This paper outlines the role that factors play in fixed income, which will help investors differentiate between return sources and in turn help build better portfolios.

We define the principal macro and style factors that are found in fixed income and describe those that have historically driven returns and been most rewarded.

Finally, we introduce a case study on how fixed income factors can be used in a portfolio context in an effort to pursue improved risk and return outcomes.

**Tom and Jeff’s Take**

Recent years have seen a shift in the way equity investors build exposures, with many now viewing their portfolios as a set of building blocks made up of beta, factor, and alpha-seeking components. Understanding the role that factors play in equity returns has become an integral part of portfolio construction. However, this framework has not yet transferred to the fixed income portion of most investors’ portfolios. We believe it is due to several reasons including the perception of outperformance of fixed income managers versus benchmarks.

However, in our view, much of that active manager outperformance is likely due to permanent tilts to factor exposures rather than what we call “pure” alpha. We believe an increasing understanding about the role of factors in fixed income returns will empower investors to build portfolios with the efficiency and control they now experience in the equity portion of their portfolios.

The dominant role of the credit risk factor as one of the key sources of outperformance has long been the hallmark of active fixed income investing and is summed up through the old bond manager’s adage “to outperform, outyield”. In this sense, factors lend a new lens to an old problem and represent the worst kept secret in fixed income investing.

**Similar to equities, a majority of returns in fixed income can be attributed to exposure to macro and style factors.**

**Fixed income factors can enable investors to seek enhanced returns, reduce risk, and have a better overall perspective of the sources of returns in their entire portfolio.**

**Understanding factors allows investors to build portfolios with the level of efficiency and control that they now experience in the equity portion of their portfolios.**

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Why factor adoption has lagged in fixed income

Although equity-based factor investing has gained considerable traction in recent years, the understanding of fixed income factors has lagged for several reasons:

- **Less research on fixed income factors** – The base of academic research around fixed income factors is smaller than that around equity factors. Factor research on equities began in the 1970s and most of the market has come to a commonly shared framework. Fixed income factor research is still a developing field of study and a market consensus has not yet been fully established. This research imbalance has likely resulted in less investor familiarity.

- **Fixed income markets are less transparent** – The structure of fixed income markets creates additional challenges when conducting academic research that requires large and accurate historical price data. By comparison, equity markets have a transparency advantage due to the wider availability of reliable transaction data. However, new advances in technology are chipping away at this barrier.

- **Less urgency to rethink fixed income strategies** – Unlike equities, there has been less urgency to rethink investment approaches because historically, many active bond managers have tended to achieve better active returns compared to equity managers. However, our research shows that the excess returns generated by many managers can be explained by persistent tilts to factor exposures. As such, we believe such returns should be attributed to factors rather than alpha.

In fact, a 2015 study spanning 121 US Core Plus fixed income investment managers found that:

> “On average 67% of active risk in these fixed-income strategies can be explained by smart-beta factors. For about 38% of the funds, 90% or more of the active risk can be explained by smart-beta factors. Compared with equities, fixed-income managers appear to derive an even greater proportion of their active risk from static exposures to smart-beta factors.”

We believe that understanding fixed income factors will help investors to appreciate the true sources of risk and return across their entire portfolios, not just the equity allocation. In turn, this will allow those risk sources to be properly managed in the most efficient manner.

**Defining a factor**

Factor investing seeks to identify the broad, persistent drivers of return – factors – that have historically earned positive long-run results both across and within asset classes.2

Similar to equities, fixed income factors are grounded in economically sensible ideas that have historically delivered a premium because of one or more of the following drivers:

- **Rewarded risk** – Investors have earned a long-term return in exchange for taking on a specific risk.

- **Structural impediments** – Market rules or restrictions have segmented the market or made parts of the market difficult for some investors to access, which creates opportunities for a subset of investors.

- **Behavioral biases** – Not all investor decisions are perfectly rational, which creates opportunities for a contrarian view or to exploit existing trends.

**Different types of factors**

Academic research has identified a number of factors that have persisted in fixed income markets. These can be divided into two general categories – macro and style factors:

- **Macro factors** help explain risks and returns across asset classes. These are systematic, economy-wide sources of risk such as real rates and inflation.

- **Style factors** help explain risks and returns within asset classes. They are characteristics, such as value and momentum, which explain the outperformance of certain securities relative to other securities in the same asset class.

In a factor framework, the return of every fixed income security is influenced by a unique mixture of both macro and style factor exposures.

> “Compared with equities, fixed-income managers appear to derive an even greater proportion of their active risk from static exposures to smart-beta factors.”

