



Alternative

Thinking

Style Investing in Fixed Income

Systematic style investing is increasingly popular in equity markets but much less frequently applied in fixed income markets. In this paper, we show that the classic style premia that have been applied to stock selection and equity country allocation — value, momentum, carry, and defensive — could have also performed well in fixed income markets, whether in selecting government bonds or corporate bonds. Fixed income may be the next frontier for style investing.

Third Quarter 2016

AQR Capital Management, LLC
Two Greenwich Plaza
Greenwich, CT 06830

p: +1.203.742.3600
f: +1.203.742.3100
w: aqr.com

Executive Summary

- Systematic style investing has become increasingly popular in stock selection and has also gained followers in market-neutral, multi-asset-class applications. The most pervasive styles with positive long-run historical track records in many asset classes include value, momentum, carry and defensive (based on evidence we've provided in other papers that cheap, recently improving, high-yielding and boring – low risk or high quality – assets tend to outperform in the long run).¹
- Although style investing has attracted less attention in fixed income (FI), our analysis shows that these four styles could have improved risk-adjusted returns of issuer selection strategies in two FI universes: global government bonds and U.S. corporate bonds. Each of the main styles shows evidence of positive risk-adjusted performance; however, gains are even more pronounced for portfolios that integrate all four styles.
- Even though style premia ideas travel well and have performed strongly in FI markets, incumbent active FI managers appear to be underexposed to styles. Instead, directional exposures, such as duration and credit risk, dominate their portfolios (just as equity market risk dominates active long-only equity manager portfolios and even contributes to many long/short manager portfolios). Looking ahead, style investing may well gain ground in FI markets, whether through long-only or market-neutral applications.

¹ We provide evidence for the styles applied in stock selection and equity country allocation in other AQR papers, including "Value and Momentum Everywhere" (2013) and "Investing with Style" (2015).

Introduction

Style premia, or factor-based, investing has been applied in equity markets for over 20 years and has become increasingly popular, mainly in long-only applications (i.e., "smart beta"). Style investing has also been extended to long/short, market-neutral applications in several asset classes, including bonds, currencies and commodities. Still, style investing appears to have a smaller footprint in FI than in equities, both in academic literature and in investment practice (see Brooks and Moskowitz (2016, forthcoming) and Israel, Palhares and Richardson ("IPR" 2016)).

Despite the slower adoption of style investing in FI, well-established style premia identified in other asset classes – value, momentum, carry and defensive – could have enhanced returns in various FI markets over the past two decades. We demonstrate FI style investing efficacy with market-neutral country allocation strategies in global government bond markets, and with individual issuer allocation strategies in U.S. corporate bond markets (our universe includes both investment-grade (IG) and speculative-grade, or high-yield (HY), bonds). We find positive Sharpe ratios for all styles in both contexts (see Exhibits 3 and 4). We also cite research which shows that similar style premia have worked in other corners of FI markets including curve, duration timing and credit timing strategies.

While active FI managers as a group have some exposures to style premia, their portfolios are overwhelmingly dominated by market risks (i.e., duration and credit exposures).² Most active FI managers are discretionary, and as such, their use of quantitative signals including styles is

² The universe of active fixed income managers considered consists of 121 fixed income investment managers from the U.S. Core Plus fixed income universe on eVestment, with returns from April 2011 to March 2014.



limited to, at most, informing their qualitative security selection and asset allocation decisions.

This report focuses on the empirical evidence and only briefly discusses various implementation options. The low correlation between styles gives credence to our belief in strategic style diversification (in contrast to concentrating in a favorite style or to aggressive tactical rotations across style premia). We find that both long-only style-tilted portfolios and long/short style portfolios have important uses and the right mix between the two approaches depends on investor constraints.

We proceed as follows: The next section describes the four key style premia in government bond and corporate bond markets followed by a section with evidence on historical performance of these style premia. We then discuss different ways to harvest these premia and conclude with evidence that active FI managers tend to have only modest exposures to style premia. Therefore, there is still substantial opportunity for investors to enhance portfolios with FI styles.

