Standard Quotation Practice and Price/Yield Formulae for Thai Government Securities*

1. Treasury Bill

- ▓ Short-term discount instrument maturing within 12 months

Quotation Practice

- ▓ Yield per annum specified to two decimal places

Day Count

- ▓ Actual number of days from settement date to maturity date on the basis of 365 days a year

Formula

$$P = \frac{F}{1 + \dfrac{Y}{100} \times \dfrac{D}{365}}$$

โดย   P =   Settlement price

F =   Face value

Y =   Simple yield per annum

D =   Number of days from settlement to maturity

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*This is an unofficial English translation. In case of doubts, reference should be made to the original Thai text.

2. Accumulated-interest Bond

■ Long-term security (maturity of 1 year or greater) with accumulated

interest, compounding semi-annually, paid on the maturity date

Quotation Practice

■ Price per cent, accompanied by semi-annual yield to maturity—both specified

to two decimal places

Day Count

■ Actual/365 days basis

Formula

$$P = \frac{N}{\left(1 + \dfrac{Y}{200}\right)^{\frac{D}{182.5}}}$$

โดย   P =   Settlement price

N =   Total redemption amount (principal plus accumulated interest)

received at maturity

Y =   Semi-annual yield to maturity

D =   Number of days from settlement to maturity

3. Bond paying interest every 6 months

- Long-term security (maturity of 1 year or greater) with semi-annual coupon payments

- In case where maturity date does not fall on the last coupon payment date, holder will on maturity also receive interest accrued from the last coupon payment date to maturity date.

Quotation Practice

- "Clean" price per cent, accompanied by semi-annual yield to maturity—both specified to two decimal places

### Day Count

- Actual/365 days basis

Formula

$$Q + AI = \sum_{i=0}^{n-1} \frac{g/2}{\left(1 + \dfrac{y}{200}\right)^{\left(i + \frac{DSC}{182.5}\right)}} + \frac{100 + \left(g \times \dfrac{DCD}{365}\right)}{\left(1 + \dfrac{y}{200}\right)^{\left(n-1 + \frac{DSC+DCD}{182.5}\right)}}$$

Note : For ex-coupon trade, g/2 = 0 for the first coupon payment after settlement

				Unit
Q	=	Clean price (Quoted price)		Baht/100 Baht
AI	=	Accrued interest		Baht/100 Baht
	=	$g \times \dfrac{DCS}{365}$	cum-coupon trade	
	=	$-\left(g \times \dfrac{DSC}{365}\right)$	ex-coupon trade	
g	=	Coupon rate		% p.a.
y	=	semi-annual yield to maturity		% p.a.
DCS	=	Number of days from previous coupon payment to settlement		days
DSC	=	Number of days from settlement to next coupon payment		days
DCD	=	Number of days from last coupon payment to maturity		days
n	=	Number of coupon payments outstanding		times
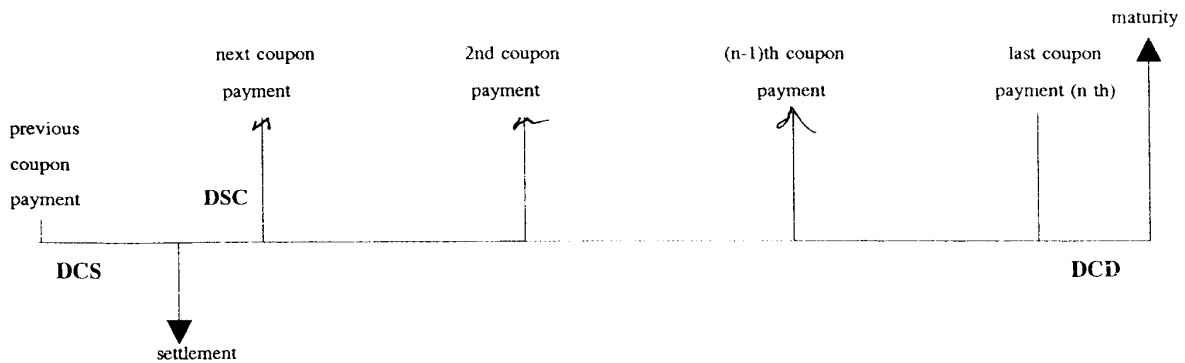
Alternative formula :

