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CGB Ten-Year Government of Canada Bond Futures

A Guide to Futures Roll Analysis

"The Roll"

A roll period occurs in futures contracts because the contracts have quarterly expiry dates and, more importantly, a delivery period during which the buyer of a contract risks having a non-cash derivative transformed into a cash bond holding by the seller of the contract. Rolling a futures contract involves selling a long position in, for example, an expiring June contract, and buying an equivalent position in the September contract. By doing so before the notice or delivery period, an investor maintains his or her derivative position rather than converting it to a cash position through delivery.

For many fixed income managers, taking delivery on the large number of bonds underlying their futures positions is problematic due to cash-usage or funding considerations, or impossible under their existing investment objectives. In either case, both long futures positions and short futures positions are usually either closed out at the end of the contract life, or rolled to the next contract near the end of the month prior to the delivery month.

Since the "active" contract typically has far more trading and depth of liquidity, open interest is usually concentrated in the front contract until switching to the back contract during the roll period. Since rolling all, or most of, the positions that exist in the front contract to the back contract is a large amount of activity in both contracts concentrated into just a few days, opportunities emerge periodically as long and short investors search for the liquidity to close their positions in front contracts. This search for liquidity can cause the front (or back) contract to trade rich or cheap depending on supply and demand which can often be anticipated and capitalized on by good analysis and astute risk taking.

Timing

The first point to note on the timing of roll activity in futures is that the roll is always driven by the first delivery date of the contract. By counting 3 settlement days backwards from first delivery we can arrive at the first notice date which is the date at which any long position[1] risks delivery. For positions that can't risk early delivery, regardless of how remote that possibility, they must complete the roll by the first notice date. In our chosen example of the CGBM16 contract, first delivery was June 1 and first notice was May 27.

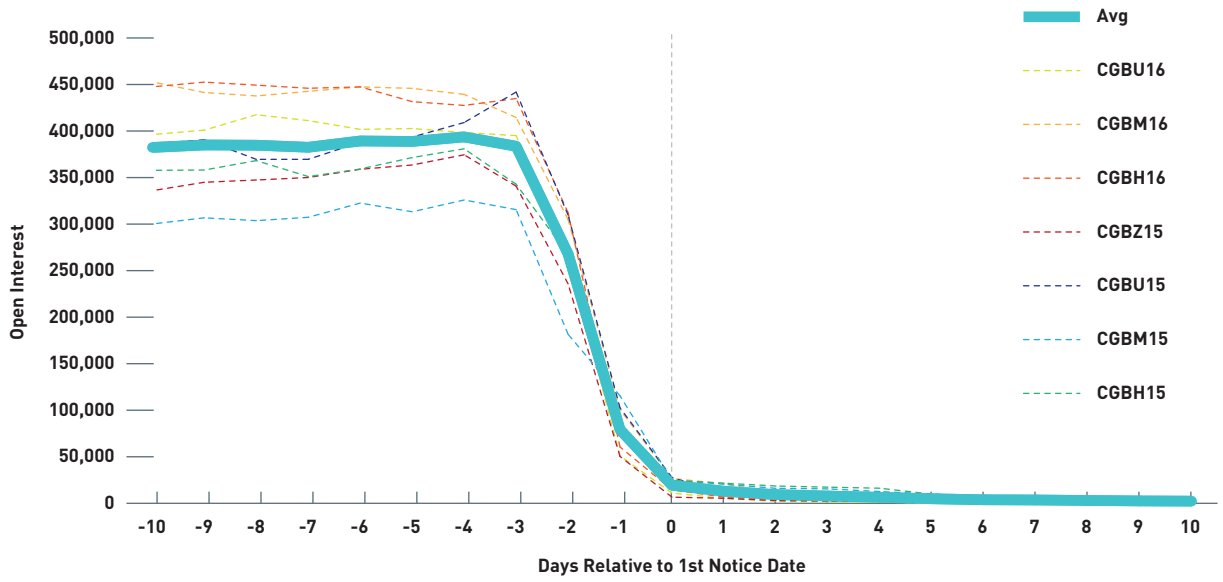
The roll has recently been completed in just 3 days for both the CGB and CGF contracts. We can see this trend using the past seven rolls in CGB contracts and plotting the open interest in the contract that is giving up active status against the number of days to the first notice date. As can be observed in Figure 1 below, the open interest, on average, remains high until T-3 from first notice[2] and plummets to almost zero by first notice day. Similar findings occur in the same analysis of CGF rolls recently. Open Interest in the front contract remains high until three days before first notice, with a corresponding small or zero open interest in the back contract, and then virtually the entire roll is completed within three trading days.

