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Quantitative Portfolio Strategy

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Equity Momentum in Credit (EMC)

- We analyse the effect of equity price momentum on excess returns of corporate bonds of the same issuer and find a strong positive relationship. Stronger equity momentum tends to lead to higher subsequent returns of corporate bonds. Equity momentum could therefore be used as a quantitative signal for name selection in credit markets.
- We design a strategy that buys corporate bonds with strong equity momentum and sells bonds with negative equity momentum. This Equity Momentum in Credit (EMC) strategy has exhibited strong and persistent performance over the past two decades with average excess returns of 6.34%/year (US IG) and 15.9%/year (US HY), and information ratios above 1.5 before transaction costs.
- EMC strategy performance is robust with respect to the exact specification of equity momentum and holds for liquid and illiquid corporate bonds. We do not find that EMC performance is attributed to illiquidity.
- EMC strategy has been negatively correlated with equity and credit markets, but positively correlated with a quality factor in equities. Returns of the EMC strategy have been high during credit and stock market down-cycles.
- Momentum and value styles complement each other in credit markets. Combining equity momentum and relative value signals has delivered robust absolute and risk-adjusted returns since January 1993.
- Turnover and transaction costs can significantly reduce EMC performance. However, equity momentum signals may still be highly valuable when deploying cash or as building blocks in a combination of signals.

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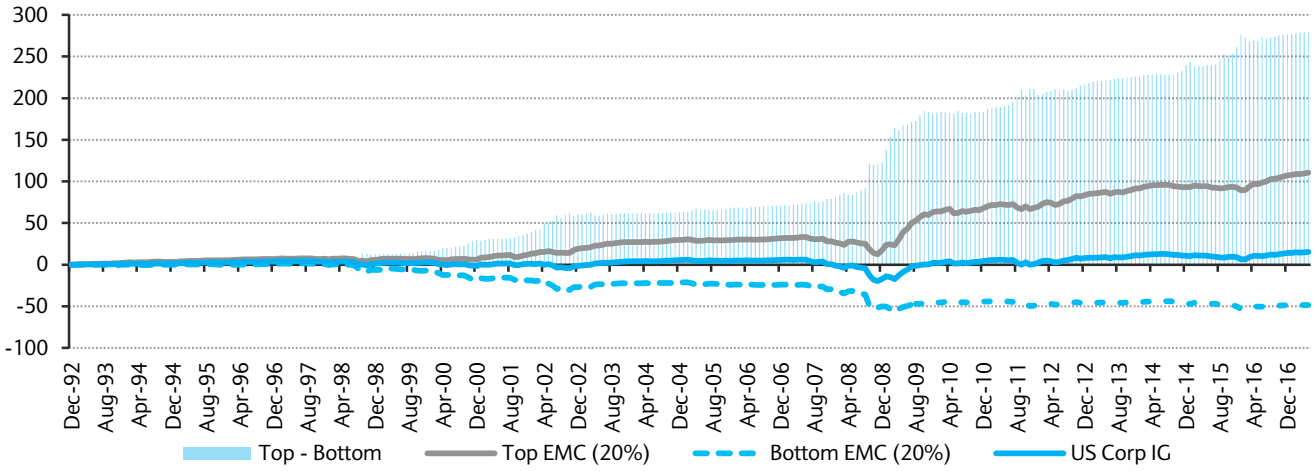
Introduction

Cross-asset momentum, particularly between equity and credit markets, has received special attention given the fact that bonds and stocks constitute the building blocks of a firm's capital structure and form the core of most investor portfolios.

Stock price returns and subsequent excess returns of corporate bonds tend to be positively related. To illustrate this, we sort constituents of the Bloomberg Barclays US Corporate Bond Index by equity price momentum [1] over three months and report subsequent bond performance of top and bottom quintiles (20%). Figure 1 shows a strong and persistent outperformance of the top quintile portfolio over the index and the bottom quintile portfolio.

FIGURE 1

Cumulative excess returns of corporate bond portfolios based on issuer's three-month equity price momentum, December 1992 – May 2017, (bp)



Source: Bloomberg Barclays Indices, Barclays Research

Equity momentum in credit (EMC) is closely related to the momentum strategy in stocks where stocks with high past returns tend to continue to outperform, an empirical fact well known to investors. Indeed, numerous studies show that the momentum strategy of buying past winners and selling past losers has proved effective in the US stock market[2], stock markets in other developed countries, and also in emerging markets. More recently, Asness, Moskowitz, and Pedersen, 2013 established that the momentum strategy (along with value) has also worked well in many other asset classes, including currencies, government bonds, and commodities.

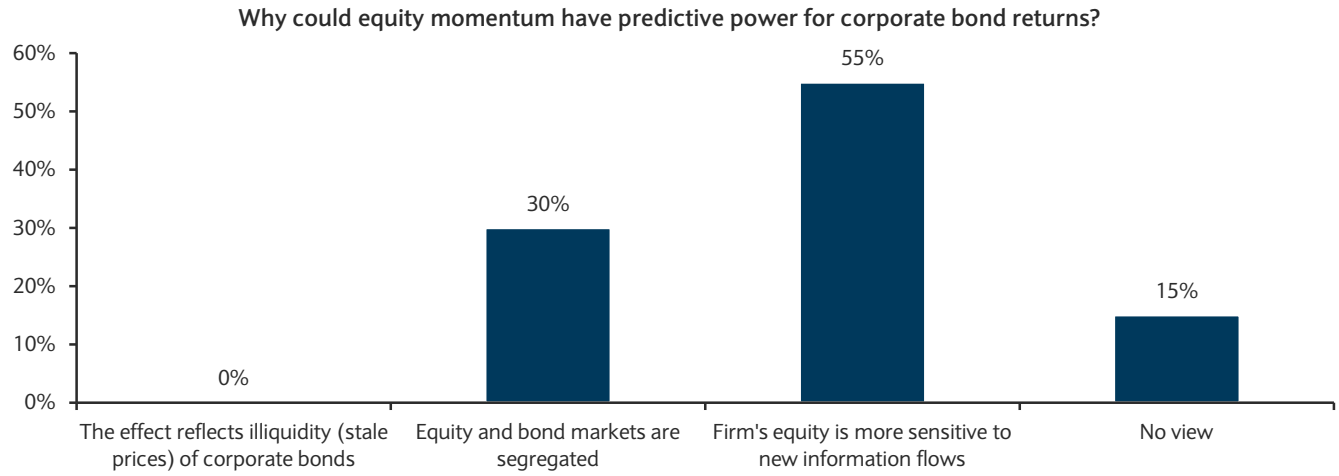
In stock markets, the main reasons for momentum to exist are believed to be behavioural in nature, like herding, over- and under-reaction, and the confirmation biases; with the most prominent interpretation being that stocks tend to under-react to new information.

Equity momentum in credit (EMC), however, might have different reasons to exist. For example, Lin, H. J. Wang, and C. Wu, 2013 attribute a large part of the phenomenon to liquidity risk.

In contrast, according to a poll of large institutional bond managers conducted by Barclays QPS Research in the summer 2017[3], equity momentum in credit is seen as predominantly associated with the segregation of equity and bond markets, as well as with the fact that stocks tend to be more sensitive to new information flows than bonds. Figure 2 summarises the poll results.

[1] Corporate bonds issued by private companies were excluded.
[2] See, for example, Jegadeesh, N. and S. Titman, 1993.
[3] Polling results from the 17th QPS Americas Analytics Advisory Council, an interactive forum where Barclays QPS Research discusses a variety of research topics with large institutional asset managers.

FIGURE 2
Results of the survey among US institutional bond managers, QPS American Advisory Council (AAC), 25 June 2017



Source: Barclays Research

In this analysis, we document the relationship between stock price momentum and subsequent excess returns of corporate bonds of the same issuer. We consider the *equity momentum strategy in credit* (EMC) that buys corporate bonds of issuers with strong momentum and sells bonds with weak or negative momentum. We study the performance of the EMC strategy in different parts of the US corporate bond universe (by sector, quality, and liquidity) and analyse its characteristics in different macro-regimes. We also discuss robustness, selection risk, signal decay over time, and portfolio turnover.