1. Describing Style Premia in FI

There is extensive literature in financial economics documenting robust evidence of a positive relationship between value, momentum, carry and defensive styles and future asset returns in numerous asset classes. Except for carry, this literature first focused on stock selection strategies but eventually found that these style premia “travel well” to other domains and generated long-run outperformance in several asset classes (stocks, bonds, currencies and commodities) over the periods considered.³

³ See Asness, Moskowitz and Pedersen (2013) on value and momentum; Kojien, Moskowitz, Pedersen and Vrugt (2014) on carry; Frazzini and Pedersen (2013) and Asness, Frazzini and Pedersen (2013) on the low-

In this report, we apply style premia to country allocation across global government bond markets and to individual issuer selection across U.S. corporate credits. The results are closely related to two articles – Brooks and Moskowitz (2016) and IPR (2016) – which provide many extensions and further detail on style investing in government bond markets and corporate credit markets, respectively.

For global government bonds, we employ a hypothetical country allocation strategy across 13 developed markets and three maturity buckets⁴ using one simple indicator per style, with monthly rebalancing:

- Value: Real yield (nominal bond yield minus maturity-matched consensus inflation forecast)
- Momentum: Past 12-month excess return
- Carry: Term spread (bond yield minus short-term yield)
- Defensive: Short duration (within country, buy short-dated bonds and sell duration-equivalent amount of long-dated bonds).⁵

Since we only use one indicator per style for government bonds here, we capture momentum only by each country’s own past excess return. It may be worth noting that the momentum style is

risk and quality aspects of defensive; and, finally, Asness, Ilmanen, Israel and Moskowitz (2015) on a combination of all four characteristics. This list is admittedly AQR-biased, but we are proud of our often-pioneering research on style investing, and the studies above provide references to earlier literature.

⁴ For the styles that allocate across countries – value, momentum and carry – we create duration-neutral long/short positions from “country portfolios” using 1-5yr, 5-10yr and 10-30yr portfolio buckets (see Brooks and Moskowitz (2016)). Because all bond positions are financed in local currency, cross-country positions are effectively currency-hedged. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

⁵ The first three styles are done at the country level, while defensive is pure maturity selection (“curve steepener”) within countries. That is, while the value strategy goes long countries with high real yields and short countries with low real yields, the defensive strategy goes long 1-5yr bonds and short a smaller (duration weighted) amount of 10-30yr bonds in each country.



in many applications represented by both “own price momentum” and “fundamental momentum.”⁶ Similarly, the defensive style is often represented by both low risk and high quality proxies; here we only use short duration as a measure of low risk.

For U.S. corporate credits, an issuer selection strategy identifies one tradeable bond per issuer and then ranks about 1,300 bonds (about 600 IG and 700 HY) each month,⁷ using 1-3 indicators per style:

- Value: Averaging two indicators, both of which compare the current credit spread (see “OAS” under Carry) to a fundamental anchor. One anchor is a structural model which measures the bond’s “distance to default” (the number of standard deviations the asset value is away from the default threshold); another anchor is an empirical model (based on a regression of the spread on duration, rating and return volatility).
- Momentum: Averaging indicators based on the past six-month return of the corporate bond itself (in excess of Treasuries) and of the issuer’s equity.

- Carry: The option-adjusted spread (“OAS”) versus Treasuries, as estimated by Bank of America Merrill Lynch.
- Defensive: Averaging indicators based on profitability (gross profits over assets), short duration and low leverage (measured by the ratio of net debt to the sum of net debt and market equity).

