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MONTREAL EXCHANGE

CGB as Substitute for 10y Benchmark Bonds

The Historical Experience: 2011-2016.

This paper is the first in a series of analyses which will examine the broad performance of fixed income futures contracts relative to cash bond strategies. Various strategies will be examined in stages, starting here with a systematic approach to using CGB futures to replicate an all-cash, long-only, strategy in Canada 10y benchmark bonds.

Summary

The historical performance of replicating a cash position in the Canada 10y benchmark bond using only CGB contracts has been reasonable since 2011 despite a difficult environment and the potential for additional transaction costs incurred by rolling a futures position each quarter. Portfolio Managers should be interested in utilizing a futures replication strategy for their 10y bond holdings if they:

- Wish to minimize costs while outperforming over medium to long investment horizons or,
- Want to increase cash available for potential withdrawals or,
- Have an interest to leverage bond holdings without running a time-consuming repo program or,
- Have a steepening market view and would like a cheap option on that view.

Model Description

Two total return historical series were calculated to compare their results. To generalize the models, and to reduce the assumptions about investor behavior, the management of the positions is minimized and the systematic strategies operate on very few rules. Both strategies start with \$10 million CAD in cash. Both transact at market closes and sell to the closing bid level or buy at the closing ask level with no reduction in transaction costs for simultaneous buy/sell transactions.

10Y Cash Bond Strategy

- investor is 100% invested in the current 10y Canada benchmark bond at all times.
- On the first day of a new 10y benchmark bond (generally once per year), the strategy sells all of its previous holdings and invests the total proceeds in the new bond.
- Coupons received are fully re-invested on the day they are received.

CGB Strategy

- DV01 of the CGB holdings matches the 10y Cash Bond Strategy above on each day, rounding up or down to two whole contracts.
- Initial margin is posted at the speculator rate and maintenance margin is settled daily. No interest is earned on posted margin.
- Leftover cash is invested in highly liquid short term money market securities at Bank of Canada recorded rates.
- The strategy never takes, or risks, delivery. All open contracts are rolled each quarter to the active contract on T-5 from First Notice Date.

Results

The CGB strategy has closely tracked a real cash portfolio of 10y benchmark bonds over the past 6 years. Results are shown in dollar terms in Figure 1, in Sharpe ratio terms in Figure 2, and charted over time in Figure 3. From Figure 1 it is readily apparent that the CGB strategy replicating a 10y bond strategy has outperformed from a medium and long term P(L) perspective as well as held its own from a return per unit of risk perspective¹. As shown by the red line in the upper chart of Figure 3 the weekly outperformance of the CGB strategy versus the cash bond strategy has only dipped into negative territory on two short-lived occasions. This outperformance or positive variance by the CGB strategy, while on the surface somewhat expected, is a minor surprise given the market environment between 2011 and 2016 and the nature of the two strategies.

FIGURE 1

DOLLAR TERMS	CGB P(L)	10Y P(L)	Difference
2011	1,492,133	1,459,806	32,327
2012	435,541	456,793	-21,252
2013	-627,245	-648,552	21,307
2014	1,410,584	1,380,065	30,520
2015	745,740	748,031	-2,291
2016	-189,852	-195,283	5,430
Total	3,266,901	3,200,860	66,042