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2 “Foundations of Factor Investing”; Jennifer Bender, Remy Briand, Dimitris Melas, and Raman Aylur Subramanian; December 30, 2013; MSCI.
Macro factors in fixed income

Over the long run, investors bearing exposure to macro factors are expected to be paid a premium because they are taking on a degree of risk. Compared to style factors, macro factors help explain the vast majority of fixed income returns. Academic research further indicates five principal macro factors that may have historically driven returns across fixed income securities:

- **Real rates** – The potential reward for taking on exposure to real interest rate changes. Rising real interest rates decrease the present value of future cash flows, and thereby the market value of fixed income securities.
- **Inflation** – The potential reward for taking on exposure to changes in nominal prices and suffering erosion of buying power.
- **Credit** – The potential reward for taking on the risk of an issuer default or spread widening.
- **Liquidity** – The potential reward for taking on exposure to illiquid securities that are hard to trade and can experience extreme price losses in crisis conditions.
- **Emerging markets** – The potential reward for taking on the risk of a government issuer default, spread widening or FX exposure. Political upheaval may lead a sovereign to change capital market rules and/or render it unable or unwilling to service debt.

"...Macro factors help explain the vast majority of fixed income returns."

Macro factors as portfolio building blocks

Decomposing typical fixed income instruments can illustrate how these macro factors may be the building blocks of asset classes. Importantly, this also demonstrates how factors help explain each asset’s expected sources of return (Figure 1).

Through a factor lens, the traditional categorization of portfolio holdings along asset class labels—government bonds, corporates, emerging market bonds, etc.—is replaced with a categorization by overall factor mix.

For each asset class, the sum of these macro factor returns represents how it is expected to perform. For example, the return on a nominal government bond can be shown to derive primarily from three macro factor sources: inflation, real rates, and liquidity. At the other end of the spectrum, emerging market corporate bonds are typically influenced by all five of the macro factors that can influence their return potential: real rates, inflation, credit, emerging markets, and liquidity.

The degree of sensitivity to each macro factor also differs across asset classes. Looking at Figure 1, the concept of relatively lower credit risk of investment-grade corporate bonds could give them a lower sensitivity to the credit factor than high-yield corporate bonds.

Applying a factor lens, we would expect the total return of any given portfolio to be a function of its aggregate blend of macro factor exposures. While pure exposures to individual factors are rare within most assets, investors can combine factors to create targeted portfolio exposures.

Figure 1: Conceptual macro factor decomposition of fixed income instruments

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Source: BlackRock. For illustrative purposes only. Size and magnitude of macro factors may vary over time. Chart does not depict actual data.
A key implication for portfolio construction is that while a portfolio comprising numerous fixed income asset classes may appear diversified, it may in reality be deriving its risk and return from a few sources of concentrated and unintended macro factor bets.

For instance, the Bloomberg Barclays U.S. Aggregate Bond Index comprises over 10,000 securities from six different sectors, making it one of the broadest bond benchmarks.

However, when analyzing the index from a factor perspective, the Bloomberg Barclays U.S. Aggregate Bond Index currently derives approximately 80% of its returns from interest-rate risk, which is a combination of the real rates and inflation macro factors (Figure 2).

Investors are already exposed to a mix of macro factors based on their asset allocation, although those macro factor exposures are unlikely to be deliberate or carefully managed. By taking a macro factor perspective and looking beyond asset class labels to the fundamental drivers of return, investors can gain a more precise way to manage portfolio risk.

Thinking intentionally about the desired macro factor mix in the broader portfolio can enable greater control and transparency when managing complex asset allocations, and help avoid unintended outcomes.

“...By taking a macro factor perspective and looking beyond asset class labels to the fundamental drivers of return, investors can gain a more precise way to manage portfolio risk.”

**Style factors in fixed income**

The second category of factors can be observed by examining securities within each fixed income asset class. Style factors help explain, for example, why one security outperforms another.

This can help identify the factors that have persistently rewarded investors over the long run.

As a rapidly evolving area of study in fixed income, there are still differing opinions among researchers on the number, nomenclature, and definitions of certain style factors.

We present below the four fixed income style factors that we believe are the most relevant for investors to consider:

- **Value** – Cheap bonds (relative to fundamentals) have tended to outperform expensive bonds.
- **Momentum** – Bonds with strong recent performance have tended to maintain or reverse current price trends.
- **Low volatility** – Investor demand for higher-yielding bonds means stable bonds can potentially outperform more volatile bonds on a risk-adjusted basis.
- **Quality** – Bonds with a lower probability of default can potentially outperform bonds with a higher probability of default on a risk-adjusted basis.

