BOOST YOUR Bonds

Real return versus nominal bonds.

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In February 1991, the Bank of Canada and the Canadian Department of Finance issued a joint policy announcement that clearly approved an anti-inflationist monetary policy for Canada. The core Consumer Price Index (CPI) inflation target was set to be 3% in 1992, 2.5% in 1993 and 1994, and 2% in 1995. Ten months later, the Canadian Government acted upon this and began to offer Real Return Bonds (RRB). RRBs consist of bonds for which the principal is adjusted in response to changes in the CPI. Although the coupon rate of an RRB remains fixed, the actual interest payment rises as the value of the principal increases with inflation. In that manner, the purchasing power of every coupon and principal remains constant for the holding period of the bond. Because the government will pay the realized inflation over the holding period, regardless if it happens to be 2% or 20%, RRBs are viewed as an insurance against unexpected inflation for the investor. However, as is always the case with insurance products, the inflation insurance is not free. When the investor is buying an RRB over a conventional nominal bond, he is transferring the inflation risk to the issuer, but at the same time, he is paying a higher price (through a lower required return) for the RRB than he would have for the nominal bond. This premium is usually called the inflation risk premium (IRP).

The modified Fisher equation (1) shows that the required return (or yield-to-maturity YTM) on a conventional bond consists of three parts: the real return rate, the expected inflation rate over the life of the bond and the IRP. The last element compensates the investor for the risk of having a wrong expectation of inflation. In the case of the RRB, since the investors do not assume this risk, the required return only contains the first two parts.

$$E(R_{nominal}) = Y_{real} + E(I) + IRP \qquad (1)$$

$$E(R_{real}) = Y_{real} + E(I) \qquad (2)$$

Where :

$E(R_{nominal})$ = expected nominal return on nominal return bond

$E(R_{real})$ = expected nominal return on real return bond

Y_{real} = real interest rate

$E(I)$ = expected inflation

IRP = inflation risk premium

Siegel and Waring (2004) explain the utility for an institutional investor with a liability linked or partly linked to inflation of combining real return bonds and nominal bonds to minimize surplus (asset minus liabilities) risk. Nowadays, the expected return of such a portfolio is relatively low. Consequently, adding value is necessary to achieve the required rate of return of the actuarial evaluations. Tactical allocation between nominal and real return bonds can be a source of added value. In that manner, the amount of money that an investor is expected to leave on the table (IRP) by purchasing an RRB instead of a conventional bond needs to be quantified. We contribute to this field of research along three dimensions. First, we provide a time-series estimation of the IRP figure priced in the Canadian bond market. Second, we formally test for the relationship between the IRP and the subsequent difference of returns between RRBs and conventional bonds. Finally, we implement different systematic decision rules for the allocation between real and conventional bonds. We find

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that the IRP provides significant economic benefits when tactically moving money from real to conventional bonds.

INFLATION RISK PREMIUM

Studies on inflation-linked bonds have mainly focused on the U.S. (Roll 2004, Kothari and Shanken 2004) and the UK markets. Some of these studies attempt to measure the IRP embedded in conventional bonds. Campbell & Shiller (1996) suggest that the IRP might be 50 to 100 basis points a year on five-year nominal bonds in the U.S. They use two different methods. The IRP is first measured by the excess return of a five-year Treasury conventional bond over that of a riskless asset (three-month T-bill). The implied assumption is that all of the excess return of the nominal bond is attributable to its IRP. The authors report 70 to 100 basis points of excess return over the 1953 to 1994 period. With the second method, they estimate the IRP implied by the covariance of bond returns with relevant state variables (stock index and growth rate of aggregate consumption). This method suggests an IRP of about 90 to 150 basis points. In the UK, Shen (1998) finds an IRP between 70 and 140 basis points on 10-year nominal bonds. Among other international studies, Kandel, Ofer and Sarig (1996) measure the IRP in Israel (the first country to issue inflation-linked bonds in 1984). Over the period August 1985 to March 1992, a period of relatively low and stable inflation for Israel, they report an average IRP of 58 basis points. For Mexico, over the 1992-1999 period, Perales et al. (2001) report an average IRP of 486 basis points. For the Canadian market, Fung et al. (1999) use a multi-factor affine-yield model jointly for the U.S. and Canada to estimate the IRP. They report an average IRP of 57 basis points for Canada over the 1984-98 period.