A number of studies have also looked at the relationship between equity momentum and subsequent returns of corporate bonds. Naik, V., M. Trinh, and G. Rennison, 2002 showed that equity returns tend to predict subsequent returns of corporate bonds, especially in lower quality sectors[4]. More recently, Haesen D., P. Houweling, and J. Van Zundert, 2017 suggested using firm-specific stock returns to improve risk properties of momentum-based bond portfolios. Barclays US credit strategy research documented a strong and persistent equity momentum effect in the US high yield market, see *The Big Mo*, April 2015.

Equity Momentum in Credit (EMC)

We analyse the phenomenon of equity momentum in credit (EMC) using Bloomberg Barclays US corporate bond data. Our universe consists of all bonds included in Bloomberg Barclays US Corporate investment grade (IG) and high yield (HY) indices in the period between December 1992 and May 2017. The sample contains monthly bond returns over duration-matched treasuries[5], as well as bond analytics, such as spreads and durations.

In order to measure equity price momentum of individual issuers, we assemble a historical mapping between corporate bonds and respective stocks[6]. Issuers with missing equity data are excluded from the sample[7].

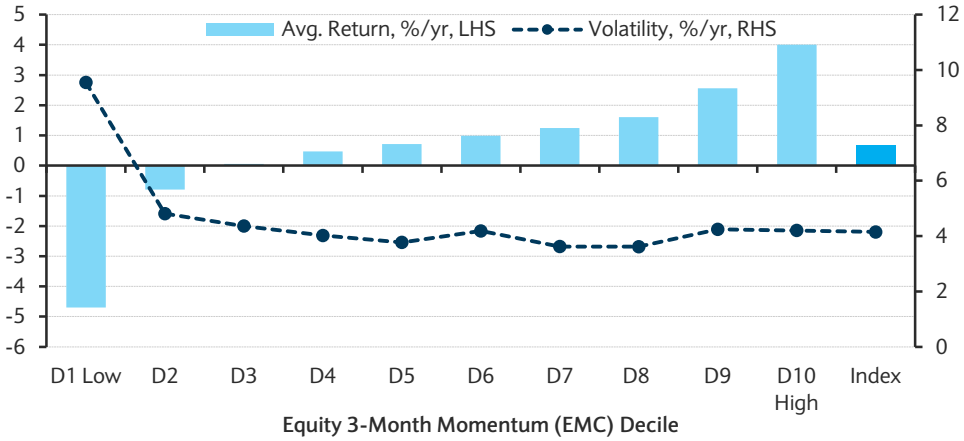
We measure equity momentum as equity price return in a formation period. Let us consider a signal formation period of three months as an illustration. At the beginning of each month,

[4] See also Gebhardt W.R., S. Hvidkjaer, and B. Swaminathan, 2005.
[5] All bond returns reported in this publication are in excess of duration-matched treasury portfolios, as provided by Bloomberg Barclays bonds indices.
[6] Please see *BEAM (Bonds in Equity Asset Momentum): Value of Bond Market Information in Equity Momentum Strategies* for the detailed description of the bond-equity mapping.
[7] For example, private companies are excluded.

corporate bonds are sorted into decile portfolios based on three-month equity momentum. We then report subsequent returns of the resulting portfolios. Figure 3 shows average returns and volatilities of all decile portfolios and provides evidence of a strong positive relationship between equity momentum and subsequent returns of corporate bonds: average portfolio returns increase monotonically as equity momentum strengthens[8].

FIGURE 3

Average excess returns and volatilities of corporate bonds by equity momentum deciles, January 1993 – May 2017



Source: Bloomberg Barclays Indices, Barclays Research

The bottom decile portfolio (D1) contains bonds with the weakest or most negative equity momentum. It delivered negative average excess return of -4.7% per year between 1993 and 2017. In contrast, the average excess return of the top decile portfolio (D10), with the strongest equity momentum, was 4.01% per year. These numbers are highly economically significant as the average excess return of the Bloomberg Barclays US Corporate IG index was only 0.67% per year in the same period. Interestingly, return volatilities, also reported on Figure 3, seem to be relatively stable across decile portfolios, excluding the bottom one (D1). The volatility of the bottom portfolio is almost twice as high as that of the other portfolios, which indicates higher risk for issuers with strong negative equity momentum.

The three-month horizon used to measure equity momentum period in Figure 3 was chosen arbitrarily. In the appendix, we try different horizons (1, 3, and 6 months) for signal formation and show that equity momentum appears to retain the predictive power for bond returns irrespective of the chosen horizon. Therefore, in the subsequent analysis, we use a momentum signal constructed as an equally weighted combination of stock returns over most recent one, three, and six months, rescaled for different lengths of respective formation periods[9]. The benefits of this approach are two-fold. First, equity momentum signals measured at different horizons might not be perfectly correlated, so that a diversified signal might be "cleaner" and have a stronger predictive power for bond returns. Second, combining momentum signals at different horizons helps to validate (confirm) a trend in stock prices. Indeed, a stock with continuing upward price trend over the previous six months has a stronger combined signal than a stock with positive price return over the past month only. Using multiple horizons in signal formation helps distinguish between issuers with trending and fluctuating stock prices.

[8] Please note that these results do not account for transactions costs.

[9] Equity returns measured at 1, 3, and 6 month horizons would have different magnitudes, with 6-month returns likely to be larger in absolute terms. In order to put different period returns on equal footing, we normalise them by the square root of period lengths over which they are measured, which corresponds to the increase in return volatility with time. So that three and six month returns are normalised by $\sqrt{3}$ and $\sqrt{6}$ respectively.

Figure 23 in the appendix compares the performance of corporate bond portfolios sorted on equity momentum measured over one, three, and six months, as well as on the combined momentum signal.

The predictive relationship between equity returns and excess returns of corporate bonds may be formally evaluated by looking at the performance of a long-short portfolio that buys bonds with strong equity momentum and sells bonds with strong negative equity momentum. For the purpose of this exercise we build diversified *quintile* portfolios sorted by equity momentum and define the *equity momentum strategy in credit* (EMC strategy) as running a long position in the top quintile portfolio (Q5) against a short position in the bottom quintile portfolios (Q1). Figure 4 reports the performance of the EMC strategy in different periods and compares the top quintile portfolio (Q5) with the bottom quintile portfolio (Q1) and the Bloomberg Barclays US Corporate Index. The EMC strategy performed well in both sub-periods (1993–2007 and 2007-2017), delivering average return of 6.34% per year with information ratio of 1.56 in the overall sample. These statistics validate a persistently positive relationship between equity momentum and subsequent bond returns[10].

FIGURE 4

EMC strategy performance in different periods

	US Corp IG Index	Q1 (Bottom)	Q5 (Top)	EMC Strategy: 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: Bloomberg Barclays Indices , Barclays Research

Next, we analyse the performance of the EMC strategy by credit quality. We split the US investment-grade bond universe into bonds rated A3 or higher and bonds rated Baa. We also report the EMC strategy performance in the high yield market.

Figure 5 shows that, irrespective of credit quality, bond excess returns tend to increase with equity momentum. The effect seems to be stronger, however, for lower quality names. Indeed, the average return of the EMC strategy for bonds rated A3 and higher is 3.9% per year with an information ratio of 0.83. In comparison, average returns of the EMC strategy among Baa-rated and HY bonds in the same period were 8.8% per year and 19.9% per year with information ratios of 1.87 and 1.74, respectively. The corresponding average returns of top quintile portfolios (Q5) by equity momentum across the three quality buckets were 2.02% per year, 4.74% per year and 10.38% per year, respectively. Equity momentum appears to be a highly informative signal for lower quality names.

[10] All returns ignore transaction costs as, at this stage, we aim to illustrate broad performance patterns and properties of the strategy.

FIGURE 5

EMC strategy performance by credit quality, January 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: Bloomberg Barclays Indices, Barclays Research

Characteristics of the EMC strategy

Equity momentum signals tend to vary significantly over time and deteriorate quickly, so investors face the practical choice of holding bonds with weakened equity momentum and poorer performance prospects or incurring transaction costs that could significantly reduce returns. Investment horizons along with turnover and transaction costs all need to be considered to assess the practical value of the EMC strategy to portfolio managers.

Figure 6 reports average transition probabilities of issuer equity momentum ranks over three-month horizons between 1993 and 2017.