“Style factors help explain, for example, why one security outperforms another.”

**Figure 2: Asset class and factor composition of Bloomberg Barclays U.S. Aggregate Bond Index**

- **Asset class composition**
  - Treasuries: 28.2%
  - Government-related: 2.0%
  - Corporates: 6.1%
  - MBS: 38.8%
  - CMBS: 24.3%
  - ABS: 0.5%

- **Macro factor composition**
  - Interest Rates (Real Rates + Inflation): 79.0%
  - Credit: 21.0%

Source: BlackRock, and Bloomberg index data, as of 3/31/2019.
Macro factor composition based on BlackRock Solutions’ Aladdin risk models as of 3/31/2019 and is subject to change.
Empirical evidence of style factors

Using the Bloomberg Barclays U.S. Corporate Bond Index as a proxy for the broad U.S. investment-grade corporate bond market, we demonstrate how bonds with greater exposure to the four style factors have performed versus those with lower factor exposure (Figure 3).

In these illustrative examples, we stratify the U.S. investment-grade corporate bond index into five quintiles based on exposure to a single style factor, with the fifth quintile (Q5) representing the highest exposure to the given factor, and the first quintile (Q1) representing the lowest exposure. For the sake of simplicity, we assign a set of metrics to represent each factor's exposure. It is important to note that each quintile group is created on a sector and rating-neutral basis to avoid any unintended tilts to a given credit quality or industry which could skew the results. Additionally, this analysis does not include transaction costs and is not representative of any particular strategy.

To measure the value style factor, we calculated the fair spread of a bond by taking into account duration, rating, sector, seniority, and issuer probability of default and then compared it to its market option-adjusted spread (OAS).

To measure the momentum style factor, we used either the 3-month trailing spread return to calculate reversal or 6-month trailing spread return to calculate momentum depending on where a bond lies on the credit risk spectrum. Bonds which have lower credit risk display short-term reversal and as we move towards higher credit risk, bonds display longer-term momentum.

For the low volatility style factor, we used the duration-times-yield (DTY) statistic to proxy low volatility.\(^3\)

To calculate the quality style factor, we used a BlackRock-developed, Merton-based probability-to-default model.

The analysis shows that in each of the four style factor examples, bond quintiles with a higher exposure to the given factor measure (Q5) produced higher excess returns per unit of risk (as measured by the Sharpe ratio) compared to those with lower factor exposure (Q1) and the overall market cap-weighted index.

The key takeaway is that, as with equities, empirical evidence indicates that style factor exposures have played a key role in driving return differentials between U.S. investment-grade corporate bonds. We have conducted similar analysis in other fixed income markets, including U.S. high-yield corporates and European bond markets, and found similar evidence of style factors.

From a portfolio attribution perspective, we believe investors should assess style factor contribution as a long-term determinant of returns alongside traditional dimensions such as sector, credit quality, and maturity.

Figure 3: Excess returns and Sharpe ratios of single style factors

The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results. Source: BlackRock, Bloomberg, from 12/31/07–12/31/18. Index represented by Bloomberg Barclays U.S. Corporate Bond Index. Returns are shown as annualized returns above the duration-matched U.S. Treasury rate. Risk measured as annualized standard deviation. Index performance returns do not reflect any management fees, transaction costs or expenses. Indices are unmanaged and one cannot invest directly in an index.

Differentiating factor returns from alpha

It is common to think of alpha as analogous to excess returns above a specific market beta. However, we believe that alpha should be defined as returns in excess of market beta and factor returns—making alpha a much rarer commodity than the market presently assumes. Most traditional attribution frameworks may offer too simplistic a view of the return sources in a portfolio.

What is thought to be alpha resulting from idiosyncratic security selection decisions at a granular level, may actually be a long-term tilt towards a specific macro or style factor at the aggregate portfolio level.

We believe it is important to distinguish clearly between these sources of fixed income returns to help investors make better portfolio construction decisions.

Factors represent long-term exposures to broad and persistent sources of return that arise from risk premia, the existence of structural impediments, and/or behavioral differences between market participants. Factors can be captured through transparent, rules-based strategies.

In contrast, alpha arises from an investment process designed to capture returns without persistent broad based market or factor exposures. We call this “pure” alpha, and by its nature is generally associated with idiosyncratic risks arising from security selection across asset classes to capture mispricing based on anticipated future market evolution or underappreciated historical developments.