$$\text{If} \quad v = \frac{1}{1 + \dfrac{y}{200}}$$

$$Q + AI = (v)^{\frac{DSC}{182.5}} \times g \left[\frac{k}{2} + \frac{1 - (v)^{n-1}}{y/100} \right]$$

$$+ \left[100 + \left(g \times \frac{DCD}{365} \right) \right] \times (v)^{\left(n - 1 + \frac{DSC+DCD}{182.5} \right)}$$

For cum-coupon trade, $\quad AI = \dfrac{g \times DCS}{365} \quad$ and $\quad k = 1$

ex-coupon trade, $\quad AI = - \dfrac{g \times DSC}{365} \quad$ and $\quad k = 0$

Quoted price $\qquad = Q$

Settlement price, for cum-coupon trade $= \quad Q + \left(g \times \dfrac{DCS}{365} \right)$

for ex-coupon trade $= \quad Q - \left(g \times \dfrac{DSC}{365} \right)$

In case settlement within DCD

given n = 1

DSC
DCS
DCD

DCD

4. General Bond Formula

$$Q + AI = \sum_{i=0}^{n-1} \frac{g/H}{\left(1 + \dfrac{y}{100 \times H}\right)^{\left(i + \frac{DSC \times H}{365}\right)}}$$

$$+ \frac{100 + \left(g \times \dfrac{DCD}{365}\right)}{\left(1 + \dfrac{y}{100 \times H}\right)^{\left(n-1 + \frac{(DSC+DCD) \times H}{365}\right)}}$$

Note : For ex-coupon trade, g/h = 0 for the first coupon payment after settlement

or

$$Q + AI = (v)^{\frac{DSC \times H}{365}} \times g \left[\frac{k}{H} + \frac{1 - (v)^{n-1}}{y/100} \right]$$

$$+ \left[100 + \left(g \times \frac{DCD}{365} \right) \right] \times (v)^{\left[n-1 + \frac{(DSC+DCD) \times H}{365} \right]}$$

$$\text{Let} \quad v = \frac{1}{1 + \dfrac{y}{H \times 100}}$$

and k = 1   for cum-coupon trade

= 0   for ex-coupon trade

			Unit
Q	=	Clean price (Quoted price)	Baht/100 Baht
AI	=	Accrued interest	Baht/100 Baht

$$= \quad g \times \frac{DCS}{365} \qquad \text{for cum-coupon trade}$$

$$= \quad -g \times \frac{DSC}{365} \qquad \text{for ex-coupon trade}$$

			Unit
Q + AI	=	Dirty price (Settlement price)	Baht/100 Baht
g	=	Coupon rate	% p.a.
y	=	Yield compounded H times per annum	% p.a.
H	=	Coupon frequency	times/year
DCS	=	Number of days from previous coupon payment to settlement	days
DSC	=	Number of days from settlement to next coupon payment	days
DCD	=	Number of days from last coupon payment to maturity	days
n	=	Number of coupon payments outstanding	periods

$$\text{Quoted price} \quad = \quad Q$$

$$\text{Settlement price} \quad = \quad Q + AI$$

$$\text{For cum-coupon trade, } AI \quad = \quad g \times \frac{DCS}{365}$$

$$\text{ex-coupon trade, } AI \quad = \quad - \left(g \times \frac{DSC}{365} \right)$$

■ For comparison purpose, a semi-annual yield to maturity (Ys) should always be stated, using the following conversion formula:

$$Ys = 200 \times \left[\left(1 + \frac{y}{100 \times H} \right)^{H/2} - 1 \right]$$

or

$$y = H \times 100 \left[\left(1 + \frac{Ys}{200} \right)^{2/H} - 1 \right]$$

A-1 : Treasury bill

■ A bill, which matures on January 30, 1995, is sold for settlement on December 20, 1994

