



## Treasury Bill Index - Methodology

October 26, 2006

### Overview

PC-Bond\* publishes indices to track the performance of Government of Canada Treasury Bills, with separate indices for 1-month, 2-month, 3-month, 6-month, and 1-year T-Bills. Each index is designed to reflect the performance of a portfolio that only owns a single security, the current on the run T-Bill for the relevant term, switching into the new T-Bill at each auction.

In April 2002 the Treasury Bill methodology was revised to enable the way the index returns are calculated to better reflect the performance of a T-Bill fund manager during the auction period. Under the new methodology, the index will recognize gains and losses on the new T-Bill each day from the day of the auction to the auction settlement date. It will only recognize income on the old T-Bill during this time. The old system recognized these amounts as well, but not until the auction settlement date, when a retroactive adjustment was made.

It is important to note that the new methodology only affects the daily returns between the day of the T-Bill auction and the auction settlement date. As of the auction settlement date, the new methodology produces the same index level as the old methodology. There is thus no lasting impact on cumulative index returns. The remainder of this report describes how the T-Bill Indices are now calculated.

### Methodology

Each T-Bill index is assumed to always own the current on the run T-Bill for the relevant term to maturity. Based on current auction schedules, the three-month index rolls over the current T-Bill every two weeks, when a new 3-month T-Bill is auctioned. The six and one-year indices roll over the current T-Bill every four weeks (every second 6-month and 1-year auction is a re-opening of the current T-Bill, and hence has no impact on the T-Bill index). The 1 and 2-month T-Bills are treated differently because there are no auctions, though they also roll over every two weeks. We discuss treatment of the 3-month, 6-month, and 1-year indices first.

The index sells the old T-Bill just prior to the auction bid deadline of 12:30 on Tuesday, for settlement on Thursday at the trading desk's bid side.

The index buys the new T-Bill at the average auction yield, which is known at 12:45 pm on the day of the auction, for settlement on Thursday. The index uses the full proceeds from the sale of the old Bill for Thursday settlement to purchase the new T-Bill for Thursday settlement. There are thus no cash flows in or out of the index due to the switch to the new security.

The index recognizes capital gains or losses on the new T-Bill between the time of the auction and the close of business on the day of the auction. It continues to recognize capital gains and losses on the new T-Bill up to and including the auction settlement date, which in most cases will



be Thursday given a Tuesday auction. The index does not recognize any income on the new T-Bill prior to settlement.

The index recognizes income accrual on the old T-Bill between the time it is sold on the day of the auction, and the auction settlement date (typically from Tuesday to Thursday). However, the index no longer recognizes capital gains or losses on the old T-Bill once it is sold on the day of the auction.

### **One and Two-Month Indices**

There are no auctions for one and two-month T-Bills. Market convention is to switch to new one and two month benchmarks at the same time as the 3-month T-Bill auction settles. The index is therefore assumed to sell the old one (or two) month T-Bill on the auction settlement date (i.e. Thursday) for same day settlement, and to buy the new one (or two) month T-Bill for same day settlement.

### **Contact Information:**

Please direct any questions and or comments to:

PC-Bond  
TSX Group  
The Exchange Tower  
130 King Street West  
Toronto, Ontario Canada M5X 1J2

(416) 862 5800



## **Disclaimer**

PC-Bond\* calculates and publishes the Scotia Capital Real Return Bond Index and other Scotia Capital fixed income indices at its own expense as an information service to financial market participants. The indices are published on a best-efforts basis, and do not constitute a recommendation to trade any particular security.

The Scotia Capital High Yield Bond Index and Scotia Capital Universe Bond Index Copyright PC-Bond\* 2006 and are Trade Marks of, or licensed by PC-Bond\*.

This report has been prepared by PC-Bond\*. Opinions, estimates and projections contained herein are our own as of the date hereof and are subject to change without notice. The information and opinions contained herein have been compiled or arrived at from sources believed reliable but no representation or warranty, express or implied, is made as to their accuracy or completeness. Neither PC-Bond\* nor its affiliates accepts any liability whatsoever for any loss arising from any use of this report or its contents.

This report is not, and is not to be construed as, an offer to sell or solicitation to buy any securities and/or commodity futures contracts. PC-Bond\* and/or their respective officers, directors or employees may from time to time acquire hold or sell securities and/or commodities and/or commodity futures contracts mentioned herein. This research and all the information opinions and conclusions contained in it are protected by copyright. This report may not be reproduced in whole or in part, or referred to in an manner whatsoever, nor may the information, opinions, and conclusions contained in it be referred to without in each case the prior express written consent the PC-Bond\*.

