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Fact or fiction? Bond investors can add returns with factor-based investing

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There has been an explosion of interest in factor-based investing strategies among equity investors over recent years. Sometimes categorised as smart beta, these strategies seek to add value over traditional market-capitalization indices through the identification of long-run sources of return. They are rules-based, transparent, and generally cheaper than active strategies[1].

The success of factor strategies in equities has spawned a growing discussion of whether the concept can also be exploited by fixed income investors. For seasoned investors in fixed income markets, this discussion might seem puzzling – fixed income investors have relied on factor approaches for decades. Factor investing in fixed income, however, takes a different form from factor investing in equities because there are fundamental differences between bonds and bond markets on the one hand, and equities and equity markets on the other.

This note argues that there may be scope for new types of systematically-constructed bond portfolios in some fixed income markets, but that an appreciation of the differences across asset markets is essential to success. In order to highlight these differences, we use the example of corporate credit markets, illustrating the difficulties in applying strategies from equity markets to bond markets. We then consider two approaches in sovereign bond markets: first, a replication of a popular equity strategy (momentum), which struggles to add value; and second, an implementation of commonly-used bond factors, which fares better.

Bonds, equities and factors: a brief recap

We must be cautious in replicating equity factor strategies in bond markets, as they differ in some important aspects. Equities are perpetual securities, traded on liquid exchanges, for which any given issuer typically issues a single type. Bonds are securities with a finite maturity date, traded over the counter, for which any given issuer may issue tens or even hundreds of issue types. Moreover, relative to equities, which are (by definition) issued by corporates, bonds are highly heterogeneous: they may represent unsecured claims on corporates or sovereigns, or they may represent claims on more exotic underlying cash flows, such as securitized mortgages. Each market has strengths and weaknesses for developing investment factors.

Equity markets are a fertile ground for empirical testing. There is a long history of reliable prices (and associated accounting data) for several thousand issuers globally, implying sufficient breadth for development of research ideas, without overwhelming researchers with detail. This structure has enabled researchers to develop hundreds of possible equity factors, of which a handful are well known and used broadly. These include: value, or buying stocks which trade cheaply relative to accounting fundamentals; momentum, or buying stocks which have performed well in the recent past; quality, or buying stocks which appear to have reliable earnings profiles; and low volatility, or buying stocks whose price (or some element of whose price) is less volatile than most of the market.

The key element which aids factor investing for bonds is that a bond's promised cash flows are known in advance, often subject to some explicit risk such as corporate default[2]. By eliminating the need to model uncertain growth in future cash flows – perhaps the central challenge in equity pricing – bond modelling can focus easily on the relevant source of risk for a given type of bond. The main factor across corporate bonds is the relative default risk of the issuing entity. By investing in bonds that are more likely to default, an investor can increase both their risk and their expected return. The major factor across developed market sovereign bonds is duration, or how distant in time are the bulk of the promised cash flows.The greater the duration of bonds, the greater (in general) their expected return, but also the greater the mark-to-market risk of the bonds. Relative to equity factors, these factors are far more successful in accounting for most of the risk and return in corporate and sovereign bond portfolios. Not surprisingly, fixed income investors have relied on these factors for decades.

1 We provide an overview of our perspective on factor strategies in "Primer: the factor drivers of investment returns", by Ashley Lester, *Investment Horizons 6*, 2016, Schroders.

2 There are important caveats to this statement. Agency bonds make promises on an uncertain stream of future cash flows. Floating rate or inflation-linked bonds make promises relative to some index. However, in virtually all cases, the stream of future cash flows is more tightly defined – and more closely tied to price – than the stream of future dividends associated with an equity.

Since most bond markets can be clearly segmented by these factors, which account for most of the risk and return differences across bonds, the scope for equity-style smart beta factors is correspondingly limited. Some other features of bonds further restrict the scope of smart beta–like factors. These can best be illustrated in corporate credit markets. In what follows, we restrict the scope of our discussion to factors which, like most smart beta equity factors, correspond to the level of risk of the underlying cap-weighted portfolio.

Bond features and liquidity: the case of corporate bonds

A single issuer of corporate debt may issue many bonds, each with slightly different characteristics and, therefore, different prices. Accordingly, when considering a hypothetical systematic factor investment, the investor must decide whether to focus their decision on a generic bond (or spread) for an issuer, or each bond in isolation. If the focus is on the issuer, then inevitably there will be a difference between the theoretical return on the issuer and the actual return realised by any given bond. If the focus is on a particular bond, there will be limited history of that bond, because bonds mature. More importantly, the quoted price of the bond may not be a reliable guide to the price, if any, at which a transaction can actually occur.

