

You have the entire class period to finish this exam. You may use a calculator, scrap paper, and a writing tool to complete this exam. You may hand in the scrap paper (with your name on it) if you think it will help you receive partial credit for incorrect answers. Total points=100.

Part I. Answer all questions in this section to receive full credit. (80 points)

(5 pts.) 1. For each of the following expectations, write next to it whether it is consistent with a flat (F), inverted (I) or upward-sloping (U) yield curve:

- |                                                    |   |
|----------------------------------------------------|---|
| a. A drop in the FF rate                           | I |
| b. A recession                                     | I |
| c. Rates will stay fairly constant                 | F |
| d. A sharp increase in inflation                   | U |
| e. The appointment of a new chairman who is a dove | U |

(5 pts.) 2. Consider each of the following statements about forwards and futures. Circle ALL that are true.

- a) Future contracts can be used for non-standard contracts whereas forward contracts are standardized.
- b) A forward contract has a greater degree of default risk than a futures contract.
- c) You can identify the counterparty to your futures contract.
- d) Futures are marked to market daily whereas forward contracts are not.
- e) When either a future or forward contract is executed, the price is agreed upon today, but the asset is exchanged at some later date.

(2 pts.) 3. Circle the firm that is likely to have the highest average recovery rate if it were to default:

- a) A grocer that did a recapitalization (to 90% debt) just prior to the onset of a mild recession.
- b) A cellphone provider that uses a system of low flying satellites to provide worldwide service.
- c) The same cellphone provider, except that it has only secured debt in the capital structure.

(2 pts.) 4. Circle the institution below which engages in asset transformation to the greatest degree:

- a) An electric utility
- b) A mutual fund
- c) A commercial bank

(4 pts.) 5. Company A and Company B enter a swap agreement with a notional principal of \$200 m. B receives 8% for the next five years, in exchange for payments to A that are LIBOR +50 bp. B owes \$200 m. on a bond with a 7.5% coupon. What is the effective rate B pays on its liabilities? LIBOR

B receives 8% in the swap, pays L +50 bp, and pays 7.5 to bondholders. So  $8 - 7.5 - (\text{LIBOR} + .5) = \text{LIBOR}$

(9 pts.) 5. Your neighbor, Dr. Brown, invents a time machine and you use it to travel to the year 2034. In your trip you go to a public library that has a copy of the Economic Report of the President and use the copy machine to copy the appendix, which has many tables reporting historical data on economic and financial variables.) Circle ONE answer in each of the following questions (a – c).

- a. Upon your return, you read your materials and observe that inflation over the next 8 years will average 6 percent per year. Which of the following actions is most lucrative?
1. Invest in a mutual fund that includes only small and medium-sized bank stocks.
  2. Take out a 30-year fixed rate mortgage to buy the large home you can in an upscale neighborhood.
  3. Buy 30-year Treasury bonds.
  4. Pursue a strategy of investing in a series of one-year Treasury bills for the next 30 years.

b. Upon your return, you observe that the Federal government budget deficit for the next three years balloons to 6% of GDP, but then returns to normal in the years after. Which of the following actions is most lucrative?

1. Buy 3 year Treasury notes.
2. Enter a plain vanilla swap contract for five years, agreeing to pay floating and to receive fixed.
3. Buy put options on 3-year Treasury notes.
4. Pursue a strategy of investing in a series of one-year Treasury bills for the next 30 years.

c. Upon your return, you observe that the Federal Reserve was very aggressive in its anti-inflation policies beginning in the Summer of 2004 and continuing for one year. Which of the following actions is most lucrative?

1. Sell Fed Funds futures contracts for one year, starting in the Summer of 2004.
2. Buy 1 month Treasury bills starting in the Summer of 2004 and continue doing so for one year.
3. Buy call options on Treasury notes beginning in the Summer of 2004 and continuing doing so for one year.
4. After the Summer of 2004 ends, pursue a strategy of investing in a series of one-year Treasury bills for the next 30 years.