We estimate the IRP figure for Canada over the period 1992-2006 using two Canada bonds with the same maturity, the RRB issue paying a 4.25% coupon that matures in 2021 (the RRB) and the conventional issue paying a 9.75% coupon that also matures in 2021 (the nominal bond). The RRB was issued in December 1991 and the nominal bond in April 1991. The yield spread between these two bonds is referred to as the break-even inflation rate (BEIR). In other words, it is the inflation rate over the period up to maturity that would make the investment return of the two bonds equal. The information content of the BEIR is important but not necessarily easy to infer. Most of the BEIR can be attributable to the inflation rate over the life of the bonds that the financial market is expecting. The other important part of the BEIR is attributable to the IRP. The rest of the BEIR is less structurally important: many authors suggest a liquidity premium for the fact that RRBs are less liquid than their nominal counterparts. Such a premium implies that *ceteris paribus,* the yield on an RRB should be higher than the yield on a nominal bond. A clientele effect is also largely recognized. This premium represents the fact that the demand (mainly from institutional investors like pension and insurance funds) for RRBs is very high (in relation to the limited offer) and that *ceteris paribus,* the yield on an RRB should be lower than the yield on the nominal bond. To summarize: these two premiums are hardly distinguishable but tend to offset each other.

Table 1: Historical performance of bond indices

January 1992 to December 2006	Average Return	Standard Deviation
Long-term government bond index (LTGB index)	10.2%	7.8%
Real return bond index (RRB index)	8.5%	7.1%
Difference	1.4%	6.5%

A fair approximation of the IRP figure can be obtained from the spread between real and nominal bond yields with the same characteristics, and an estimation of the expected inflation for the time horizon of the bonds. We use the survey of Consensus Economics in Canada to estimate the long-run expected inflation level. Since the expected inflation hypothesis is important when estimating the IRP, we test whether two alternative measures of expected inflation change significantly the time-series estimations of the IRP. First, we use a naïve expectation model where expected inflation equals past inflation. Second, we use a prospective model where the expected inflation is equal to the midpoint of the target range provided by the Bank of Canada.

No matter which hypothesis is used for the expected inflation, the IRP is quite volatile over the period. For example, the IRP Consensus forecast ranges from 2.15% in June 1994 to -0.83% in January 1999. Also, we note that the IRP Consensus forecast has been very close to the IRP Bank of Canada target for the entire period. It shows that the motivation of the Bank of Canada to control inflation is taken very seriously by investors in the consensus as they keep their expectations close to the Bank's target. Surprisingly, for every measure of expected inflation, the IRP is negative during some periods. This seems to suggest that investors could be paid to eliminate the inflation risk during those periods, which is counterintuitive. This could be a consequence of not taking into account liquidity premiums and clientele effects. Shen (2006) notably finds that the liquidity premium for TIPS in the U.S. market is consistently larger than the IRP over the 1999 to 2003

Table 2: Summary statistics on returns of the strategy over the 1992- 2006 period