The reason why it may not be possible to trade a given bond at its quoted price relates to the relatively illiquid nature of over-the-counter corporate bond markets.

Compared with bond markets, equity markets are very liquid; a particular stock is almost always available to trade, although large orders can have an impact on the price. This is not necessarily true of corporate bond markets. Many corporate bond market participants are buy-and-hold investors, or at least are loath to sell holdings, as the same issues may not be available for repurchase at a lower price. So investors looking to buy a bond (or issuer of a bond) may find that no counterparty has it in their inventory. In turn, this illiquidity also makes it difficult to find buyers of bonds that an investor may wish to sell, as market makers will be reluctant to take the risk of buying a bond which may then sit in their inventory for an extended period.

In practice, banks offer inventory to clients who choose from that supply to best meet their needs. In order to replicate an investible strategy in corporate bonds, a researcher needs to have the historic inventory for banks in their panel and make assumptions about the availability of that inventory when they actually get to trade[3].

Even with this data in hand, the current market environment means that the past is not representative of today or of the future. One factor in particular that may have reduced the capacity to actively trade corporate bonds is central bank purchases[4].

3 There is increasing discussion about non-bank trading in corporate bonds, and there is some evidence of increased use of electronic venues. However, this does not affect the basic conclusion that it is problematic to infer prices at which trades at scale can actually happen from quoted prices.

4 For example, over the eight months from June 2016 to February 2017, the European Central Bank purchased approximately 5% of the stock of the overall eligible market under its Corporate Sector Purchase Programme. These very large scale purchases have removed a substantial amount of inventory from the opportunity set of investment managers. The universe of available bonds is considered to be the BAML ER00 index (the overall European corporate bond index), excluding the EB00 financial index sub-index.

Looking at trends over time, there has been much discussion of whether liquidity has fallen in corporate bond markets since the financial crisis of 2008, perhaps driven by regulatory changes affecting traditional market makers (banks). Most studies to date have focused on the cost of trading (which is assessed using bid-ask spreads or related measures) and have found marginal evidence of reduced liquidity in the post-crisis period compared with that of the pre-crisis period[5].

However, while transactions may generally occur at reasonable prices, a number of volume-based measures highlight the increasing difficulty of actually undertaking a transaction in the secondary market. Based on TRACE data reporting transactions in the US corporate bond market, Mizrach (2015) found that median daily turnover in the 1,000 most actively traded bonds fell from 1.8% to just 1%, between 2003 and 2015. Similarly, measures of secondary trading suggest a significant decline in transactions. After 90 days in the secondary market, trading volume fell (relative to trading volume when first on the market) by about 12% in 2003 and by 38% in 2015. This is further evidence that strategies reliant on active secondary market trading are likely to struggle in today's corporate bond market. In UK markets, meanwhile, the FCA (2016) reports that around 70% of corporate bonds do not trade at all on any given day.

The most compelling recent data relate to UK markets. The FCA (2017)[6] has gained access to data on attempts to trade by a single market participant since August 2007. Over that period, the success rate of attempted trades has fallen from about 65% to about 20–25%, as of mid-2016, with many orders rejected or ignored by dealers. This strongly suggests that current market dynamics are less favourable for factor-based investing strategies targeting bond-specific characteristics.

It is fair to note that the post-crisis period has witnessed a shift in dealing activities towards electronic platforms and that eventually this may lead to greater liquidity and capacity. And there are some interesting avenues of research into profitable systematic, or nearly systematic, trading strategies for corporate bonds, a good recent example being Friewald et al. (2014)[7]. Hence, we do not rule out the possibility of successful rules-based corporate bond strategies in future; we are merely cautious of them under conditions similar to those currently prevailing. This view may evolve going forward, as market dynamics shift or research uncovers new opportunities that may be exploited under certain conditions.

5 See Bruce Mizrach, *Analysis of Corporate Bond Liquidity*, FINRA Office of the Chief Economist, Research Note, 2015, and Financial Conduct Authority (FCA), *Liquidity in the UK corporate bond market: Evidence from trade data*, FCA Occasional Paper 14, March 2016.

6 Financial Conduct Authority, *New evidence on liquidity in UK corporate bond markets*, February 2017.

7 Nils Friewald, Christian Wagner, and Josef Zechner, "The Cross-Section of Credit Risk Premia and Equity Returns", *The Journal of Finance 69 no. 6*, 2419–2469, 2014.