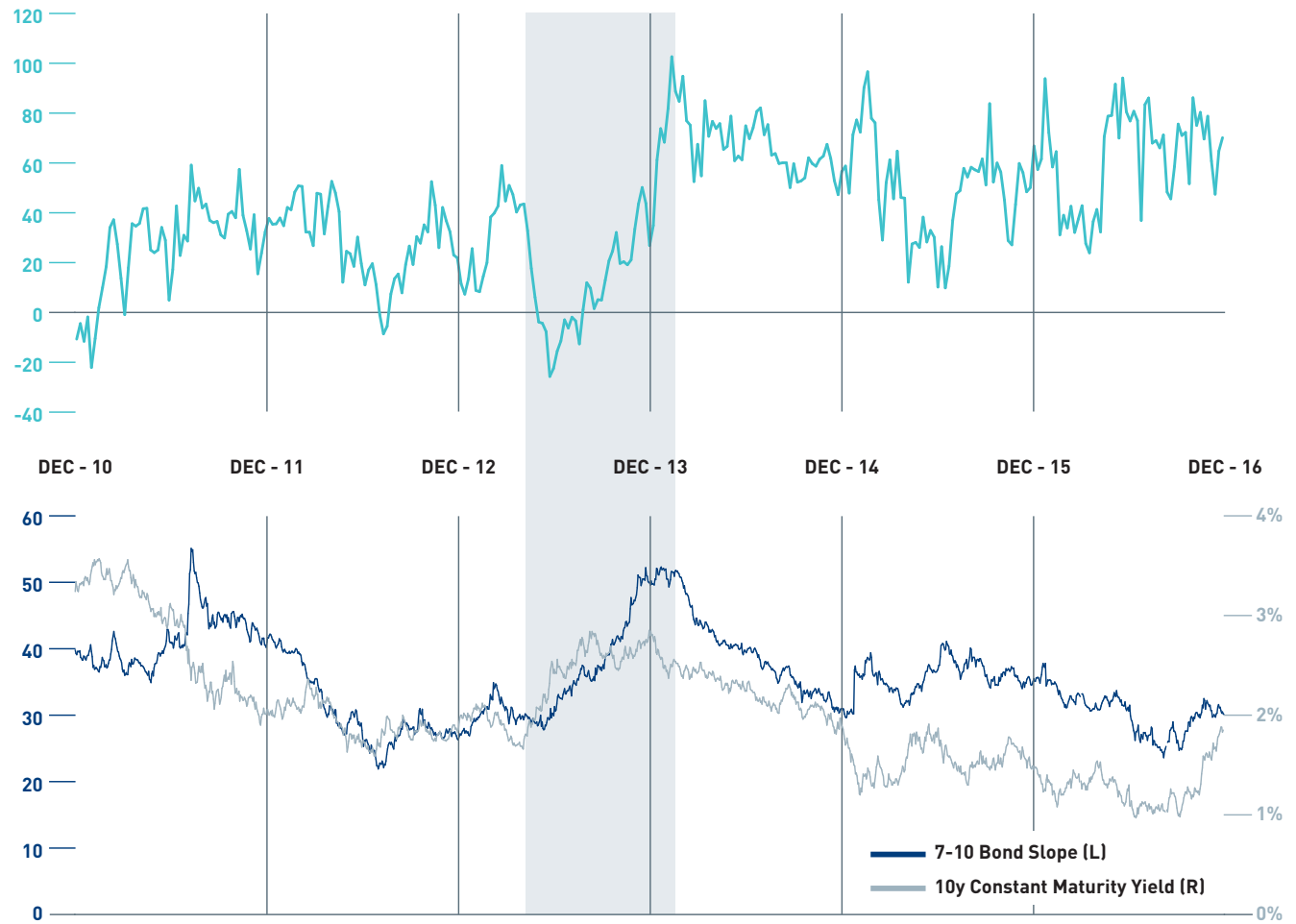
FIGURE 2

SHARPE RATIO TERMS	CGB Annual Sharpe	10Y Annual Sharpe	Difference
2011	2.0	2.0	0.0
2012	0.7	0.8	0.1
2013	-0.9	-1.0	-0.1
2014	2.3	2.4	0.1
2015	0.8	0.8	0.0
2016	-0.2	-0.2	0.0
Total	0.68	0.70	0.0

¹ In fact, some of the P(L) difference in this model is model-specific and due to the lack of identical closing data. For example, on October 4, 2011 a late surge in the DJI sent stocks up =4% between 3pm and 4pm. On that date, bond closing prices were negative while futures prices were positive owing to the 3pm and 4pm respective capture times for bid/ask data. These end-of-day deviations correct themselves the following day but create additional volatility for the futures contracts which record a later close to the trading session

FIGURE 3

Relative Performance Weekly P(L) (CGB minus 10y Bonds)



Source: BMO Capital Markets² Fixed Income Sapphire database

Sources of Variance

Several sources of variance between the 10y cash bond strategy and the CGB replication strategy exist. They are listed in Figure 4 and discussed in the paragraphs below.

FIGURE 4

VARIANCE SOURCE

CGB Strategy Out-Performance

VARIANCE SOURCE	CGB Strategy Out-Performance
7-10 Flattening	-20,000
Transaction Costs	15,000
Residual (Net Basis)	71,000
Total	66,000

² BMO Capital Markets is a trade name used by BMO Financial Group for the wholesale banking business of Bank of Montreal, BMO Harris Bank N.A. (member FDIC), Bank of Montreal Ireland plc., and Bank of Montreal (China) Co. Ltd and the institutional broker dealer businesses of BMO Capital Markets Corp. (Member SIPC) in the U.S., BMO Nesbitt Burns Inc. (Member Canadian Investor Protection Fund) in Canada and Asia and BMO Capital Markets Limited (authorized and regulated by the Financial Conduct Authority) in Europe and Australia. "BMO Capital Markets" is a trademark of Bank of Montreal, used under license

Term To Maturity / Historical Flattening

The strategies differ in that the 10y bond strategy always owns the “single old” 10y Canada bond that has reached sufficient size to become the benchmark. During the 2011-2016 period the benchmark 10y bond had an average term to maturity of 9.7 years. The CGB contract equates to the bond that is most likely to be the cheapest-to-deliver bond which always has a term to maturity of at least one year less or, for short periods of time, two years less. During this period the CGB contract behaved like a bond that had an average term to maturity of just 8.5 years, more than 14 months shorter than that of the 10y strategy. Such a mismatch in maturities means that the CGB strategy should underperform in a flattening yield curve.

