34	1.35	1.35
Information Ratio	0.17	1.14	0.54	0.53	1.90	1.32	1.32
With Transaction Costs							
Avg. Return, %/y	0.97	-1.90	1.76	1.88	-2.87	0.78	0.91
Volatility, %/y	5.89	5.49	5.04	5.21	2.74	1.33	1.31
Information Ratio	0.17	-0.35	0.35	0.36	-1.05	0.59	0.70

Source: Barclays Research

Properties of the EMC Strategy

Correlation of EMC Returns with Market Factors

- We calculate correlations of EMC (Q5-Q1 in US IG) returns with:
 - US Corp IG (excess returns), US Treasury
 - Equity Market (MKT), Size (SMB), Value (HML), and Momentum (MOM) Fama-French factors
 - Equity Quality Minus Junk (QMJ) factor published by AQR
- Negative correlation with credit and equity returns
- Positive correlation with Treasury bonds, equity QMJ and MOM factors

Correlation of EMC Returns with Equity and FI Factors, Jan 1993 – May 2017

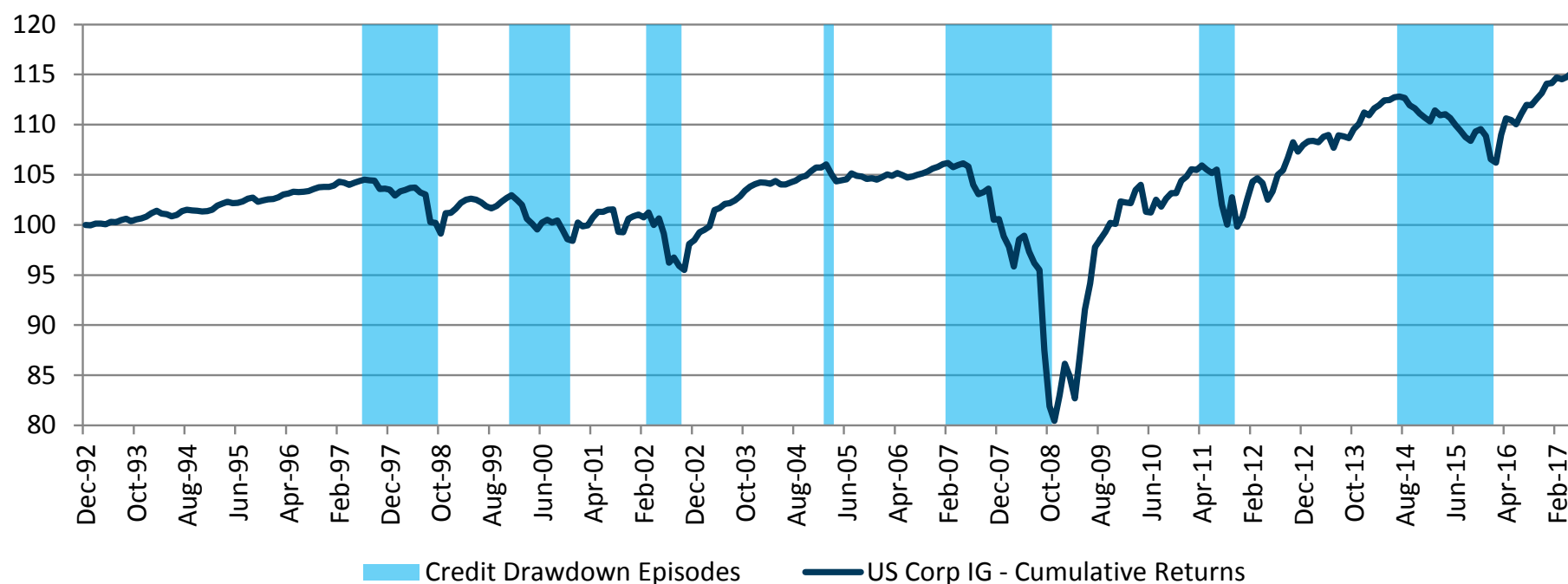
	EMC	US Corp	EQ MKT	EQ SMB	EQ HML	EQ MOM	EQ QMJ
US Corp	-43%						
EQ MKT	-38%	55%					
EQ SMB	-8%	20%	22%				
EQ HML	-9%	-2%	-15%	-30%			
EQ MOM	9%	-33%	-27%	9%	-18%		
EQ QMJ	31%	-52%	-65%	-50%	15%	29%	
US Tsy	11%	-33%	-21%	-19%	4%	19%	20%

