

Name: _____

Solution Key

Midterm exam II

266: Fi. Markets and Institutions

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Directions: You have 70 min. to do the exam (unless other arrangements have been made).

Some questions offer a bit of choice on which parts you do, so read carefully. If you answer too many parts, we will grade the first ones and ignore extras.

Where computations are required, full points will be given for the correct answer. Partial points will be given.

You may write on the backs of the exam pages. If your answer extends outside the space provided, you must label clearly where the additional portion is located.

Each part of each question will be given equal value.

Formulas you may find useful

- The variance of a random variable x is given by

$$\text{var}(x) = \sum_{j=1}^J pr_j d_j^2$$

where $d_j = x_j - x^e$, and x_j is the j^{th} outcome, which happens with probability pr_j and x^e is the mean of x .

- The covariance between random variables x and y is given by

$$\text{cov}(x, y) = \sum_{j=1}^J pr_j d_{x,j} d_{y,j}$$

where $d_{x,j} = x_j - x^e$ and $d_{y,j} = y_j - y^e$.

- The key equation of the Gordon growth model is:

$$P = \frac{D_0(1+g)}{k-g}$$

where you should understand the notation.

1 Definitions. Do 5 of 6.

1.1 Secondary market

Answer/comment

A market where investors buy and sell securities from each other, rather than from the companies issuing those assets. Examples are the New York Stock Exchange and the NASDAQ.

1.2 Stock 'total return' index

Answer/comment

Stock index reflects both the changes in the prices of the underlying stocks, but also the dividends paid. More detail: the value of the index is based on the assumption that cash payments such as dividends are reinvested back into the index.

1.3 Call Option

Answer/comment

A call option gives the buyer the right (but not the obligation) to purchase a specified quantity of a security at a predetermined price (the 'strike price') during a specified time horizon.

1.4 Stop order

Answer/comment

According to the SEC: A stop order, also referred to as a stop-loss order, is an order to buy or sell a stock once the price of the stock reaches a specified price, known as the stop price. When the stop price is reached, a stop order becomes a market order. A buy stop order is entered at a stop price above the current market price.

1.5 American option

Answer/comment

The buyer of an American option can exercise the option (buy the asset at the strike price) any time up to the expiration date. (European options can only be exercised at the expiration date.)

1.6 Dark pool

Answer/comment

Dark pool are private trading venues for equities where trading is anonymous and there is little transparency about what deals of what size are being performed at what price.

2 Do 5 of 6. Facts/Real world stuff.

- 2.1 The two most commonly reported U.S. stock indices are the Dow and the S&P 500. Which index do you think gives a better indication of broad market conditions? Why?

Answer/comment

The Dow is composed of the prices of 30 stocks. The S&P500 is an index of 500 stock prices and so gives a broader sense of market conditions.

- 2.2 Roughly what is the historical average for the price-earnings ratio of the S&P 500?

Answer/comment

Between 16 and 17. Answers in the range of 14-20 got full credit.

- 2.3 The Nikkei index as reported in the FT is about 55 percent lower today than it was in January 1991. This figure exaggerates the losses that would have been experienced by the typical U.S.-dollar-based investor who held the shares in the Nikkei over this period. Explain why this is so.

Answer/comment

The dollar returns are not as bad as the yen returns because the yen has appreciated since 1991. (Longer explanation: Suppose you converted your dollars to yen and then bought the index in Jan. 1991 then (ignoring dividends) you would have lost 55 percent of your yen value. But since the value of the yen appreciated over this period, if you sold today (receiving yen) and then converted the yen back to dollars, each yen would have purchased more dollars than in 1991. Thus, your losses in dollars would be smaller than in yen.)

- 2.4 Since the recovery from the financial crisis began in early 2009, U.S. stock markets have recovered more slowly than European stock markets. True/False and explain.

Answer/comment

False – U.S. stock markets recovered more quickly. (You might have noted that the main German index performed similarly to the U.S. and most other European indices did considerably worse.) The U.S. economy also recovered more quickly than the European.

- 2.5 From the start of this year to mid-February, North American stock indices fell by more than 10 percent. Given the approximate combined market capitalization of these markets, how large, in dollar terms, is the loss in value associated with a 10 percent decline in the indices?

Answer/comment

The combined market cap is about 23 trillion dollars. The losses were in the \$2-3 trillion range.

- 2.6 In dollar terms, the size of derivative markets (e.g. futures, swaps, etc.) is smaller than, roughly the same size as, or much larger than the value of U.S. nominal GDP? Pick one: [Smaller, roughly the same as, much larger]

Answer/comment

Much larger. Nominal GDP is about 20 trillion, while the derivatives market is in the hundreds of trillions.