Due to the above considerations, anticipatory relative value trades may sometimes need to be conducted in the cash bond market rather than the futures market. Since there is often a lack of liquidity in the back contract, positioning early for a richening or cheapening of the contract can sometimes only be accomplished by trading the anticipated cheapest-to-deliver (CTD) bond prior to the start of the roll and liquidity development in the back contract.

1. For all cash deliverable fixed income futures contracts, the short position decides when in the delivery period and what bond from the eligible basket to deliver to the long position.
2. Or, identically, T-6 from the First Delivery date.

Figure 1

Recent CGB Rolls



Source: BMO Capital Markets[i] Fixed Income Sapphire database

Analysis

There are a number of types of analysis that can be done to quantify and anticipate the effect of the pending roll. This paper will focus on the CGB roll that occurred between the June (M16) and September (U16) contracts in 2016 in order to present a concrete example of the potential analyses which can be done for the roll period.

Key Metrics

When examining the roll, assembling some key metrics on the contracts and cheapest-to-deliver bonds is an important starting point.

Figure 2

KEY METRICS MAY 20, 2016	**Front CGBM16**	**Back CGBU16**	**U16 - M16**	**$25K/1 BP**
Closing Price	141.29	144.43		30.27 MM
Cheapest-to-Deliver (CTD)	CAN 2.5% June 2024	CAN 2.25% June 2025		32.40 MM
Conversion Factor	0.7802	0.7475		228 contracts
CTD Clean Price	110.4485	108.6545		
CTD Yield	1.136%	1.235%	0.099%	
Gross Basis	0.2140	0.6931		
Net Basis	-0.020	0.060	0.080	
Implied Repo	0.63%	0.35%	-0.28%	
DV01/100 of CTD	8.10	8.93	0.83	
Open interest	445,827	433		
CTD Outstanding (millions)	13,800	13,100	-700	
Bond Equivalent Notional	44,583	43		
Multiple of Outstanding	3.2x	3.4x	0.2x	

Source: BMO Capital Markets[i] Fixed Income Sapphire database

As shown in Figure 2, the change from CGBM16 to CGBU16 caused a change in the cheapest-to-deliver bond. In Canada, a change in the CTD typically occurs only in the Jun-Sep contract roll for the CGB contract, and the Dec-Mar and Jun-Sep rolls for the CGF contract.

Note that the open interest on May 20, 2016 was equal to 3.2x the total outstanding available of the CTD bond which made it impossible for all the shorts in the market to deliver into their position.

Positioning

One can calculate the correlation between price and open interest over the lifetime of the contract which can be insightful at times, if the correlation is significant.

- Positive correlation between the price and open interest indicates new positions being established at higher prices or positions driven by CTA long positioning. Typically these are speculative investors that can't or won't take delivery and would thus indicate a tendency for long positions to drive the roll period, driving futures prices downward as they initiated unwinds of their positions.
- The reverse would also be true if price and open interest had a significant negative correlation over the life of the contract.

For the Jun-Sep 2016 roll, the June contract had no significant correlation to open interest over the lifetime of the contract up to May 20th so little inference can be made with respect to positioning for that roll period.

Impact

There are two ways to assess the potential impact, and therefore the potential opportunity to change relative prices, of the futures roll in any given contract expiration.

In Figure 2, we calculated the amount of bond equivalent notional that the open interest of the front contract represents to be 3.2x, which is relatively high[3] although it is neither unusual nor cause for concern that the open interest exceeds the deliverable available. Since the amount of contracts that need to be rolled relative to the size of the underlying is considerable, the impact of the roll period, and its potential to drive pricing away from "fair" is also considerable.