Source: Barclays Research

EMC in Credit Down-Cycles

- How have EMC performed during credit down-cycles?
- Define drawdown episodes as down-cycles
- => Measure performance of the EMC strategy (Q5-Q1 IG portfolios) in drawdown episodes

Credit Drawdown Episodes, Dec 1992 – May 2017



Source: Bloomberg, Barclays Research

EMC in Credit Down-Cycles (cont'd.)

- EMC performance in credit down-cycles has been strong
 - 2002 – telecom crisis
 - 2008 – financial crisis
 - 2015 – energy crisis
- Somewhat similar pattern with equity MOM and QMJ strategies

Compounded Returns of EMC Strategy in Credit Drawdown Periods, %

Credit Down-Cycle Episodes	US Corp IG	EMC: Q5-Q1	EQ MKT	EQ SMB	EQ HML	EQ MOM	EQ QMJ
Aug 1997 - Oct 1998	-5.2	6.8	6.7	-19.4	6.4	13.5	14.6
Jan 2000 - Dec 2000	-4.4	6.5	-16.7	-5.0	38.2	16.7	23.7
Apr 2002 - Oct 2002	-5.7	12.4	-22.6	-1.7	0.3	28.2	22.9
Mar 2007 - Nov 2008	-24.2	35.4	-37.9	-6.3	-11.6	54.6	52.3
May 2011 - Nov 2011	-5.8	7.0	-8.6	-5.6	-7.7	0.7	19.7
Aug 2014 - Feb 2016	-5.8	16.0	1.2	-5.1	-12.1	21.7	36.1

Source: Barclays Research

EMC in Credit Down-Cycles (cont'd.)

- EMC performance has been strong during credit down-cycles
- EMC performance has been weaker in recoveries and benign environments
- Equity MOM and QMJ strategies also did well during drawdowns, but had weaker performance in recoveries

