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Bond Fund Performance and a Smart Beta Strategy in Japan

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Abstract

Actively-managed bond funds in Japan have one key trait in common—a tendency to overweight credit exposure. However, such funds do not utilize another source of returns, namely, carry-and-roll-down (CaRD) exposure in the JGB curve. This is puzzling since CaRD offers attractive risk-adjusted return and low correlation to credit and equities. This paper explores this issue further, highlighting the importance of understanding and improving factor exposure in fixed income funds.

1. Introduction

In academic finance, based on the rationale that the expected excess return of an asset is determined by compensation for taking exposure to systematic risk factors, analysts have made enormous efforts over many years to identify factors and explain fund performance by such factors. One practical consequence of this research has been the growth of so-called 'smart beta'[1] or factor investing in stock markets. Compared with stocks, bonds have received little attention regarding factors and their relationship with fund performance. In this study, we examine factor exposure in fixed income using a sample of actively-managed bond funds in Japan.

Active bond managers use duration, curve exposure, and sector selection strategies to outperform benchmarks. This paper examines the investable factors that correspond with these strategies, and investigates the performance of actively-managed Japanese bond funds. In addition, we examine implications for factor investments and discuss the importance of managing factor exposures effectively.

2. Factor Exposure of Bond Investments in Japan

For a long time, investors have considered the core factors driving yield curve changes as level, slope, and curvature. These factors are especially useful for risk management. In macro-finance literature, macroeconomic variables like inflation and economic growth are used as factors to determine the effects of monetary policy and economic growth on the yield curve.

In this paper, we investigate three investable factors: credit, carry-and-roll-down (CaRD), duration. The duration factor and credit factor respectively correspond to duration strategy and sector selection in active management. In their empirical study of stock and bond returns, Fama and French [1993] use the duration and credit factors, in addition to three major stock market factors (market, value, and size).

Japanese government bonds (JGBs) account for over 90% of Japan's bond market. Credit assets are less available than in USD markets. Because of this, looking for CaRD in the JGB curve, separate from duration, is a logical choice for active fund managers seeking to outperform their benchmark. The CaRD factor corresponds to such a strategy. Assuming that the shape of the yield curve is unchanged, portfolio managers can estimate expected return in each maturity bracket and identify curve points with a high expected return (for buying) and those with a low expected return (for selling). CaRD factor return is defined as the return of this long/short strategy. Koijen et al. [2016] calculate factors based on such an approach for the bond market as well as for currencies, stock index futures, commodities, and stock index options. They show that CaRD exposure delivers a positive average excess return in each market.

This paper analyzes excess returns relative to the NOMURA-BPI (hereafter BPI) because this index is used as the benchmark for most bond portfolios managed by pension funds in Japan. We define the three factors (credit, CaRD, duration) as the difference between the returns of two investable portfolios (long and short) with exposure to each factor.

(1) Credit

Bearing credit risk exposure is one way to earn excess returns. Generally, yields of corporate bonds and other non-JGB bonds are higher than those of JGBs as they reflect credit risk premia. When credit risk increases, the spread of these bonds over JGBs widens, meaning that these credit investments underperform. However, bonds with credit spreads tend to outperform the BPI.

To estimate the risk premium of credit exposure, we calculate the excess returns of JPY-denominated corporate bonds relative to maturity-equivalent JGBs. The corporate bonds used in this exercise are A-rated corporate bonds in the BPI and BBB-rated corporate bonds in the BPI Extended. We define credit factor return as the average of these two excess returns. To isolate credit risk premium from duration risk premium, we calculate the returns of the corporate bonds relative to the returns of a JGB portfolio that has the same

[1] Although the term 'smart beta' occasionally refers to passive investing in non-market-cap-weighted indexes, this study interprets it as factor investing along with Ang [2014, Chapter 14].

maturity weightings (market-value basis, one-year increments) as those of the single A-rated and triple B-rated corporate bond indexes[2]. The portfolios are rebalanced at the end of each month to align weightings.