The following is a somewhat remarkable fact that you should remember: when you produce derivative contracts on some underlying asset, those markets tend to grow massive relative to the underlying. We know that the underlying markets in nominal terms tend to be roughly the same size as nominal GDP (stock market cap., total mortgages, government debt, etc., are all in the ball park of nominal GDP) whereas derivative markets by standard measures are much larger.

Short questions

3 Probability, risk models, and value at risk

Table 1 below represents my risk model for capital gains on my portfolio on any given trading day. My model has 6 possible outcomes and the dollar gain or loss in the value of my portfolio in each outcome is given in the table along with the probability of that outcome.

Table 1: Daily capital gains or losses (\$millions)

| Outcome | Probability | Capital Gain |
|---------|-------------|--------------|
| 1 | 0.50 | 1 |
| 2 | 0.025 | -10 |
| 3 | 0.025 | 10 |
| 4 | 0.025 | -2 |
| 5 | 0.025 | -4 |
| 6 | 0.40 | 2 |

3.1 Under this model, what is the probability that I experience positive capital gains on any given day?

Answer/comment

The probability that capital gains are positive is .925:

$$\begin{aligned} \text{Prob}(\text{CapitalGains} > 0) &= \\ \text{Prob}(\text{CapitalGains} = 1) + \text{Prob}(\text{CapitalGains} = 10) + \text{Prob}(\text{CapitalGains} = 2) \\ &= .5 + .025 + .4 = .925 \end{aligned}$$

3.2 What is the 1-day, 95% VaR (value at risk) implied by this model?

Answer/comment

The dollar value \$V such that

$$\text{Prob}(\text{DailyLosses} \leq V) = .05.$$

Which is $V = 4$ million.

We also accepted the definition that the 1-day, 95% VaR is the dollar value V such that

$$\text{Prob}(\text{DailyLosses} < V) = .05.$$

In which case the answer is $V = 2$ million.

In simple cases like we use in class, there can be a big difference between whether you take VaR to be defined in terms of strong or weak inequality—that is, ‘strictly less than’ vs. ‘less than or equal to.’ In most real-world examples, these two give essentially the same answer.

4 Mean, variance, and covariance

Table 2 presents returns for 2 assets, A and B in any given year. Asset returns are in percent. The probability of each outcome is included.

| outcome | prob. | A | B |
|---------|-------|-----|------|
| 1 | 1/3 | 0.5 | 3.2 |
| 2 | 1/3 | 1.0 | 1.5 |
| 3 | 1/3 | 1.5 | -0.7 |

4.1 What is the expected return for asset A?

Answer/comment

The expected return A is

$$E(A) = \frac{1}{3} \times 0.5 + \frac{1}{3} \times 1 + \frac{1}{3} \times 1.5 = 1$$

The units are in percent, so the expected return is 1 percent.

4.2 What is the variance of the return for asset A?

Answer/comment

The variance of the return for asset A is

$$\text{var}(A) = \frac{1}{3} \times (0.5 - 1)^2 + \frac{1}{3} \times (1 - 1)^2 + \frac{1}{3} \times (1.5 - 1)^2 = \frac{1}{6}$$

4.3 What is the standard deviation of the return for asset A?

Answer/comment

The standard deviation is the square root of the variance, so

$$\text{stdDev}(A) = \sqrt{\frac{1}{6}} \approx 0.41$$

4.4 What is the sign of the covariance of the returns of assets A and B? pick one: positive/negative

Answer/comment

The covariance is negative. When asset A gives its largest return (outcome 3), asset B yields its lowest return. When asset B gives its lowest return, asset B yields its highest (outcome 1).

5 Gordon growth model. You are an analyst at Morgan Stanley covering the pharmaceutical company Valeant. Investors believe that Valeant's dividend per share will grow by 9 percent per year, while the appropriate annual discount rate for the dividend stream is 10 percent. Valeant's dividends per share this year were \$10. (An equation for the Gordon model is listed on the first page.)

5.1 What approximate value does the Gordon growth model suggest for Valeant shares?

Answer/comment

The price according to the Gordon growth model is

$$P = \frac{10(1 + g)}{k - g} = \frac{10(1.09)}{.10 - .09} = \$1090$$

5.2 Over drinks, your pal who works in the CFO's office at Valeant tells you that dividends are more likely to grow each year at 3 percent instead of 9 percent. What does the Gordon growth model suggest will be the value of Valeant shares after this information becomes public?

Answer/comment

Now changing the growth rate of dividends to 3 percent, the price would be

$$P = \frac{10(1 + g)}{k - g} = \frac{10(1.03)}{.10 - .03} \approx \$147$$

5.3 Your pal suggests that before the information becomes public, you sell short 1,000 shares of Valeant and split the proceeds with him. What does it mean to 'sell short'?