EMC Returns in Credit Down-Cycles and Recoveries, Jan 1993 – Apr 2017

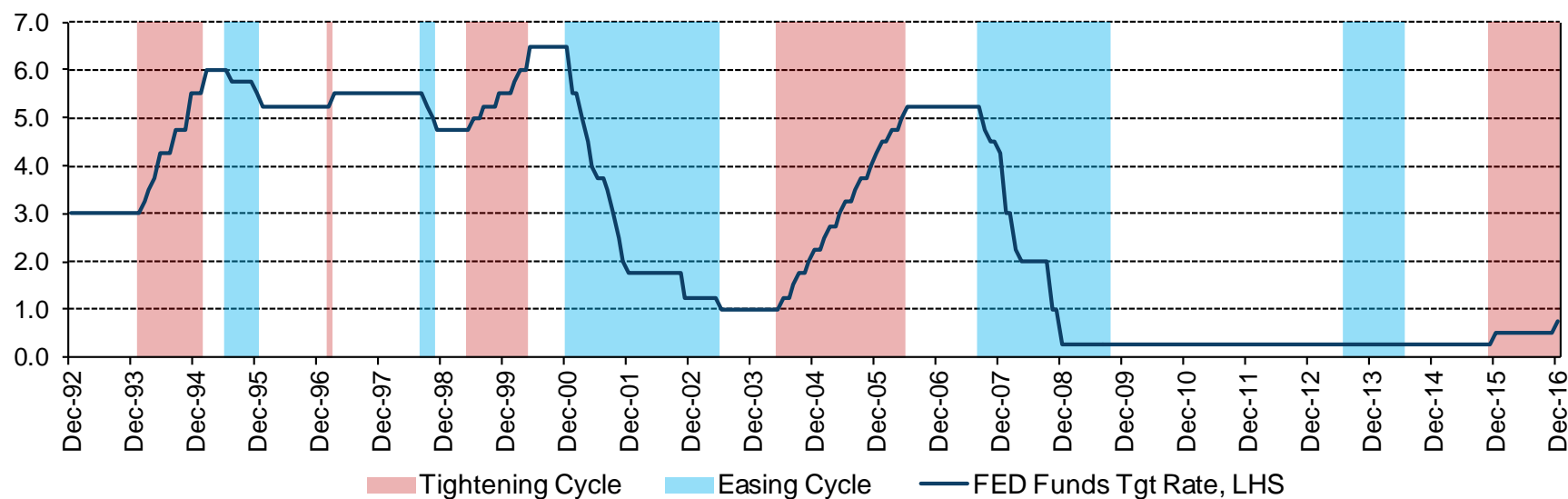
	Drawdown			Recovery			Overall		
	Avg. Ret	Vol	IR	Avg. Ret	Vol	IR	Avg. Ret	Vol	IR
<i>US Corp IG</i>	-8.07	5.15	-1.57	4.12	3.18	1.29	0.65	4.15	0.16
EMC (Q5-Q1)	11.53	5.43	2.13	4.30	3.22	1.34	6.35	4.06	1.56
EQ MKT	-12.34	18.12	-0.68	15.73	12.56	1.25	7.75	14.76	0.53
EQ SMB	-6.24	15.55	-0.40	5.14	9.11	0.56	1.90	11.37	0.17
EQ HML	1.74	12.53	0.14	3.58	9.93	0.36	3.06	10.70	0.29
EQ MOM	18.36	17.08	1.07	0.26	17.23	0.02	5.40	17.29	0.31
EQ QMJ	22.58	11.77	1.92	-1.54	8.66	-0.18	5.32	10.11	0.53

Source: Barclays Research

EMC in Fed Monetary Cycles

- How did EMC strategy perform in different monetary cycles?
 - Tightening = rising Fed Rate
 - Easing = falling Fed rate or yoy growth in Fed assets above 25% (Dec 2008 – Nov 2015)
- We measure performance of the EMC strategy in Fed monetary cycles
 - Easing: 1st half / 2nd half
 - Tightening: 1st half / 2nd half
 - On-hold pre-easing / on-hold pre-tightening