2. Empirical Evidence

We present evidence for government bond country allocation strategies since 1995 and for corporate issuer selection strategies since 1997 (reflecting data availability). We start with visual evidence and plot the (arithmetic) average returns of single-style-sorted long-only portfolios: tercile portfolios for governments and quintile portfolios for corporates. For governments, bonds within each bucket are equal-weighted; for corporates, they are value-weighted. (The choice of just three portfolios and equal weighting for government bonds reflects the narrower cross-section of only 13 countries, compared to 1,300 corporates.) All returns shown in this report are gross of trading costs and fees. Government bond returns are in excess of cash, while corporate bond returns are in excess of key-rates-duration-matched treasuries in order to isolate the credit component of corporate bond returns from the embedded government component.

Exhibit 1 shows monotonic patterns between bottom/middle/top ranked countries for all styles within government bonds, with the largest differences for value.

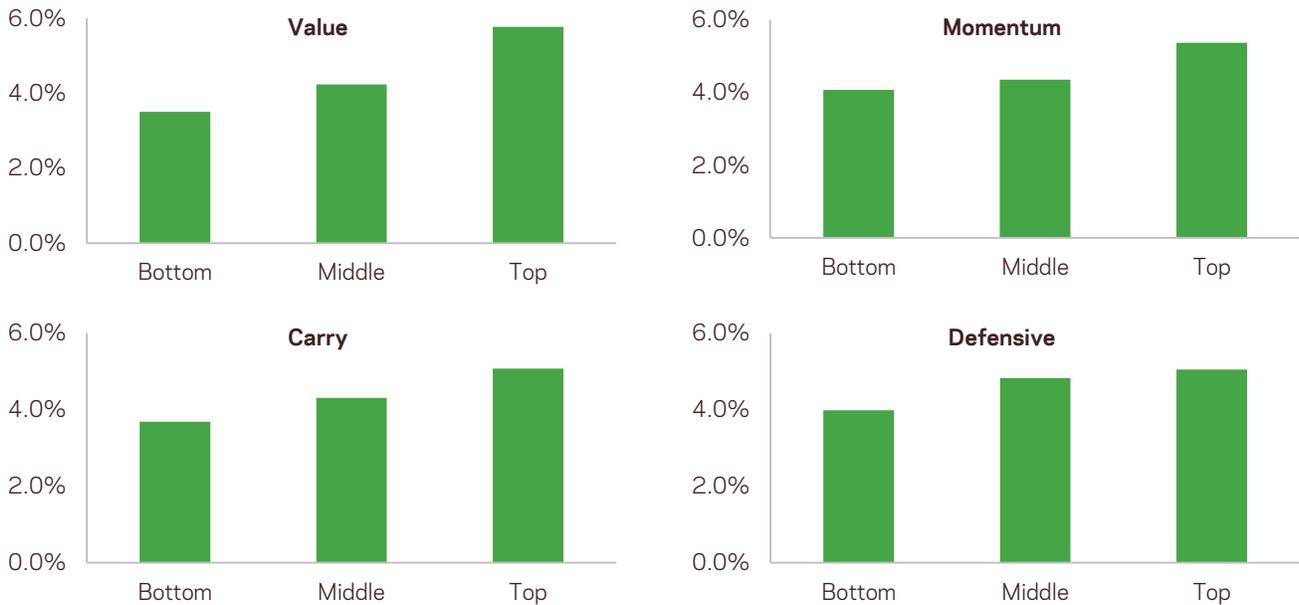
Exhibit 2 shows the average returns of quintile portfolios of corporate bonds (in excess of duration-matched Treasuries) when issuers are sorted monthly into five buckets using each style

⁶Fundamental momentum refers to the empirical ability of certain fundamental indicators or news (firm-specific news on a single security or macro news on a country) to predict future asset returns. News that moves the market contemporaneously often also predicts market moves mildly in the same direction in later weeks or months — an apparent underreaction effect. For example, negative growth surprises and inflation surprises tend to boost government bond prices instantly but also predict positive future performance. The best-known fundamental momentum indicators are earnings momentum and analyst forecast revisions in stock selection, but the concept applies elsewhere (see, for example, Abarbanell-Bernard (1992) and Brooks et al. (2014)). Fundamental momentum may also be proxied by related assets’ past returns; for example, when equity returns are used to predict future bond returns (positively for corporates, inversely for governments).