Another way to examine the potential impact of the roll period is to consider the additional DV01 that might need to be supplied by the market if all of the open interest longs in the front contract rolled to the back contract in a 1:1 ratio. While many participants in futures markets take DV01 differences between the front and back contracts into account, many do not[4] and many tend to trade 1:1 ratios when transacting large rolls[5].

In the CGB example cited above, the DV01 of the CTD for the back contract was 8.93 versus a DV01 of the CTD for the front contract of 8.10. The difference of 0.83 would represent $3.7 million of DV01 which, of course, isn't actually what happens since there is a short position for every long position. However, calculating the size of a 1:1 ratio roll of long positions and comparing it over time can provide a good gauge of the impact a futures roll may have but, like the bond equivalent notional above, it provides no clues towards relative value in either contract. For reference, the Jun-Sep 2015 roll was a duration extension of an even greater 1.14 but for a theoretical DV01 demand of only $3.4 million so the 2016 Jun-Sep roll was likely to have greater impact than that of 2015.

Relative Value

With an assessment of the impact of the roll complete, one turns an eye to assessing the relative value of the underlying CTD bonds and forecasting the optimal roll times for long and short positions.

Net Basis and Implied Repo

Again from Figure 1, we can examine the Net Basis and Implied Repo[6] for each contract and determine, at the very least, the optimal times for certain position types to roll contracts. Specifically, the Net Basis was lower for the June contract than for the September contract so, given that the Net Basis is the amount, in cents, that the futures contract is priced cheaper than the equivalent cash bond position, the September contract was relatively cheaper to its CTD bond than the June contract was.

- Long positions in the M16 should roll as early as possible to the U16
- Short positions in the M16 should roll as late as possible to the U16

3. The recent range has been 2.2x to 3.3x for the CGB contract.
4. Pure hedging positions, for example, rather than speculative positions.
5. Correcting the notional amount later is often referred to as buying or selling "the tail."
6. See Appendix for calculation of Net Basis and Implied Repo.

Similar to the Net Basis comparison, one can also calculate the Implied Repo rate[7] for each contract which is also shown in Figure 1. This analysis should result in identical conclusions to the Net Basis analysis since the Implied Repo rate is simply the rate that an investor earns by borrowing to buy an asset in the spot market and then delivering it into the futures market. Therefore, higher Implied Repo rates indicate relatively more expensive futures contracts relative to cash bond prices and vice-versa. Since the Implied Repo rate on the June contract is higher than that of the September contract, long positions should sell rich and buy cheap by rolling as early as possible.