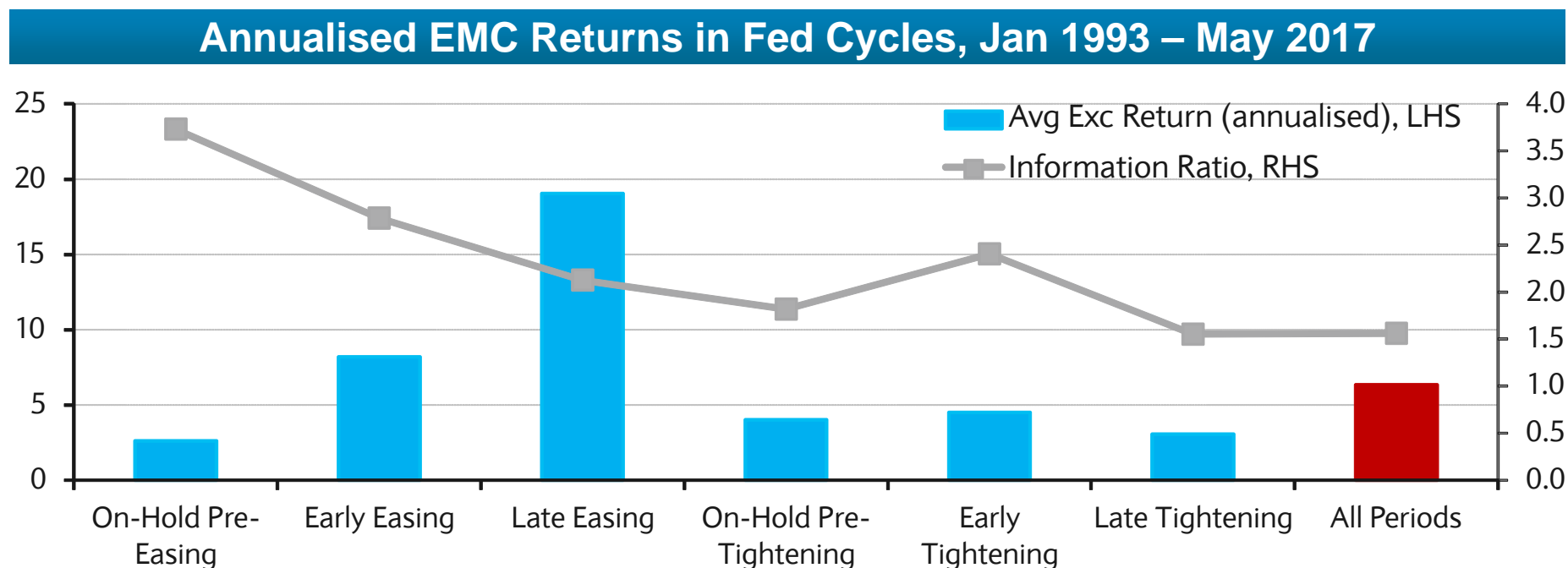
Fed Easing and Tightening Episodes



Source: Barclays Research

EMC in Fed Monetary Cycles (cont'd.)

- EMC returns were highest during easing (especially the 2nd half)
- EMC had modest returns, but high information ratio during pre-easing
- Weaker, but still positive performance during pre-tightening and tightening



Source: Barclays Research

EMC in Fed Monetary Cycles (cont'd.)

- Very strong returns during late easing
- Strong returns during early easing
- Weaker returns during late tightening and on-hold before easing

Annualised EMC Performance in Fed Cycles, Jan 1993 – May 2017

	# obs	EMC Strategy			US Corp IG		
		Avg. Ret	Volatility	IR	Avg. Ret	Volatility	IR
On-Hold Pre-Easing	42	2.61	0.70	3.73	-0.87	1.50	-0.58
Early Easing	40	8.20	2.94	2.79	-1.52	3.95	-0.39
Late Easing	38	19.06	8.96	2.13	1.97	8.93	0.22
On-Hold Pre-Tightening	103	4.02	2.21	1.82	1.59	3.03	0.52
Early Tightening	46	4.51	1.88	2.41	1.58	2.28	0.69
Late Tightening	24	3.06	1.97	1.55	-0.77	1.29	-0.60
All Periods	293	6.34	4.06	1.56	0.67	4.14	0.16

Source: Bloomberg, Barclays Research

Applications

- Corporate bond portfolios with stronger equity momentum (EMC) tend to perform better than their peers in absolute and risk-adjusted terms
- Practical applications of EMC include:
 - Screening for companies with improving or worsening conditions
 - When it is necessary to buy or sell bonds -
 - Buy bonds of issuers with positive equity momentum
 - Avoid issuers with negative equity momentum
 - EMC can be combined with other signals, e.g. relative value (ESP Scorecard)
 - Use as a quantitative input in fundamental research

Conclusions

- We present Equity Momentum (EMC) strategy in credit
- Corporate bond portfolios with stronger equity momentum tend to perform better than those with low equity momentum in absolute and risk-adjusted terms
- EMC “validation” strategy goes long above top 20% (Q5) of issuers by equity momentum and shorts below the bottom 20% (Q1)
 - The strategy has attractive risk-return characteristics
 - Security selection risk is moderate and declines with the investment horizon
 - The strategy has low correlation with returns of the credit market
 - Strategy performance is stronger in down-cycles and weaker in benign environment
- The EMC strategy has a high turnover due to varying equity momentum signal, but it can be reduced by buying liquid bonds with top momentum signal and holding them until the signal turns significantly negative – this modified strategy remains profitable after transaction costs
- EMC signal can be used tactically when it is necessary to buy or sell bonds in the portfolio or to screen the investment universe for companies with “improving” and “deteriorating” conditions

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