⁷ IPR (2016) studies a trading strategy in which the IG and HY universes are combined. The rules for selecting one liquid bond per issuer based on issue size, rating and maturity are described in IPR (2016), as are further details on the style indicators and portfolio construction. Because all styles have meaningful carry tilts in raw data, these are reduced by sorting assets on other styles within several carry buckets.

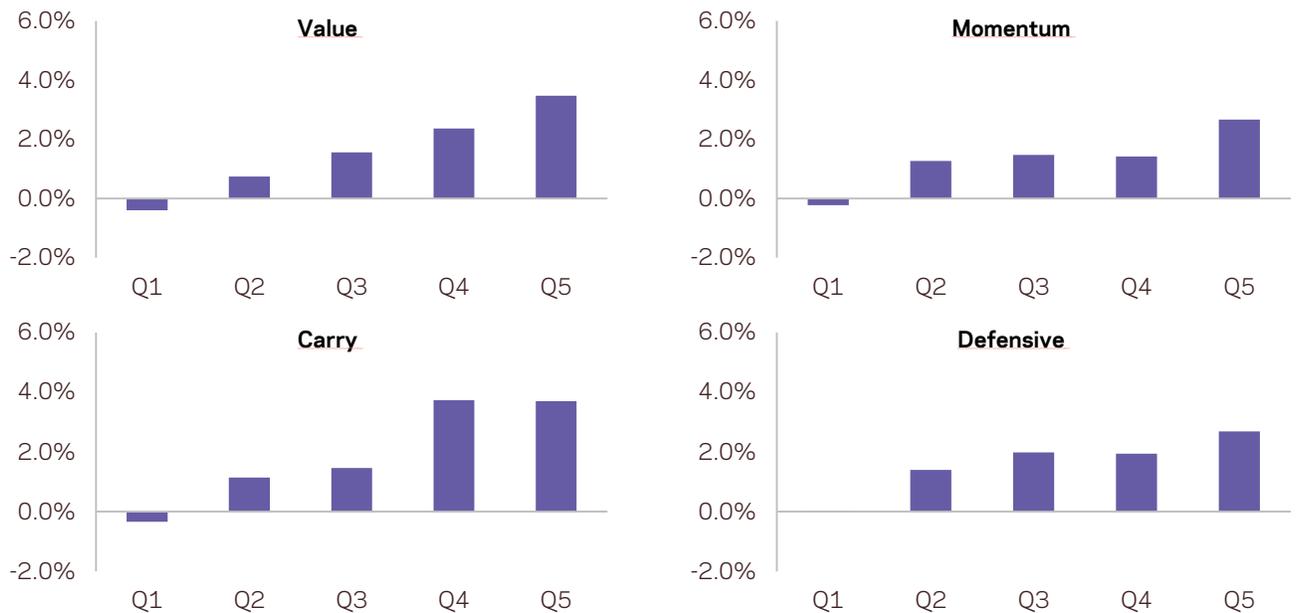


Exhibit 1 | Tercile Portfolio Excess Returns for Each Style When Government Bonds Are Ranked Across 13 Countries Based on Four Styles, March 1995-April 2016



Source: AQR, J.P. Morgan, Consensus Economics. Value, momentum and carry are applied across countries; defensive is applied across maturities within each country. Portfolios formed by ranking all bonds along the four styles described on page 2, and then going long the top tercile, short the bottom tercile. All returns are excess of local cash. Within each tercile, the bonds are equal-weighted. Please see Appendix Exhibit A1 for more details on the construction of these portfolios. Past performance is not a guarantee of future performance. These are not the returns of an actual portfolio AQR managed and are for illustrative purposes only. Please read important disclosures in the Appendix.