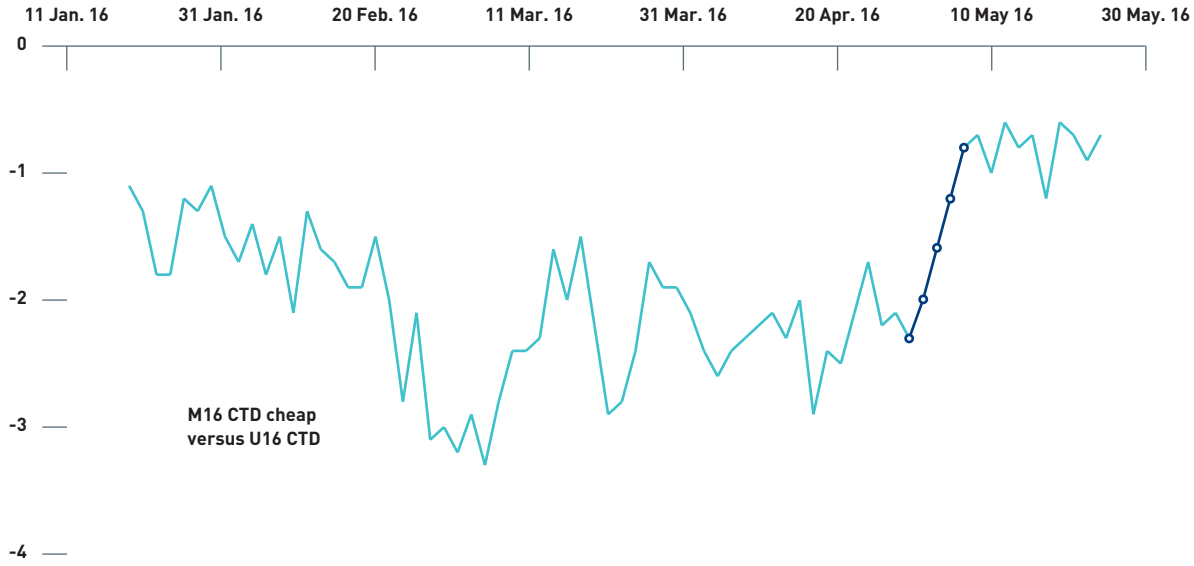
Front-Back Swap Spread

Net Basis and Implied Repo analysis allows one to determine whether each futures contract is rich or cheap relative to the CTD bond for each but it doesn't tell the investor anything about the relative value of those bonds.

If we define a metric called the Front-Back Swap Spread as the asset swap of the CTD for the September contract minus the asset swap of the CTD for the June contract, we can assess the relative value of the two bonds versus the swap curve, which should eliminate most of the potential changes between the yield of the two bonds caused by other factors such as a steepening yield curve, yield levels, etc. Figure 3 shows the Front-Back Swap Spread for the life of the M16 contract up to May 20, 2016.

Figure 3

New CTD minus Old CTD, Asset Swap Spread



Source: BMO Capital Markets' Fixed Income Sapphire database

As we can see in Figure 3 there was a pronounced move, shown in blue, in the relative swap spreads from a roughly constant -2.25 level to -0.75 in early May of 2016 but the level had been fairly constant since the second week of May at around -0.75. In this metric, higher (less negative) levels means the CTD of the front contract is relatively more expensive than the CTD of the back contract. The ≈+1.5 bp move in early May could have been initial positioning by relative value speculators in anticipation of Jun CTD demand to meet roll requirements.

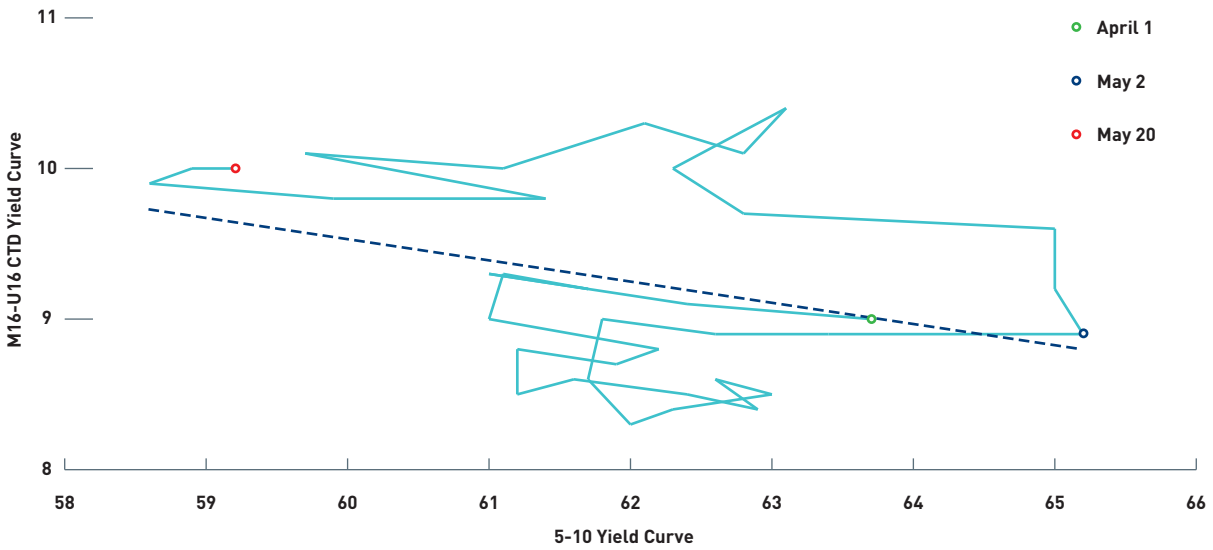
Yield Curve

Another method that an investor may take into account for relative value analysis is how much curve value there is between the two bonds and whether that is an unusual amount for the segment of the curve spanned by the two bonds. One can analyze the yield difference between the two CTD bonds by regression analysis between the slope of the curve between the two CTD bonds and the slope of the 5-10 curve over time. As shown in Figure 4 below, the M16 CTD traded quite cheap relative to the U16 CTD in April but moved back to fair by May 2nd and to relative rich levels after the 1.5 bps richening from May 2nd onwards. A the time of this analysis there is no indication that the CTD for either bond is rich or cheap.