Figure 1 shows factor returns between April 2002 and March 2016. From panel (A) the average return of the credit factor is positive and significant at the 5% level. As one can see in panel (C), performance deteriorated sharply between December 2007 and March 2009 (i.e., during the financial crisis), and recovered subsequently.

Note that the standard deviation of returns differs for each factor. Due to these differences, the graph in panel (C) (which shows cumulative returns) is scaled so that each ex-post standard deviation is an annualized 1% during the entire period.

(2) Carry-and-roll-down (CaRD)

In the bond market, a particular point on the yield curve may be higher or lower relative to others. One explanation of this phenomenon is the preferred habitat theory, which says some market participants tend to favor one part of the yield curve more than others. For example, life insurance companies seeking to match long-dated liabilities might prefer to use longer-term bonds, while banks traditionally seek shorter-term maturities. It also accounts for how many market players might have non-commercial motives for purchasing certain parts of the yield curve, for example central banks pursuing quantitative easing as part of monetary policy. Vayanos and Vila [2009] and Greenwood and Vayanos [2014] argue that investors who prefer specific maturity tenors tend to have a supply and demand impact on yields in those areas. An issuer targeting a particular tenor can also impact yields. Both of these effects can impact the slope of the yield curve to create opportunities for the CaRD strategy.

In empirical studies of carry-and-roll-down factors, Yamada [2000] reports that this factor had a positive average return in the JGB market during the period from 1988 to 2000. In addition, Koijen et al. [2016] find that it had a positive average return between 1971 and 2012 in the US Treasury market, and argue that it is not possible to attribute it to any risk premia. Our research also avoids taking a position on the question of whether factor return on CaRD reflects mispricing or risk premia.

We use the following methodology to calculate the carry-and-roll-down (CaRD) factor. First, we calculate the expected one-month return from holding each of the 29 BPI JGB indexes divided by the remaining years to maturity (one to 30 years). Assuming that the shape of the yield curve is unchanged, we add carry and roll-down to obtain the expected return. Carry is the income gain expected from holding a bond at the current yield. Roll-down is the valuation gain/loss resulting from changes in the yield as the bond’s remaining life becomes shorter, and can be seen as an expected capital gain.

Next, we create a portfolio by using two indexes with different years to maturity. The portfolio is structured to have a modified duration that matches that of the BPI and to have the maximum expected return. The weighting of each index is between 0 and 1, and the total of these weightings should be 1. We then use the same method to create a portfolio with the minimum expected return. We use the difference between the returns of these two portfolios as the CaRD factor return. Portfolios are rebalanced at the end of each month.

While the duration factor reflects a parallel shift in the yield curve, the CaRD factor reflects the slope of the yield curve. And, while modified duration matches that of the BPI, it does not reflect whole yield curve movement. Because of this, excess return can be negative if interest rates fall sharply only in maturities where CaRD is not high; or yields rise sharply only in maturities that have high CaRD.

As shown in panel (A) of Figure 1, average CaRD return is significant at the 1% level and positive. This is consistent with the results obtained by Yamada [2000] and Koijen et al. [2016]. In addition, the CaRD factor has the highest Sharpe ratio[3] of all three factors. Panel (C) shows that CaRD return remained stable even

[2] We also examined a methodology in which the corporate bond portfolio and JGB portfolio were matched by modified duration, but the results were nearly identical.

[3] Although this is not an indicator of a fund’s actual performance, it is called a Sharpe ratio because it is obtained by dividing average excess return for a zero-cost investment strategy by its standard deviation.

during the VaR shock in 2003 (when duration sold off) and during the financial crisis of 2008 (when credit sold off).