FIGURE 6

Average three-month equity momentum rank transition frequencies, December 1992 – May 2017

Equity Momentum Deciles Beginning of Period	Equity Momentum Deciles - Beginning of Period									
	D1 Low	D2	D3	D4	D5	D6	D7	D8	D9	D10 High
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

These transition probabilities are high. For example, an issuer with equity momentum in the top 10% (D10) has only a 17% probability of remaining top ranked after three months and an 83% probability of transiting into a lower decile.

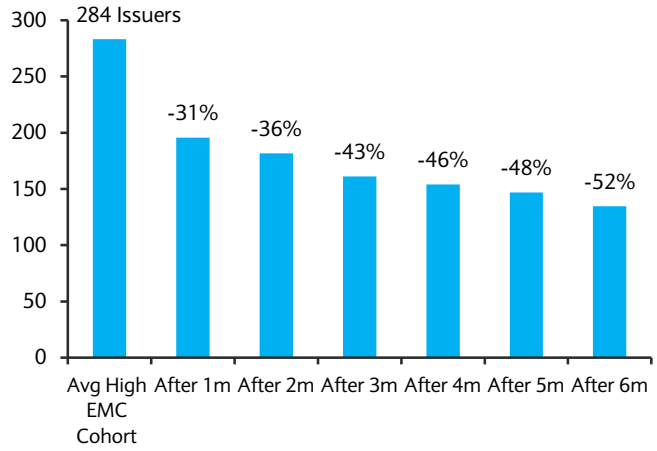
Panel A of Figure 7 shows the average number of above-median momentum issuers as a function of holding period. The number of issuers that remain above median drops by 31% in the first month after momentum signal formation. 52% of issuers drop out after six months. Both Figures 6 and 7 indicate that equity momentum-based corporate bond portfolios could experience relatively high turnover.

FIGURE 7

Turnover and returns of EMC portfolios as a function of time since inception

PANEL A

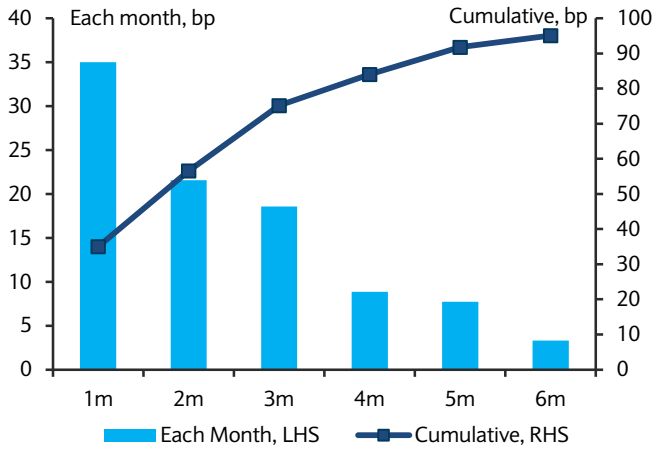
Number of issuers with above-median equity momentum, July 2007 – May 2017



Source: Bloomberg Barclays Indices, Barclays Research

PANEL B

Average outperformance of High (above median) vs. Low (below median) EMC portfolios after inception, July 2007 – May 2017



Source: Bloomberg Barclays Indices, Barclays Research

While, equity momentum seems to be a relatively volatile signal, Panel B of Figure 7 shows that the high EMC portfolio (bonds of issuers with above-median equity momentum) continued to outperform the low EMC one (below-median equity momentum) in the six months that follow signal formation. A fixed cohort of bonds with high equity momentum outperformed a similar cohort of bonds with low equity momentum by 35bp, 22bp, and 19bp in months 1, 2, and 3 respectively. The cumulative outperformance after six months was 95bp, with the first three months accounting for nearly 80% of the outperformance.

While a quarterly rebalancing period offers a suitable trade-off between turnover and performance, there appears to be little penalty for keeping the portfolio unchanged for longer as the high EMC portfolio continued to outperform.[11]

However, even a volatile signal could potentially be useful when a portfolio manager must deploy new cash or sell bonds. Indeed, high EMC bonds could be selected when adding new bonds to the portfolio, while low EMC bonds could be chosen when liquidating positions. EMC could potentially be used as a filter for issuer selection and may also be combined with other signals with a view to providing robust outperformance.

[11] Additional turnover reduction techniques may be implemented in actual portfolios. Investors could introduce a hold buffer, an "acceptable" range of the equity momentum signal where new bonds would not be added to the portfolio and previously bought old bonds would be kept unchanged (see the Appendix). Alternatively, investors could implement implicit turnover budget, so that bonds with the most negative momentum would be replaced by new bonds with the positive momentum to the extent the turnover budget permits.

Security Selection Risk

The EMC strategy performance presented above is based on very broad portfolios of several thousand bonds. Realistic portfolios are often much more concentrated and subject to selection risk. Therefore, a concentrated portfolio of bonds with strong equity momentum could potentially underperform a portfolio with negative momentum.

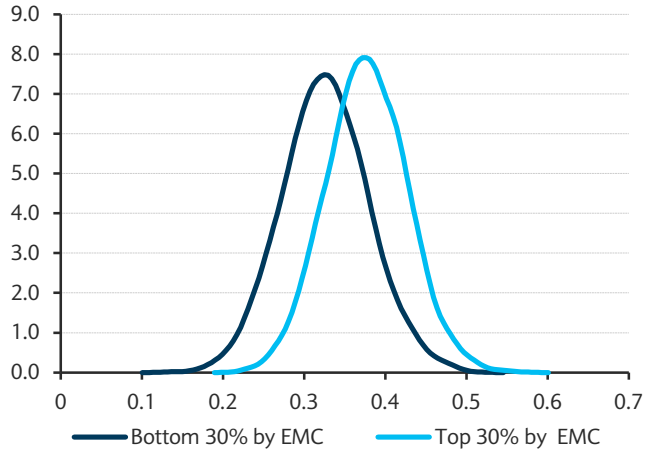
To assess selection risk, we plot return distributions of concentrated bond portfolios with high and low EMC. The distributions, shown in Figure 8, are obtained by randomly selecting 100 bonds with equity momentum rank in top 30% or bottom 30%, while ensuring that portfolio allocations remain broadly in line with that of the IG index. In particular, we match the index allocation by sector (financials, non-financials), rating (A3-Aaa, Baa3-Baa1), and maturity (1-5y, 5+y). The return distributions presented in Figure 8 use 5000 randomly re-sampled portfolios of 100 bonds.

FIGURE 8

Return distributions of 100-bond EMC portfolios with randomly selected bonds

PANEL A

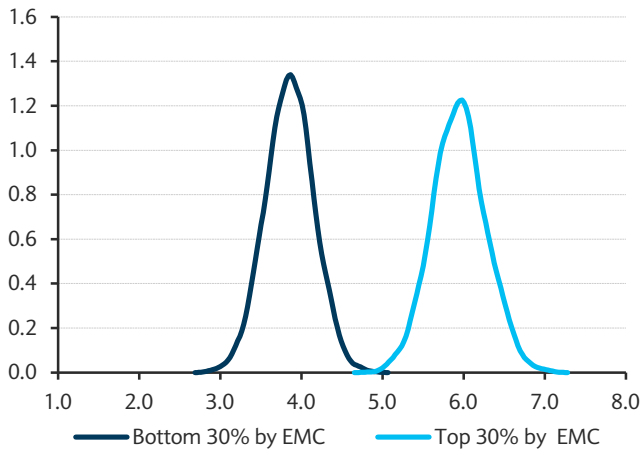
One-month horizon: May 2017



Source: Bloomberg Barclays Indices; Barclays Research

PANEL B

Twelve-month horizon: June 2016 – May 2017



Source: Bloomberg Barclays Indices; Barclays Research

Panel A of Figure 8 shows a very large overlap between May 2017 return distributions of high and low equity momentum portfolios, meaning that, in that month, there was a relatively high probability for a randomly chosen portfolio of 100 bonds with top 30% equity momentum to underperform a similarly constructed portfolio with equity momentum in the bottom 30%. Panel B of Figure 8 shows that over longer time horizons (one year, from June 2016 to May 2017 in this example) the probability that a high EMC portfolio underperforms a low EMC portfolio was very low[12].