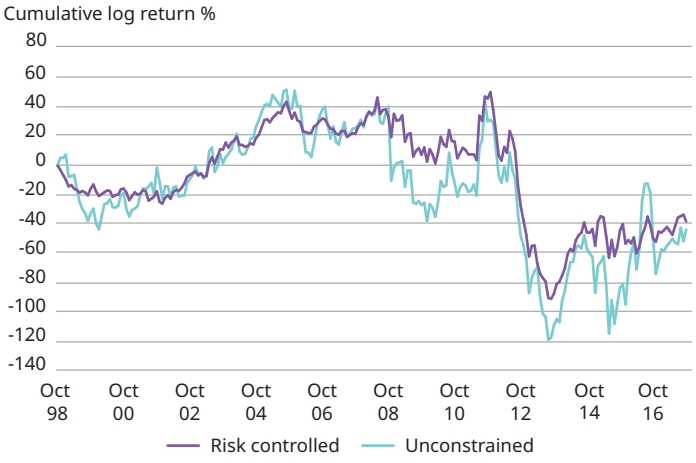
The case of developed sovereign bonds: approach with caution

Unlike the corporate bond markets, most large developed sovereign bond markets have reasonable liquidity – enough, we believe, to create opportunities for a factor-based investment approach. But these factors are not necessarily reproduced from the equity market. It is unclear, for example, what would constitute a good measure of "value" in a sovereign bond[8]. Instead, we emphasise bond-specific factors in constructing a factor-based portfolio of developed market sovereign bonds.

To illustrate the potential pitfalls of seeking to apply ideas from other markets directly to the sovereign bond market, we construct a hypothetical momentum strategy that mimics a form of momentum widely used in equity markets.

The basic momentum exposure is calculated in a standardised way: bonds are ranked on the cumulative return over the previous 2–12 months.

Figure 1: Evaluating the momentum factor for bonds – unconstrained and risk controlled



Source: Citibank and Schroders, 1998–2017.

This momentum construction is common in the academic literature, after the pioneering work on equities of Jegadeesh and Titman (1993)[9]. This construction is also used for bonds, for example, in Asness et al. (2013)[10]. Using the portfolio construction described in the Asness paper, we construct two versions of the strategy. In one we control the risk across bonds with similar maturities and durations by adjusting exposure only across sovereign bonds within a maturity bucket (risk controlled), and in the other we remove this constraint (unconstrained). Figure 1 shows the cumulative log return for the strategies. Neither strategy adds value over the long term.

Digging further into the result for the unconstrained strategy, we find that holdings are driven not by momentum but mainly by duration. The average position over the full backtest is shown in Figure 2 (naturally, average position relative to benchmark across maturities is effectively zero for the risk-controlled strategy).

8 One possible candidate sometimes cited is those bonds (or types of bonds) that have fared worst over some lengthy period in the past, such as the last five years. Whether this really accords to the idea of "value", we leave as an open question.

9 Narasimhan Jegadeesh and Sheridan Titman, "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency", *The Journal of Finance 48 no. 1*, 65–91, 1993.

10 Clifford S. Asness, Tobias J. Moskowitz, and Lasse Heje Pedersen, "Value and Momentum Everywhere", *The Journal of Finance* 68 *no. 3*, 929–985, 2013.

Figure 2: Duration drives the unconstrained strategy

	Bucket 1–3 years	Bucket 3–7 years	Bucket 7–10 years	Bucket 10–20 years	Bucket 20+ years
Average position	-14%	-3%	4%	6%	6%

Source: Citibank and Schroders, 1998–2017.

Thus, neither the unconstrained strategy, which adds significant exposure to duration, nor the risk-controlled strategy appears able to generate excess returns in this market. Value and momentum may very well be important factors across many markets, as researchers and practitioners have shown, but their presence must not be assumed everywhere.

By contrast, we now consider three well-known bond-specific factors: carry, roll-down and steepness. Carry and roll-down are often combined in fixed income portfolio management, but we separate the concept, with the goal of achieving more flexibility and precision in exposure. We define pure carry as the excess yield of a bond of a given maturity over the local risk-free rate. This pure carry strategy seeks bonds of countries for which the yield curve is steepest between the risk-free rate and a given maturity. (Note that carry is the only one of the three factors we consider here which is notably present in many other markets, although ironically it seems weakest in equity markets.)

Roll-down refers to the change in the price of a bond (generally positive) as it approaches maturity. The roll-down factor seeks exposure to bonds where the yield curve is locally steepest – that is, where the difference between yield to a given maturity and yield to a slightly smaller maturity is greatest.

