

# MATH4511 Quantitative Methods for Fixed Income Derivatives

## Tutorial 3

Forward rate

$f(t)$ : investing 1 unit of currency from year  $t-0.5$  for six months generates, at year  $t$ ,  $(1 + \frac{f(t)}{2})$

$$(1 + \frac{\hat{r}(t)}{2})^{2t} = \left(1 + \frac{f(.5)}{2}\right) \left(1 + \frac{f(1)}{2}\right) \dots \left(1 + \frac{f(t)}{2}\right)$$

$$f(t) = 2 \left( \frac{d(t-.5)}{d(t)} - 1 \right)$$

Swap rate (par yield)

$$s(T) = \frac{1 - d(T)}{\sum_{i=1}^{2T} \frac{1}{2} d(\frac{i}{2})}$$

Ex 1

### Bond information

T2M	Maturity	Coupon	Freq	Price
0.5y	15/11/2001	7.5	2	101.8046875
1y	15/05/2002	7.5	2	103.4042969
1.5y	15/11/2002	11.625	2	110.6640625

### The cash flows of the bonds

Time	15/05/2001	15/11/2001	15/05/2002	15/11/2002
Bond1	101.8046875	103.75	0	0
Bond2	103.4042969	3.75	103.75	0
Bond3	110.6640625	5.8125	5.8125	105.8125
T2M	0	0.5	1	1.5
Disc. Factors	1	0.98125	0.961201054	0.939147698
Spot rates	0	3.8217%	3.9966%	4.2296%
Forward rates	0	3.8217%	4.1716%	4.6965%

Ex 2

**TABLE 2.1** Discount Factors, Spot Rates, and Forward Rates Implied by Par USD Swap Rates as of May 28, 2010

Term in Years	Swap Rate	Discount Factor	Spot Rate	Forward Rate
0.5	.705%	.996489	.705%	.705%
1.0	.875%	.991306	.875%	1.046%
1.5	1.043%	.984494	1.045%	1.384%
2.0	1.235%	.975616	1.238%	1.820%
2.5	1.445%	.964519	1.450%	2.301%

T2M	Coupon(%)	Freq	Price
0.5	0.71%	2	100
1	0.88%	2	100
1.5	1.04%	2	100
2	1.24%	2	100
2.5	1.45%	2	100

Time	0	0.5	1	1.5	2	2.5
swap1	100	100.3525	0	0	0	0
swap2	100	0.4375	100.4375	0	0	0
swap3	100	0.5215	0.5215	100.5215	0	0
swap4	100	0.6175	0.6175	0.6175	100.6175	0
swap5	100	0.7225	0.7225	0.7225	0.7225	100.7225
discount factor	1	0.996487382	0.991303415	0.984499506	0.975621644	0.964507768
spot rate		0.705%	0.875%	1.044%	1.238%	1.451%
forward rate		0.705%	1.046%	1.382%	1.820%	2.305%

### Ex3 Y2M

Coupon	11.625
T2M	1.5
Price	110.6640625
Y2M	4.2140%
P	110.6640618
Residue	-6.63436E-07

T2M	0	0.5	1	1.5
CF	-110.6640625	5.8125	5.8125	105.8125
IRR	2.1070%			
Y2M	4.2140%			

### Ex4. Accrued interest

Face amount	100,000
Maturity	15/2/2011
Purchased	15/5/2001
Coupon	5
Quoted Price	96.734375

Last coupon	Purchased	Next coupon
15/2/2001	15/5/2001	15/8/2001
	89	181
Accrued interest	1.2293	
Invoice price	97,963.66	