“Pure” alpha is the result of manager skill in security selection, country/industry selection, or tactical market and factor timing. Portfolio construction alongside execution and liquidity risk management also contribute to alpha (Figure 4).

Factors offer higher capacity, with opportunities for many investors to participate without the return source being arbitrated away or “crowded out.” Alpha insights are typically more capacity constrained.

Alpha is rare and hard to produce, making true alpha-generating strategies command higher fees than strategies that offer long-term exposures or static tilts to factors (Figure 5).

Figure 4: Factor and alpha return sources

Factors represent broad and persistent sources of return that arise from risk premia, the existence of structural impediments, and/or behavioral differences between market participants. Factors can be captured through transparent, rules-based strategies.

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Factor portfolio construction strategies

Alongside better informed risk management and more precise portfolio attribution, factor-based insights can be used to create broad, risk-efficient strategies that pursue a particular portfolio outcome, such as improved total return, lower overall volatility, lower duration risk, increased yield, or an optimized mix of these characteristics.

In the following section, we review a case study illustrating how factors can be applied to portfolio construction.

I. Case study

Seeking to improve risk/returns in a core bond allocation

Core strategies are typically the largest holdings in investors’ fixed income allocations. We showed earlier that the Bloomberg Barclays U.S. Aggregate Bond Index (“Aggregate”), a benchmark comprising over 10,000 securities, derives almost all of its risk and returns from just two macro factors—interest rates and credit.

In general, interest-rate risk has tended to generate positive returns in “risk-off”, flight-to-quality environments, while credit risk has tended to generate positive returns during “risk-on” periods or high economic growth environments. Among these two risk factors, interest rates have historically been 70-90% of total portfolio risk in the Aggregate Index.4

This concentration of factor risk typically results in a portfolio with relatively high levels of duration and sensitivity to interest-rate risk, but with limited yield to compensate for the risk. While interest-rate risk can help diversify exposure during an equity market downturn, the low yield levels may result in muted long-term total return potential, especially during extended economic expansions when increased credit exposure is typically better rewarded.

Fortunately, interest-rate and credit risk factors have historically been negatively correlated (Figure 6), making them ideal building blocks for constructing diversified portfolios.

Figure 6: Correlation between interest-rate and credit component returns of Bloomberg Barclays U.S. Aggregate Bond Index

The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results. Source: BlackRock and Bloomberg index data from 8/31/1988 – 12/31/2018. Spread returns represented by excess total returns of Bloomberg Barclays U.S. Aggregate Bond Index. Diversification does not guarantee a profit or eliminate the potential for loss. Index performance returns do not reflect any management fees, transaction costs or expenses. Indices are unmanaged and one cannot invest directly in an index.

4 Source: BlackRock, Bloomberg index data, as of 3/31/2019. Based on BlackRock Solutions’ Aladdin risk models using 120 monthly observations and is subject to change.
II. Potential solution

Diversifying factors in a core bond allocation

One approach to systematically take advantage of these two diversifying factors is to create a portfolio that targets an even balance between interest-rate and credit risk exposures, similar to the concept of risk parity (Figure 7).

To build such a strategy, portfolio weights are not created bottom-up, by overweighting or underweighting securities based on conviction (similar to a traditional active approach). Rather, the portfolio is constructed top-down, with portfolio weights based on target factor risk contribution.

To demonstrate the efficacy of a factor-based core bond strategy, BlackRock partnered with Bloomberg Barclays Indices to develop an investable index called the Bloomberg Barclays U.S. Fixed Income Balanced Risk Index (“Balanced Risk”).

Portfolio construction process

The Balanced Risk index methodology follows a three-step process:

1. **Target equal interest-rate and credit risk** – The index targets equal exposure to interest-rate and credit risk based on 24-month trailing return volatility.

2. **Diversify across credit sectors** – The credit exposure of the index is built with a diversified mix of five credit sectors that have together historically exhibited the highest risk-adjusted returns. In this case, the index allocates to U.S. agency MBS, 1-5-year investment-grade corporate bonds, 5-10-year investment-grade corporate bonds, BB-rated high-yield corporate bonds, and high-yield corporate bonds rated below BB.

3. **Apply hedge to balance** – The resulting interest-rate exposure of the portfolio is adjusted upwards or downwards via Treasury futures to bring the portfolio in line with the target 50/50 risk allocation.

Comparing portfolio composition

This methodology of balancing the contribution of factor risk results in a core fixed income portfolio with lower duration and higher yield compared to the Aggregate Index (Figure 7).

