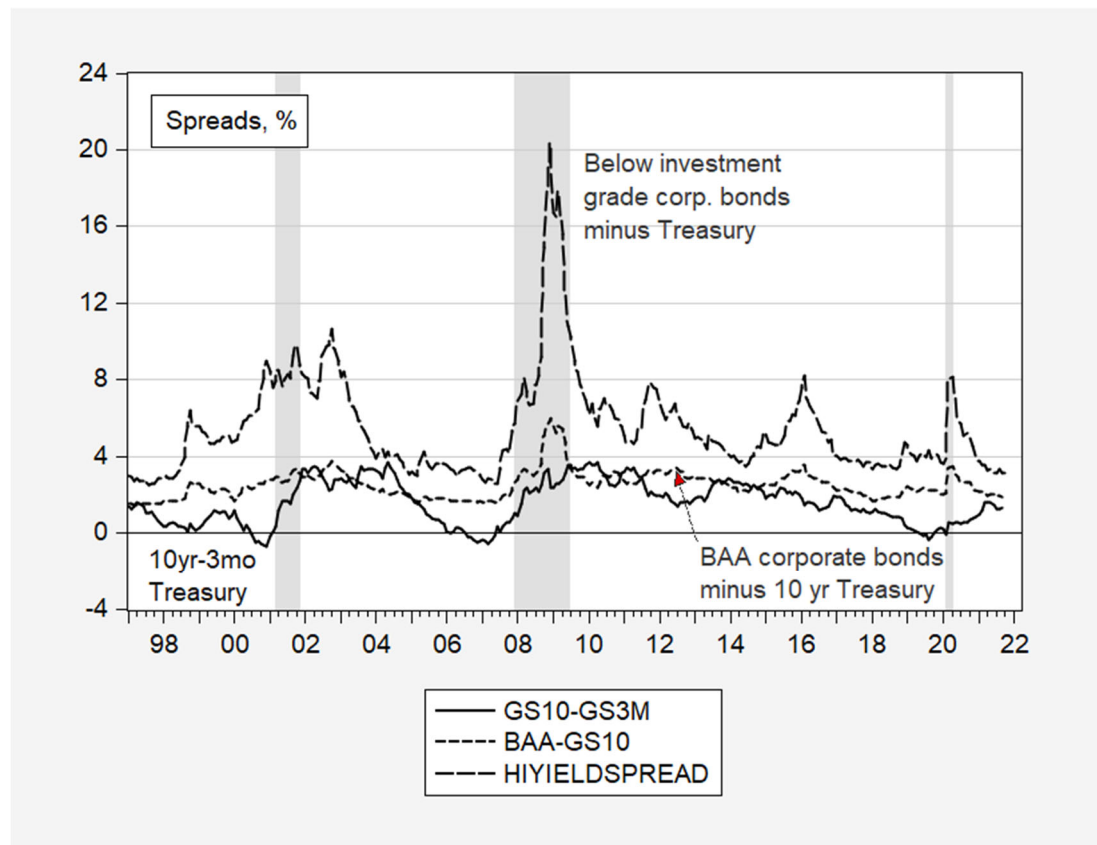


Midterm Exam 2 Answers

You have 70 minutes to complete this 60 minute exam. Be sure to “box in” your answers. Show your work (so that partial credit can be granted if the final answer is incorrect).

1. [15 minutes] Spreads and recessions. Consider the following graph of term (10yr-3mo Treasury) and credit spreads (BAA-Treasury; High yield [below investment grade] minus Treasury).



NBER recession dates shaded gray.

As of October, the spread is 1.3%, with the three month yield essentially zero; assume the inflation risk premium for 10 year bond is 1% (100 basis points).

1.1 (5 minutes) Explain what you think the short term rate will average over the next ten years. Use math to help explain your answer.