(6 pts.) 6. Rank the following debt obligations in terms of how much value they would lose if interest rates rose: (Rank 1 is for the bond that loses the most value, 6 is for the bond that loses the least value)

- |                                                                          |   |
|--------------------------------------------------------------------------|---|
| a. A 30 year home mortgage with a stated interest rate of 6%             | 2 |
| b. A 30 year Treasury bond principal-only STRIP (interest is taken out)  | 1 |
| c. A 5 year Treasury bond with a semi-annual coupon of 6% trading at 102 | 3 |
| d. A 5 year Treasury bond with a semi-annual coupon of 6% trading at par | 4 |
| e. A 1 month Treasury bill                                               | 6 |
| f. A 5 year auto loan with a stated interest rate of 4%                  | 5 |

(3 pts.) 7. The one-year default rate on a Ba3 bond averages about 2.5%. Therefore, defaults on B+ bonds should average more than 2.5%.

(3 pts.) 8. A ten year bond issued by Hunters Bank with a YTM of 5.5% is available for purchase.

Alternatively, one could purchase a bond issued by Bank Two that matures in 2013 with a coupon of 5.25% at a price of 96. Which is the safer bond in terms of credit risk? Hunters.

You need to get some sense of the YTM on Bank Two to get its spread. Assuming 8 years MD at par is reasonable. Price is 96, so it fell 4% from 100 at issue. So  $-4\% = -8 \times \text{rate change}$  means the yield went up 50 bp since issuance or a YTM of 5.75%. If you did not know MD, you know the minimum rate change would occur with the longest guess on MD. Given D has to be shorter than maturity (of 9 years) you know  $9/1.02625$  is the absolute highest value for MD and therefore using  $-4\% = -8.75 \times \text{rate change}$  to get the increase would get you a YTM of 5.72. If the maturities were identical, it would make sense to just compare YTMs and not bother with spreads. Just to carry through, though, if the 10 year Treasury were 4.4%, Hunters would have a credit spread of 110 bp while Bank Two's would be closer to 135. The fact that Bank Two has a slightly shorter maturity means that 4.4% is a tad high and therefore the spread is a bit more than 135 (say by 3 bp higher).

(2 pts.) 9. If a firm defaults on its bonds, how long will it typically be before the bondholders recover any money (assuming they do not sell to another investor)? between 8 months and 2-1/2 years, depending on the type of restructuring (workout vs. prepack vs. traditional Chapter 11).

(6 pts.) 10. The yield to maturity on a three-year Treasury note is 4%. The yield on a two-year note is 3%. The yield on a one-year Treasury bill is 2%. What do participants in the Treasury market believe will be the path of one year interest rates over the next three years (assuming the expectations theory of the yield curve holds exactly. Note you are given the first rate in the path – give me the next two.) 4%, 6%  
(Show your work, and round interest rates to the nearest basis point)

One year rate a year from now:

$$R_1 = 1.02 \quad R_2 = [(1+0.02)(1+x)]^{1/2} = 1.03$$

Square both sides to get  $1.02(1+x) = 1.03^2$   $(1+x) = 1.04009$  or 4% the first year

One year rate two years from now:

$$R_3 = (1.02 * 1.04 * 1+x)^{1/3} = 1.04$$

Raise both sides to the third power to get  $1.02 * 1.04 * (1+x) = 1.04^3$   
 $(1+x) = 1.06039$  or 6% the second year

(6 pts) 11. Calculate the duration of the following bond:

6% coupon, paid semi-annually  
 Maturity of 2.5 years  
 Trades at a yield to maturity of 8%.