				Discriminatory *IRP*				
January 1992 to December 2006	LTGB Index	RRB Index	Index 50/50	0.10%	0.30%	0.50%	0.70%	0.90%
Geometric average return	10.21%	8.54%	9.43%	11.12%	11.86%	13.08%	11.65%	11.38%
Standard deviation	7.82%	7.12%	6.73%	7.29%	7.31%	7.18%	7.11%	7.03%
Reward-to-volatility ratio	1.31	1.20	1.40	1.53	1.62	1.82	1.64	1.62
Market risk-adjusted return (alpha)[1]				+1.87%	+2.50%	+3.77%	+2.60%	+2.48%
t-statistic				2.07*	2.77*	4.29*	2.89*	2.76*
Beta[2]				0.97	0.98	0.96	0.94	0.93
t-statistic				-0.82	-0.64	-1.13	-1.57	-1.96
Maximum transaction cost[3]				0.11%	0.79%	1.45%	0.82%	0.94%
Percent of time invested in RRB				25%	38%	52%	64%	70%
Percent of time invested in nominal				75%	62%	48%	36%	30%

Notes: 1 We regress the returns of the strategies against the Index 50/50. 2 Relative to an Index 50/50. 3 Maximum transaction cost for alpha to remain statistically significant at the 5% level.
*Statistically significant at the 5% level.

period. Major shifts in the IRP are captured by each of the three methods: from 1992 to 1998, the IRP values are high: around 1.5%. However, from 1998 to January 2006, the IRP values are more stable, around 0.25%. Recently, the IRP moved up to 0.8% in April 2006. Over the whole period, the average IRP figure is 0.5% with the consensus forecast, 0.6% with the naive forecast and 0.5% with the Bank of Canada target. For the rest of the article, we use the expected inflation from the Consensus forecast to calculate the IRP.

PREDICTIVE POWER OF IRP

We investigate whether the level of IRP has predictive power over the difference in realized returns between nominal and real return bonds. The underlying hypothesis is that when the price of insurance against inflation is too high (low) it reverts back to its 'normal' level. Historically, this would have meant that the high level of the IRP in the beginning of the '90s signalled an over-performance of nominal bonds over real return bonds, while the negative IRP in 1998 indicated the opposite.

We use the same pair of real and nominal bonds as in Section 2 to determine the level of the IRP—namely the Canada 4.25 2021 RRB and the Canada 9.75 2021 nominal. To implement the strategy, we use total return indices from Scotia Capital, namely the Long-term Government Bond Index and the Real Return Bond Index. The historical performance of these indices is in Table 1.

Over the 1992-2006 period, nominal return bonds outperformed real return ones (10.2% average annual return compared to 8.5%). However, real return bonds have presented a lower risk with an annual standard deviation of 7.1% as opposed to 7.8% for the nominal return bonds. The average difference in return between those two types of bonds over the period is 1.4% and the standard deviation of this difference is 6.5%.

We first test the relation between the IRP and the difference in subsequent returns between nominal and real return bond indices with the following equation:

$$(RtnNOM - RtnREAL)_{t+1} = \alpha + b^* \; IRP_t + \varepsilon \qquad (3)$$

Where :

RtnNOM : Monthly return of the *SC Long-term Government Bond index*

RtnREAL: Monthly return of the *SC Real Return Bond index*

β : Beta (sensitiveness to the IRP)

The estimated beta coefficient is significantly different from zero at 0.72 and the R2 is 5.9%. It seems to support the hypothesis that for a weak (high) IRP in a given month, real return bonds over- (under-) perform nominal bonds the next month. Therefore, a value added strategy is to invest in the nominal (real) return bonds in a month following an IRP over (under) a specific level. The underlying objective of this strategy is to determine when the price of the insurance against inflation is too high (low) and then when it is rewarding to sell (buy) inflation insurance by investing in nominal (real) return bonds.

We test different discriminatory levels for the IRP ranging from 0.10% to 0.90%. Results of this strategy are compared to an equally weighted index made of the nominal and the real return bonds, used as a benchmark. We also present the returns of investing solely in the real or nominal bonds index for comparison purposes.

The portfolios based on the strategy generate significant annual market risk-adjusted excess return for levels of discriminatory IRP between 0.10% and 0.90%. The annual market risk-adjusted excess returns (alpha) range from 1.87% to 2.48% for these levels of IRP. Moreover, the volatilities of the portfolios are not much higher than the benchmark portfolio, which leads to a significant increase in the reward-to-volatility ratio.