Risk exposures of the EMC strategy over time

The EMC (Q5-Q1) strategy has delivered strong and robust performance over time. Did varying strategy credit exposure played a role? Panels A and B of Figure 9 plot time series of the net option-adjusted spread of the EMC strategy together with the S&P 500 index and the average spread of the US corporate index. As Panel A of Figure 9 illustrates, the strategy net spread tends to decline and become negative during *equity* down-cycles. Panel B shows a similar pattern for *credit* down-cycles.

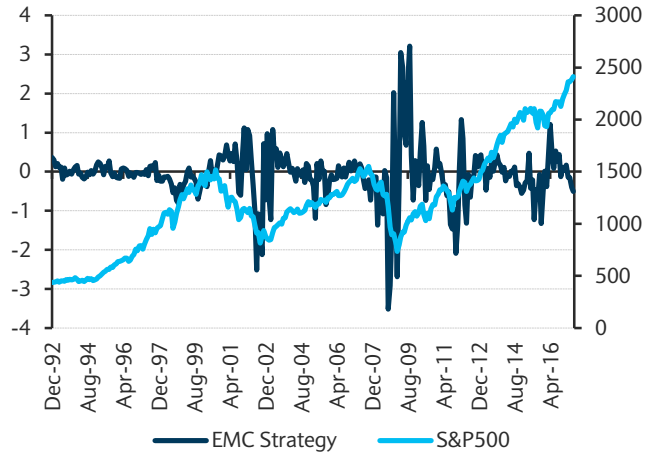
[12] Portfolios are assumed to be rebalanced monthly based on issuer equity momentum and broad index composition.

FIGURE 9

Historical net OAS of the EMC strategy (Q5-Q1), December 1992 – May 2017

PANEL A

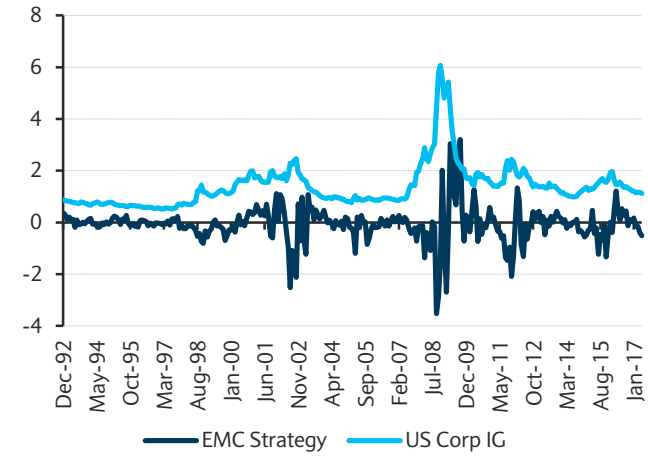
Net OAS of the EMC strategy vs. S&P 500 index



Source: Bloomberg Barclays Bond Indices, Barclays Research

PANEL B

Net OAS of the EMC strategy and Bloomberg Barclays US Corporate Bond Index



Source: Bloomberg Barclays Bond Indices, Barclays Research

Panels A and B of Figure 9 suggest that credit exposure of the EMC strategy is directional on the performance of the overall equity market: the EMC strategy is long spread and therefore has a positive credit exposure in benign environments and negative exposure in a market down-cycle[13]. In equity down markets, the "risk-off" would lead to selling of risky stocks, which creates a negative momentum for EMC. As a result, risky high-OAS bonds are likely to fall in the negative momentum quintile (Q1). In market rallies the opposite is likely to occur with risky high-OAS bonds falling into the top equity momentum quintile (Q5).

Figure 10 splits our sample by monthly return of S&P500 into bottom 30%, mid-40% and top 30%; and reports characteristics of the EMC strategy: net spread (OAS), net duration (OAD), and net duration times spread (DTS). The figure confirms the pattern seen in Figure 9: the EMC strategy tends to have a negative credit exposure during a bearish market and positive credit exposure during a bullish market. These results point to potential diversification properties of the EMC strategy with respect to equity or credit market returns.

FIGURE 10

Exposures of the EMC strategy by equity market regimes (S&P500), January 1993 – May 2017

	Bottom 30% = -4.2%			Mid 40% = 1.0%			Top 30% = 5.1%		
	Btm EMC (Q1)	Top EMC (Q5)	EMC Strategy (Q5-Q1)	Btm EMC (Q1)	Top EMC (Q5)	EMC Strategy (Q5-Q1)	Btm EMC (Q1)	Top EMC (Q5)	EMC Strategy (Q5-Q1)
OAS, %	1.95	1.64	**-0.31**	1.43	1.37	-0.06	1.45	1.59	**0.14**
OAD, yr	6.03	6.46	**0.43**	6.34	6.28	-0.06	6.35	6.15	**-0.20**
DTS, % x yr	11.47	10.53	**-0.94**	9.09	8.71	-0.38	9.16	9.62	**0.45**

Source: Bloomberg Barclays Indices, Barclays Research

[13] Similar results were obtained by Haesen, D., P. Houweling, and J. Van Zundert, 2017, who proposed to measure equity momentum using idiosyncratic stock returns (by first subtracting beta-adjusted market returns from those of individual stocks) to improve the performance of the strategy around market turning points. The respective results, albeit with otherwise different specification of the momentum signal (as per our previous discussion in the text), are reported in the Appendix.

EMC strategy returns in different market environments

We saw in the previous section that the net spread of the strategy tends to be positive when equity markets perform well and when spreads rally. Does this mean that returns of the EMC strategy are correlated with credit, treasury, and equity returns?

Figure 11 reports correlations of the EMC strategy returns with fixed income and equity market factors. These are excess returns of the Bloomberg Barclays US Corporate IG index (US Corp), total returns of the Bloomberg Barclays US Treasury index (US Tsy) and a selection of equity risk factors that comprises Fama-French Market (EQ MKT), Size (EQ SMB), Value (EQ HML) and Momentum (EQ MOM) factors as well as a Quality Minus Junk (EQ QMJ) equity factor.[14]

EMC is negatively correlated with corporate excess returns (-43%) and with returns of the equity market (-38%). These negative correlations reflect the contra-cyclical dynamics of credit exposure highlighted in Figures 9 and 10. As a result, the strategy should have attractive diversification properties for credit or equity investors. Correlations of the EMC strategy with treasury returns and equity size, value and momentum factors are also low or negative. Finally, the strategy is positively correlated with the Quality Minus Junk (QMJ) equity factor, which also has defensive properties with respect to credit and equity allocations. EMC correlation with the equity momentum factor (EQ MOM) is positive but low and statistically insignificant, which illustrates the different nature of the two strategies. This may be because momentum is defined differently for EQ MOM and EMC [15] or because the subsequent performance of bonds is different from that of equities.

FIGURE 11

Correlation of EMC returns with equity and fixed income market factors, January 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: Bloomberg Barclays Indices, Data Library of K. French, AQR Data Library, Barclays Research

The negative correlation of EMC with credit market returns implies that the strategy may do well during credit down-cycles. We verify this using the available history of corporate bond excess returns.

Figure 12 plots cumulative excess returns of the Bloomberg Barclays US Corporate IG index and highlights periods of significant drawdowns. Based on this chart, we select six bearish episodes in the credit market: Aug 1997 - Oct 1998 (LTCM, Asian, Russian crisis), Jan 2000 - Dec 2000 (dot-com crisis), Apr 2002 - Oct 2002 (telecom crisis), Mar 2007 - Nov 2008 (financial crisis), May 2011 - Nov 2011(Euro sovereign crisis), Aug 2014 - Feb 2016 (energy sector crisis).[16] For each of these episodes, we report the performance of EMC alongside that of other equity market factors.