(Show your work for full credit. Your answer should show the duration to the nearest hundredth of a year.) 2.355

Time in Half Years	CF or Coupon	Half YTM	Discount Factor	Present Value of C	time * PV of C	wt	wt* time
1	3	1.04	1.040	2.885	2.885	0.030	0.030
2	3	1.04	1.082	2.774	5.547	0.029	0.058
3	3	1.04	1.125	2.667	8.001	0.028	0.084
4	3	1.04	1.170	2.564	10.258	0.027	0.107
5	103	1.04	1.217	84.658	423.292	0.886	4.430
			Sums	95.548	449.983	1.000	
				Price	95.548		
				Duration	2.355		4.709

(6 pts) 12. A semi-annual coupon bond has a coupon of 6% and its duration is 5.78 years. It trades at a yield of 7%, or a price of \$94.54 per \$100 face. The comparable Treasury rate is 5%. If the yield curve shifts up across the board by 50 bp and the spread increases to 280 bp, what is the new price of the bond? (Show your work for full credit and show the price to the nearest cent per \$100 face). 87.68

Use %change P = -MD \* change in rates. MD is 5.78/1.035=5.58. The tricky part here was to identify the size of the spread change. The spread was originally 200 bp (7%-5%) and you are told it went to 280, so the YTM changed 80bp just because of the spread. But it also went up 50 bp because of the yield curve. So the change in rates is 130 bp. From this we know the price fell 7.254%. Given that it was at \$94.54, that means a \$6.86 drop to \$87.68.

(8 pts) 13. You are seeking a bank loan for \$12000 and go to Prosper Bank and to Skyline Bank to see which loan has a lower rate. Your plan is to open a restaurant on High Street, which is quite risky. Prosper Bank expects that it could recover \$10,000 if you defaulted while Skyline thinks it would only recoup \$9000. However, Skyline puts your probability of repayment at 97% while Prosper only has it at 96%. Which loan has the lower interest rate? Assume both banks are aiming to earn 6%. (Show your work for full credit). Prosper Bank by about 1.5bp

Prosper:

Skyline:

Recovery rate is 10/12 or .833

Recovery rate is 9/12 or .75

$$1.06 = .96(1+k) + .04 * .833$$

$$1.06 = .97(1+k) + .03 * .75$$

$$1.06 = .96(1+k) + .03332$$

k solves to 6.9458%

$$1.06 = .97(1+k) + .0225$$

k solves to 6.9588%

(8 pts) 14. You observe a put contract in the Treasury option market with a price of \$1 and an option strike price of \$100 (for a bond with a face value of \$100). The coupon on the underlying Treasury bond is 6% and it trades at a price of \$103.80 (per \$100 face value). This bond has a duration of 7.71 years and the current yield to maturity (YTM) is 5.5%.

(2 pts) a. What bond price would cause the put option to be exercised? P below 100

(6 pts) b. What interest rate would make the net value (to the buyer) of this put option equal to \$2? 11.18% (Show your work for full credit; interest rates are expressed to the nearest basis point. Use DURATION to approximate bond prices).

For the net value to equal \$2, the exercise price would have to be \$97. That way the \$3 made on the exercise will cover the \$1 cost of the option and leave a net profit of \$2. Solve for the interest rate that makes the bond worth \$97.

$$MD = 7.71 / 1.0275 = 7.50 \text{ (YTM is 5.5\%, so divide by 1.0275 not 1.03)}$$

$$\% \text{ change in P} = (97-103.80)/103.80 = -6.55\%$$

$$-6.55\% = -MD \times \text{change in rates}$$

$$-6.65 = -7.5 \times \text{change in rates}$$

$$\text{change in rates} = .873\% \text{ or a YTM of } 5.5\% + .87\% = 6.37\%$$

(5 pts.) 15. A bond has two years to maturity, and bondholders will receive two payments, one after exactly a year and the second in exactly two years. The duration of the bond is 1.66 years. The present value of the first cashflow is 10. What is the value of the bond? (Show your work for full credit.) 29.41

It helps to know that duration is a weighted average of the times that money shows up. In this case money shows up in year 1 and year 2. We just need to know what fraction of the money comes in year one and what fraction comes in year 2.

$$D = \frac{10 * 1}{\text{Bond P}} + \frac{x * 2}{\text{Bond P}} = 1.66 \text{ and you know Bond P} = 10 + x. \text{ So } \frac{10 * 1}{10+x} + \frac{x * 2}{10+x} = 1.66. \text{ Solve for x.}$$

You will find that x equals 19.41 (after multiplying both sides by 10+x you get 10+2x=16.6+1.66x) and thus the bond price is 19.41 + 10 or 29.41.

