

BILL PRICING

OPENGAMMA QUANTITATIVE RESEARCH



ABSTRACT. The details of the implementation of pricing for (Treasury) bills is provided.

1. INTRODUCTION

Treasury bills are instruments where the notional is paid at maturity, with no explicit interest is paid on top of the notional at maturity. In this note the maturity date is denoted t_p .

The interest is implicit through the settlement amount which differs from the notional. When the implicit interest rate or yield is positive, the paid amount is smaller than the notional.

2. PRESENT VALUE

For a bill, the cash flow is known and directly discounted with the credit curve relevant for the issuer. The settlement amount is discounted with the risk-free curve, as the amount to be paid for settlement is collateralised by the bill (delivery versus payment (DVP)).

The two curves used are

- (1) Discounting (risk-free) : $P^D(t)$.
- (2) Credit (issuer): $P^C(t)$.

$$PV_{\text{Discounting}}^{\text{Security}} = P^C(t_p)$$

The present value of a transaction with settlement amount S is given by

$$(1) \quad PV_{\text{Discounting}}^{\text{Transaction}} = PV_{\text{Discounting}}^{\text{Security}} + SP^D(t_s).$$

3. YIELD AND PRICE

3.1. US convention. Bills, which mature in a year or less, are quoted differently from notes and bonds, since bills do not pay an established rate of interest. An investor's return on a bill is the difference between the purchase and subsequent sale price or, when held to maturity, the face value paid by the Treasury. Consequently, bills are quoted at *a discount from face value*, with the discount expressed as an annual rate based on a 360-day year.

To determine the settlement amount paid (A) from the rate (R), rate is multiplied by the number of days to maturity and divided by 360 days (accrual factor δ_i). This is subtracted from the face value:

$$(2) \quad A = 1 - \delta_i R.$$

In the US convention no price is quoted.

The US conventions can be found at <http://newyorkfed.org/aboutthefed/fedpoint/fed07.html>.

3.2. **Canada.** The day count convention is ACT/365. For a bill with accrual factor δ_i and rate R , the amount paid is A :

$$(3) \quad A = \frac{1}{1 + \delta_i R}.$$

The amount paid is also called *price*.

The Canadian conventions can be found at <http://www.fin.gc.ca/invest/bondprice-eng.asp>.

3.3. **Germany, Belgium.** The day count convention is ACT/360. For a accrual factor δ_i and a rate R , the amount paid is A :

$$(4) \quad A = \frac{1}{1 + \delta_i R}.$$

The amount paid is also called *price*. The standard settlement is T+2.

The Belgian conventions can be found in the *Procedure Manual* available at http://debtagency.be/en_products_tc_characteristics.htm.

3.4. **France (BTF).** The day count convention is ACT/360.

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