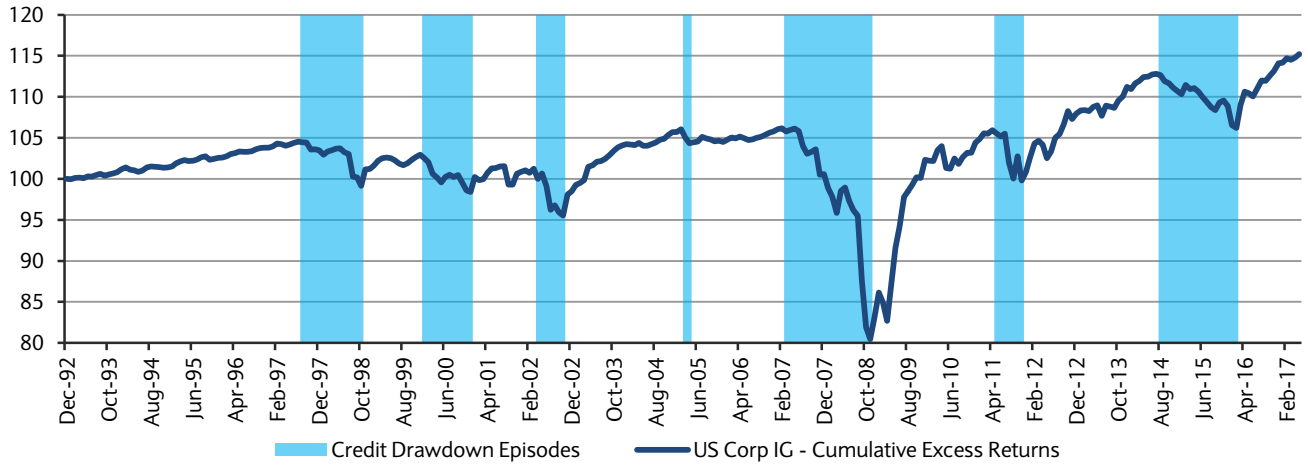
[14] Fama-French equity factors are available in the web data library of Kenneth R. French: *http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html*. For an introduction to the Quality Minus Junk (QMJ) factor, see Asness, C. S., A. Frazzini, and L.H. Pedersen, 2017.

[15] Equity momentum in EQ MOM strategy uses 12-month stock returns excluding the last month (due to mean-reversion), while the EMC strategy uses an equally-weighted combination of equity returns in previous six, three, and one months.

[16] The attribution of credit down-cycle episodes to market events is arbitrary.

FIGURE 12

US Credit drawdown episodes, December 1992 – May 2017



Source: Barclays Research

Figure 13 shows the performance of the EMC strategy and equity factors in credit drawdown episodes. The first column defines the down-cycle periods. Cumulative excess returns of the corporate index are reported in the second column and are all significantly negative. The third column includes cumulative returns of EMC, while the rest of the table shows equity factor portfolios: market, size, value, momentum and quality. Consistently with the correlations shown in Figure 11, the performance of EMC during credit down-cycles is positive, highlighting its contra-cyclical nature. During the telecom, financial, and energy crises, EMC returns before transaction costs exceeded 10%.

FIGURE 13

Returns of the EMC strategy in credit down-cycles in %, December 1992 – May 2017

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: Bloomberg Barclays Indices, Data Library of K. French, AQR Data Library, Barclays Research

While Figure 13 reports only drawdown episodes, Figure 14 includes the entire period of our analysis split in two subsets -credit down-cycles and recoveries - and shows annualized returns of EMC alongside various market indices or factors. While the corporate index has average returns of -8.07%/yr in drawdown episodes and 4.12%/yr in recovery times, the EMC strategy performed well in both regimes: 11.53%/yr in credit drawdowns and 4.30%/yr in recoveries. No other factors had comparable performance characteristics in the two regimes.

FIGURE 14

Annualised returns of the EMC strategy in credit down-cycles and recoveries in %/yr, January 1993 – April 2017

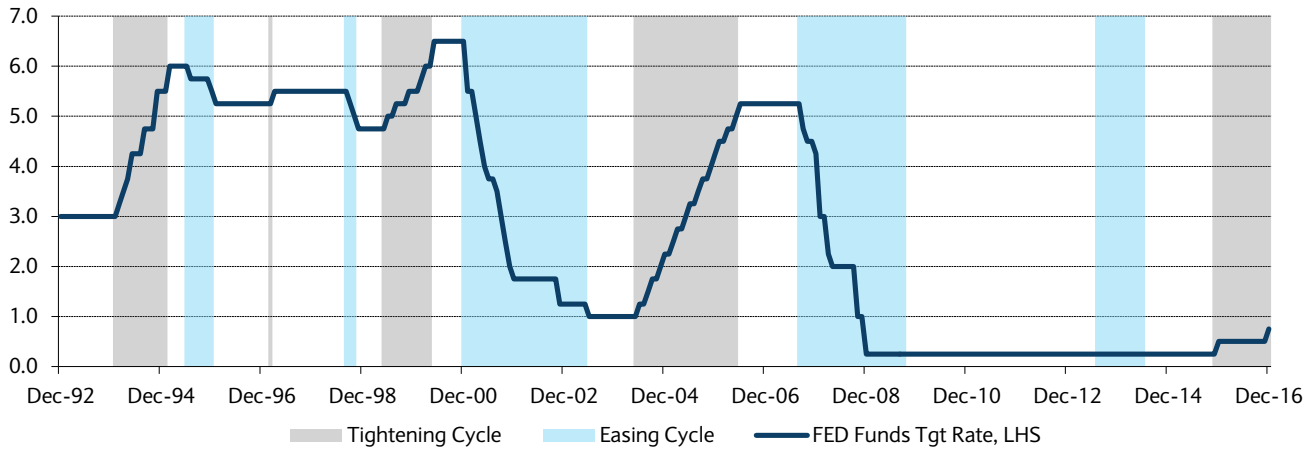
	Drawdown			Recovery			Overall		
	Avg. Ret	Vol	IR	Avg. Ret	Vol	IR	Avg. Ret	Vol	IR
US Corp IG	-8.07	5.15	-1.57	4.12	3.18	1.29	0.65	4.15	0.16
EMC (Q5-Q1)	11.53	5.43	2.13	4.30	3.22	1.34	6.35	4.06	1.56
EQ MKT	-12.34	18.12	-0.68	15.73	12.56	1.25	7.75	14.76	0.53
EQ SMB	-6.24	15.55	-0.40	5.14	9.11	0.56	1.90	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: Bloomberg Barclays Indices, Data Library of K. French, AQR Data Library, Barclays Research

Next we analyse the performance of the EMC strategy during Federal Reserve (Fed) monetary cycles. Monthly observations are associated with monetary tightening or monetary easing regimes. Monetary easing includes months when the federal funds target rate declined,[17] while tightening includes months when the federal fund target rate increased. Figure 15 highlights monetary easing and tightening episodes in our sample. In addition, we separately split each tightening or easing period into two halves: early and late tightening / easing (not shown).

FIGURE 15

Federal Reserve easing and tightening episodes

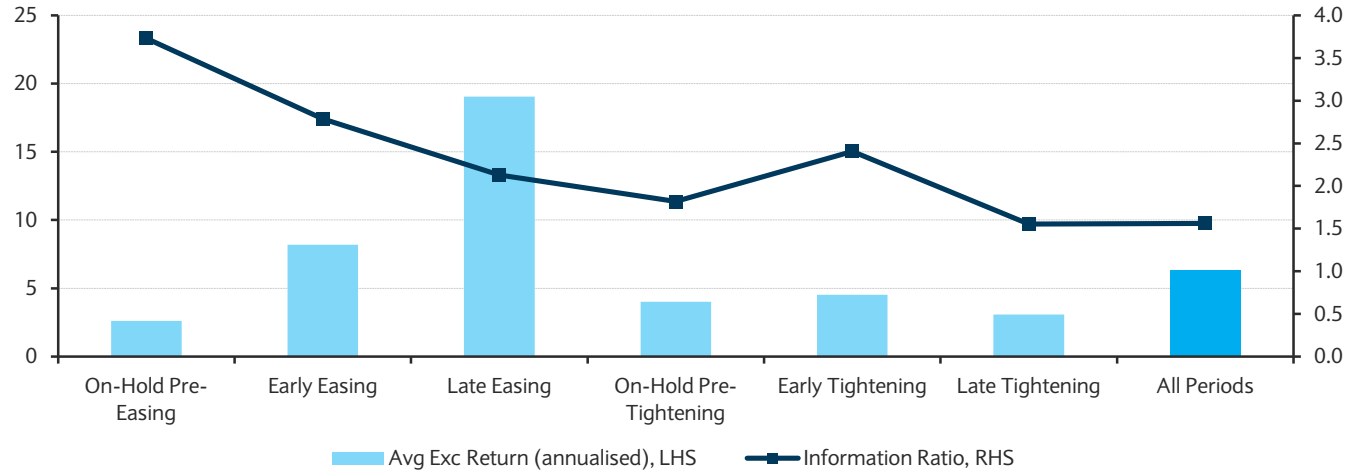


Source: Bloomberg, Barclays Research

The chart in Figure 16 and table in Figure 17 report average excess returns and information ratios of EMC in the different Fed cycles. The strategy performed best during early and late monetary easing with average excess returns over 8%/yr. In all other monetary regimes, average returns were below 5%/yr. Nevertheless, the EMC strategy also demonstrated very high risk-adjusted performance during pre-easing (information ratio of 3.7) and early tightening (information ratio of 2.4) periods, which probably reflects low dispersion and volatility of corporate excess returns in these two periods.