Figure 1: Factor returns

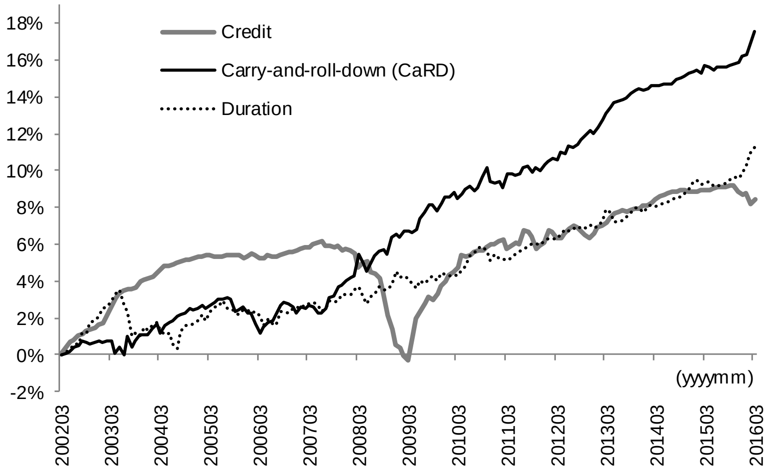
(A) Factor returns (annualized)

	Avg.	(*t*-value)	Standard deviation	Sharpe ratio
Credit	1.00%	(2.26) **	1.65%	0.60
Carry-and-roll-down	1.34%	(4.68) ***	1.07%	1.25
Duration	0.67%	(3.01) ***	0.83%	0.81

(B) Correlation among factor returns

	Carry-and-roll-down	Duration	Stock
Credit	-0.158	-0.114	0.384
Carry-and-roll-down		0.323	-0.227
Duration			-0.313

(C) Cummulative factor returns



(D) Sharpe ratio by phase (annualized)

	Credit		Carry-and-roll-down		Duration		Stock	
	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
Number of sample months	120	48	119	49	106	62	91	77
Credit			0.43	1.00	0.58	0.64	1.33	-0.11
Carry-and roll-down	1.01	1.82			2.02	0.33	0.67	2.13
Duration	0.63	1.42	1.64	-0.60			-0.10	2.29

Notes: Data reflects monthly factor returns for the period between April 2002 and March 2016. * indicates return is significant at the 10% level, ** at the 5% level, and *** at the 1% level. Stock indicates TOPIX return, including dividends, minus the 3-month government bond rate. Panel (C) shows cumulative returns and is scaled so that ex-post standard deviation is an annualized 1% during the entire period.
Source: Authors (same hereafter).

(3) Duration

When interest rates fall, a portfolio with longer duration than the BPI will outperform. In contrast, a portfolio with a shorter duration can perform better when interest rates are rising. As such, the duration factor is a reflection of excess return obtained by extending portfolio duration relative to the benchmark.

We define the duration factor as the difference in returns of two portfolios divided by two. One is a portfolio with a reduced weighting of bonds dated shorter than three years to obtain a modified duration one year longer than the BPI. The other is a portfolio with a reduced weighting of bonds dated seven years or longer to obtain a modified duration one year shorter than the BPI. Portfolios are rebalanced at the end of each month. Because interest rates had a downward trend over the period, as shown by panels (A) and (C) in Figure 1, average return of the duration factor is significant and positive.

(4) Factor correlation

Panel (B) of Figure 1 shows correlations among the three factors. For comparison, this panel also includes their correlations with stock market return. The credit factor has a slight negative correlation with the CaRD and duration factors, while a positive correlation of 0.323 exists between the CaRD and duration factors.

A regression of CaRD factor return on the duration factor return results in an intercept of 106bp annualized and significant at the 1% level. That means 106bp of the CaRD factor's average return of 134bp is specific to this factor, and therefore cannot be explained by the duration factor.

While the duration and CaRD factors have negative correlations with stock market return (-0.313 and -0.227, respectively), the credit factor's correlation is positive (0.384). According to the structural model of Merton [1974], corporate bond spreads and stocks can be considered options on the underlying asset value of the firm. This positive correlation between credit and equities should therefore be considered natural because they both have exposure to the same balance sheet. This suggests credit exposure provides a diversification benefit relative to other bond factors, but will suffer losses at the same time as equities in bad times. In fact, both credit and equities suffered large drawdowns during the financial crisis of 2008, as well as during other risk-off events on a smaller scale.

