



CRSP US TOTAL MARKET (AUD HEDGED) TOTAL RETURN INDEX (CRSPTAHT)

CRSP US TOTAL MARKET (CAD HEDGED) TOTAL RETURN INDEX (CRSPTCHT)

CRSP provides hedged indexes for Canadian and Australian investors who only want exposure to the total U.S. equity market hedging the foreign exchange risk between the U.S. dollar and Canadian dollar or Australian dollar.

The construction of the hedged indexes closely mimics the hedging process in practice. WM/Reuters is CRSP's source for spot and forward rates. The hedged amount, or the size for the Forward contract, is defined as the end-of-day hedged index level at the second-to-last business day of the previous month. The Forward rate for the contract is the 4 p.m. UK closing rate at the last business day of the previous month. The amount hedged is kept constant for the month. If the WM/Reuters Spot rate and/or the Forward rate are missing, CRSP will use the previous business day's Spot and Forward rates.

The value of the index is driven by two parts: the amount tracking the underlying CRSP U.S. Total Market Index; and the value of the Forward contract. This is described in detail in the Formula section. The reported level of the index and also the index return are in terms of Canadian or Australian dollars.

HEDGED INDEX FORMULA

Index Level

CRSP calculates the levels of the hedged indexes on a daily basis. The levels of the hedged indexes reflects the component that tracks the underlying CRSP U.S. Total Market Index and the value of the Forward contract, the hedging part.

Within any month M , the daily Hedged index level is calculated as:

Equation 1

$$Y_t = S_t \rho_0 T ind_t + \tilde{X}_0 \left[F_{0,T} - S_t - (F_{t,1-month} - S_t) \times \frac{RemD}{TD} \right]$$

Where:

Y_t the Hedged Index level in terms of the foreign currency at date t

S_t the Spot rate on date t , 4 pm UK closing Spot rate

- ρ_0 the Hedged Level Multiplier for the month; constant for month M
- $Tind_t$ The Total U.S. Market Index level at date t
- \tilde{X}_0 the hedged amount, the end-of-day hedged index level at the second-to-last business day of month M-1, in terms of U.S. dollars
- $F_{0,T}$ the 4 pm UK closing one-month Forward rate at the last business day of month M-1
- $F_{t,1\text{-month}}$ the 4 pm UK closing one-month Forward rate on date t
- $RemD$ the remaining counted days till the last business day of the month (excluding day t) ¹
- TD the total number of counted days within the month

As shown in Equation 1, $S_t \rho_0 Tind_t$ tracks the performance of the underlying CRSP U.S. Total Market Index and $\tilde{X}_0 \left[F_{0,T} - S_t - (F_{t,1\text{-month}} - S_t) \times \frac{RemD}{TD} \right]$ is the value of the Forward contract at date t. The term, $S_t + (F_{t,1\text{-month}} - S_t) \times \frac{RemD}{TD}$, marks to market the value of Canadian or Australian dollars on the last business day of month M.

Index Return

Daily index returns can be easily calculated from the index levels,

$$r_{Y,t} = \frac{Y_t}{Y_{t-1}} - 1$$

Where:

- $r_{Y,t}$ the Hedged Index daily return at date t
- Y_{t-1} the Hedged Index level in terms of the foreign currency at date t-1

INDEX MAINTENANCE

CRSP maintains the hedged indexes to closely reflect fund managers' hedging activities. CRSP resets the Hedged Level Multiplier (P_0) and the Hedged Amount (\tilde{X}_0) on a monthly basis, consistent with the fact that fund managers roll the Forward contract monthly. For each month, the Hedged Level Multiplier (P_0) is determined by the ratio between the end-of-day Hedged Index level in U.S. dollars and the U.S. Total Market Index level on the last business day of the previous month. The Hedged Amount (\tilde{X}_0) is determined by end-of-day hedged index level, in U.S. dollars, on the second-to-last business day of the previous month.

¹ Counted days include weekends and holidays. Or, in other words, every day counts.