[17] After 2008, as the Fed rate reached its lower bound, we also qualified as monetary easing the periods when Fed assets expanded at a rate faster than 25% p.a. This occurred in 2009 and 2013.

FIGURE 16
Annualised returns of the EMC strategy in FED cycles, January 1993 – May 2017



Source: Bloomberg Barclays Indices, Barclays Research

Figure 17 summarises the performance of the EMC strategy during Fed monetary cycles and contrasts it with that of the corporate index. Strategy performance is much stronger during monetary easing and weaker during monetary tightening. These results are not surprising in light of the contra-cyclicality of EMC returns documented earlier. Indeed, Fed monetary cycles are likely to coincide with economic downturns (Fed easing) and recoveries (Fed tightening).

FIGURE 17
Annualised returns of the EMC strategy in FED cycles, January 1993 – May 2017

	EMC Strategy				US Corporate IG index		
	# obs	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 Indices, Barclays Research

Is EMC a liquidity phenomenon?

One possible explanation for the performance of equity momentum in credit is that it is an artefact of the illiquidity of corporate bonds, as discussed by Lin, H. J. Wang, and C. Wu, 2013. Indeed, bonds may react more slowly than stocks to news affecting a corporation. This can be due to various factors, including market structure and differences in transaction costs and liquidity. In this case, the relationship between equity momentum and subsequent returns of corporate bonds can be an illusion: investors, trying to implement the strategy, would in reality be offered "updated" prices of corporate bonds that would adjust for recent equity returns.

This logic implies that, on paper, the EMC strategy should perform better for less liquid corporate bonds than for liquid ones. We test the liquidity explanation of EMC by first sorting corporate bonds by a liquidity measure and then by equity momentum within each liquidity category. If illiquidity plays a significant role, EMC should perform better when applied to illiquid bonds.

In this exercise we use bond-level Trade Efficiency Scores (TES) published by Barclays QPS Research, a relative measure of liquidity that combines information on liquidity cost scores (bid-offer spreads) and monthly trading volumes of individual securities to rank all constituents of the corporate index on a monthly basis. TES increases as corporate bond liquidity declines, so bonds with lower TES are more liquid and actively traded.

We split bonds into three TES buckets: liquid, actively traded bonds with TES between 1 and 3, moderately liquid bonds with TES between 4 and 7, and illiquid infrequently traded bonds with TES between 8 and 10. We further sort bonds in each TES bucket into five equity momentum quintile portfolios and calculate return of the EMC strategy as the return differential between top (Q5) and bottom (Q1) quintile portfolios.

Figure 18 reports the performance of the EMC strategy and of the five momentum quintile portfolios in each TES bucket in the period from 2007 to 2017.[18] We observe that the average returns of the EMC strategy are broadly similar across TES buckets, while volatility declines for less liquid bonds, so that the information ratio increases from 1.48 to 1.99 as liquidity worsens. Nevertheless, strategy performance remains very strong for the most liquid and actively traded securities. So we cannot state that the illiquidity of corporate bonds is the main factor explaining the EMC phenomenon.

FIGURE 18

Performance of the EMC strategy by bond Trade Efficiency Scores (TES), February 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)	-4.78	-0.26	2.25	2.23	4.67	9.45
TES 4-7	-4.03	0.17	1.72	2.80	5.38	9.41
TES 8-10 (illiquid)	-4.04	0.16	1.91	3.03	4.77	8.81
	Annualised Volatility, %/yr					
TES 1-3 (liquid)	10.41	6.45	5.56	5.94	7.11	6.39
TES 4-7	8.76	5.71	5.34	5.78	6.64	5.38
TES 8-10 (illiquid)	7.34	5.93	5.27	5.72	5.70	4.43
	Information Ratio					
TES 1-3 (liquid)	-0.46	-0.04	0.41	0.38	0.66	1.48
TES 4-7	-0.46	0.03	0.32	0.49	0.81	1.75
TES 8-10 (illiquid)	-0.55	0.03	0.36	0.53	0.84	1.99

Source: Bloomberg Barclays Indices, Barclays Research

Autocorrelation of corporate bond excess returns can also be used as a measure of liquidity. Indeed, if corporate bond prices are only infrequently updated and subject to "stale" pricing, their returns are likely to be positively correlated as new information slowly gets priced in. Using this logic, we look at the performance of the EMC strategy within buckets sorted by the autocorrelation of monthly bond excess returns.

We sort bonds by autocorrelation calculated in the previous 12 months and form three buckets: low (bottom 30%), medium (mid 40%) and high (top 30%). Then, within each autocorrelation bucket, we sort bonds by equity momentum to form quintile portfolios and measure the performance of the EMC strategy (Q5-Q1).

[18] Bond Efficiency Scores (TES) for constituents of the US Corporate IG index are available from January 2007.

As shown in Figure 19, the EMC strategy works equally well in all autocorrelation buckets. The strategy performance does not seem to be attributed to illiquidity of corporate bonds.

On the other hand, average returns of individual quintile portfolios show an interesting pattern: as autocorrelation of bond returns increases, so do returns across all quintile portfolios. This could be seen as potential evidence of momentum in corporate bond excess returns.

FIGURE 19

Performance of the EMC strategy by autocorrelation of bond excess returns, January 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: Bloomberg Barclays Indices, Barclays Research

Combining equity momentum with relative value

Equity momentum in credit (EMC) can be combined with other systematic strategies with the aim of achieving better performance. This can be done by combining the EMC signal with other model-driven signals. If individual signals are predictive of future performance and imperfectly correlated with each other, a significant increase in portfolio performance could be achieved.

Let us consider EMC in combination with a credit relative value signal from our quantitative Excess Spread over Peers (ESP) scorecard, which is designed to identify relative value opportunities in credit. The ESP Scorecard ranks individual bonds based on their excess spread over peers adjusted for issuer fundamentals. The ESP methodology includes the following steps: 19

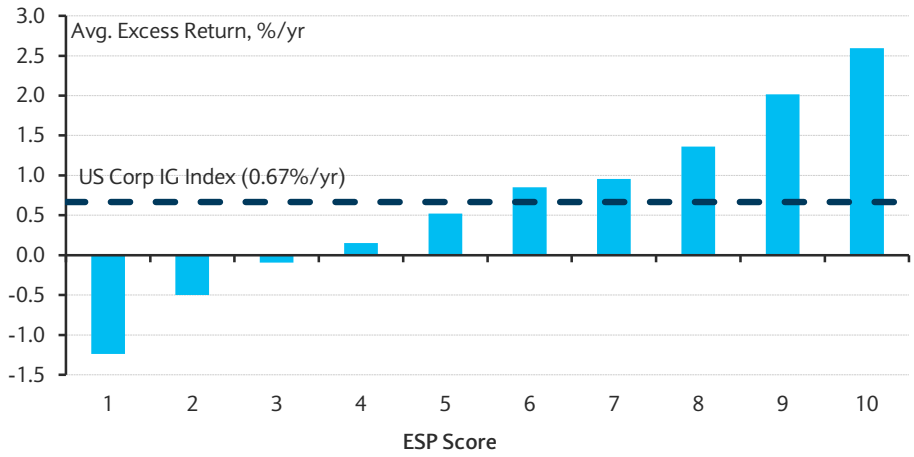
1. The initial ESP is calculated as a bond excess spread over its peer group average. Peer groups are defined by rating, sector and maturity.
2. Within peer groups, variation in excess spreads can often be explained by issuer fundamentals. Thus, in a second step, excess spreads are adjusted for fundamentals by regressing them on a combination of debt/assets, net debt/EBITDA and interest coverage measures.
3. Excess spreads over peers unexplained by fundamentals are scored from 1 to 10. High scores (6-10) indicate potentially undervalued securities, while low scores (1-5) indicate potentially overvalued securities with tight spreads over peers given issuer fundamentals.[20]

[19] The details are available in *An Update on the ESP Scorecard: A Framework to Identify Relative Value in Credit*.
[20] We publish a monthly *ESP Scorecard* that analyses the performance of a portfolio of High and Low ESP bonds. The scorecard also discusses respective ESP portfolio characteristics such as duration, spread, liquidity, ad turnover. The ESP Scorecard currently covers US investment grade, US high yield (non-distressed) and European investment grade senior credit.