Exhibit 2 | Quintile Portfolio Returns for Each Style When U.S. Corporate Bond Issuers Are Ranked Based on Four Styles, January 1997-June 2015



Source: AQR, Bank of America Merrill Lynch. Portfolios are formed by ranking the bonds along the four styles defined on page 3, and then sorting into quintiles. The portfolios go long the top quintile and short the bottom quintile. Within each quintile, bonds are value-weighted. All returns are excess of key-rates-duration-matched treasury portfolios. Please see Appendix Exhibit A1 for more details on the construction of these portfolios. Past performance is not a guarantee of future performance. These are not the returns of an actual portfolio AQR managed and are for illustrative purposes only. Please read important disclosures in the Appendix.



Exhibit 3 | Long/Short (Tercile 3-Tercile 1) Portfolio Performance When Government Bonds Are Ranked Based Across 13 Countries (Paired on Three Maturity Buckets) Based on Four Styles and Their Combination, March 1995-April 2016

Governments	Value	Momentum	Carry	Defensive	Combo-4
Annual Mean Return	2.3%	1.3%	1.4%	1.1%	1.5%
Annual Volatility	3.5%	4.4%	3.5%	2.8%	1.6%
Sharpe Ratio	0.65	0.29	0.40	0.39	0.93
Market Correlation	0.16	0.07	0.10	-0.06	0.17
Ann. Alpha over Mkt	1.7%	1.0%	1.0%	1.2%	1.2%
t-statistic of Alpha	2.2	1.0	1.3	2.0	3.4

Source: AQR, J.P. Morgan. The "Market" here is the cap-weighted portfolio comprised of the government bonds in the 13 markets we consider (Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, U.K., U.S.). Portfolios formed by ranking all bonds along the four styles described on page 2, and then going long the top tercile, short the bottom tercile. All returns are excess of local cash. Within each tercile, the bonds are equal-weighted. Please see Appendix Exhibit A1 for more details on the construction of these portfolios. Past performance is not a guarantee of future performance. These are not the returns of an actual portfolio AQR managed and are for illustrative purposes only. Please read important disclosures in the Appendix. Diversification does not eliminate the risk of experiencing losses.

premium separately. Average returns increase monotonically for value and almost monotonically for the other styles. The patterns for value and carry *look* roughly equally good, but these quintile bar charts can conceal different volatility patterns. Below we shall see that the carry premium involves much higher volatility and thus implies much lower risk-adjusted returns than value.

Then we move from eyeballing bar charts to reviewing portfolio statistics in Exhibits 3-4. The first four columns depict the performance of long/short single-style portfolios based on the difference between the extreme bars in Exhibits 1-2. The Combo-4 combines information from all style rankings to come up with an aggregate long/short portfolio.

Exhibit 3 shows that in cross-country government bond allocation, all styles performed well, whether measured by Sharpe ratio (SR) or alpha to the cap-weighted J.P. Morgan government bond index (though the latter was not statistically significant for momentum and carry). Among single styles, the value style offered the highest average return, SR and alpha. Thanks to diversification, the Combo-4 offered an even higher SR of 0.93. Diversification across style premia is so effective because the style

correlations averaged close to zero (see Exhibit A2 in the Appendix).

Turning to corporates, Exhibit 4 shows that all style premia earned positive SRs and alphas (though not statistically significant for carry). Value and carry styles had comparable returns but carry was five times more volatile, resulting in a five times lower SR. Carry also had a high correlation (0.90) with the credit market, reducing its diversification benefits.⁸ The SR of value (1.75) was exceptionally high, but it should be noted it is shown gross of trading costs. (These costs can be significant compared to the strategy's low volatility because this is a relatively high-turnover strategy and corporate bonds tend to be less liquid than other major assets.) Also the defensive and momentum styles had SRs near 1,⁹ and the Combo-4 earned a SR of 2.19. The pairwise correlation between the four style premia averaged zero (see Exhibit A2 in the Appendix).