The spread is 10yr-3mo, and if the 3 month yield is 0%, then the 10 year yield is 1.3%. Subtracting off the term premium in the following equation:

$$i_{10t} = \frac{(i_{1t} + i_{1t+1}^e + \dots + i_{1t+9}^e)}{10} + tp_{nt} \quad (10)$$

Leads to the pure expectations hypothesis of the term structure, for a 10 year bond

$$i_{10t} = \frac{(i_{1t} + i_{1t+1}^e + \dots + i_{t,9}^e)}{10}$$

So

$$0.3\% = \frac{(i_{1t} + i_{1t+1}^e + \dots + i_{t,9}^e)}{10}$$

Hence, the expected average interest rate over the next 10 years is 0.3%.

- 1.2 (5 minutes) From your inspection of the graph, do you believe a recession is likely over the next ~~year~~ **ten** years? Indicate what series you are paying attention to in order to make your decision, and explain.

Pay attention to the 10yr-3mo term spread. Since the yield curve is positively sloped (i.e., the term spread is positive), and the 10yr-3mo has predictive power for recessions for the US (as shown in Chinn-Kucko), it seems unlikely that a recession will occur over the next year.

- 1.3 (5 minutes) From your inspection of the graph, do you believe we are currently in a recession? Indicate what series you are paying attention to in order to make your decision, and explain.

Pay attention to the credit spreads, the BAA-10yr and “Below investment grade Treasury spread”. We know that such spreads rise in a recession (we are less sure that they rise before a recession). With both of these spreads shrinking, it seems unlikely we are currently in a recession.

2. [10 minutes] Asset pricing. Suppose the stock price is given by:

$$P_t = \frac{D_{t+1}}{1+rp_t+rf_t} + \frac{E_t P_{t+1}}{1+rp_t+rf_t} \quad (1)$$

Where each period is one day, and no dividends are ~~not~~ being paid out over the relevant period.

2.1 (5 minutes) Suppose $\log(E(X)) = E(\log(X))$. Derive a mathematical expression that describes the evolution of (log) stock prices over time. Describe in words the behavior of log stock prices if people have “rational expectations”.

No dividends means:

$$P_t = \frac{E_t P_{t+1}}{1 + (rf + rp)}$$

With assumption of log-Normality, then:

$$p_t = E_t p_{t+1} - \ln(1 + rf + rp)$$

Given rational expectations, so

$$X_t = E_{t-1} X_t + u_t \\ u_t \sim iid(0, \sigma_u)$$

Then

$$p_{t+1} = E_t p_{t+1} + u_{t+1}$$

Substitute in:

$$p_{t+1} = p_t + (rf + rp) + \tilde{u}_{t+1}$$

Where

$$\tilde{u}_{t+1} = -u_{t+1}$$

2.2 (5 minutes) Suppose lots of “news” comes in for a certain number of periods. What do you think would happen to either average growth rate or volatility of stock prices.

“news” is the information that comes in that drives changes in the price. When there are no dividends:

$$P_{t+1} - P_t = (E_t P_{t+1} - P_t) + \left[\frac{D_{t+2} - E_t D_{t+2}}{(1+rp+rf)} + \frac{E_{t+1} P_{t+2} - E_t P_{t+2}}{(1+rp+rf)} \right]$$

becomes

$$P_{t+1} - P_t = (E_t P_{t+1} - P_t) + \left[\frac{E_{t+1} P_{t+2} - E_t P_{t+2}}{(1+rp+rf)} \right]$$