We also note that the excess return of the strategy comes from both the timely choice of nominal and real return bonds. The average annual return of the nominal bonds when included in the portfolios (discretionary IRP level of 0.5%) is 15.3%, compared to an average return for the nominal bonds of 9.9% over the period. For the real return bonds, their average annual return when included in the strategy portfolios is 11.7%, compared to 8.7%. Those results suggest that the level of the IRP can be used to detect both over- and under-pricing of inflation insurance and to take advantage of it.

TRANSACTION COSTS

We performed a sensitivity analysis to find the break-even transaction cost—that is, the maximum cost per transaction for which the market risk-adjusted performance of each strategy remains significantly profitable at a 5 percent confidence level. For the strategy where the discriminatory IRP level is 0.5%, 20 transactions would have been necessary in a period of 180 months. The cost associated with these 20 transactions (selling nominal bonds and buying real return bonds or the opposite) would have to be higher than 1.45% of the notional for the strategy not to be significantly profitable net of transaction costs. Institutional investors could surely transact nominal or real return bonds for less than 145 bps per transaction. Christensen, Dion and Reid (2004) estimate the bid-ask spread on RRBs to be around 10 bps. Strategies with a higher or lower discriminatory level of IRP have also fairly high levels of break-even transaction costs. Table 2 shows the results.

As of November 2007, the Scotia RRB index is composed of only 12 issues—5 Federal government, 4 province of Quebec, 2 province of Manitoba and 1 province of Ontario. The total market value for those issues is around 40 G$. In addition to being relatively small, the market for Canadian RRBs is not very liquid. Indeed, RRBs are mostly held by a few pension funds and life insurance companies who keep them until maturity. Christensen, Dion and Reid (2004) show that the ratio of monthly volume traded/bonds outstanding was only around 8% in 2003 for federal RRBs. This represents an average monthly volume of 3.2 billion$ for a total market value of around 40 G$. As a comparison, nominal government bonds had a ratio of 44% over the same period on a much larger market. As long as the Canadian market for RRBs does not offer more liquidity, an active strategy as we described can only be done with a limited amount of investment. However, the size of the IRP could also be used as a timing tool for every investor looking to invest in RRBs. Indeed, if one wishes to establish a long-term position in RRBs, it would be more profitable to build this position when the IRP is relatively low. To implement the active strategy at a larger extent we can also look at other countries where RRBs markets are larger and much more liquid. Table 3 shows the market size for RRBs in numerous countries. The United States and the United Kingdom present the largest markets. The U.S. Department of the Treasury estimated daily TIPS trading volume to be over $US 8 billion in 2005. For the GILTs in the UK, the UK Debt Management Office estimates daily volume at around $30.2 billion in 2006 and 2007. Those two markets are therefore far more liquid than the Canadian market and would be appropriate to implement a larger-scale active timing strategy between real return and nominal bonds.

Table 3: Data on large international inflation-indexed government bond markets (as of November 2007)

Country	Market Value ($US billion)	Number of Indexed Bonds
Australia	7	3
Canada	31	4
France	155	10
Germany	12	1
Greece	12	1
Italy	81	5
Japan	37	9
Sweden	37	6
UK	257	11
USA	403	20

Source: UK, Debt Management office. http://www.dmo.gov.uk/

CONCLUSION

We have presented three alternative methods to calculate the IRP over the 1992-2006 period. We found that the IRP fluctuated significantly during this period and did so for each measure of expected inflation. These fluctuations allowed us to construct a strategy that chooses between nominal and real return bonds following the level of the IRP. The strategy appears highly profitable and significant even after considering transaction costs. It highlights the importance of considering the IRP when making allocation decisions between nominal and real return bonds. The small size and the low liquidity of the Canadian RRBs market make the implementation of this type of strategy at a large scale difficult in the Canadian market. The U.S. and UK markets are then an interesting alternative for larger investors. ∎

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