7. For a complete discussion of Implied Repo analysis and how to calculate this measure, CGF Implied Repo Analysis - EN.pdf

Figure 4

M16 CTD to U16 CTD Curve vs 5-10 Curve



Source: BMO Capital Markets[i] Fixed Income Sapphire database

Value of Options

The back contract has more option time value than the front contract since the time between the current date and expiry is always longer. However, for this analysis, we will ignore any option value given that the quality option is nearly worthless given the current level of rates. In other words, the CTD bonds identified in this paper will be the delivered bonds at expiry with near certainty[8].

Conclusion

From this analysis we have made the following observations:

- The roll should begin 6 business days before first delivery on May24 and be completed by May26. ***Timing***
- The impact of the Jun-Sep CTD roll should be fairly significant and it should result in opportunities associated with scarcity of the deliverable bond. ***Impact***
- We can draw little or no insight into whether speculators, or fast-money, that cannot risk delivery has net long or short positions. ***Positioning***
- Long positions should roll as early as possible while short positions should wait as long as they are able to. ***Net Basis & Implied Repo***
- The CTD of the M16 contract had been cheap relative to that of the U16 contract until early May but has richened somewhat, possibly in anticipation of the large roll at the end of May. ***Front-Back Swap Spread***
- Similarly, the M16 CTD had been cheap relative to the U16 CTD, when accounting for curve moves in regression analysis, until early May but has richened by 1.5 bps up to May20. ***Yield Curve***

In terms of final conclusions, the strongest conclusion to be made at the time of this analysis is that long positions, given the relative richness of the front contract to the back, would have an interest in rolling early if they are keeping their position. Shorts may try to hold out for a later roll but will face increasing pressure given the large amount of M16 needed to be bought back (or CTD acquired) in order to close positions combined with the likely rapid falloff in liquidity in the M16 contract as first notice day approaches.

Note that even the negative Net Basis of the M16 contract doesn't mean it can't be driven richer during the roll period given the likely demand for contracts due to the shortage of the deliverable bond relative to the size of the open interest. Since the CTD bond for the M16 contract is, according to the Front-Back Swap Spread metric, still roughly fair value compared to the U16 CTD, we might expect M16 and its CTD bond to richen more as demand from futures shorts drives up the price of the scarce deliverable bond as well as the contract itself. One savvy investor appears to have implemented this trade early in May, probably trading the underlying bond for the U16 CTD since the open interest in the U16 contract was too low to facilitate a trade that early in the cycle.

8. One could conduct an analysis of the Implied Repo for each bond in the deliverable basket at various price/yield levels to verify this. 10y bond yields would need to rise several hundred basis points from today's level to cause a CTD switch

Appendix

Net Basis can be calculated for each day using:

$$Gross\ Basis = P\text{-}(F \times CF)$$

$$Net\ Basis = Gross\ Basis + (P+AI) \times r\text{-}(100 \times C) \times (D/365)$$

Where:

P = Clean price of the bond

F = Futures contract price

CF = Futures Conversion Factor

r = actual term repo rate or assumed average

AI_2 = Accrued interest on the bond at settlement

C = Coupon

D = Days between bond purchase and delivery

Implied Repo can be calculated for each day using:

$$r = \frac{(F)(CF) + AI_2 - MV + C}{MV\,(D_1/365) - \mathrm{C}\,(D_2/365)}$$

Where:

R = Implied Repo Rate

F = Futures contract price

CF = Futures Conversion Factor

C = Coupon received

AI_2 = Accrued Interest on the bond at delivery

MV = Market Value (dirty price) of the bond at purchase date

D_1 = Days between bond purchase and delivery

D_2 = Days between coupon receipt and futures delivery

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