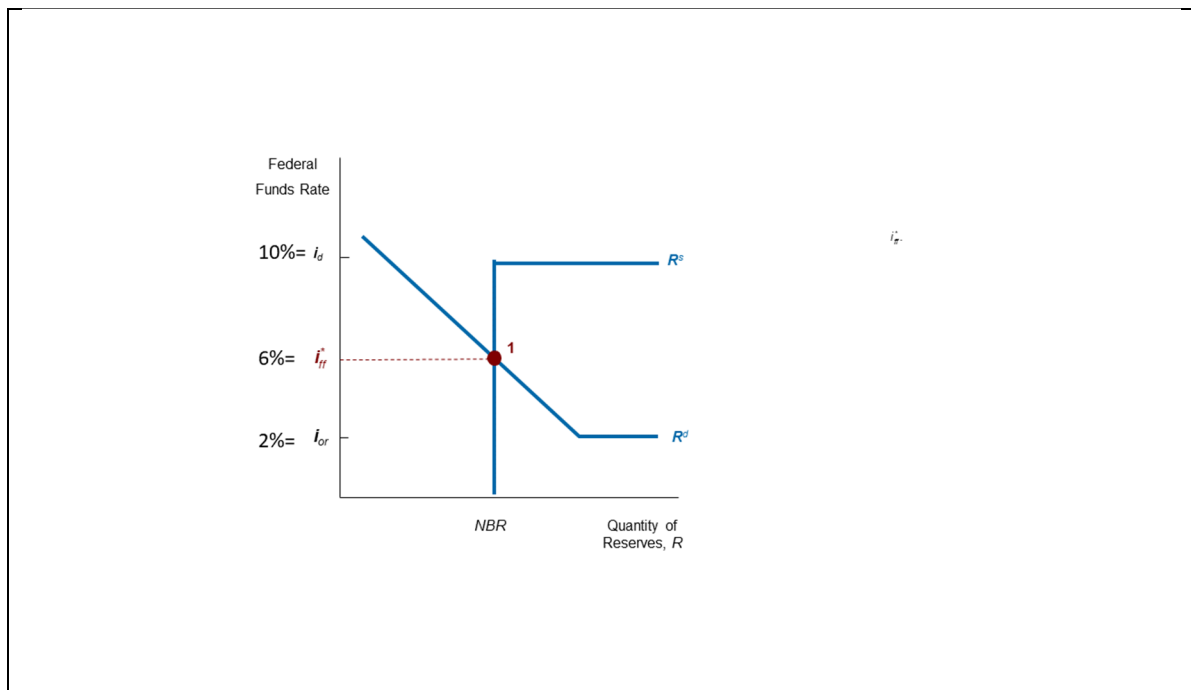
When more news comes in, then the term in the square bracket is bigger (in absolute value) than when little news comes in, so the change in the stock price becomes more volatile.

However, there should not necessarily be any impact on the average change in stock prices.

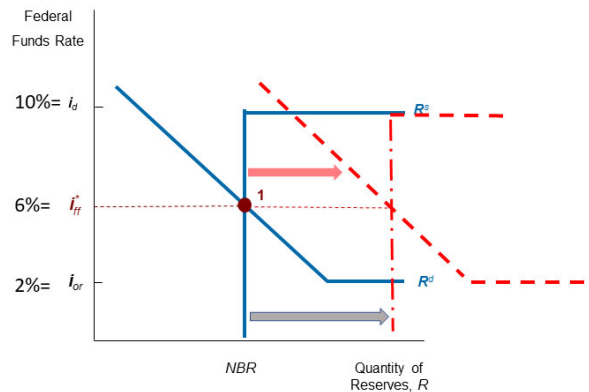
(Note: some people might say with rational expectations, the errors are i.i.d.; that could be correct in some interpretations.)

3. [10 minutes] The market for reserves.

3.1. (5 minutes) Draw the supply and demand graph where the Fed sets the discount rate at 10%, the interest rate on excess reserves at 2%, and targets the effective fed funds rate 6%.



3.2. (5 minutes) Suppose reserve demand increases enormously, so that in the absence of any Fed action, interest rates would rise to 10%. Show what the Fed must do in order to re-attain the target fed funds rate.