First, the 7-10 bond curve flattened about 8 bps over the period examined which caused approximately \$20,000 of underperformance.

The net result of the maturity mismatch is best observed during the 2013 “Taper Tantrum,” the region shaded blue in Figure 3. As shown in the lower portion of Figure 3, in the first few weeks of the selloff, bond yields moved higher but the yield curve flattened. A bear flattening means futures often underperform bonds due to the move higher in rates plus the CGB contract underperforms the 10y due to the flattening of the curve. In Figure 3 that resulted in a net underperformance of \$60,000 in just a few weeks before the curve “turned” and began to steepen. Although yields continued to go higher, the steepening curve more than offset the cheapening of contracts relative to bonds, which is inherently temporary anyway, and the CGB strategy gained back all of its advantage and more.

Transaction Costs

The full CGB position must be rolled³ to the active contract each quarter while the 10y bond strategy transacts far less often; only when it receives a coupon or when a new benchmark bond is adopted. One would think that this increased activity would cause transaction costs to be higher for the CGB strategy versus the bond strategy. However, available data shows that the CGB strategy actually has lower transaction costs relative to the cash bond strategy.

Second, \$15,000 of outperformance by the CGB strategy was realized by the lower costs of rolling CGB contracts versus rolling a cash bond position each year.

Transaction costs here are defined as the loss incurred by marking the bonds or futures purchased on the transaction date (purchased at, by definition, the “ask” price) to the closing bid price. The increased transaction frequency does handicap the CGB strategy as transaction costs always reduce P(L) for any portfolio strategy but the extremely low bid/ ask for CGB during the roll period (when almost all CGB transactions occurred), means the CGB strategy outperforms on transaction costs even though it transacts over twice as often. The tabulated transaction costs are summarized and shown in Figure 5.

FIGURE 5

	CGB Transactions	10Y Bond Transaction	Difference
Total Count	60	25	-35
Total Cost	29,430	44,644	15,214
Annual	4,935	7,489	2,554

³ For a full discussion of quarterly futures rolls refer to: “A Guide to Futures Roll”.

⁴ 10y Canada yields fell from 3.35% to 1.85%, or around 150 basis points during the period studied.

Net Basis (despite Low Yields)

An additional source of outperformance comes from the positive drift of capturing the small discount (essentially selling the Net Basis each quarter) associated with owning CGB contracts rather than the cheapest-to-deliver cash bond. Given the +\$15,000 from lower transaction costs but the -\$20,000 from curve flattening, we can estimate that the benefit from owning futures as a proxy for bonds was \$71,000 over the entire time period, or about \$11,000 per year (11 basis points for a cash portfolio).

Although yields have fallen and remain low⁴ and the low level of rates has reduced significantly the Net Basis, the benefit from owning futures contracts rather than the equivalent cash bonds is still measurable and significant.

Finally, backing out the residual of the performance difference gives us the amount of outperformance realized by the CGB strategy due to systematically buying futures contracts that are cheaper than equivalent bonds; \$71,000 of outperformance in the period examined.

Net Effect? Still Positive

The CGB strategy outperformance found in this historical strategy comparison are therefore surprising since contracts have outperformed against a pure cash strategy of longer maturity (but identical DV01, of course), in spite of transacting roughly two times as often, (every quarter versus once each year) and the detrimental bull flattening⁵ of the yield curve over the historical period examined.

Conclusions

Several important conclusions can be drawn from this historical modelling exercise:

- Over the medium to long term outlook, a CGB strategy to replicate 10y bonds can outperform even in a market environment that is mixed or unfavorable for the futures strategy. Under more favorable market conditions, one would expect the CGB strategy to handily outperform the 10y bond strategy over reasonable investment horizons.
- Since the strategy has more than held its own in unfavorable conditions since 2011, one could view the CGB strategy as a way to achieve a market view on steeper curves and higher rates with limited medium-term downside due to the positive drift associated with being systematically short the Net Basis.
- Since little cash is used⁶ in the CGB strategy, a manager can generate leverage from bond holdings that could be deployed elsewhere if investment guidelines permit. This leverage is generated without the need to conduct frequent and time-consuming repo/reverse repo operations.

⁵ The 7-10 constant maturity yield slope both steepened and flattened but generally fell from =39 bps at the outset of 2011 to =31 basis points at the end of the period studied.

⁶ As noted in the strategy description, some cash is unavailable as it is posted for initial and daily variance margin of the CGB positions.



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