Quotation

Maturity date	Days to maturity	Yield (% p.a.) ·	
		Bid	Offer
30/1/95	41	6.91	6.41

Settlement Price

■ Price per face value of 100 Baht

$$P = \frac{100}{1 + \frac{6.41}{100} \times \frac{41}{365}}$$

$$= 99.2851199353 \quad \text{Baht}$$

■ The settlement amount is calculated to 100th of 1 baht (no rounding up of decimal points eg. if face value is 1 million Baht, the settlement price is 992,851.19 Baht)

A-2 : Accumulated-interest bond

■ A 7-year accumulated-interest bond which matures on December 25, 1997, with

interest compounding semi-annually at a rate of 8.5% per annum, is sold

for settlement on December 20, 1994

Quotation

Maturity date	Redemption value	Bid Price	Bid Yield	Offer Price	Offer Yield
25/12/97	179.09	137.36	9.00 %	138.35	8.75 %

Settlement Price

■ Number of days to maturity = 3 years and 5 days = (365 x 3) + 5 = 1,100 days

Offered price per face value of 100 Baht,

$$P = \frac{179.09}{\left(1 + \frac{8.75}{200} \right)^{(1100 / 182.5)}}$$

$$= 138.35 \quad \text{Baht}$$

A-3 : Bond paying interest every 6 months

- A 10-year bond, which matures on April 30, 1996, pays interest at a rate of 11.25% per annum every 6 months on January 15 and July 15
- Settlement date is December 20, 1994

a. Cum-Coupon Period

Quotation

		Bid		Offer	
Coupon	Maturity	Price	Yield	Price	Yield
11.25%	30/4/96	102.79	9.00%	103.11	8.75%

Settlement Price

Number of days from previous coupon payment to settlement (DCS)

Jul. 16, 94 to Dec. 20, 94   =   158   days

Accrued interest in DCS period   = $11.25 \times \dfrac{158}{365}$

=   4.86986301 Baht/100 Baht

Settlement price per face value of 10 million baht

=   10,311,000.00 + 486,986.30

=   10,797,986.30 Baht

Price/yield calculation using given formulae :

DCS (Jul. 16, 94 - Dec. 20, 94)   =   158 days

DSC (Dec. 21, 94 - Jan. 15, 95)   =   26 days

DCD (Jan. 16, 96 - Apr. 30, 96)   =   106 days

$$Q + \left(\frac{11.25 \times 158}{365} \right) = \frac{11.25/2}{\left(1 + \frac{8.75}{200}\right)^{\left(\frac{26}{182.5}\right)}} + \frac{11.25/2}{\left(1 + \frac{8.75}{200}\right)^{\left(1 + \frac{26}{182.5}\right)}} +$$

$$\frac{11.25/2}{\left(1 + \frac{8.75}{200}\right)^{\left(2 + \frac{26}{182.5}\right)}} + \frac{100 + [\, 11.25 \times 106/365 \,]}{\left(1 + \frac{8.75}{200}\right)^{\left(2 + \frac{26 + 106}{182.5}\right)}}$$

$Q + 4.86986301$ $= 5.59078980 + 5.35644532 + 5.13192366 + 91.90063056$

Quoted price = Q   **= 103.1099263 Baht**

or alternatively :

$$v = \frac{1}{1 + \frac{8.75}{200}} = 0.95808383$$

$$Q + \left(\frac{11.25 \times 158}{365} \right) = (0.9581)^{\frac{26}{182.5}} \times 11.25 \left[\frac{1}{2} + \frac{1 - (0.9581)^{3-1}}{8.75/100} \right]$$

$$+ [\, 100 + (11.25 \times \frac{106}{365}) \,] \times (0.9581)^{\left[\frac{3 - 1 + 26 + 106}{182.5} \right]}$$