Panel (D) of Figure 1 shows the performance of each factor by phase. The panel shows Sharpe ratios under conditions where other factor returns are either positive or negative. The sizes of premia differ depending on phase, and are consistent with the correlations in panel (B). While credit and duration factors have negative Sharpe ratios in some phases, the Sharpe ratio for CaRD is not negative. Most strikingly, although the credit factor's Sharpe ratio is negative when stock market return is negative, that of the CaRD factor is still a fairly large positive value.

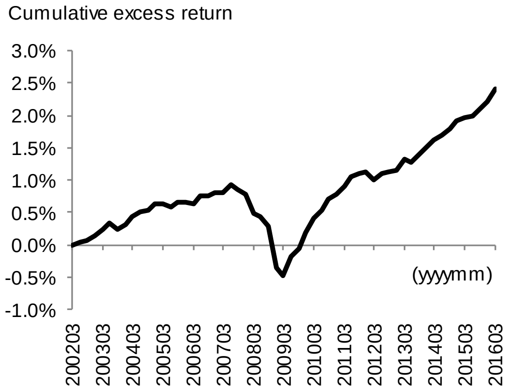
3. Performance of Active Funds

(1) Data used

This section uses the three-factor model in the previous section to evaluate performance of actively-managed bond funds in Japan.

Our analysis covers pension funds and uses quarterly returns for joint trust accounts, i.e. pooled pension funds managed by trust banks. Fund return data is from a *Nenkin Joho* database by Rating and Investment Information (R&I), a subsidiary of the *Nikkei* newspaper group. Based on descriptions of funds, we select all that are regarded as active funds with the BPI as benchmark. Fund return data covers the period from April 2002 to March 2016, a total of 56 quarters. We connect time series data if fund name changed due to merger of asset managers (trust banks) or for other reasons. It also includes funds that were newly started or terminated during the 56 quarters. As a result, we use 20 funds. Data for analysis exists for all 56 quarters for 13 of these funds, for 18 quarters for two funds, and for 25, 31, 35, 39 and 47 quarters for five other funds.

Figure 2: Performance of active bond funds (AUM-weighted average return)



Excess return				
Average (ann., bp)	17.25	(2.32)	**	
Std.dev (ann., bp)	27.58			
IR	0.63			
Three-factor model	Coefficient			Return contribution (ann., bp)
Credit	0.22	(9.05)	***	9.76
Carry-and-roll-down	-0.02	(-0.67)		-2.22
Duration	0.03	(1.20)		2.31

Notes: Data reflects quarterly returns for the period between April 2002 and March 2016. Excess returns are obtained by subtracting the BPI return from the average return weighted by AUM at the end of the previous quarters on 20 active bond funds. The three-factor model indicates a multiple regression of AUM-weighted average excess returns on returns of the three factors in the time series. Each factor return is scaled so that ex-post standard deviation is an annualized 1%. Return contribution indicates a component of the excess return, which is the regression coefficient multiplied by average factor return (annualized). Parenthesized figures are *t*-values. * indicates return is significant at the 10% level, ** at the 5% level, and *** at the 1% level.

(2) Average performance of funds

We begin with an examination of average fund performance. Figure 2 shows the results of excess return obtained by subtracting BPI return from AUM (assets under management)-weighted average return in each active fund. The AUM-weighted average return of active funds is 17.25bp higher (annualized) than that for the BPI, which is positive and significant at the 5% level. There has been a limited amount of research on the performance of bond funds. Blake et al. [1993], Elton et al. [1995], Ferson et al. [2006], and Chen et al. [2010] report that average excess return of US bond mutual funds before deducting asset management fees is either slightly positive or nil (and is negative after these fees). The average return of joint trust accounts is slightly higher than these, though admittedly it is a small sample.

Next, we investigate the source of excess returns by using quarterly returns of the three factors that we presented in Section 2. The table in Figure 2 shows the result of a multiple regression of AUM-weighted average excess returns in the time series. To facilitate comparisons of the amount of exposure among these factors, each factor return is scaled so that ex-post standard deviation is an annualized 1%[4].