Figure 20 shows the performance of corporate bond portfolios sorted by ESP scores in the period between 1993 and 2017. The performance of credit portfolios increases monotonically with ESP scores, with higher ESP portfolios generating superior returns on average.

FIGURE 20

Average excess returns of US corporate IG portfolios by ESP score, January 1993 – May 2017



Source: Bloomberg Barclays Indices, Barclays Research

There are many different ways to construct a credit portfolio that combines value and momentum signals. We choose a simple and intuitive approach to illustrate the properties of the combination. In order to combine momentum (EMC) and relative value (ESP) signals, we double sort bonds to form four buckets: high ESP and high EMC (HH), high ESP and low EMC (HL), low ESP and high EMC (LH), and low ESP and low EMC (LL). Panel A of Figure 21 illustrates the approach. The High (Low) ESP bucket includes bonds with ESP scores between 6 and 10 (1 and 5). Similarly, the High EMC bucket includes issuers with above median equity momentum while the low EMC bucket includes issuers with below median equity momentum.

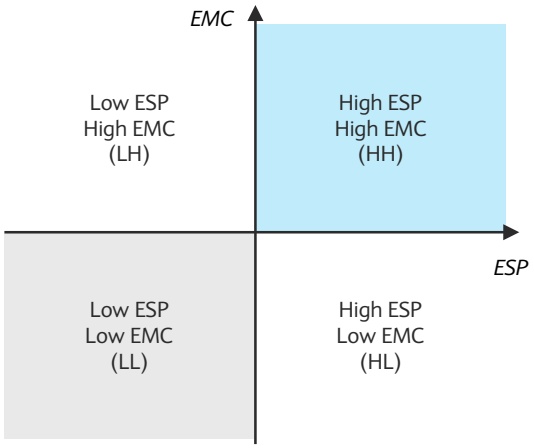
Panel B of Figure 21 shows average returns of these four credit portfolios based on the combination of relative value (ESP) and equity momentum (EMC) signals. The portfolio with high ESP and EMC signals (HH portfolio) significantly outperforms the other three combinations as well as the index.

FIGURE 21

Combining relative value (ESP) and equity momentum (EMC) Signals, January 1993 – May 2017

PANEL A

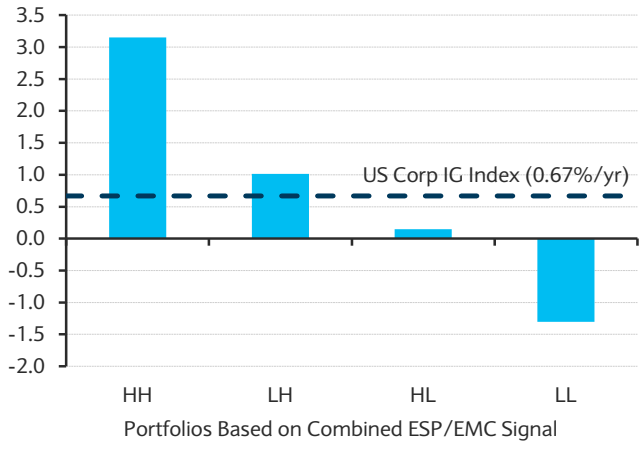
Sorting Bonds on ESP and EMC Signals



Source: Barclays Research

PANEL B

Performance



Source: Bloomberg Barclays Indices, Barclays Research

Figure 22 reports the performance of the High ESP (top 50% by ESP) and High EMC (top 50% by EMC) portfolios as well as the portfolio based on the combination of ESP and EMC signals (HH) and compares their performance statistics with those of the Bloomberg Barclays US Corp IG Index. Combining the two signals increases portfolio performance very significantly.

FIGURE 22

Performance of relative value (ESP) and equity momentum (EMC) style portfolios relative to index

	Absolute Performance				Performance over Index		
	Index	High ESP	High EMC	Combined (HH)	ESP - Index	EMC - Index	Comb - Index
	January 1993 - May 2017						
Avg. Ret [%/yr]	0.67	1.52	2.09	3.15	0.85	1.43	2.49
Volatility [%/yr]	4.15	4.43	3.97	4.17	0.56	0.99	1.16
Information Ratio	0.16	0.34	0.53	0.76	1.54	1.44	2.14
Corr with Index	100%	99%	97%	96%	46%	-30%	-12%
	January 1993 - June 2007						
Avg. Ret [%/yr]	0.41	0.97	1.24	2.00	0.56	0.83	1.59
Volatility [%/yr]	2.09	2.42	1.89	2.13	0.48	0.57	0.70
Information Ratio	0.20	0.40	0.66	0.94	1.18	1.46	2.28
Corr with Index	100%	99%	96%	95%	63%	-47%	-10%
	July 2007 - May 2017						
Avg. Ret [%/yr]	1.04	2.32	3.34	4.83	1.28	2.30	3.79
Volatility [%/yr]	6.01	6.31	5.79	6.00	0.63	1.35	1.54
Information Ratio	0.17	0.37	0.58	0.81	2.02	1.70	2.46
Corr with Index	100%	100%	97%	97%	43%	-27%	-14%

Source: Bloomberg Barclays Indices, Barclays Research

In the overall sample, High ESP and High EMC portfolios outperformed the index by 0.85%/yr and 1.43%/yr, respectively, with information ratios of 1.54 and 1.44. The combined portfolio (HH), on the other hand, outperformed the index by 2.49%/yr with an information ratio of 2.14. As the two signals complement each other, the portfolio based on the signal combination outperformed the index by more than the sum of the two strategies taken in isolation.

Summary

We analyze the effect of equity price momentum on excess returns of corporate bonds issued by the same firm and find a strong positive relationship. Stronger equity momentum leads to higher corporate bond returns. Equity momentum could therefore be used systematically as a signal for issuer selection.

We design a strategy (EMC) that buys corporate bonds with strong equity momentum and sells bonds with negative momentum. The strategy has demonstrated strong and persistent performance over the past two decades with average excess returns of 6.34%/yr (US IG) and 15.9%/yr (US HY) and information ratios above 1.5 before transaction costs.

The results are robust with respect to the exact specification of equity momentum and hold for liquid and illiquid corporate bonds. We do not find that EMC strategy performance can be explained by the illiquidity.

The EMC strategy has been negatively correlated with equity and credit markets but positively correlated with a quality factor. Returns of the EMC strategy have been particularly strong during credit down-cycles.

High turnover and transaction costs can significantly reduce the performance of the EMC strategy. Nevertheless, equity momentum signal can still be used to inform any portfolio rebalancing or as a building block in a combined signal.

Credit investors could consider combining EMC and relative value signals by buying undervalued bonds with strong issuer equity momentum. This strategy has delivered robust absolute and risk-adjusted returns since January 1993.

Appendix 1: Robustness of the EMC Strategy

Does EMC strategy performance depend on the signal formation period? Figure 23 reports the performance of credit portfolios sorted by equity price momentum observed in the previous one, three, and six months. Performance is consistent across all signal formation periods: portfolio returns and information ratios increase as equity momentum strengthens. The combined strategy that equally combines signals measured over different horizons (after adjusting for differences in length of the formation periods) delivers the highest absolute and risk-adjusted returns. Results do not change qualitatively according to the length of the signal formation period.