EXAMPLES

Index calculation example

The following example illustrates how the CRSP Canadian Hedged Index level and daily return was calculated. Only the relevant data are shown in the table below, and numbers are not shown in full precision. The same approach is used to calculate the CRSP Australian Hedged Index level and daily return.

	Spot Rate	Forward Rate 1 Month	Underlying US Total Market Index ,Tind(\$)	TD	RemD	CRSPTCHT (C\$)
1/30/2013	1.00290					1161.166
1/31/2013	0.99885	0.99945	1163.154			1159.429
2/6/2013						1171.030
2/7/2013	0.99785	0.99846	1172.823	28	21	

For February 2013, CRSP reset the HLM (P_0) and Hedged Amount (\tilde{X}_0) based on relevant information at the end of January 2013. At the close on January 31, 2013, the underlying U.S. Total Market Index level (\$) is 1163.154, the Canadian Hedged Index level is 1159.429, and the spot rate is C\$ 0.99885/\$. Thus, the HLM for February, 2013 is

$$\rho_0 = \frac{1159.429}{0.99885 \times 1163.154} = 0.9979$$

The Hedged amount,

$$\tilde{X}_0 = \frac{1161.166}{1.0029} = 1157.808$$

is the Canadian Hedged Index level on Jan. 30, 2013, in terms of US dollars.

Since the last day of the month, February 28, 2013 is a business day, there are 21 days left on the hedging Forward contract from Feb. 07, 2013. Thus, $RemD=21$.

Based on Equation 1, the Canadian Hedged Index level on Feb. 07, 2013 is

$$Y_{Feb.07,2013} = 0.99785 \times 0.9979 \times 1172.823 + 1157.808 \\ \times \left[0.99945 - 0.99785 - (0.99846 - 0.99785) \frac{21}{28} \right] = 1169.167$$

And the daily return on Feb. 07, 2013 is

$$r_{Feb.07,2013} = \frac{1169.167}{1171.030} - 1 = -0.159\%$$

Hedged Amount and Forward Rate Examples

Since fund managers roll the forward contract on the last business day of each month, the hedged amount \tilde{X}_0 is calculated based on the end-of-day level of the hedged index on the second-to-last business day before the beginning of the current month. And $F_{0,T}$ is taken as the 4 pm UK closing (11:00 am EST) Forward rate one business day before the beginning of the this month.

Several examples illustrate this process:

EXAMPLE 1:

October 01, 2011 is a Saturday. The forward contract will be rolled on Friday, September 30, 2011. \tilde{X}_0 will be calculated based on the end-of-day hedged index level on September 29, 2011. And $F_{0,T}$ is taken as the 4 pm UK closing (11 am EST) 1-month forward rate on Friday, September 30, 2011.

EXAMPLE 2:

July 01, 2012 is a Sunday. Since June 30, 2012 is a Saturday, the forward contract will be rolled on Friday, June 29, 2012. \tilde{X}_0 will be calculated based on the end-of-day hedged index level on June 28, 2012. And $F_{0,T}$ is taken as the 4 pm UK closing (11 am EST) 1-month forward rate on Friday, June 29, 2012.

EXAMPLE 3:

May 01, 2012 is a Tuesday. The forward contract will be rolled on Monday, April 30, 2012. Since April 28 and 29 are Saturday and Sunday, \tilde{X}_0 will be calculated based on the end-of-day hedged index level on Friday, April 27, 2012. And $F_{0,T}$ is taken as the 4 pm UK closing (11 am EST) 1-month forward rate on Monday, April 30, 2012.

ABOUT CRSP

Founded in 1960 to develop the first definitive measurement of long-run market returns, The Center for Research in Security Prices (CRSP) has long been an integral part of the academic and commercial world of financial and economic research. Since its inception, CRSP has partnered with the investment industry to develop and maintain databases and market indexes that are widely used by academicians and commercial practitioners. Today, CRSP data is used by more than 500 leading academic, commercial and government institutions in over 30 countries.

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