⁸ The standard academic approach to build factor mimicking portfolios is to create a dollar neutral long-short portfolio. We have used this approach but a consequence of that choice for carry (credit spread) is that the resulting long-short portfolio returns will exhibit a high correlation with credit market returns. This is an expected result as credit beta is captured by duration and spreads. Thus, the long side of the carry portfolio effectively has a much higher beta than the short side. Alternative approaches can be used to generate beta neutral long-short factor mimicking portfolios.

⁹ Recall that for corporates, equity momentum is half of the 'momentum' style. In fact, it was the more effective half, with SR exceeding 1, while own credit momentum had SR near zero.



Exhibit 4 | Long/Short (Quintile 5-Quintile 1) Portfolio Performance When U.S. Corporate Bond Issuers Are Ranked Based on Four Styles and Their Combination, January 1997-June 2015

Corporates	Value	Momentum	Carry	Defensive	Combo-4
Annual Mean Return	3.9%	2.9%	4.1%	2.7%	5.4%
Annual Volatility	2.2%	3.4%	11.7%	2.4%	2.5%
Sharpe Ratio	1.75	0.85	0.35	1.11	2.19
Market Correlation	0.00	-0.18	0.90	-0.17	0.16
Ann. Alpha over Mkt	3.9%	3.0%	1.6%	2.8%	5.3%
t-statistic of Alpha	7.5	3.9	1.3	5.0	9.3

Source: AQR, Bank of America Merrill Lynch. The "Market" here is the cap-weighted portfolio comprised of the bonds in the corporate universe. Portfolios are formed by ranking the bonds along the four styles defined on page 3, and then sorting into quintiles. The portfolios go long the top quintile and short the bottom quintile. Within each quintile, bonds are value-weighted. All returns are excess of key-rates-duration-matched treasury portfolios. Please see Appendix Exhibit A1 for more details on the construction of these portfolios. Past performance is not a guarantee of future performance. These are not the returns of an actual portfolio AQR managed and are for illustrative purposes only. Please read important disclosures in the Appendix.

The main results are that all style premia had positive SRs in both FI universes we studied¹⁰ and that the style premia were lowly correlated with each other and their combination was lowly correlated with relevant market indices, providing valuable diversification benefits. Diversifying across FI segments in our analysis would potentially raise risk-adjusted returns further, but we do not pursue that avenue here.

We remind again that the results shown are gross of trading costs and fees. Especially for corporate bonds, trading costs are relatively high and shorting can be hard. (However, IPR (2016) discusses an implementable long-only corporate bond strategy with SR 1.03 and information ratio 0.86 net of assumed realistic trading costs.) High trading costs are one explanation for why the results are stronger for corporates than for governments. In addition, a broader cross-section gave better breadth for corporates, as did a multi-indicator representation of styles. With governments, it would be easy to improve breadth by including curve trading alongside cross-country trading (see Brooks and Moskowitz (2016) which also covers cross-country trades

between various duration-neutral yield curve strategies).¹¹

3. How to Use?

We have presented backtest results for systematic FI strategies. Few active FI managers proclaim to be style-oriented or factor investors. Instead, they tend to be discretionary managers, plying their craft in bottom-up security selection and/or in top-down asset allocation. Nonetheless, their decisions may be guided by similar indicators as those used by systematic quants. In practice, recent research concludes that while active FI managers have some exposures to style tilts, end-investors who want strategic exposures to FI style premia do not get much of them from traditional active FI managers.¹²

¹¹ While our analysis focused on two large FI cross-sections, similar style premia could also be applied in other parts of FI markets, such as agency and securitized debt, emerging market debt and inflation-linked bonds. The literature to date has focused more on directional strategies — such as duration timing, curve shape timing and credit timing — where value, carry and momentum are key indicators (see e.g., Ilmanen and Sayood (2002), Ilmanen (2011), Asvanunt and Richardson (2016)).