Carry and roll-down both relate to features of the yield curve at a point in time. Our steepness factor takes into account the average steepness of a country's yield curve; it seeks bonds of countries for which the yield curve is currently steepest compared with its own history. This may be interpreted as seeking mean reversion in steepness, or as signalling a change in business cycle conditions that is likely to be favourable for bond markets. An inverted yield curve (in which short-term government rates are higher than long-term government rates) signifies that investors have little confidence in the economy, receiving a lower yield on capital which is tied up for a longer time period. If they expect the economy to fall into recession, they may expect short-term rates to decline further as the central bank lowers rates[11].

11 In line with our definition of factor investing, we use our signals to tilt the portfolio towards bonds of particular countries, while maintaining overall duration and yield similar to the benchmark. We also take care to apply these signals only to risk-free interest rate curves; therefore, we do not apply them to emerging markets or European peripherals.

Figure 3: Comparing correlations

Citi WGBI	100%					
Active	28%	100%				
Carry	37%	81%	100%			
Roll-down	9%	64%	41%	100%		
Steepness	26%	52%	52%	4%	100%	
MSCI World	-29%	0%	-6%	14%	-21%	100%
	Citi WGBI[12]	Active	Carry	Roll-down	Steepness	MSCI World

12 Citi World Government Bond Index.
Source: Citibank, MSCI and Schroders, December 2001 to March 2017.

The co-movement of factors is a critical consideration for building and maintaining these portfolios. Empirically, the three factors we consider here have quite distinct characteristics, with generally low correlations. Moreover, returns to the factors are largely uncorrelated with the returns to the broad fixed income market.

Figure 3 shows the correlation of returns from the market portfolio (proxied by the Citi World Government Bond Index), the combined factor portfolio, and the individual sub-strategies, from December 2001 to March 2017. We also show the correlation with the MSCI World Index in US dollars as a comparison.

As a further test, we also look at the correlation conditional on a 2% fall in the MSCI World Index. The correlation of the MSCI World with the residual returns is –12%; that is, the residual in the portfolio is uncorrelated with "bad" states of the equity world.

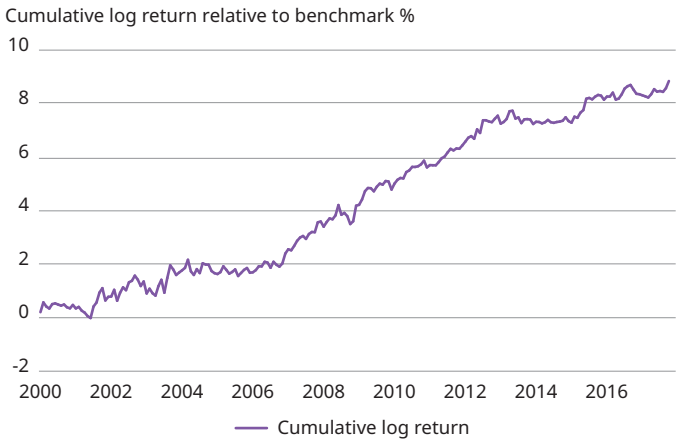
A multi-factor approach

Figure 4 shows the cumulative log return of the resulting multi-factor strategy relative to the benchmark. Using a rules-based, transparent and cost-effective approach to bonds generates consistent, moderate outperformance over its benchmark in the backtest period. The strategy in backtest achieved an impressive information ratio of greater than 0.8, delivering 43 basis points annually of excess returns (over index returns of just under 450 bps annually).

As discussed above, actual results would likely vary from the backtest results, since holding a particular selection of sovereign bonds (rather than the universe) itself inevitably generates some additional tracking error. This relatively small additional tracking error, however, seems unlikely to change the systematic risks of the portfolio.

Critically, the excess returns were achieved while maintaining duration and yield characteristics almost identical to the benchmark. Differences in yield never exceeded 25 basis points, while differences in duration almost never exceeded six months.

Figure 4: A multi-factor approach to sovereign bonds



Source: Citibank (Citi World Government Bond Index restricted to the 11 highest weighted countries) and Schroders as at January 2016.

Conclusion: not all factors are created equal

Factor-based bond strategies are nearly as old as bond investing itself. However, attempts to use factors for fully systematic investing, whether those traditionally found in bond markets or others, are still in their early days. We are cautiously optimistic of the potential for factors in fixed income markets that are liquid enough to support such trading strategies. Developed sovereign bond markets seem to meet this criterion; we believe that credit markets currently do not. Another avenue for further exploration is emerging market sovereign bonds. Investors should be wary, however, that straightforward application of factors from equity markets is unlikely to provide the best way forward. Rather, each factor must be shown to be theoretically sound and empirically valid within the chosen asset class. In this analysis, we illustrated these ideas with a hypothetical portfolio of developed market sovereign bonds and showed that, in backtest, such ideas are capable of generating attractive risk-adjusted returns.

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