Solution key HW CH#15

CHAPTER 15: THE TERM STRUCTURE OF INTEREST RATES

PROBLEM SETS

1. In general, the forward rate can be viewed as the sum of the market's expectation of the future short rate plus a potential risk (or 'liquidity') premium. According to the expectations theory of the term structure of interest rates, the liquidity premium is zero so that the forward rate is equal to the market's expectation of the future short rate. Therefore, the market's expectation of future short rates (i.e., forward rates) can be derived from the yield curve, and there is no risk premium for longer maturities.

   The liquidity preference theory, on the other hand, specifies that the liquidity premium is positive so that the forward rate is greater than the market's expectation of the future short rate. This could result in an upward sloping term structure even if the market does not anticipate an increase in interest rates. The liquidity preference theory is based on the assumption that the financial markets are dominated by short-term investors who demand a premium in order to be induced to invest in long maturity securities.

7.

Maturity	Price	YTM	Forward Rate
1	\$943.40	6.00%	
2	\$898.47	5.50%	$(1.055^2/1.06) - 1 = 5.0\%$
3	\$847.62	5.67%	$(1.0567^3/1.055^2) - 1 = 6.0\%$
4	\$792.16	6.00%	$(1.06^4/1.0567^3) - 1 = 7.0\%$

9. If expectations theory holds, then the forward rate equals the short rate, and the one year interest rate three years from now would be

$$\frac{(1.07)^4}{(1.065)^3} - 1 = .0851 = 8.51\%$$

13.

Year	Forward Rate	PV of $1 received at period end
1	5%	$1/1.05 = $0.9524
2	7%	$1/(1.05×1.07) = $0.8901
3	8%	$1/(1.05×1.07×1.08) = $0.8241

a. Price = ($60 × 0.9524) + ($60 × 0.8901) + ($1,060 × 0.8241) = $984.14

b. To find the yield to maturity, solve for y in the following equation:

$984.10 = [$60 × Annuity factor (y, 3)] + [$1,000 × PV factor (y, 3)]

This can be solved using a financial calculator to show that y = 6.60%

c.

Period	Payment received at end of period:	Will grow by a factor of:	To a future value of:
1	$60.00	1.07 × 1.08	$69.34
2	$60.00	1.08	$64.80
3	$1,060.00	1.00	$1,060.00
			$1,194.14

$$\$984.10 \times (1 + y_{\text{realized}})^3 = \$1,194.14$$

$$1 + y_{\text{realized}} = \left(\frac{\$1,194.14}{\$984.10}\right)^{1/3} = 1.0666 \Rightarrow y_{\text{realized}} = 6.66\%$$

d. Next year, the price of the bond will be:

[$60 × Annuity factor (7%, 2)] + [$1,000 × PV factor (7%, 2)] = $981.92

Therefore, there will be a capital loss equal to: $984.10 – $981.92 = $2.18

The holding period return is: $\dfrac{\$60 + (-\$2.18)}{\$984.10} = 0.0588 = 5.88\%$

18. a.

Maturity (years)	Price	YTM	Forward rate
1	$925.93	8.00%	
2	$853.39	8.25%	8.50%
3	$782.92	8.50%	9.00%
4	$715.00	8.75%	9.50%
5	$650.00	9.00%	10.00%

b. For each 3-year zero issued today, use the proceeds to buy:

$782.92/$715.00 = 1.095 four-year zeros

Your cash flows are thus as follows:

Time	Cash Flow	
0	$ 0	
3	-$1,000	The 3-year zero issued at time 0 matures; the issuer pays out $1,000 face value
4	+$1,095	The 4-year zeros purchased at time 0 mature; receive face value

This is a synthetic one-year loan originating at time 3. The rate on the synthetic loan is 0.095 = 9.5%, precisely the forward rate for year 4.

c. For each 4-year zero issued today, use the proceeds to buy:

$715.00/$650.00 = 1.100 five-year zeros

Your cash flows are thus as follows:

Time	Cash Flow	
0	$ 0	
4	-$1,000	The 4-year zero issued at time 0 matures; the issuer pays out $1,000 face value
5	+$1,100	The 5-year zeros purchased at time 0 mature; receive face value

This is a synthetic one-year loan originating at time 4. The rate on the synthetic loan is 0.100 = 10.0%, precisely the forward rate for year 5.