Figure 7: Factor risk contribution composition & portfolio statistic summary

<table>
<thead>
<tr>
<th>Index</th>
<th>Duration</th>
<th>Spread Duration</th>
<th>YTW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced Risk</td>
<td>3.59 yrs</td>
<td>5.00</td>
<td>3.82%</td>
</tr>
<tr>
<td>Aggregate</td>
<td>5.50 yrs</td>
<td>3.54</td>
<td>3.02%</td>
</tr>
</tbody>
</table>

The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results. Source: Bloomberg Barclays Indices, Bloomberg as of 3/31/2019. Index performance is for illustrative purposes only. Index performance does not reflect any management fees, transaction costs or expenses. Indexes are unmanaged and one cannot invest directly in an index.
III. Measuring results

In terms of performance, the Bloomberg Barclays U.S. Fixed Income Balanced Risk Index produced a much more favorable return profile, both on an absolute basis and from a risk-efficiency standpoint, as measured by the Sharpe ratio (Figure 8).

Figure 8: Portfolio risk and return comparison

<table>
<thead>
<tr>
<th>Index</th>
<th>Return 1 Year</th>
<th>Return 5 Year</th>
<th>Return 10 Year</th>
<th>Risk 1 Year</th>
<th>Risk 5 Year</th>
<th>Risk 10 Year</th>
<th>Sharpe Ratio 1 Year</th>
<th>Sharpe Ratio 5 Year</th>
<th>Sharpe Ratio 10 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced Risk</td>
<td>5.52%</td>
<td>3.37%</td>
<td>5.59%</td>
<td>3.09%</td>
<td>2.55%</td>
<td>3.20%</td>
<td>1.07</td>
<td>1.02</td>
<td>1.59</td>
</tr>
<tr>
<td>Aggregate</td>
<td>4.48%</td>
<td>2.74%</td>
<td>3.77%</td>
<td>3.21%</td>
<td>2.86%</td>
<td>2.84%</td>
<td>0.73</td>
<td>0.68</td>
<td>1.16</td>
</tr>
</tbody>
</table>

Past performance is not a guarantee of future results. This analysis contains back-tested index data. The index was incepted on 4/1/2015. Data for time periods prior to the index inception date is hypothetical and is provided for informational purposes only to indicate historical performance had the index been available over the relevant time period. Hypothetical data results are based on criteria applied retroactively with the benefit of hindsight and knowledge of factors that may have positively affected its performance, and cannot account for risk factors that may affect actual performance. Index returns are for illustrative purposes only and do not represent any actual fund or strategy performance. Actual performance of a fund or strategy may vary significantly from hypothetical index performance due to transaction costs, liquidity or other market factors. Index performance returns do not reflect any management fees, transaction costs or expenses. Indexes are unmanaged and one cannot invest directly in an index. Index methodology is available at https://www.bloomberg.com/professional/product/indices/bloomberg-barclays-indices-fact-sheets-publications.

Source: Bloomberg Barclays Indices, Bloomberg as of 3/31/2019. Index performance is for illustrative purposes only. Index performance does not reflect any management fees, transaction costs or expenses. Indexes are unmanaged and one cannot invest directly in an index.

IV. Summary

In this example, we were able to show how reweighting the factor exposures in a core bond portfolio can diversify return sources—leading to greater total return potential without taking on outsized levels of risk. As the demands on institutional portfolios continue to expand, applying a factor lens to analyze the underlying drivers of fixed income returns can help to target more specific outcomes that can be tailored to meet those growing needs.

While we focused on using macro factors to create a core fixed income solution in this case study, style factors can also be blended in single asset classes like high-yield or investment-grade bonds to pursue outcomes such as reduced drawdown risk or improved total returns.
Conclusion

As with equities, factors play a pivotal role in the risk and return outcomes within fixed income markets. Macro factors drive the majority of returns across asset classes, while style factors help determine the differences in returns within asset classes.

As familiarity with fixed income factors grows, investors may seek to use factor-based insights or strategies in an effort to enhance their existing portfolios. Across multiple assets, the decomposition of asset exposures into factor exposures can improve the understanding of portfolio performance. It reveals hidden, outsized risks where concentrations may arise unintentionally from traditional asset-class-based allocations.

Within portfolio construction, this understanding may allow better diversification, enhanced returns, and/or reduced risks. Likewise, in performance attribution, a factor framework can help investors disentangle factor-driven returns from pure alpha, thus helping to improve decision-making in manager selection.

We believe that factors are the next evolution in fixed income portfolio construction. Having a clear understanding of their role in generating returns will ultimately help investors build better portfolios.

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