Answer/comment

Short selling Valeant would mean borrowing Valeant stock, and selling the borrowed shares (your broker does the borrowing of the shares). Eventually, you must buy Valeant shares to replace those you borrowed. If you borrow and sell shares when the price is high, and then purchase (to repay the loan) later when the price is low, you make money. If instead the price goes up, when you eventually ‘cover your shorts’ by buying the shares, you lose money.

5.4 You tell your pal (circle one),

- (a) This sounds illegal. Let me run this by the compliance officer at my firm first.
- (b) Why go small? Let’s short 2,000 shares instead.

Answer/comment

This would be illegal (insider trading). We’ve covered lots of examples of rogue traders blowing up firms, or costing their employers literally billions of dollars in fines.

Notice that answer A does not say ‘dont’ do it,’ it says that when you are faced with something that sounds a bit fishy, you should run it by somebody at the firm who knows what is ok and what isn’t.

This is *always* good advice, unless i) You are sufficiently experienced that you are pretty certain of the answer, or ii) You are not trustworthy and want to join the pantheon of folks who gamble the firm on personal fortune and glory.

If you choose the later path you may well get rich, but we hope that instead you suffer for it.

6 A growing burrito restaurant chain, Burrito Loco, wants to go public by having an initial public offering of equity.

6.1 Burrito Loco hires an investment bank to help with the process. Describe 2 services that the investment bank will likely provide.

Answer/comment

The investment bank might advise on structuring the equity sale, setting the share prices, advertising the IPO, lining up buyers, helping comply with regulation, etc.

- 6.2 Burrito Loco intends to issue 1 million shares. Burrito Loco earnings next year are expected to be about \$2 million. If the average price-earnings ratio for similar firms is about 10, what might be a reasonable approximate value for the new Burrito Loco shares?

Answer/comment

The price-earnings ratio is the ratio of price per share to earnings per share. Burrito Loco's earnings per share are expected to be \$2. Similar companies have a p-e ratio of 10. To match them, Burrito Loco would issue shares worth \$20.

$$\frac{P}{E} = 10 = \frac{20}{2}$$

- 6.3 The investment bank agrees to 'underwrite' the offering by purchasing all of the shares. Describe two steps the investment bank might take to reduce the risk that after purchasing the shares, it will take a loss when attempting to sell the shares to the public.

Answer/comment

The investment bank could line up buyers, team up with other investment banks (the 'syndicate') to spread the risk, sell at a low price to ensure there are enough buyers, etc.

It would be unlikely that the firm can buy insurance such as credit default swaps on the new shares, since the shares don't exist yet. These answers received partial credit.

7 Visitors and the news.

- 7.1 According to Patricia Little, CFOs spend time (a) managing the leverage and liquidity of the firm and (b) providing financial advice to units of the firm that are attempting to evaluate the financial merits of current and prospective business activities. Which of these endeavors (a or b) takes up most of the CFOs time?

Answer/comment

B. According to Ms. Little, a CFOs spends most of her time helping units of the firm figure out what business projects make financial sense. In particular, the key financial decisions such as what leverage and figuring out adequate liquidity

are vital decisions, but they are made periodically and don't require constant day-to-day attention.

- 7.2 Some of the largest financial institutions in the U.S. combine both commercial banking and investment banking. According to a Financial Times article we discussed, the shareholders of some of these institutions are beginning to demand that the firms break themselves up into smaller, more specialized companies. Explain the role that financial regulation plays in motivating these demands.

Answer/comment

The basic idea we were looking for here is that regulation is expensive for large, complex institutions.

Detail: Broken up, some units (such as investment banking) would face lower regulation than others (commercial banking). Further, under new regulations, bigness itself leads to higher regulation on the whole entity. Becoming smaller would also avoid this 'bigness' burden.

8 Portfolio theory basics

- 8.1 The variance of an asset's return is the main thing driving the premium that investors demand to hold the asset. True/False, explain?

Answer/comment

False – agents should mainly be concerned with covariance of the asset returns with other things the agent cares about. This is what, as we said, distinguishes lottery tickets from insurance against house fires.

In the CAPM, 'other things the agent cares about' are entirely summarized by the return on the market portfolio. Thus, variance unrelated to the market portfolio (zero beta variance) demands no risk premium at all.

- 8.2 Take two assets with returns that have the same variance. One pays a much lower expected return. Give two reasons why sensible folks may want to hold the asset paying the lower expected return.

Answer/comment

- The asset may lower risk (as measured by covariance). The classic example we covered in class is home insurance. The expected return is low, but it pays off when we need it the most (when the house burns down). In the language of CAPM, assets with a low beta have a lower expected return.
- Another reason is liquidity premia. All else equal, assets that are more liquid will tend to be more expensive/have a lower return on average.

Congratulations. The End.