This result reveals that exposure (the regression coefficient) is significantly positive only for the credit factor. The contribution in the table in Figure 2 is the regression coefficient multiplied by average factor return, representing a component of excess return. The credit factor contribution accounts for 9.76bp of the 17.25bp AUM-weighted average excess return. That means credit is the major source of excess returns in active bond funds. The shape of the cumulative excess return line in the graph in Figure 2 is also consistent with this view. In fact, excess return fell sharply when the credit spread widened during the 2008 financial crisis.

In contrast, exposures for the CaRD and duration factors are not statistically significant and almost nil. The fact that CaRD exposure is not positive is noteworthy. As we explained in Section 2 (2), the CaRD factor has a large premium. As this factor is easy to calculate and it invests in JGBs, which are sufficiently liquid, it looks a fairly viable investment. Nevertheless, active bond funds are apparently not utilizing the CaRD factor.

[4] Scaling the factor return of the explanatory variables alters the size of the regression coefficient to the factors, but *t*-value remains the same.

Finally, the fact that duration exposure is virtually zero means that active bond funds did not tend to bet on directional interest-rate movements during the period. As JGB yields continued to fall, bond funds could have earned substantial excess return if they had tilted duration risk towards positive exposure.

Forecasting changes in interest rates is difficult. Fama and Bliss [1987] and Cochrane and Piazzesi [2005] indicate that future bond returns in the US Treasury market are predictable by using the shape of the yield curve. While this proves risk premium changes over time, it is considered of little help in consistently improving the performance of active bond investments. In addition, Ilmanen [2011, Chapter 9] refers to US Treasury market data over a number of years, including periods when interest rates were rising, and finds that the Sharpe ratio for long-term bonds is lower than for short-term bonds. Although average returns on long-term bonds are relatively high, these bonds have a volatility that is even higher. This means increasing duration risk exposure is difficult for active bond funds, because their performance is evaluated by excess return.

(3) Performance of individual funds

Next, we evaluate the performance of individual funds by using a methodology similar to that used for the fund average. Figure 3 shows these results. Average excess return is significantly positive for nine funds at the 10% level and for eight funds at the 5% level. Additionally, 16 funds in panel (B) have positive average excess return, and three of these have excess returns of more than 50bp.

In the previous subsection, we explained that a tilt toward the credit factor is the primary source of AUM-weighted average excess returns. This tendency is also observed in individual funds. Panels (A) and (C) show that 17 of the 20 funds have positive credit factor exposure, and that 16 of them have significant exposure at the 5% level.

In contrast, panel (A) shows that the majority of active funds have no significant exposure to the CaRD factor. Two funds have significant negative exposure at the 5% level and five at the 10% level. This has a negative impact on excess return. Only one fund has significantly positive exposure. Moreover, many funds in panel (D) have almost no exposure.

At the same time, most funds have almost no exposure to the duration factor, showing little evidence that any of them utilize directional interest-rate movements for excess return.

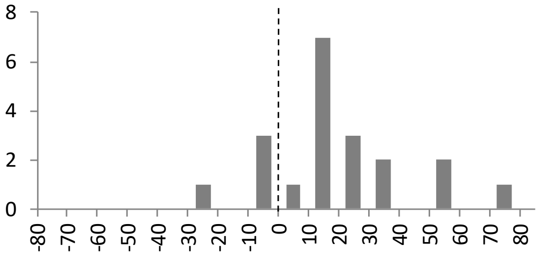
In short, active funds are homogeneous in that they rely almost entirely on the credit factor for excess returns. Furthermore, these funds do not utilize the CaRD factor even though it has a positive premium, and some even have negative exposure.