$Q + 4.86986301$ $= 16.07915877 + 91.90063056$

Quoted price = Q   **= 103.1099263 Baht**

b. Ex-Coupon Period

■ From previous example A-3 if settlement date is December 20, 1994 (after the ex-coupon date) :

Quotation

		Bid		Offer	
Coupon	**Maturity**	**Price (XC)***	**Yield**	**Price (XC)***	**Yield**
11.25%	30/4/96	102.87	9.00%	103.19	8.75%

*Ex-coupon

Settlement Price

Number of days from settlement to next coupon payment (DSC)

Dec 21, 94 to Jan 15, 95 $\quad = \quad$ 26 days

Accrued interest in DSC period $\quad = \; - 11.25 \; x \; \dfrac{26}{365}$

$$= \; - 0.80136986 \quad \text{Baht/100 Baht}$$

Settlement price per face value of 10 million Baht

$$= \quad 10,319,000.00 \; - 80,136.98 \quad \text{Baht}$$

$$= \quad 10,238,863.02 \quad \text{Baht}$$

Price/yield calculation

$$Q - \frac{(11.25 \; x \; 26)}{365} \; = \; (0.9581)^{\frac{26}{182.5}} \; x \; 11.25 \; [\; \frac{0}{2} \; + \; 1 \; - \; \frac{(0.9581)^{3-1}}{8.75/100} \;]$$

$$+ \; [\; 100 + (\; 11.25 \; x \; \frac{106}{365} \;) \;] \; x \; (0.9581)^{\frac{[\; 3-1+26+106 \;]}{182.5}}$$

$$Q - 0.80136986 \quad = \quad 10.48836897 + 91.90063056 \; = \; 102.38899953$$

Quote price = Q $\quad$ **= 103.19036939 Baht**

A-4 : Bond paying interest every quarter

■ From example A-3, if interest is paid every quarter on January 15,

April 15, July 15 and October 15 and settlement date is

December 20, 1994 :

Quotation

		Bid		Offer	
Coupon	Maturity	Price	Yield	Price	Yield
11.25%	30/04/96	102.96	9.00%	103.27	8.75%

Settlement Price

Number of days from previous coupon payment to settlement (DCS)

Oct 16, 94 to Dec 20, 94	=	66	days

Accrued interest in DCS period $\quad = \quad 11.25 \times \dfrac{66}{365}$

$$= \quad 2.03424658 \quad \text{Baht/100 Baht}$$

Settlement price per face value of 10 million baht

$$= \quad 10,327,000 + 203,424.65$$

$$= \quad 10,530,424.65 \quad \text{Baht}$$

Price/yield calculation (Formula on page 6)

$$\text{DCS (Oct. 16, 94 - Dec. 20, 94)} = 66 \text{ days}$$

$$\text{DSC (Dec. 21, 94 - Jan. 15, 95)} = 26 \text{ days}$$

$$\text{DCD (Apr. 16, 96 - Apr. 30, 96)} = 15 \text{ days}$$

■ Convert semi-annually compounded yield (Ys) to quarterly compounded yield (y) by using the following formula

$$y = H \times 100 \left[\left(1 + \frac{Ys}{200} \right)^{2/H} - 1 \right]$$

$$= 4 \times 100 \left[\left(1 + \frac{8.75}{200} \right)^{2/4} - 1 \right] \qquad = 8.65633484$$

$$v = \frac{1}{1 + \frac{8.65633484}{100 \times 4}} \qquad = 0.97881757$$

$$Q + \frac{(11.25 \times 66)}{365} = (0.97881757)^{\frac{26 \times 4}{365}} \times 11.25 \left[\frac{1}{4} + \frac{1 - (0.97881757)^{6-1}}{8.6563348/100} \right]$$

$$+ \left[100 + \frac{(11.25 \times 15)}{365} \right] \times (0.97881757)^{\frac{[6 - 1 + (26 + 15) \times 4]}{365}}$$

$$Q + 2.0342465 = 15.9088609 + 89.3993124 = 105.30817335$$

Quoted price = Q = **103.27392678 Baht**

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