FIGURE 23

Performance of the EMC strategy by signal formation period, January 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: Bloomberg Barclays Indices, Barclays Research

Another important issue could be that the momentum signals are measured over periods ending at a point when the EMC portfolios are constructed (usually the last business day of a month). One could argue that, from a practical perspective, end-of-period stock prices should be taken with a lag to give enough time to build a corporate bond portfolio. Figure 24 shows the performance of quintile portfolios sorted on the combined equity momentum signal but with end-of-period stock prices lagged by one, two or three business days.[21] The lag in stock prices does not change results much, and the equity momentum signal is found to work very well across all specifications.

[21] In our analysis we used monthly stock prices available on the last business day of each month. For this exercise, however, we used daily equity prices. Hence the small differences in the results related to the zero lag case.

FIGURE 24

Performance of the EMC strategy with lagged stock prices, January 1993 – May 2017

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: Bloomberg Barclays Indices, Barclays Research

The EMC strategy that goes long the top quintile and shorts the bottom quintile portfolios sorted by equity momentum shows time-varying credit exposure (see Figures 9 and 10). In credit down-cycles the strategy typically has a negative net spread, while during recoveries, the strategy has a positive net spread. Haesen, D., P. Houweling, and J. Van Zundert (2017) argued that this varying exposure can make the strategy vulnerable in periods of market turning points, for example when a market downturn is followed by a recovery. The authors suggested that risk and performance characteristics of the EMC strategy can be improved if equity momentum is measured from issuer-specific stock returns, having taken out the market (or, more generally, systematic) return component.

Figure 25 shows the performance of top and bottom quintile credit portfolios sorted on *residual* equity momentum after a beta-adjusted market returns[22] were taken out. The results are slightly worse than those reported in Figure 4, where total price returns were used to measure equity momentum. So, issuer-specific equity momentum signal does not lead to an improvement in strategy performance in our case.[23]

[22] We used returns of the S&P 500 index as the market component. Price returns of individual stocks were regressed on returns of S&P500 in a 12-month rolling window to estimate market beta and obtain the residuals. Residual returns over 1, 3, and 6 months were we rescaled to account for differences in period lengths and equally weighted to measure *issuer-specific* equity momentum.

[23] Our signal formation period is different from those used in Haesen, D., P. Houweling, and J. Van Zundert (2017).

FIGURE 25

Performance of the EMC strategy based on issuer-specific equity momentum, January 1993 – May 2017

	US Corp IG Index	Q1 (Bottom)	Q5 (Top)	EMC Strategy: Q5 - Q1	EMC Strategy: Q5 - Index
	January 1993 - May 2017				
Avg. Exc. Return, %/yr	0.67	-2.52	3.52	6.04	2.85
Volatility, %/yr	4.15	6.30	4.53	4.32	1.90
Information Ratio	0.16	-0.40	0.78	1.40	1.50
	January 1993 - June 2007				
Avg. Exc. Return, %/yr	0.41	-1.67	2.23	3.90	1.82
Volatility, %/yr	2.09	3.58	2.34	2.49	1.10
Information Ratio	0.20	-0.47	0.95	1.57	1.66
	July 2007 - May 2017				
Avg. Exc. Return, %/yr	1.04	-3.76	5.41	9.17	4.37
Volatility, %/yr	6.01	8.90	6.51	5.99	2.61
Information Ratio	0.17	-0.42	0.83	1.53	1.67

Source: Bloomberg Barclays Indices, Barclays Research

Appendix 2: Controlling Turnover and Transaction Costs

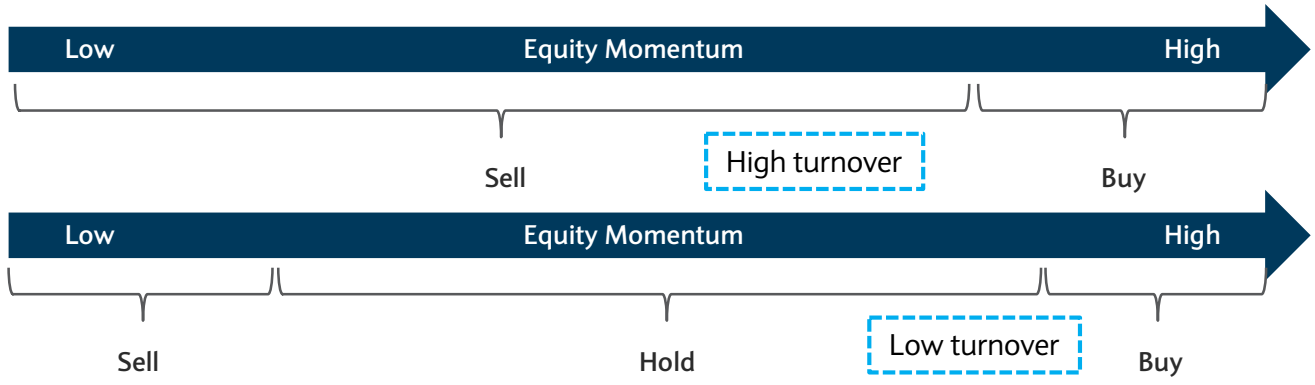
The EMC strategy presented in our analysis can raise some portfolio construction challenges. First, selling short the bottom momentum portfolio is likely to be infeasible due to the limitations of the financing market for corporate bonds. Second, portfolio turnover is likely to be high as momentum signal changes.

So, we briefly discuss a practical approach to long only portfolio construction that recognizes the need to limit turnover and accounts for estimated transaction costs.

Figure 26 outlines how turnover can be limited. In the top panel, the buy/sell signal can flip sign as soon as a security crosses a particular threshold such as, for example, the population median. In that case, frequent migration around the threshold can generate high and undesirable turnover. In contrast, the bottom panel illustrates a rebalancing logic that only buys bonds when the signal is very strong and sells when the signal is very weak, with a large "no-trade" buffer zone in between. It requires choosing distinct thresholds for triggering either purchase or liquidation of a bond. The further apart these thresholds are from each other, the lower the portfolio turnover. But aggressively restricting turnover can also have an impact on performance.

FIGURE 26

Reducing turnover using a hold buffer between "Buy" and "Sell" triggers



Source: Barclays Research

Figure 27 illustrates long-only EMC portfolios based on different buy and sell rules. The second column of Figure 27 summarizes index performance while the next three columns show different EMC portfolios and the last three present portfolio performances relative to the index. All portfolios rebalance a calendar month-end according to EMC signals.

The first portfolio holds only bonds in the top decile of equity momentum, meaning it buys when a bond passes the top 10th percentile and sells when it drops below it. Turnover is very high (73% per month) and performance before transaction costs is also very high (return of 7.31%/y, or 6.34% in excess of the index, with IR of 1.90 over the index) but transaction costs are so large that, once accounted for, both absolute and relative performance become negative.

The second portfolio buys when a bond passes the top 10th percentile but sells only when a bond drops below the 90th percentile of EMC. In that case, the existence of a large buffer between buy and sell triggers allows for a considerable reduction in portfolio turnover, to 8.9%/month. Before cost, performance is much lower than that of portfolio 1, but it remains positive and substantially higher than that of the index after transaction costs (estimated using Barclays Liquidity Cost Scores). Portfolio 2 outperforms the index by 0.78%/y with an information ratio of 0.59 after transaction costs.

The third portfolio is similar to Portfolio 2 but only buys liquid bonds. In this context, a bond is deemed liquid if its Trade Efficiency Score (TES) is between 1 and 3. This constraint makes portfolio simulation realistic. It has virtually no effect on before cost performance, but after transaction costs both excess return over the index (0.91%/y) and information ratio vs the index (0.70) improve relative to Portfolio 2.

One should note that these long-only portfolios are not assembled to closely match the risk profile of the index and so some scope remains to improve tracking error volatility and enhance risk-adjusted performance relative to the index. However, their absolute performances (shown on the left hand side of Figure 27) compare well with the index not only in terms of return but also in terms of volatility. For example, the volatility of Portfolio 3 excess returns (after costs) is 5.21%/y, markedly lower than that of the index (5.89%/y).

FIGURE 27

Performance of EMC portfolios controlling for turnover and after transaction costs, February 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
After 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: Bloomberg Barclays Indices, Barclays Research

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