\* PC-Bond is registered to 2092242 Ontario Inc. a subsidiary of TSX Group Inc..



## Index Formulas

The following formulas are used to calculate total return indices for 3-month, 6-month, and 1-year T-Bills during standard auction periods, when the auction occurs on a Tuesday and settles on Thursday.<sup>1</sup> Because the index consists of a single security, we do not need to follow the usual practice of including the par holdings in the index formulas, since they would just cancel out of the equations. We can therefore assume par holdings to \$1 without affecting the resulting index return calculation. During auction periods the amount of the new T-Bill that is bought can be expressed in terms of the old security and the relative prices of the two securities, so again we can simply assume \$1 par holding of the old T-Bill.

### 1. Index calculations for days except auction period:

$$I_t = I_{t-1} \times \left( \frac{P_{t,t}}{P_{t-1,t-1}} \right) \quad [1]$$

where  $I_t$  is the total return index level at the close on day  $t$ , and  $P_{i,j}$  is the mark-to-market price given the yield known at time  $i$ , for settlement on day  $j$ . In most cases,  $i = j$  and the yield is as of the close of business. Thus,  $P_{t,t}$  is the mark-to-market price on day  $t$  for same day settlement.

### 2. Auction (Tuesday):

At the close on the day of the auction (Tuesday), the index recognizes the capital gain or loss from selling the old T-Bill, but only recognizes income earned up to Tuesday. We therefore recalculate the price of the old T-Bill for same day settlement rather than Thursday settlement, holding the yield fixed. We recognize gains or losses on the new T-Bill due to changes in yield between the 12:45 auction result and the close at the end of the day. In order to reinvest the full proceeds from the sale in the new Bill, we buy a par amount  $Q$  of the new T-Bill for each dollar par amount of the old T-Bill. The capital gains or losses on the new T-Bill are therefore calculated with respect to this par amount  $Q$ .

$$I_{Tues} = I_{Mon} \times \left( \frac{P_{Auction,Tues}^{Old} + Q \cdot (P_{Tues,Thurs}^{New} - P_{Auction,Thurs}^{New})}{P_{Mon,Mon}^{Old}} \right) \quad [2]$$

where:

$$Q = \frac{P_{Auction,Thurs}^{Old}}{P_{Auction,Thurs}^{New}} = \text{Par holdings of new T - Bill per \$1 par holdings of old T - Bill} \quad [3]$$

<sup>1</sup> There are times when the auction may not be held on Tuesday, and settlement may not be on Thursday, such as a holiday-shortened week like the first week of January. The subscripts Tues and Thurs have been used to make the notation easier to read, but should be understood in more general terms as the auction date and the auction settlement date, respectively.



$P_{Auction,Thurs}^{Old}$  = Price of old T - Bill established before auction for settlement Thursday

$P_{Auction,Thurs}^{New}$  = Price of new T - Bill at Tuesday's auction for settlement Thursday

Other prices are defined similarly. For example,  $P_{Auction,Tues}^{Old}$  is the price of the old T-Bill at the yield established prior to Tuesday's auction, calculated for same day settlement.

### 3. Auction + 1 (Wednesday):

The index return calculation on Wednesday, one day after the auction, follows a similar method. We recognize capital gains or losses but no income on the new T-Bill, and we recognize one more day of income on the old T-Bill.

$$I_{Wed} = I_{Mon} \times \left( \frac{P_{Auction,Wed}^{Old} + Q \cdot (P_{Wed,Thurs}^{New} - P_{Auction,Thurs}^{New})}{P_{Mon,Mon}^{Old}} \right) \quad [4]$$

Note that Wednesday's index return is measured relative to Monday's index level and prices established at the auction on Tuesday. In particular, the dollars invested in the index do not yet include the dollar gains or losses on the new T-Bill, since the forward purchase is in effect a levered position prior to the settlement date (by contrast, the return calculation outside of the auction period would be measured with respect to the previous day's index level, and would include the previous day's closing valuations in the denominator).

### 4. Auction Settlement (Thursday):

The index calculation for Thursday is similar. Now, we recognize the full proceeds from the sale of the old T-Bill. We continue to recognize only capital gains or losses on the new T-Bill, with respect to its original purchase price. As well, the index return is again measured with respect to Monday's index level and the transaction prices from Tuesday's auction.

$$I_{Thurs} = I_{Mon} \times \left( \frac{P_{Auction,Thurs}^{Old} + Q \cdot (P_{Thurs,Thurs}^{New} - P_{Auction,Thurs}^{New})}{P_{Mon,Mon}^{Old}} \right) \quad [5]$$

The index calculations for auction settlement + 1 onward use the regular formula [1].