The question implies the demand curve shifts to the left (red dashed line, pink arrow) so much that the demand curve intersects the supply curve on the flat portion. In order to re-establish the original target interest rate, the Fed must shift supply (by increasing reserves) to the right (red dot-dash-dot line, gray arrow) so the vertical portion intersects the demand curve at 6%.

4. [25 minutes] Bank balance sheets.

4.1 (5 minutes) Suppose the bank has the following balance sheet:

Assets		Liabilities	
Reserves	\$25M	Checkable Deposits	\$230M
Securities	\$25M		
Govt Securities	\$50M		
Loans	\$125M	Bank Capital	\$20M

Bank capital is the equity of the owners (shareholders) of the bank.

Under the Basel II guidelines, government securities and reserves would have zero weight in calculating “risk weighted assets”; calculate the capital ratio for this bank. Show your work.

The capital ratio is $20/(0 \times 25 + 1 \times 25 + 0 \times 50 + 1 \times 125) = 20/150 = 13.33\%$
(if work is shown correctly, full credit)

4.2 (5 minutes) Suppose the government securities are actually as risky as non-government securities. Calculate the true capital ratio; is this ratio lower or greater than in 34.1? Show your work.

The capital ratio is $20/(1 \times 25 + 1 \times 50 + 1 \times 125) = 20/200 = 10.00\%$

(if work is shown correctly, full credit)

4.3 (5 minutes) Now consider two banks, H (high bank capital) and L (low bank capital).

High Bank Capital		Low Bank Capital	
Assets	Liabilities	Assets	Liabilities
Reserves \$17M	Deposits \$170M	Reserves \$19M	Deposits \$190M
Loans \$143M	Bank Capital \$30M	Loans \$141M	Bank Capital \$10M
ABS \$40M		ABS \$40M	

Bank capital is the equity of the owners (shareholders) of the bank. ABS stands for asset backed securities.

Calculate the return on equity (ROE) for each bank, if the rate of return on loans is 5%, and 10% on ABS, and the interest rate on deposits is 1%.

For H bank:

$$((0.05 \times 143 + 0.10 \times 40) - (0.01 \times 170)) / 30 = 9.45 / 30 = \mathbf{31.5\%}$$

For L bank:

$$((0.05 \times 141 + 0.10 \times 40) - (0.01 \times 190)) / 10 = 9.15 / 10 = 0.915 = \mathbf{91.5\%}$$

(if work is shown correctly, full credit)

4.4 (5 minutes) Show what happens to each of the bank balance sheets when the asset backed securities lose 50% of their value.

High Bank Capital		Low Bank Capital	
Assets	Liabilities	Assets	Liabilities
Reserves \$17M	Deposits \$170M	Reserves \$19M	Deposits \$180M
Loans \$143M	Bank Capital \$10M	Loans \$141M	Bank Capital \$00M
ABS \$20M		ABS \$20M	

ABS value drops from \$40M to \$20M in each case. For the high capital bank, bank capital (equity) absorbs the entire loss, dropping to \$10M, so that bank remains solvent. For the low capital bank, bank capital is wiped out, and depositors lose \$10M.

4.5 (5 minutes) Now consider two banks, one which borrows ~~a nothing~~ **something** in short term money markets (via corporate paper), and one that borrows a lot on short term money markets.

Bank Deposit Based		Money Market Based	
Assets	Liabilities	Assets	Liabilities

Reserves \$12M	Deposits \$120M	Reserves \$6M	Deposits \$60M
Loans \$148M	Short term \$60M	Loans \$154M borrowing	Short term \$120M borrowing
ABS \$40M	Bank Capital \$20M	ABS \$40M	Bank Capital \$20M

In a world with no deposit insurance, and no lender of last resort, which one of these banks is more susceptible to “runs”? Explain your answer.

Deposits can be withdrawn at a moments notice (if they are checking deposits), while short term borrowing is at least overnight, up to several weeks. Hence, the deposit-based bank is more susceptible to “runs” in this world without LoLR and Deposit Insurance.