Figure 3: Performance of individual active bond funds

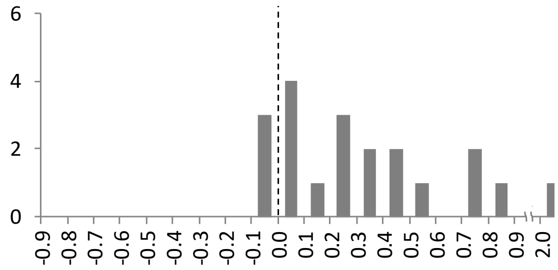
(A) Performance analysis of individual funds

	Equally weighted average	Number of funds that are significant and positive		Number of funds that are significant and negative	
		5% level	10% level	5% level	10% level
Excess return					
Average (annualized, bp)	19.37	8	9	0	0
Three-factor model (coefficient)					
Credit	0.38	16	16	0	0
Carry-and-roll-down	-0.05	1	1	2	5
Duration	-0.02	2	3	1	1

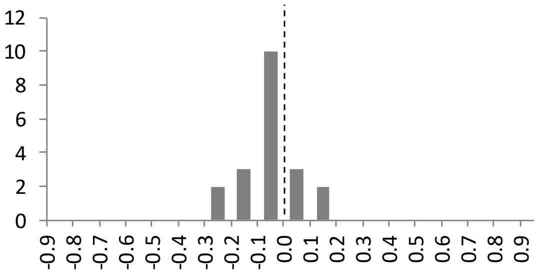
(B) Distribution of average excess returns (annualized, bp)



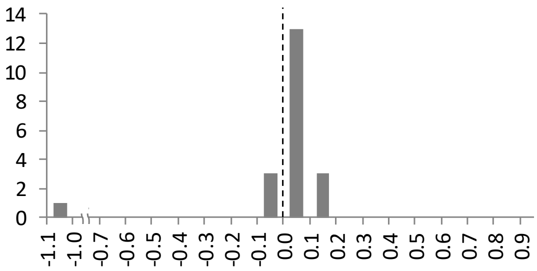
(C) Distribution of coefficients in three-factor model (credit)



(D) Distribution of coefficients in three-factor model (carry-and-roll-down)



(E) Distribution of coefficients in three-factor model (duration)



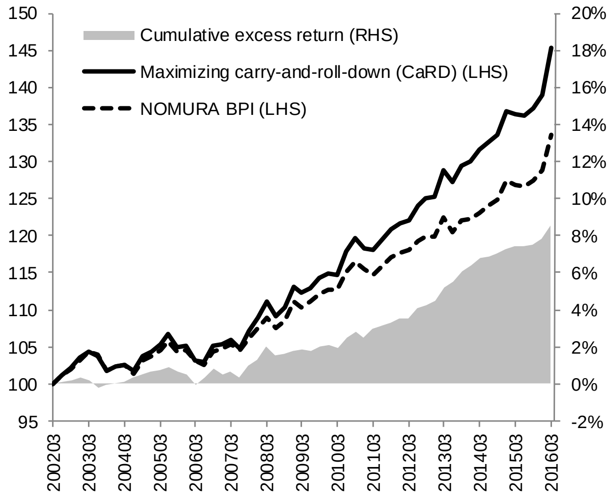
Notes: Data reflects quarterly returns for the period between April 2002 and March 2016. 20 active bond funds are used. Excess returns are obtained by subtracting BPI return. The excess return of each fund is regressed on the three factor returns in the time series. Each factor return is scaled so that ex-post standard deviation is an annualized 1%. The *y*-axis in panels (B), (C), (D), and (E) indicates the number of funds, and *x*-axis the regression coefficient, except in panel (B) where the *x*-axis is average excess returns in annualized basis points.

4. Application to Factor Investing (smart beta)

The results in Section 3 demonstrate that excess returns from active funds are almost entirely attributable to the credit factor. At the same time, these funds have almost no exposure, or even negative exposure, to the duration and CaRD factors. These points imply that for pension funds, incorporating investments in the CaRD factor into their existing active funds will yield excess return while diversifying factor risk, improving their fund performance. This CaRD exposure is a smart beta strategy, enabling exposure to a factor that most investors ignore.