Part II. Answer 2 of the following 3 questions. If you answer all the questions, only the first two will be graded. (Total points = 20 points; 10 points for each question answered.)

1. (10 pts) Hunterdom Bank has the following balance sheet:

\$100 m. 30 year mortgage loans @ 6%	\$92 m. 1 year CDs @ 3%
Mod. Duration=8.25 years	With MD=0.9 yr
	\$8 m. common stock
\$100 million	\$100 million

- a. (2 pts) What is the maturity gap of this bank? 29 years
- b. (2 pts) Does the maturity gap overstate, understate, or exactly measure the interest rate risk of this bank? (By overstate, I mean, does it imply more risk than actually exists; by understate, I mean does it imply less interest rate risk than actually exists?)  
overstates
- c. (6 pts) If the yield curve shifts up 50 bp across the board (a parallel shift in the curve), what is the new market value of equity at Hunterdom? (Show your calculations for full credit.)  
4.289

\$100 m. 30 year mortgage loans	\$92 m. 1 year CDs
Now prices change by:	Now prices change by
= -8.25 * 50 bp = -4.125%	= -.9 * 50 bp = -.45% to \$91.586
= 4.125m drop	common stock is now 4.289 m.
\$95.875 million	\$95.875 million

(10 pts) 2. Fill in the blanks in the following paragraph.

Arthur Burns, who was Fed chairman during the 1960s and 1970s is considered to be a dove. In the face of rising interest rates, Burns chose to increase the money supply. Whether he intentionally meant to monetize the deficit that arose as part of Johnson's decisions on the Vietnam War and welfare programs, or whether he was just trying to control interest rates, we may never know. But regardless of the intent, the outcome was that inflation rose to double-digits by the end of his tenure. Particularly during the 1970s, when the price of oil rose, many blamed this situation on unusual economic factors instead of the money supply. Milton Friedman was one of only a few critics of Burns who claimed that inflation was always and everywhere a monetary phenomenon. When Volcker later took over this job, he had to establish his reputation as a(n) hawk. Volcker determined that the best way to solve the problems left to him by Burns's policies was to target the money supply instead of interest rates. In the short term, people did not believe his resolve, but over time inflation expectations fell as Volcker persisted in his policies. Some argue that Volcker could have made these changes more gradually and avoided two recessions.

(10 pts.) 3. Answer True or False to the following statements:

1. The highest default rate on junk bonds since 1970 occurred during the most severe recession since 1970. **F**
2. LIBOR is a rate that banks charge each other for excess reserves, and therefore is a useful target for the Federal Reserve in implementing monetary policy. **F**
3. Absolute priority rule implies that senior subordinated bondholders will receive a higher payment in bankruptcy than investors in debentures of the same firm. **F**
4. Bond prices are at par when YTMs and coupons are the same. **T**
5. A primary dealer is unlikely to own an on-the-run Treasury. **F**
6. An advantage of a prepackaged bankruptcy over an exchange offer is that there is no incentive for bondholders to hold out (be a free rider). **T**
7. Over two-thirds of bond defaults occur on bonds that had a rating of BB+ or lower within a year of default. **T**
8. The notional principal on a swap is exchanged every six months during the life of the swap. **F**
9. Junk bonds issued during the last decade have had higher ratings on average than junk bonds issued during the 1980s. **F**
10. The swap market was started in the 1960s, as investors tried to find ways to hedge inflation. **F**