¹² Brooks and Moskowitz (2016) show that the average active returns of global government bond managers in the eVestment database load significantly on directional risks: both duration (JPM GBI) and credit (Barclays U.S. HY Index). The only significant style exposure for this universe of government bond managers is to carry. Likewise, the portfolio risk of active credit managers tends to be dominated by directional credit risk. IPR (2016) documents that credit hedge funds as a group have statistically significant positive exposures on value but not on other styles, while credit mutual funds load significantly on momentum, carry

¹⁰ In fact, when we split the corporate universe into IG and HY and study each, all four styles (as defined above) had positive SRs in both.



Another implementation decision is between single-style and multi-style investing, and if the latter, further between hiring specialist single-style managers or integrated multi-style managers. We firmly favor the integrated multi-style approach due to its better diversification and efficiency.¹³

Finally, style investing can be applied through long-only tilts or through long/short strategies. Both can make sense. Long/short strategies provide better diversification but investor constraints and limited shorting ability/capacity may make the long-only path more realistic for many investors. While the results in this paper are for long/short strategies, these strategies are also implementable in a long-only context as style tilts which enhance portfolio returns.

4. Conclusions

Style investing has become quite popular in stock selection and has been gradually gaining popularity in multi-asset-class investing, but this adoption has not carried over to FI. Yet the ideas behind style investing travel well across asset classes, and as shown empirically here, include FI government and corporate credits over the past two decades. A well-diversified style-oriented strategy serves as both a return-enhancer – which is especially important in today’s low-yield world – and as a portfolio diversifier (thanks to the documented low or negative correlations between style premia and market premia).

and defensive styles but not on value. Even then style premia have low explanatory power in such regressions.

¹³ Fitzgibbons, Friedman, Pomorski and Serban (2016) show that combining several single-style managers is inefficient from a trading cost perspective and, more importantly, misses securities that are attractive from an integrated perspective but not from a narrow single-style perspective. They make this argument in the context of stock selection, but the argument should apply equally well in FI investing.



Appendix

Exhibit A1 | Description of Data Used

Governments: Government bonds include all bonds covered by the J.P. Morgan Government Bond Index (GBI). The GBI is a market-cap-weighted index of all liquid government bonds across 13 markets (Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, U.K., U.S.). It excludes securities with time-to-maturity (TTM) of less than 12 months, illiquid securities, and securities with embedded optionality (e.g., convertible bonds). The GBI is sub-divided into two country-maturity partitions. We use the first, more coarse partition in this analysis, which divides bonds into 1yr-5yr TTM, 5yr-10yr TTM, and 10yr-30yr TTM. We sort the bonds into terciles based on the style metrics described on page 2. The portfolios go long the top tercile and short the bottom tercile. Bonds are equal-weighted in each tercile.

Corporates: Corporate bonds include 1,300 bonds that roughly comprise the Bank of America Merrill Lynch investment grade (U.S. Corporate Master) and high yield (U.S. High Yield Master) corporate bond indices. Of the 1,300, 600 are investment grade, and 700 are high yield bonds. We sort the bonds into quintiles based on the four style metrics described on page 3. The portfolios go long the top quintile and short the bottom quintile. Bonds are value-weighted, not equal-weighted, within each quintile.

Exhibit A2 | Correlations Between the Four Style Premia in Two Universes

Governments	Value	Momentum	Carry	Defensive
Value	1.00			
Momentum	-0.25	1.00		
Carry	0.39	-0.36	1.00	
Defensive	0.18	-0.25	0.11	1.00

Corporates	Value	Momentum	Carry	Defensive
Value	1.00			
Momentum	-0.33	1.00		
Carry	0.17	-0.36	1.00	
Defensive	0.30	0.49	-0.12	1.00

Source: AQR, Bank of America Merrill Lynch, J.P. Morgan. Data series described in Exhibit A1.

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