CaRD factor return, as discussed earlier, is the difference in returns between steeper and flatter parts of the curve, as steeper parts of the curve tend to have higher carry and roll-down. This is essentially the return for a long-short strategy. In practice, however, bond funds tend to have long-only positions and rarely take short positions. Because of this, we consider a long-only portfolio consisting of steeper maturity tenors to maximize return from the CaRD factor. The method for creating this portfolio was explained in Section 2 (2).

Figure 4: Performance of (long-only) portfolio maximizing the carry-and-roll-down (CaRD) factor



Excess return		
Average (ann., bp)	61.28	(3.91) ***
Std.dev (ann., bp)	58.09	
IR	1.05	
Coefficients in three-factor model		
Credit	-0.01	(-0.38)
Carry-and-roll-down	0.48	(11.53) ***
Duration	0.08	(1.84) *

Notes: Data reflects quarterly returns for the period between April 2002 and March 2016. Excess returns are obtained by subtracting BPI return from the return of the CaRD maximized portfolio. The three-factor model gives a multiple regression of the excess return of the CaRD maximized portfolio on the three factor returns in the time series. Each factor return is scaled so that ex-post standard deviation is an annualized 1%. Parenthesized figures are *t*-values. * indicates return is significant at the 10% level, ** at the 5% level, and *** at the 1% level.

As shown in Figure 4, the portfolio performs fairly well. Average excess return is an annualized 61.28bp, tracking error (standard deviation) an annualized 58.09bp, and information ratio (IR) 1.05. There are clear differences in characteristics between the return of this portfolio and that of typical active bond funds, which rely almost exclusively on credit factor exposures (Figure 2).

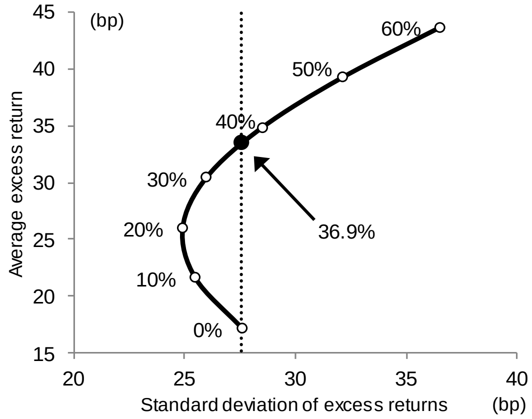
Examining the factor exposure of excess returns, there is a significantly positive coefficient of 0.48 on the CaRD factor, as expected. While the coefficient on the credit factor is almost zero, that on the duration factor is a small positive value of 0.08, significant at the 10% level. The latter small positive value is a reflection of the positive correlation between returns of the CaRD factor and those of the duration factor.

Therefore, we examine return on a portfolio with no duration factor exposure at all. In doing so, we multiply the duration factor return by its coefficient (0.08) and deduct the result from return on the long-only portfolio maximizing the CaRD factor. The resulting performance is still good. Annualized average excess return is 55.58bp with an annualized tracking error of 55.21bp and an IR of 1.01.

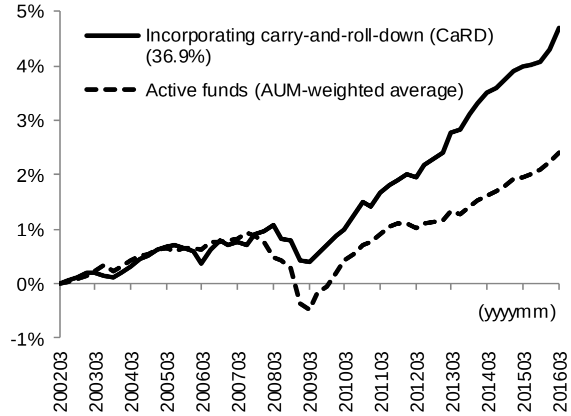
Returns of active bond funds in the joint trust accounts which we study are gross of management fees, but they should reflect bond transaction costs. Assuming these costs are 0.25bp (in terms of bid-ask yield spread), average excess return on the long-only portfolio maximizing the CaRD factor falls by 8.91bp to an annualized 52.37bp. Assuming 0.5bp for bond transaction costs, average excess return falls by 17.82bp to an annualized 43.46bp. Excess return remains high even considering bond transaction costs.

Figure 5: Effect of carry-and-roll-down (CaRD) factor incorporated into portfolio

(A) Weighting of carry-and-roll-down and risk/return (ann., bp)



(B) Cumulative excess returns



(C) Portfolio performance after carry-and-roll-down (CaRD) is incorporated (36.9%)

Excess return				Coefficients in three-factor model			
Average (ann., bp)	33.52	(3.97)	***	Credit	0.13	(5.13)	***
Standard deviation (ann., bp)	27.58			Carry-and-roll-down	0.17	(6.05)	***
IR	1.22			Duration	0.05	(1.74)	*

Notes: Data reflects quarterly factor returns for the period between April 2002 and March 2016. The long-only portfolio maximizing CaRD is incorporated into average return on 20 active bond funds, weighted by AUM at the end of the preceding quarter. Excess returns are obtained by subtracting BPI return. The three-factor model gives a multiple regression of the excess return of the portfolio incorporating CaRD on the three factor returns in the time series. Each factor return is scaled so that ex-post standard deviation is an annualized 1%. Parenthesized figures are *t*-values. * indicates return is significant at the 10% level, **at the 5% level, and *** at the 1% level.

Next, we look at the effect on excess return of an average pension fund when it invests in the CaRD factor. We examine performance of existing actively managed bond funds (AUM-weighted average return), as shown in Figure 2, after incorporating the long-only portfolio maximizing CaRD, as shown in Figure 4.

Panel (A) of Figure 5 shows the extent to which performance improves when the CaRD-maximized portfolio is added in 10% increments (the 0% point represents no addition, meaning return is the AUM-weighted average for the active bond funds). As the weight of the CaRD-maximized portfolio is increased, tracking error initially decreases thanks to the diversification effect. However, as more of this portfolio is added, the tracking error starts to rise, while average excess return increases monotonically. Tracking error becomes the same as for the existing active bond fund when the weighting of the CaRD-maximized portfolio rises to 36.9%, with the remaining 63.1% held in active funds.

Panels (B) and (C) of Figure 5 show portfolio performance at this specific portfolio weighting. Exposure to the CaRD factor increases while exposure to the credit factor is retained. As a result, average excess return rises from 17.25bp to 33.52bp with the tracking error remaining at 27.58bp. In addition, this portfolio reduces losses from the 2008 financial crisis.

This result suggests asset owners can improve the performance of their funds by managing factor exposures more effectively. Particularly for large funds, where returns are determined mostly by factors, properly managing and allocating factor risk is of critical importance.

In recent years, central banks have implemented policies that interfere with the shape of the yield curve. If Japanese experience is any guide, such policies could well lead to attractive returns for the CaRD factor.

5. Conclusions

In this paper, we studied factors and fund performance in the bond market in Japan, which very few studies have thus far investigated. Our main conclusions are as follows.

First, excess returns (relative to BPI) of Japan's active bond funds held by pension funds are positive on average. These bond funds are homogeneous in that they rely on the credit factor as the primary source of excess returns. But credit spreads are subject to similar risk drivers as equities, leading them to be correlated. In contrast, the carry-and-roll-down factor (CaRD), which takes advantage of steeper sectors of the JGB yield curve, is rarely used by active bond funds in Japan.

Second, based on this first conclusion, we examined the application of these insights to factor investing. The CaRD factor has a high premium and low correlation with credit and stocks. Investing in this factor therefore diversifies risk and improves a fund's performance. This result suggests the importance of managing factor exposures more effectively.

Innovation in the asset management industry in recent years has led to the use of smart beta strategies, primarily among stock markets. This has enabled asset owners to select and allocate factors at a low cost in accordance with their own preferences. Going forward, we expect such innovation for bond investments as well.

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